



Santa Monica Beach Restoration Pilot Project

Project Update Report

December 2016

Prepared for:

Metabolic Studio, Annenberg Foundation
US Environmental Protection Agency
City of Santa Monica
California Department of Parks and Recreation



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Suggested Citation:

Johnston, K.K. and M. Grubbs. 2016. Santa Monica Beach Restoration Pilot Project: Project Update Report. Report prepared by The Bay Foundation for Metabolic Studio, US Environmental Protection Agency, City of Santa Monica, and California Department of Parks and Recreation. 25 pages.

Acknowledgements

We would like to thank the US Environmental Protection Agency and the Metabolic Studio (Annenberg Foundation; Grant 15-541) for funding this pilot project, and our partners: City of Santa Monica and California Department of Parks and Recreation. Their support will allow us to explore soft-scape protection measures to combat climate change, while bringing back an important coastal habitat to the Los Angeles region.

The contents of this report do not necessarily reflect the views and policies of the US Environmental Protection Agency or Metabolic Studio, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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Executive Summary

This report summarizes activities for the Santa Monica Beach Restoration Pilot Project from the time period December 2015 through the end of November 2016. During this time period, substantial outreach was conducted, the partnership and Memorandum of Understanding (MOU) between The Bay Foundation (TBF) and the City of Santa Monica was finalized, permitting was applied for and finalized, and the installation of the project and restoration activities commenced.

One significant step for this project during the time period included applying for and receiving a Coastal Development Permit from the California Coastal Commission (CDP No. 5-16-0632) which required significant public outreach and in depth communications with the Commission, including developing an Implementation and Monitoring Plan, Site Plan, and several additional project summary requirements. Additionally, project webpages were developed and released on The Bay Foundation's (TBF) website on 2 June 2016: <http://www.santamonicabay.org/explore/beaches-dunes-bluffs/beach-restoration/santa-monica-beach-restoration-pilot/>. In addition to public meetings with local residents and stakeholders, significant media outreach also occurred during this time period. Lastly, all supplies were ordered and the fence installation began with several volunteer events.



Figure 1. View of the restoration area facing south during the fence installation (top). Stand up paddle boarders using the newly-installed pathway through the middle of the restoration area (bottom).

Introduction

Background

Over 17 million visitors frequent the beaches of Santa Monica every year. 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 daily vegetation and top soil removal through grooming and other regular maintenance (Dugan et al. 2003). However, these systems also offer essentially the last line of defense in terms of natural “softscape” protection. 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. Beach habitats and dunes 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, beaches in the Los Angeles area have been subjected to the continuous removal of natural features as they begin to develop. Mechanical maintenance of beaches has significant impacts on the physical and biological processes of natural beach and dune ecosystems (Dugan et al. 2003, Dugan and Hubbard 2009, Hubbard et al. 2013). Over much of the state, and in many parts of the country, beaches are not frequently groomed, but are instead allowed to develop natural features, such as low dunes away from active recreation areas. These features not only support native, and in many cases, rare and endemic species of plants and animals, they also provide a cost-effective buffer to storm surges and other regular, predictable threats, including SLR and increased erosion.

In addition to providing habitat for avifauna, including Federally-designated “Critical Habitat” (USFWS) for the threatened western snowy plover (*Charadrius nivosus alexandrius*), coastal strand habitats have a varied native vegetation community, including species such as red sand verbena (*Abronia maritima*), dune evening-primrose (*Camissoniopsis cheiranthifolia*), and beach saltbush (*Atriplex leucophylla*), and provide a vital habitat for invertebrate species. Thus, the current condition of groomed and flattened sand with vegetation removed provides almost no habitat value and removes all of the ecosystem services (Dugan et al. 2003, Hubbard et al. 2013, Gilburn 2012). Without vegetation, erosion is more frequent and there is nothing to trap wind-driven aeolian transport of sand (Nordstrom et al. 2011).

Future, restored conditions would include no mechanized ‘flattening’ of the sand and removal of vegetation. After seeding and planting vegetation, sandy coastal strand habitats and plant hummocks would develop, which would then support higher levels of the ecological community (e.g. invertebrates, birds). Recent 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).

Project Goals

This pilot project is restoring approximately three acres of sandy coastal habitat located on the beaches of Santa Monica by utilizing existing sediments to transform a portion of the current beach into a sustainable coastal strand and foredune 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.

Another project goal is to bring back a diverse, endemic-rich, coastal plant and wildlife community which has been almost completely extirpated from the Los Angeles region. Returning broad ecosystem functions will create increased protection for coastal infrastructure and residences from sea level rise and erosion while providing a vital refuge for invertebrates, birds, and rare coastal vegetation species.

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 “soft” low-cost natural shore protection from sea-level rise and storms while providing public benefits and enhancing natural resource values. All of these benefits are expected to have low-to-no impact on existing recreational uses of the beach.

Additional benefits of healthy beach ecosystems include, but are not limited to:

- Enhancing a developed coastline
- Critical habitat for rare coastal strand vegetation and invertebrate species
- Habitat for birds, possibly including the threatened western snowy plover
- Familiarizing residents, especially children, with a healthy, natural landscape
- Promoting tourism through unique aesthetic and bird watching opportunities
- Educational opportunities including native plants and healthy beach management practices
- Understanding of a ‘soft-scape’ climate change protection project
- Natural shoreline protection through buffering and absorption of wave energy
- Sea water filtration and food web support
- Detrital processing and nutrient recycling



Project Description

The pilot project of approximately three acres aims to return a healthy and beautiful ecosystem to Santa Monica State Beach (Figure 2), which in turn, will address climate change issues for both humans and wildlife. This pilot project uses low-lying sand fencing and native plant seeds to actively restore approximately two out of three acres of a highly impacted beach system (Figure 3). The third acre is comprised of the dry and wet sand shore-ward of the project area that will remain ungrooved (passive restoration through not raking the sand), and the area immediately adjacent to the perimeter of the sand fence, which will also remain ungrooved.

Design aspects feature curved, flowing, low-lying fence lines, a path through the restoration area, and an unenclosed perimeter along the water's edge – all components requested by various members of the public during the first few months of outreach about the project. Many of these design components are incorporated to minimize disturbance, and even enhance different forms of interactions and recreation along the beach. The site allows visitors to continue to recreate as well as enjoy the local native flora and fauna that are currently absent along the groomed beaches of the Santa Monica Bay.

Once seeded, specialized coastal strand and foredune vegetation will grow, develop, and begin trapping sand transported by wind. Wind-driven sand will bump into vegetation, fall, and accrete, naturally increasing the elevation of plant hummocks over time to an estimated height of 1-3 feet. Additional trapping of sand will occur through the deployment of sand fencing (Nordstrom et al. 2011). Because beach dunes accrete sediment transported from the ocean they will continue to grow concurrently with rising sea levels. This dynamic 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.

Project implementation began in November and December 2016, and requires approximately 3-4 weeks, including monitoring. It will be followed by post-restoration monitoring for a time period of no less than five years. For more information, details, artistic renderings, and links to public documents and photographs, please visit the project website: <http://www.santamonicabay.org/santa-monica-beach-restoration-pilot/>.

This project would not be possible without two additional project partners: City of Santa Monica (land managers) and California Department of Parks and Recreation (land owners). We are grateful for their support and enthusiasm for this pilot project. Additionally, we are also grateful for the many proponents and project supporters for this project, including but not limited to: Audubon Society – Santa Monica Chapter, California Native Plant Society, Loyola Marymount University, University of California, Santa Barbara, Cooper Ecological Monitoring, Inc., Coastal Restoration Consultants, Inc., Congress Member Ted Lieu, Assembly Member Richard Bloom, Senator Fran Pavley, Los Angeles World Airport Dune Preserve, Friends of Ballona Wetlands, US Fish and Wildlife Service, Heal the Bay, University of Southern California – SeaGrant, Santa Monica Bay Restoration Commission, Santa Monica Bay National Estuary Program, US Environmental Protection Agency, Patagonia, Council Member Paul Koretz, Girl Scout Troop 10975, Friends of LAX Dunes, Mia Lehrer and Associates, US Green Building Council – LA, beach managers throughout Southern California.... and local residents!



Figure 2. Photograph of the project site at Santa Monica Beach, Santa Monica, CA.



Figure 3. Map of the Santa Monica Beach Restoration Pilot Project location and general vicinity.

Sampling Design

The project area is divided into two, roughly 1-acre, treatment plots (T1, or the North plot, and T2, or the South plot; Figure 4). The treatment plots are separated by a curved path, bordered by a symbolic rope fence. The exterior perimeter (except for the ocean-ward side) is surrounded by a low-lying sand fence (approximately 3 feet in height). Each treatment plot is further subdivided into four quadrants for analysis, though there are no physical barriers within the treatment plots. This subdivision will allow for an experimental treatment design by implementing several different seeding protocols.

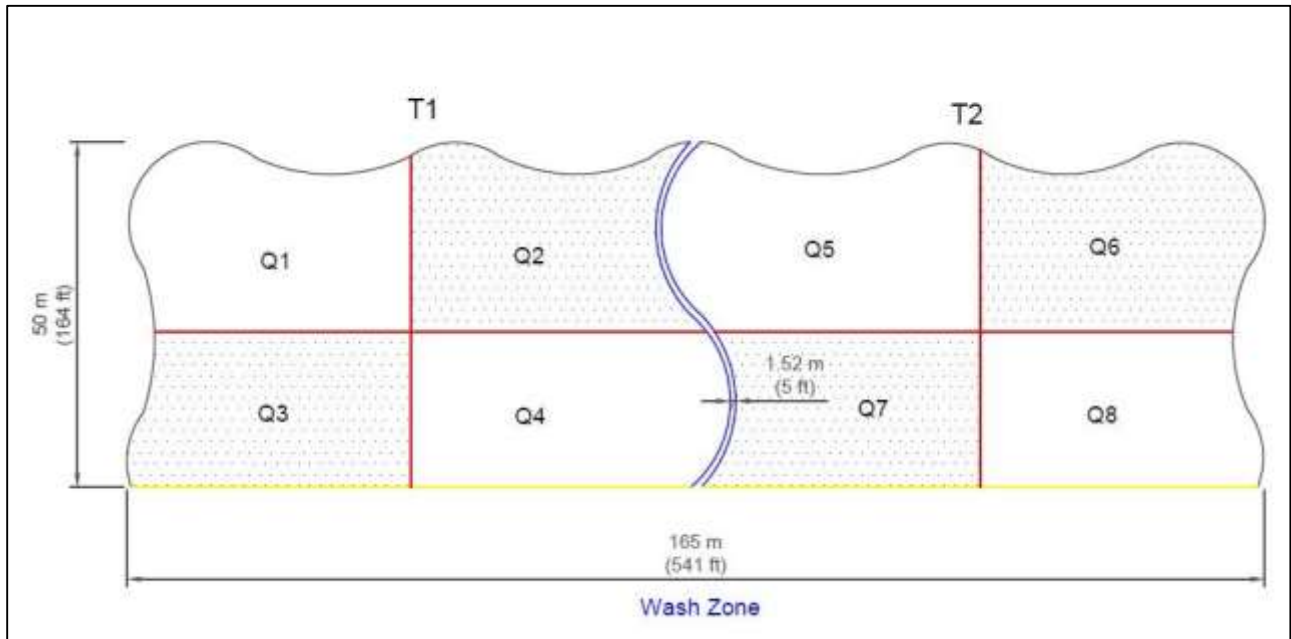


Figure 4. Restoration site graphic design, including two treatment plots (T1 and T2).

Permitting, implementation, and post-restoration maintenance and monitoring is coordinated and conducted by The Bay Foundation (TBF) and consultants.

Public Outreach

Significant public outreach has been conducted as part of this project through meetings, events, tours, social media, newspaper articles, newsletters, and a project webpage. Outreach is ongoing and also occurs on-site to beach visitors who have questions. The ability for the public to interact with, learn from, and benefit from this project are vital components of the project goals.

Members of the public had multiple opportunities to provide feedback about the project (Figure 5), and suggested changes were incorporated into the project design. Public-requested components include, but are not limited to, the curved sand fence, a 3-foot maximum fence height, several of the flowering plant species (e.g. sand verbena), no fence along the open ocean side of the project, and an extra buffer of open space on the ocean-ward side of the project area to allow for pedestrian traffic and lifeguard vehicle emergency access. Additionally, outreach occurred in advance of the application for permitting from the California Coastal Commission, in accordance with permit conditions for the project. Table 1 summarizes many of the outreach meetings and events conducted specifically for the project or that discussed and announced the project.

Possibly the most significant outreach occurred through the development of a website that highlighted artistic renderings of the project completed by Mia Lehrer and Associates (Figure 6), photographs, and project information and materials. The project website and frequently asked questions can be found here: <http://www.santamonica.org/explore/beaches-dunes-bluffs/beach-restoration/santa-monica-beach-restoration-pilot/>. Selected media links are presented below the outreach photographs.

Table 1. Summary of outreach meetings and events for the project.

Event	Location	Date
Presentation to Santa Monica City staff	City of Santa Monica - Office of Sustainability	3/17/2015
SMBRC Watershed Advisory Council Meeting	CD11 Westchester District Office, Westchester	3/30/2016
Meeting with The Beach Club	The Beach Club, Santa Monica	3/30/2016
Mailed Project Notice	Postcard Mailer to Santa Monica Residents	4/12/2016
SMBRC Governing Board Meeting	Marina del Rey Yacht Club	4/21/2016
Google Outreach Event	Google, Main St. Santa Monica	4/22/2016
Public Stakeholder Meeting	Annenberg Community Beach House, Santa Monica	4/27/2016
SMBRC Technical Advisory Committee Meeting	Loyola Marymount University	4/28/2016
Beach Ecology Coalition Meeting	Oceanside Harbor	5/18/2016
Santa Monica City Council Meeting	1685 Main Street, Santa Monica	5/24/2016
Santa Monica Land Art Generator Initiative Committee Meeting	Annenberg Community Beach House, Santa Monica	5/26/2016

Event	Location	Date
Notice in Local Paper	Santa Monica Lookout News	6/1/2016
Adapt LA Stakeholder Meeting	Santa Monica Public Library	6/2/2016
Posted to TBF Website	www.santamonocabay.org	6/2/2016
California Coastal Commission Monthly Meeting	Ukiah, CA	10/6/2016
Audubon Snowy Plover Tour	Santa Monica Beach and Project Site	10/16/2016
On-site project logistics with SaMo City staff	Project Site - Santa Monica, CA	11/1/2016
TBF Press Release	Digital	12/1/2016
News Article - "Wild Beach Coming to Santa Monica"	Santa Monica Lookout	12/5/2016
News Article - "Council to Consider Climate Change in New Land Use Rules"	Santa Monica Daily Press	12/5/2016
News Article - "Here's What Santa Monica Beach Will Look Like After It's Landscaped to Resist Rising Sea Levels"	Curbed LA	12/6/2016
Radio Interview	KPCC 89.3	12/7/2016
News Article - "Santa Monica's Beaches to Get a New Look with the Hope of Fighting Erosion Problems"	Time Out Los Angeles	12/8/2016
Association of National Estuary Programs	New Orleans, Louisiana	12/10/2016
News Article - "Santa Monica's Beach will Feature Plant Life"	Canyon News	12/11/2016
News Article - "Creating a New Ecosystem"	Santa Monica Mirror	12/12/2016



Figure 5. Photograph of community stakeholder meeting held on 30 April 2016.



Figure 6. Artistic rendering of project site by Mia Lehrer and Associates.

Selected Media Links

- [KPCC 89.3 interview](#) with Executive Director Tom Ford on 12-7-16.
- [Santa Monica Lookout](#) article on 12-5-16.
- [Curbed LA](#) article on 12-6-16.

A screenshot of a news article from Santa Monica News. The headline reads "Here's what Santa Monica Beach will look like after it's landscaped to resist rising sea levels". Below the headline, it says "Native plants will help prevent beach erosion" and "BY ELLIOTT CHILKOTI | DEC 5, 2016, 12:03PM PST". There are social media sharing icons for Twitter, Facebook, Print, and RSS. The main image is the same artistic rendering as in Figure 6. To the right of the main image is a Bank of America advertisement with a llama mascot and the text "Learn to love your app™". Below the advertisement is a "TRENDING" section with a thumbnail image of a building and the text "House of black gold". At the bottom left of the article, it says "Renderings by Mia Lehrer + Associates, courtesy The Bay Foundation".

Permitting

TBF, in coordination with the City of Santa Monica (City) and California Department of Parks and Recreation (DPR), has obtained the necessary permits to implement the Santa Monica Beach Restoration Pilot Project. Approval from the City at a public City Council meeting in the form of a Memorandum of Understanding (MOU) and restoration site plan stamped and approved by the Planning Department was obtained prior to the submittal of a Coastal Development Permit application to the California Coastal Commission (Commission). Additionally, a CEQA exemption was filed and obtained by the City to implement this project.

In October 2016, the Commission approved permit application No. 5-16-0632 with the following special conditions:

- 1) An assumption of risk, waiver of liability and indemnity;
- 2) Limited development authorization period;
- 3) Dune habitat creation plan;
- 4) Public access requirements; and
- 5) Permit compliance.

Permit condition 1 included a waiver signed by the City and DPR. Regarding permit condition 2, CDP (No. 5-16-0632) authorizes the approved beach restoration project for a period of five years from the date of Commission action. After such time, the authorization for continuation and active management of the dune habitat shall cease, unless the applicants submit an amendment to this permit, or new CDP application to the Commission, and that amendment or permit is approved, thereby extending the time period for the development. The dune habitat created pursuant to the permit may remain in place. The third permit condition was met by the Implementation and Monitoring Plan and the Site Plan. Permit conditions 4 and 5 will be met throughout the duration of the project.

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 publically available on The Bay Foundation's website: www.santamonicabay.org.

Implementation

Implementation of this project is currently happening during the rainy season to allow for natural germination and establishment of native seeds during the winter rains. The project will be implemented in two phases. The first phase, installation of fencing, including a perimeter sand fence and symbolic rope and post pathway, was completed on 7 December 2016. The second phase, native coastal strand and dune vegetation seeding, is currently occurring (December 2016).

Sand Fence Installation

Sand fencing was installed to facilitate the establishment of dune hummocks. The sand fencing is approximately 36 inches (3 feet) in height above the sand, and it is designed to be removable in the event of significant storm events or emergencies. T-posts were used to stabilize wood sand fence panels. The sand fence ends approximately 25 feet (8 meters) before the edge of the sand berm on the ocean side of the sand fence to encourage recreational activities adjacent to the ocean, and to allow for plenty of space for lifeguard vehicles to have emergency access. Additionally, there is no fence along that border – the public is welcome to still enter the project area, though we are in the process of developing signs that will encourage respect towards the plants and wildlife.

A symbolic post and rope fence was installed through the center of the project site to accommodate an approximately 5-foot wide by 164-foot long sandy trail which serves to provide public access to the shore. The post and rope fence is approximately 36 inches (3 feet) in height and designed to be removable in the event of significant storm events or emergencies.

Specific fence installation steps were conducted as follows:

1. Conducted pre-installation GPS survey to mark project boundary
2. Flagged georeferenced GPS points for each t-post and wood fence post
3. Pounded t-posts 2.5 feet into sand
4. Dug 2-foot deep fence trench with volunteers and shovels
5. Unrolled and placed sand fence along t-posts and in trench
6. Connected sand fence to t-posts using wire
7. Filled in trench and compacted sand to stabilize sand fence
8. Dug 2-ft deep holes for pathway wood fence posts
9. Installed pathway wood fence posts
10. Strung rope through holes drilled in wood fence posts to delineate pathway
11. Performed installation checks throughout length of sand fence and symbolic post fence

Both the sand fence and the symbolic fence were installed on 6 and 7 December 2016 with the help of TBF staff, volunteers, and the City of Santa Monica beach maintenance staff. Subsequent photographs document the installation of the sand fence. We are grateful to all of the help from volunteers and the questions and support from interested members of the public during the installation.







Hand-Seeding of Native Plants (Next Step)

The second phase of the installation (next step) will be hand-seeding. Seed has been sourced from S&S Seeds, who have over 30 years of experience with California native wildland seed and have provided seed for coastal dune, bluff, and wetland habitat restoration projects across all of California. TBF consulted with experts and S&S Seeds to develop a specialized plant pallet and custom seed mix design specific to local coastal strand habitat. Table 2 outlines the four species included in the custom seed mix along with the proposed seeding rate and number of pure live seeds per pound. Each of the coastal strand habitat plant species are discussed in detail below. Native plant species characteristics and growing patterns were taken from CalFlora (www.calflora.org) and S&S Seeds databases.

Table 2. Custom seed mix design by species.

Species Name	Common Name	Lbs / Acre	Number of Pure Live Seeds / Lb.
<i>Camissoniopsis cheiranthifolia</i>	beach evening primrose	0.10	2,441,000
<i>Abronia maritima</i>	sand verbena	12.00	16,000
<i>Ambrosia chamissonis</i>	beach bur sage	6.00	40,000
<i>Atriplex leucophylla</i>	sea scale	2.00	73,600

Camissoniopsis cheiranthifolia (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 7).



Figure 7. *Camissoniopsis cheiranthifolia* (beach evening primrose) [CalFlora: L. Watson 2007 (Left) and J. Pawek 2013 (right)].

Abronia maritima (Sand verbena) is a beach-adapted perennial, native to the coastlines of southern California, including the Channel Islands, and northern Baja California. 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 8). 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 8. *Abronia maritima* (Sand verbena) [CalFlora: G.A. Monroe 2010 (Left) and L. Watson 2007 (right)].

Ambrosia chamissonis (beach bur sage) 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 9). Beach bur sage has a high salt tolerance, low water requirement, and is conducive for sand stabilization and dune formation.



Figure 9. *Ambrosia chamissonis* (beach bur sage) [CalFlora: N. Kramer 2008 (left) and M. Bors 2008 (right)].

Atriplex leucophylla (sea scale) is a perennial herb native to the sandy beaches and dunes of the California coastline. Like the other species in the seed pallet, sea scale has a high salt tolerance and low water requirement, with the capability of surviving harsh dynamic coastal environments. Sea scale forms low-lying mats that spread up to 3 feet and blooms from April to October with tiny inconspicuous green flowers (Figure 10).



Figure 10. *Atriplex leucophylla* (sea scale) [CalFlora: (left) and Z. Akulova 2015 (right)].

The combined seed mix with all four species will be distributed across the restoration site using a broadcast hand seeder. The combined seed mix will be spread at a rate of 20.1 pounds per acre and will be immediately raked into the sand. The restoration site fence placement and symbolic pathway are shown in Figure 11. Treatment 1 (T1) and Treatment 2 (T2) identify the North and South sections, respectively, of the restoration area, separated by the symbolic pathway. T1 and T2 are further segmented into quadrants.

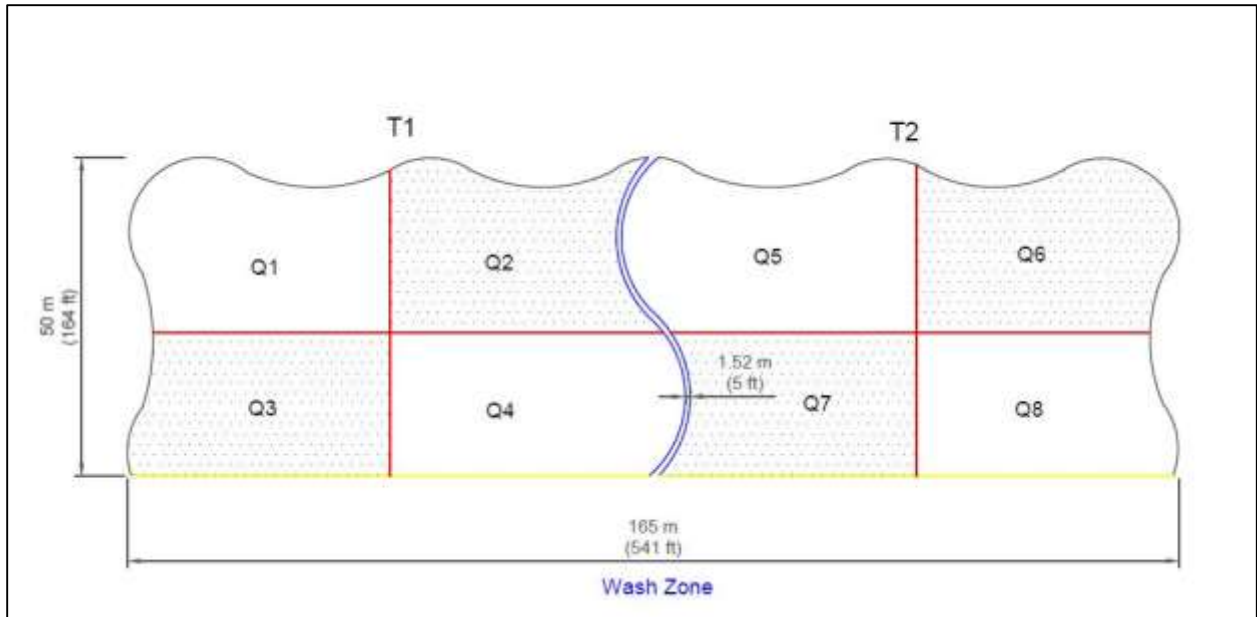


Figure 11. Restoration site graphic design, including two treatment plots (T1 and T2).

Adaptive Management

Adaptive management may be implemented based on the success of the project as interpreted by TBF, the beach managers, and the City of Santa Monica. The monitoring components and resulting data will be integral in determining the success of the project both from a socio-economic and ecological perspective. 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 ten years afterwards. Evaluation of the project will occur annually via an annual report and will be provided to the City, DPR, and the Commission and will be made publically available.

Scientific Monitoring

Accurate and robust scientific monitoring is a vital part of any restoration project. Monitoring is used to assess successful project implementation; for example, in this project, monitoring will allow an assessment of accretion rates of sand and elevation increases to combat sea level rise. TBF is currently implementing a biological, physical, and human use monitoring plan before seeding to collect baseline data. Additional monitoring will occur for the duration of the restoration project and several years afterwards to assess success. Additional “control” data along the adjacent unrestored beach is being collected as part of a before-after-control-impact ecological assessment monitoring program. Specialist scientists such as ornithologists and botanists are partners in this project and will use their expertise to advise both the monitoring program and its implementation. Data will be collected for up to ten years to evaluate the ecological health of the created coastal strand 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. The development of the monitoring plan was conducted with the input from many scientific advisors throughout southern California (details can be found in the “Implementation and Monitoring Plan” document available on the website). Table 3 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.

Pre-restoration baseline monitoring is currently occurring prior to the implementation of the seeding component of the restoration project to allow a comparison of the pre- and post-project conditions of the area. Ongoing implementation monitoring will occur throughout the duration of the restoration activities to adaptively manage and avoid impacts to 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.

Table 3. Description of protocols to be implemented during pre-restoration baseline monitoring, post-restoration evaluation monitoring, and their minimum frequency of occurrence.

Parameter	Protocol	Frequency
Photo Point	TBF SOP 7.2	Quarterly
Avifauna (+ pollinator presence)	Visual presence / behavior surveys; TBD if plover nesting	Semi-annually; Audubon: monthly
Wrack Cover	Percent cover, composition by species, average depth	Quarterly
Vegetation Cover	Selective mapping, fixed cover class quadrats along t-sects	Quarterly
Seedling Density	Fixed quadrat density counts	Semi-annually
Invertebrates	Cores along transects using 1mm mesh bags as sieve	Semi-annually
Grunion	Protocols follow www.grunion.org , and use the Walker Scale	Two times during grunion season
Physical Characteristics	Elevation profiles, cross-sections, beach width, distances from fence to berm, beach slope, hummock heights	Quarterly
Weather Conditions	Wind speed (Kestrel), max wind speed, air temperature, precipitation data (NOAA)	Quarterly
Sand Deposition	MWAC method (Goossens et al 2000)	Quarterly
Sediment Grain Size	Sieve method	Semi-annually
Site Checklist	Fence condition, trash presence and type, etc. (1-pg checklist datasheet)	Quarterly
Human Use	Visual presence / behavior surveys	Semi-annually; Audubon: monthly

For details on the individual protocols and sampling design, refer to the Santa Monica Beach Restoration Pilot Project [Implementation and Monitoring Plan](#).

Maintenance

Site visits will be conducted quarterly for a period of no less than two years to visually assess the restoration progress and evaluate the need for maintenance activities. 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 with hand tools may need to be taken. Similarly, litter or trash collection and removal from site will be conducted at least monthly.



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Western Snowy Plover (National Geographic 2016)



Santa Monica Beach (TBF 2015)