Manhattan Beach Dune Restoration Project

Restoration and Monitoring Plan

July 2021

Prepared for:

California Coastal Commission
Los Angeles County Department of Beaches and Harbors
City of Manhattan Beach
California State Coastal Conservancy

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28 July 2021

Timing of Operations: The Manhattan Beach Dune Restoration 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.

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

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Introduction

Coastal sediment transport is driven by waves and wind, which move sand between the offshore zone, nearshore zone, and coastal landforms, such as beaches, dunes, and cliffs. Within the intertidal zone, waves move sand daily. The direction of sediment transport is dependent on the local wave energy and varies seasonally. When wave energy is higher in the winter, sand from the beach, dunes, or cliffs is eroded into the surf zone. In calmer conditions, small waves push sand back onto the shore. Onshore winds also accumulate sand and build up coastal landforms. Where dune plants are present, wind transported sand can accumulate to form dunes. This increases the elevation behind the beach, and it sores sand. The increased elevation provides a buffer form coastal flooding, and the stored sand replenishes eroding beaches in storm conditions. Under stable conditions, dunes can also rebuild when wind moves sand from the beach inland.

Nature-based coastal adaptation projects aim to use restoration as a tool in returning natural processes to the shoreline to support longer-term resilience. Dune restoration is one of the tools that can alleviate some of the pressures and stressors anticipated with changing climate and rising sea levels.

Background

The Los Angeles County shoreline has some of the most recognizable and popular beaches in the world. The shoreline features cliffs, tidepools, marine life, and supports a very high level of recreational use. In recent years, over 70 million people have visited beaches in Los Angeles County annually. Although Los Angeles beaches are 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 (SLR) 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 and Hubbard 2009, 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 SLR as well as from tides, storm surges, and wave action from the ocean. Dunes and other beach habitats are critical in managing sand transport and storage 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 through grooming or raking the sand. 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 dunes, they provide a cost-effective buffer to storm surges and other regular, predictable threats, including SLR and increased erosion.

In April 2016, the 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 11 public beach facility assets at Manhattan Beach, including concessions, lifeguard facilities, restrooms, and a maintenance yard, many of which would be vulnerable to impacts from SLR. In 2021, the City of Manhattan Beach and partners published the Sea Level Rise Risk, Hazards, and Vulnerability Assessment as a part of an effort to identify adaptation strategies and update the City's Local Coastal Program. The 2021 assessment identified additional vulnerabilities to assets and infrastructure, including bike trails, beach access pathways, the storm drain system, sewer line, and buried utilities (ESA 2021). Additionally, the LACDBH 2016 analysis suggests that Manhattan Beach could lose up to 50% of its beach or more with 200 cm (6.6 ft) of SLR if no shoreline protection measures were implemented. The City of Manhattan Beach has already implemented shoreline armoring (sea walls and revetments) as an adaptation strategy upcoast and downcoast of Bruce's Beach, but these structures can contribute to beach erosion and accelerate beach loss. The City's Vulnerability Assessment identified this Manhattan Beach Dune Restoration (MBDR) project as an adaptation strategy to protect the shoreline from SLR while mitigating erosion and increasing local sand retention (ESA 2021). The MBDR project provides an opportunity to evaluate a cost-effective and low-impact solution to increase the resilience of the shoreline at Manhattan Beach in LA County and potentially inform scalable future efforts.

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. The Gabrielino-Tongva people are the first known inhabitants of the present-day Los Angeles region. The Tongva practiced a semi-nomadic coastal hunter-gatherer way of life and foraged for marine resources, including shellfish, fish, and marine mammals, in addition to terrestrial plants and animals, such as quail, deer, and other small game (Welch 2006). The Tongva people have had consistent occupation and continue to reside in the LA region.

After the arrival of Europeans to the Pacific coast in the 16th century, the Tongva people were forcibly missionized during the 18th century. Throughout the mission period, Tongva villages were displaced and the ancestral lands of the Tongva people became cattle and sheep ranches. Following the secularization of the missions and designation of California as a Mexican territory, the mission properties were given to prominent California families and soldiers, rather than the Tongva people (Welch 2006). These lands were then further developed throughout the late 19th and 20th centuries.

Prior to development in the late 1890s, Manhattan Beach was comprised of a narrow sandy beach backed by expansive coastal dunes, standing as high as 60 feet (Figures 1 and 2). From 1888 forward, developers began to build atop these natural dunes, first creating a seaside resort. It later grew into the City of Manhattan Beach after year-round residents arrived to support the newly constructed Standard Oil refinery built atop the dunes just north of Manhattan Beach in 1911. Despite development,

prevailing winds continued to move sand across streets, railroads, and boardwalks (Figure 3). Manhattan Beach residents planted *Carpobrotus edulis* (iceplant) to control the drifting sand (Figure 4). Some remnant sand dunes exist at Sand Dune Park at the northern end of Manhattan Beach, but the historical dunes have been largely urbanized and developed by residential and commercial properties (ESA 2021).

Although development led to substantial declines in dune habitat at Manhattan Beach, the beach habitat experienced net widening over time due to sand transport from upcoast construction and beach nourishment projects. In 1938, with the construction of the Hyperion Sewage Treatment Plant, 1.8 million cubic yards of sand were removed from natural coastal dunes at the Hyperion site to nourish Dockweiler Beach, upcoast of Manhattan Beach. Beach nourishment of Dockweiler, Venice, and El Segundo beaches ensued, with over 30 million cubic yards of sand being deposited onto the beaches just north of Manhattan (ESA 2021). Although Manhattan Beach did not receive direct nourishment, longshore sediment transport deposited sand to widen the beach by approximately 250 feet from the 1940s to the 1970s. Manhattan beach is now 300 to over 400 feet wide in some places (ESA 2021). The beach width is relatively stable due to limited sediment transport north and south of Manhattan Beach. On the north side, the groin at El Segundo Marine Terminal limits sediment transport and deposition onto Manhattan Beach, and on the south side, King Harbor helps retain sediment that would otherwise be lost to the Redondo Submarine Canyon. The sediment deposition proved to be an economically important event that has supported beach recreation for locals and tourists (ESA 2021)

The City of Manhattan Beach currently contains 2.1 miles of beach front, with approximately 40 acres of recreational beach area in total (Figure 5). In May of 2021, the City of Manhattan Beach published its Sea Level Rise Risk, Hazards, and Vulnerability Assessment, which incorporated the use of the USGS coastal storm modeling system (CoSMoS) to determine the effects SLR would have on Manhattan Beach (ESA 2021). The model mapped future hazards by analyzing storm and SLR scenarios (Figure 6). According to the same SLR vulnerability assessment, the width of Manhattan Beach is expected to face a loss of 11% (40 ft) by 2050 and a 47% (170 ft) loss by 2100. This estimate does not account for erosion that may occur during large storm events. Such models and projections serve as guides for prioritization of nature-based solutions to combat SLR that can occur as a result of episodic storm events and a changing climate (ESA 2021).

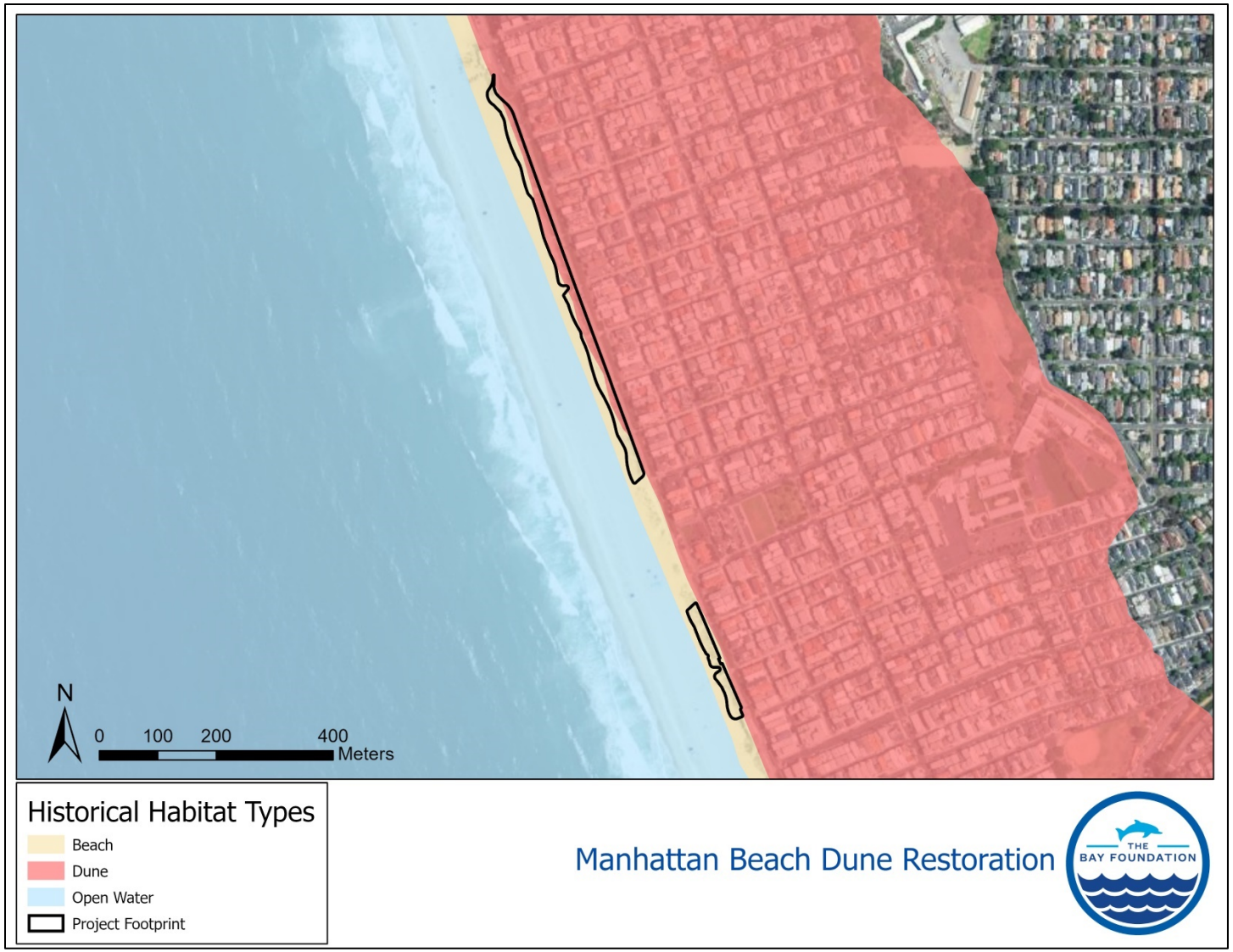

Figure 1. Historical distribution of open water, beach and dune habitat types overlaid onto present-day aerial imagery of the project site. Historical habitat types were determined by the Southern California Coastal Water Research Project 2010 analysis on the Historical Ecology of southern California Coastal Wetlands, which digitized T-sheets (historical coastal topographic maps) from 1851 to 1889.

Figure 2. USGS (United States Geological Survey) Topographical map from 1896 for the Redondo quadrangle (courtesy: USC Digital Library, downloaded March 2021, cropped).

Figure 3. Aerial photo of Manhattan Beach looking north, showing development on natural coastal dunes, circa 1927. Photo courtesy of the Manhattan Beach Historical Society.

Figure 4. Iceplant visible on original coastal dunes where homes were being developed in Manhattan Beach, 1925. Courtesy of the Dick Whittington Photography Collection, USC Libraries.

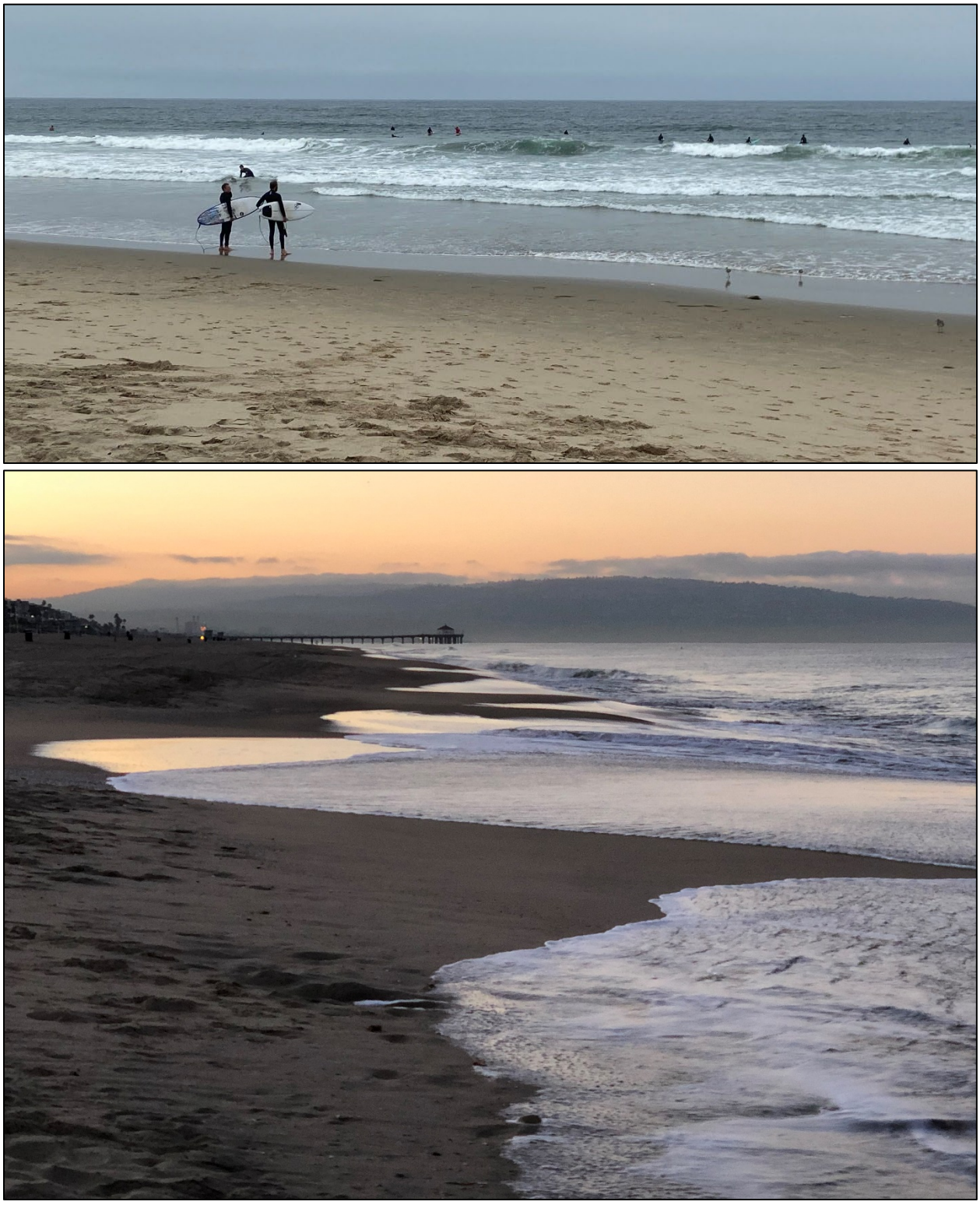

Figure 5. Representative photos of a portion of the 40 acres of recreational beach area in the City of Manhattan Beach.

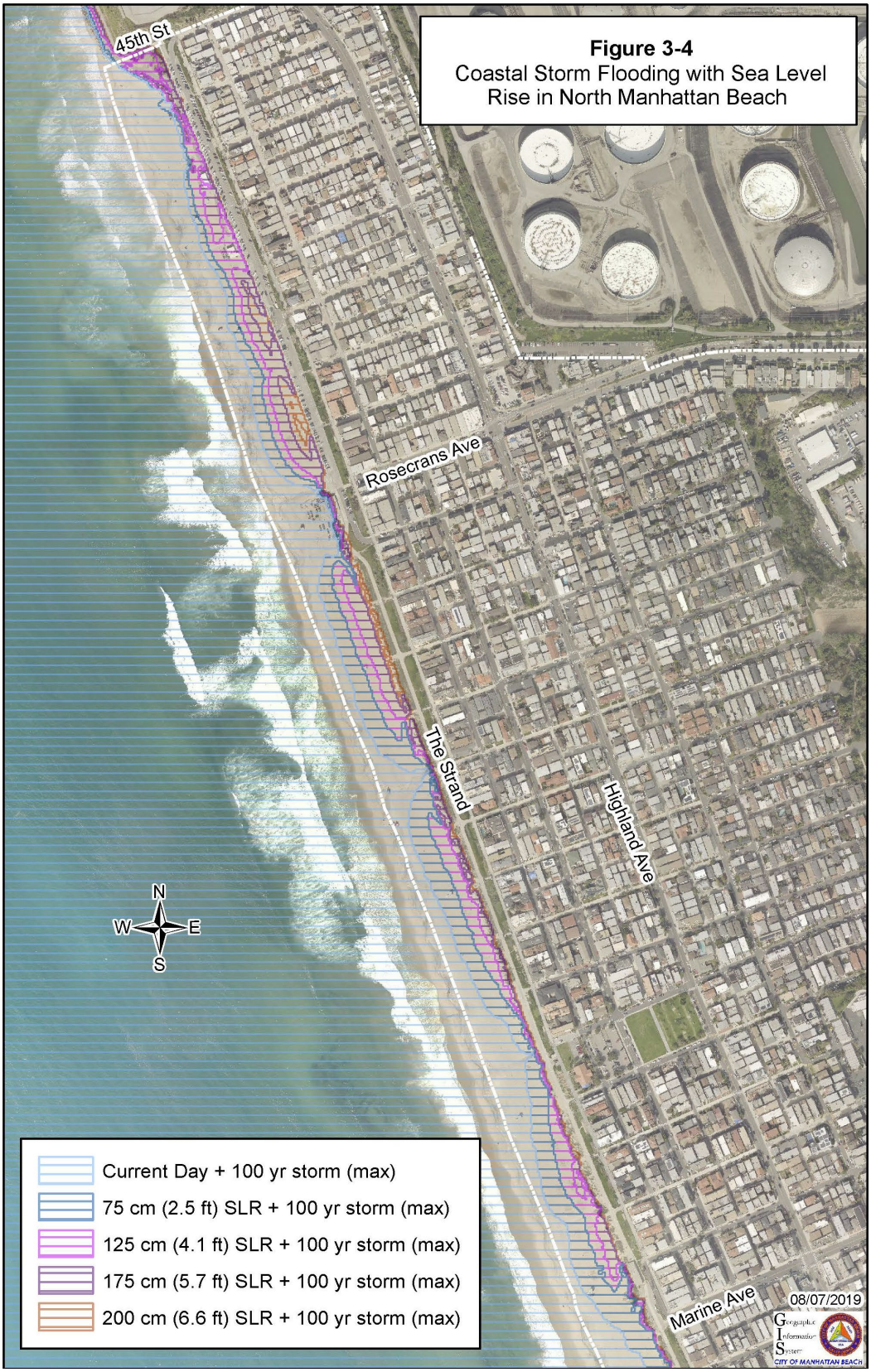

Figure 6. Visual representation of CoSMoS inundation scenarios considering SLR and episodic storm flooding in the North Manhattan Beach area. Figure replicated from ESA 2021.

Project Goals

This pilot project aims to restore approximately three acres of sandy coastal habitats located adjacent to Bruce's Beach in Manhattan Beach by utilizing existing sediments to transform a portion of the current beach into a sustainable coastal strand and foredune habitat complex with resilience to SLR. 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 MBDR project include:

1. Increasing the resiliency of the shoreline through the restoration of sandy beach and foredune habitat,
2. Implementing nature-based protection measures against SLR and coastal storms, and
3. Increasing engagement of the community through enhanced beach experiences, outreach, and education.

The project aims to encourage accretion of sand and increase dune elevation along the eastern portion of the beach through the use of native plants and seeds, sand fences, and wooden slats (biomimicry stakes). Restoration of a healthy coastal strand and foredune habitat complex will provide benefits to humans in the form of ecosystem services. Dune systems can provide ecosystem services, such as protecting against floods, tidal inundation and SLR, buffering erosion, carbon sequestration, and providing recreational opportunities and improved aesthetics. The project aims to engage the community through integration of pathways, interpretive signage, and opportunities for stakeholder engagement in project planning, implementation, and site tours.

The current condition of the site is shown below in Figure 7. 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, SLR. Intact and native dune systems are more resilient to disturbance than degraded systems. This project aims to enhance the existing dunes by replacing the iceplant and other invasive plants with native dune species as well as expanding the dune footprint seaward into areas that are currently groomed.

Iceplant is a creeping, mat-forming species that forms dense monocultures, causing a reduction in biodiversity, and competes directly with native species. It can alter hydrology, sediment movement, sediment chemistry, and have other impacts to native habitats. Native dune species are specially adapted to trap sand pushed onshore by waves and transported by the wind, keeping the sand on the beach. As native dune species grow, so will the dunes. Following iceplant removal and seeding and planting of native vegetation, sandy coastal strand habitats, foredunes, and back dunes would develop, which will then support higher levels of the ecological community (e.g., invertebrates, birds) and form a natural defense against SLR and coastal erosion. 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. 2007). 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 pilot project site will also serve as a model for the region, providing an opportunity to evaluate whether heavy recreational use of beaches and mean ingful habitat restoration are compatible 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” nature-based, low-cost natural living shoreline protection from sea level rise and storms while providing public benefits and enhancing natural resource values. This pilot project will inform the City’s climate adaptation strategies being developed as a part of the Climate Action and Adaptation Plan.

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 nesting birds, this project will encourage nature-based tourism and increase community awareness of living shorelines while still allowing all other existing recreational uses of the beach to continue. All of these benefits are expected while having low-to-no impact on existing recreational uses of the beach.

This project is led by The Bay Foundation (TBF) and would not be possible without support from three primary project partners: the City of Manhattan Beach (landowner), LACDBH (landowner and manager), and the California State Coastal Conservancy (funder). 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 stakeholders involved with this project, including many who contributed valuable information to the planning and public process: Robert Dorame, who is the Tribal Chair and Most Likely Descent of the Gabrielino Tongva Indians of California and represented the Gabrielino-Tongva Tribal Nation as a Tribal Consultant, US Fish and Wildlife Service, Los Angeles Audubon Society, El Segundo Blue Butterfly Coalition, Manhattan Beach Botanical Garden, Santa Monica Bay Audubon Society, United States Geological Survey, University of Southern California Sea Grant Program, Loyola Marymount University’s Coastal Research Institute, Manhattan Beach Sustainability Task Force, University of California Santa Barbara, Cooper Ecological Monitoring, Inc., Coastal Restoration Consultants, Inc., Heal the Bay, US Environmental Protection Agency, Climate Resolve, RIOS Clementi Hale Studios, Resource Conservation District of Santa Monica Mountains, and local residents and visitors to the site. Several presentations were also made and feedback incorporated from Manhattan Beach’s City Council.

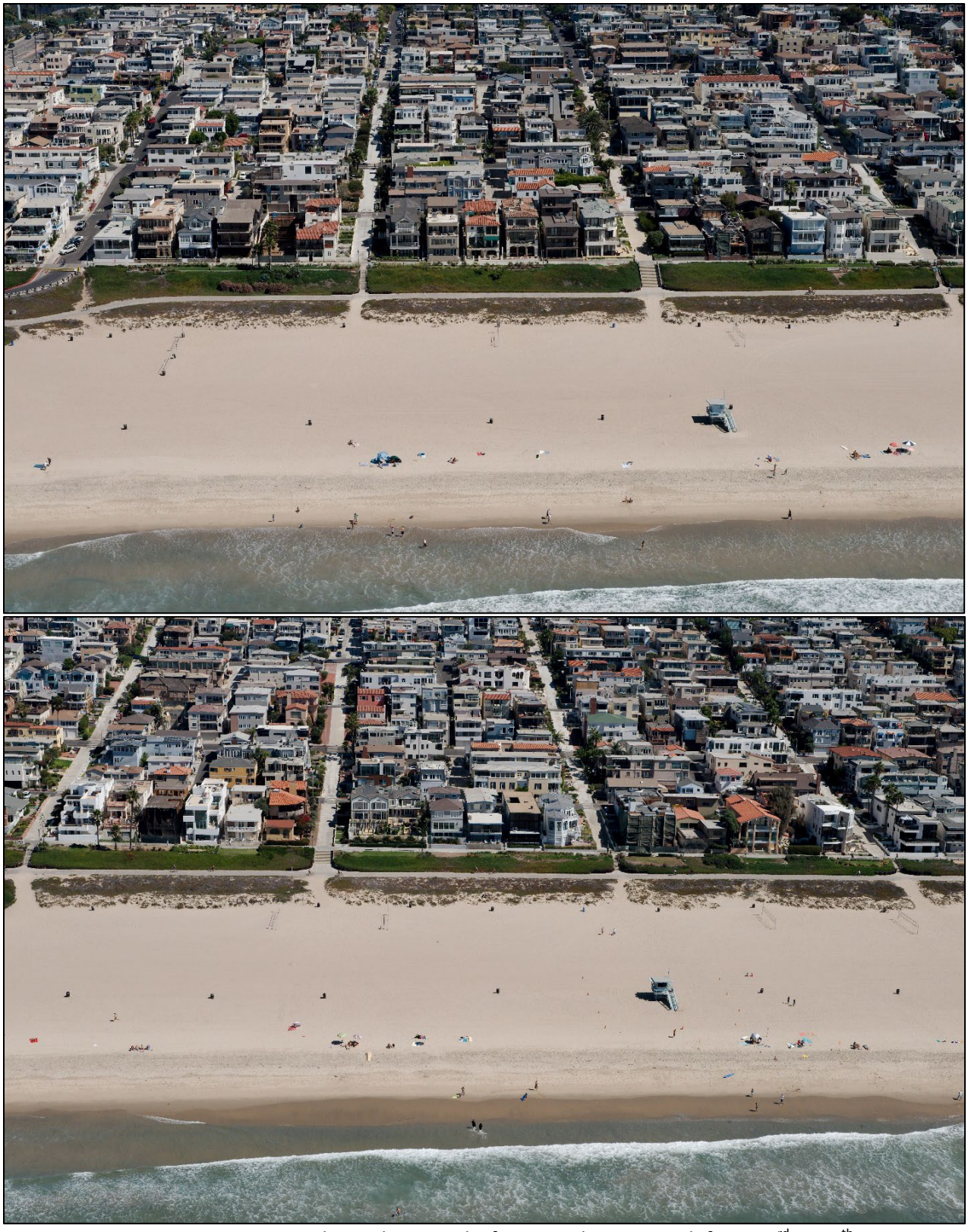

Figure 7. Representative 2013 aerial site photographs from Manhattan Beach from 33rd to 36th street (top) and from 29th to 32nd street (bottom) (courtesy California Coastal Records Project, accessed 10 May 2021).

Site Description and Baseline Data

The project site is along the Manhattan Beach shoreline, adjacent to Bruce's Beach, and is owned by the County of Los Angeles and City of Manhattan Beach and actively managed by LACDBH. The proposed project area consists of a 3.15-acre band of existing dunes lining the shoreward perimeter with unvegetated beach access pathways running east to west and a small portion of currently groomed beach at the foot of the dune (Figure 8, Figure 9). The existing dunes are currently dominated by a monoculture of invasive, non-native iceplant that provides little habitat value (Russel et al. 2009, Figure 9, Figure 10). The iceplant is sparser in the foredune, with some areas of open sandy dune, and grows denser towards the back dune, which is largely stabilized (Figure 10). In addition, seven built and capped maintenance holes exist intermittently within the back dune area of the project footprint, and two stormwater outfalls are adjacent to the area, which are owned and maintained by the Los Angeles County Flood Control District (LACFCD) (Figure 11).

The beach seaward of the project area is managed by grooming activities conducted by LACDBH (Figures 12 and 13). This area includes volleyball courts, approximately 30 feet from the project footprint, and lifeguard towers The area also supports other types of beach recreation further seaward (e.g., Figure 14 and Figure 15). Directly landward of the proposed project area is a heavily used bike path, the Marvin Braude Bike Trail (Figure 16). Further inland, densely developed residential lots, commercial areas, and infrastructure are present, as well as a paved walking "Strand" (Figure 17). The restoration area extends from 23rd Street, to the south, to 36th Street to the north. The portion of the beach between 26th Street and 28th Street, seaward of the County Lifeguard Training Center, is not included in the scope of this project (Figure 8). This area is referred to as the 26-28 block throughout the document. This 26-28 block is comprised of some existing dunes and hummocks with patchy iceplant and native beach bur (*Ambrosia chamissonis*) and larger unvegetated expanses (Figure 18, Figure 19). This area is also used for vehicle access by the LA County lifeguards and LACDBH. The 26-28 block was not included within the restoration area due to planning by the City for a potential stormwater infiltration project in that location at some point in the future.

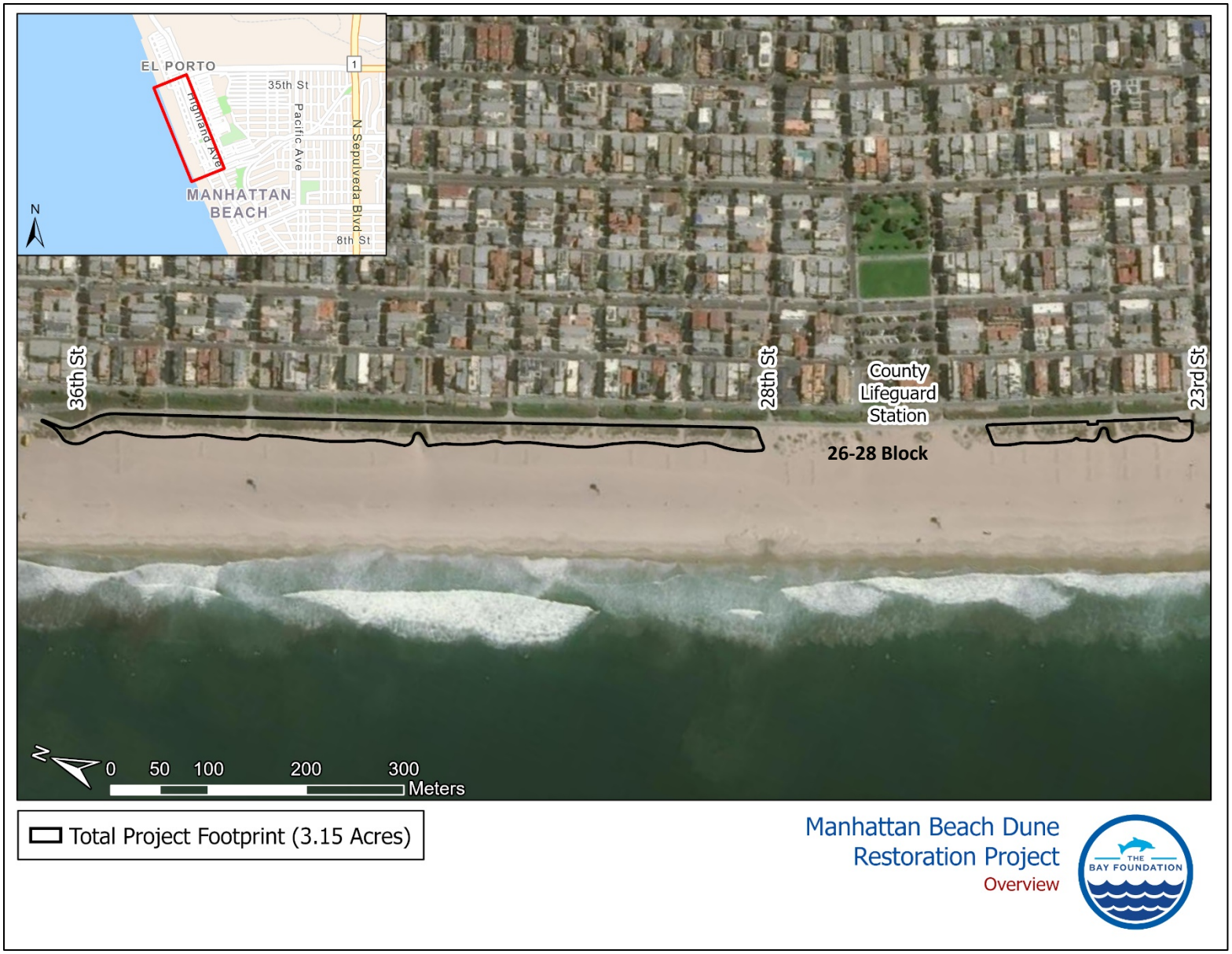

Figure 8. Overview map of the MBDR restoration area.

Figure 9. Representative photographs from project area showing iceplant dominated dunes (top) and beach access pathways (bottom).

Figure 10. Representative photographs from project area showing sparser iceplant cover in the foredune area (top) and denser cover in the backdune area (bottom).

Figure 11. Photos showing one of the seven maintenance holes within the project area (top) and one of the two outfalls adjacent to the area (bottom).

Figure 12. Photo of beach grooming activities oceanward of the project area.

Figure 13. Photo of beach grooming activities oceanward of the project area.

Figure 14. Photo showing volleyballs courts seaward of the site.

Figure 15. Photo showing lifeguard towers seaward of the site.

Figure 16. Photo showing frequently used bike path directly inland of the project site.

Figure 17. Photo showing dense residential development inland from the site.

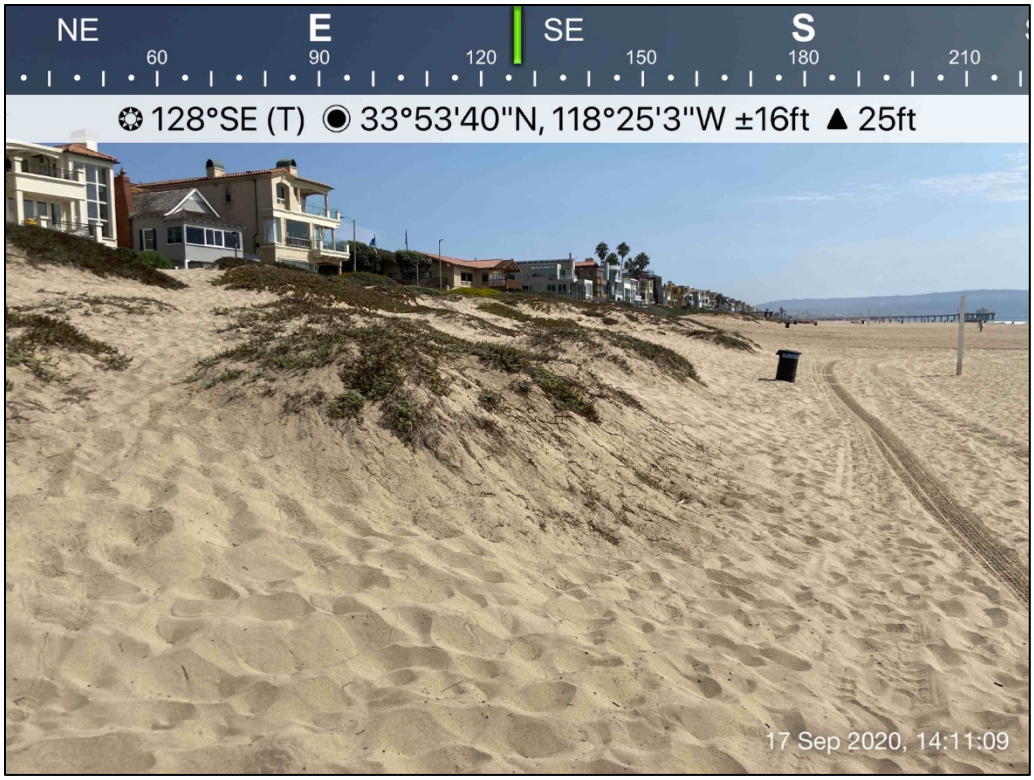

Figure 18. Photo of dune hummocks with patchy iceplant and some native beach bur in 26-28 block area outside of the project footprint (between 26th Street and 28th Street).

Figure 19. Photos of 26-28 block area outside of the project footprint (between 26th and 28th Street).

Survey Methods

To characterize existing vegetation and topographic variability at the site, fieldwork was conducted on 5, 11, and 13 August 2020 (Figure 20). Data were collected for a variety of survey protocols, 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, and inform an analysis of opportunities and constraints 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 were taken at 10 stations. The full suite of photographs will be available in future monitoring reports for comparative analysis, but representative pictures are incorporated into this document. Figure 21 displays an overview of the restoration and control monitoring areas. The baseline assessment of vegetation cover and physical characteristics will allow for comparison between restoration and control transects over time (pre- vs. post-restoration).

Vegetation cover and elevation were measured along ten transects: four 30-meter transects (T1, T5, T6, T7), and two 100-meter transects (T4 and T10) running approximately east to west, two 50-meter transects running approximately north to south (T2 and T9), and two 12-meter transects (T3 and T9) also running east to west targeted down access pathways. Transects were established in targeted areas to best capture ambient on-site conditions. T7 is located outside of the project footprint in the 26-28 block area between the northern and southern portions of the project area (Figure 22). At the time of baseline data collection, this area was tentatively planned to be included in a future restoration phase. While this area is no longer part of the scope of this project, data were included in the analyses to best characterize the contiguous dune system. Eight control transects were also established in the area to the south of the project footprint. Control transects include two 30-meter transects (C1 and C3) and two 100-meter transects (C2 and C6) running east to west, two 50-meter transects running north to south (C4 and C7), and two 12-meter transects (C5 and C8) running east to west along the access pathways. Figure 21 displays the restoration and control monitoring areas and Figures 22 and 23 display maps of the final restoration and control monitoring transects, respectively.

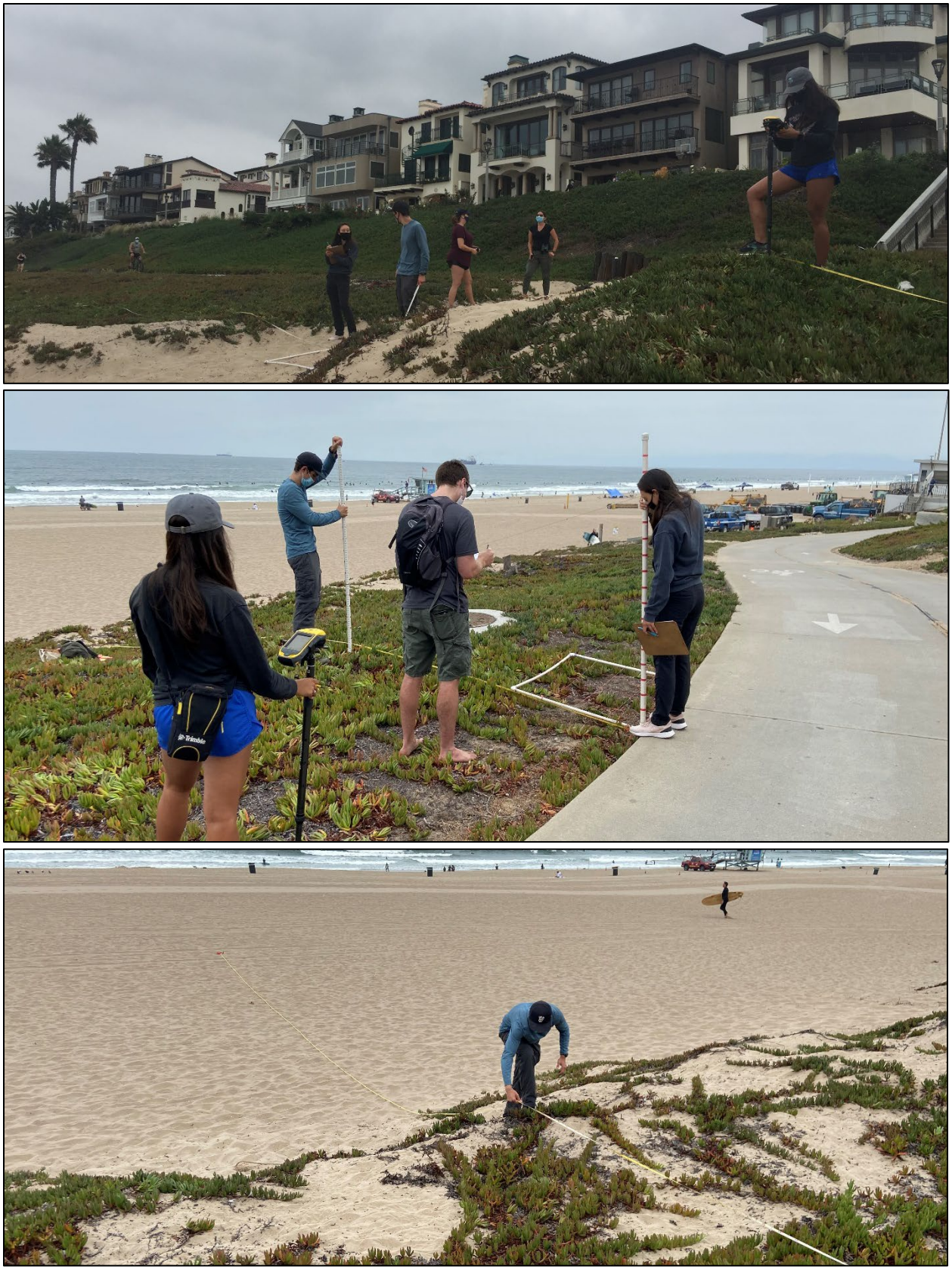

Figure 20. Photos of The Bay Foundation staff conducting baseline monitoring in August 2020.

Figure 21. Overview of restoration and control monitoring areas.

Figure 22. Map of restoration monitoring transects.

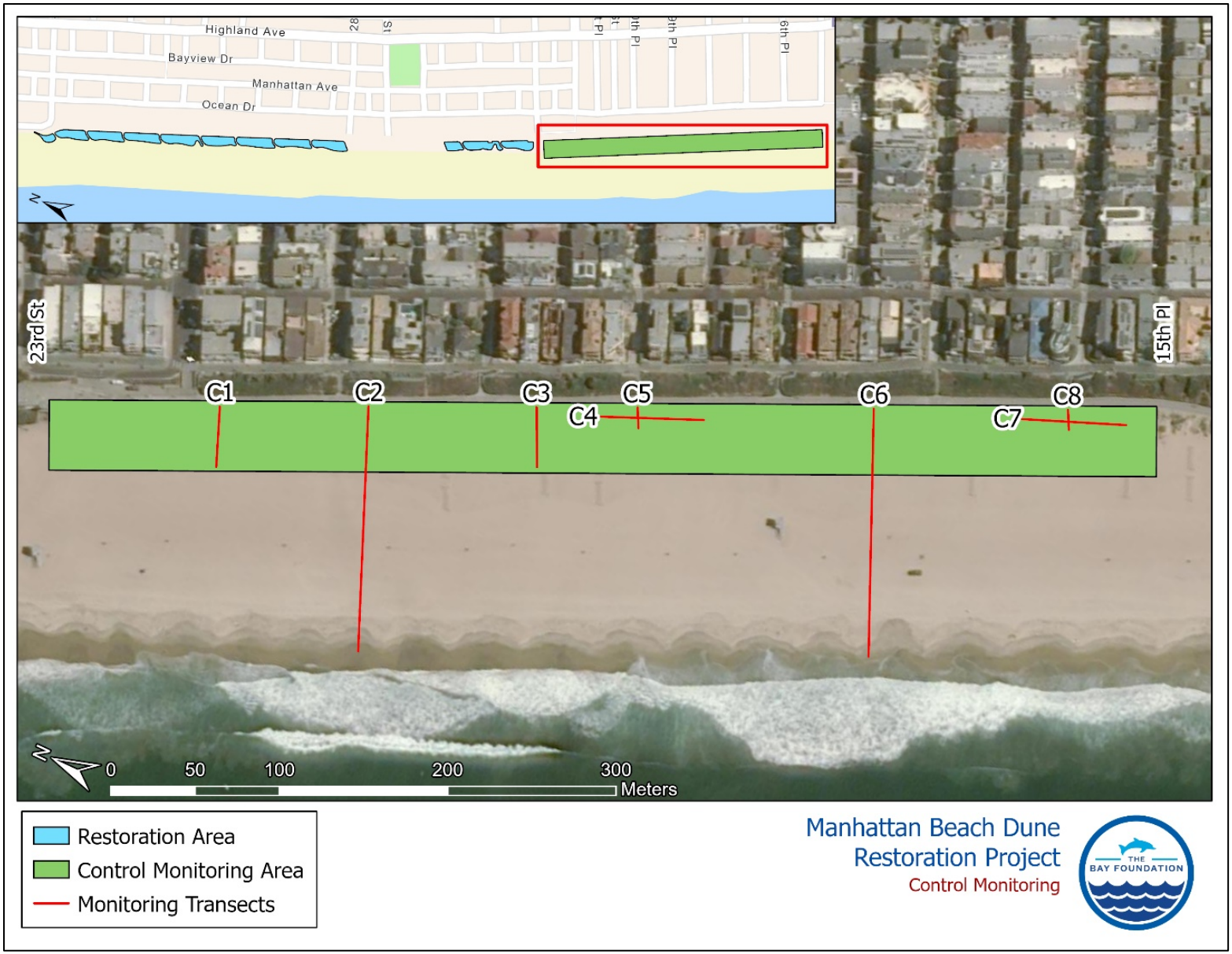

Figure 23. Map of control monitoring transects.

Table 1 displays monitoring protocols conducted for the baseline assessment. Line-intercept transect and cover class quadrat survey methods were used to assess vegetation cover. 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) and are useful for characterizing patchy habitats with substantial bare ground. Data were evaluated as percent cover by species. The estimated relative percent cover was calculated using the line-intercept transect data. To determine relative percent cover of all species present within each transect, line-intercept data were summed by species and divided by the total length of the transect occupied by vegetation. Species were characterized as native and non-native and the relative non-native percent cover within each transect was calculated by summing the length occupied by non-native species and dividing by the total length of the transect occupied by vegetation.

Additionally, vegetation mapping was conducted to further characterize the project and control areas. The absolute percent cover was calculated using the vegetation mapping data. Absolute percent cover refers to the percent of the total area occupied by a given species. The vegetation mapping protocol uses a combination of aerial imagery, high-resolution Trimble GPS, and in-situ observations to delineate polygons depicting species composition. To calculate the absolute percent cover of all species present within each polygon, the area occupied by a given species was divided by the total polygon area. Similarly, species were characterized as native or non-native and the absolute non-native percent cover within each polygon was determined by summing the area occupied by non-native species and dividing by the total polygon area. Both vegetation cover surveys and vegetation mapping are described in detail in SOP 3.2 Vegetation Cover Surveys (TBF 2015b) and SOP 3.5 Vegetation Mapping (TBF 2015c), respectively. Furthermore, elevation profiles were collected using a combination of elevation poles and a Trimble GPS and wildlife presence by species was identified and recorded.

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
Wildlife Presence	Visually identified wildlife present during all surveys

Results

Figures 24 and 25 display additional representative photographs of the project area. Photos show the existing dunes covered in non-native iceplant, scattered native plants and unvegetated beach access pathways cutting through the dunes. Figure 27 displays relative non-native cover for all restoration and control transects from line-intercept surveys. Transects running down beach access pathways (T3, T9, C5, and C8) were entirely unvegetated. Nearly all remaining transects were dominated by non-native cover. Only T7, located in the 26-28 block outside of the project footprint, was predominantly native cover (Figure 26). Figure 27 exhibits relative percent cover by species for all transects. Non-native iceplant comprised 85.0% of all vegetation cover. Native beach bur (13.0%) was found to be the second most common species within the restoration and control areas. The only other native species detected

along transects was beach evening primrose (*Camissoniopsis cheiranthifolia*; 0.6%). Non-natives besides iceplant included various non-native grasses (0.8%), sea rocket (*Cakile maritima*; 0.4%), and crown daisy (*Glebionis coronaria*; 0.3%).

The vegetation mapping results identified a similar pattern as the transect surveys, with large areas of high absolute non-native cover dominated by iceplant and small scattered patches of native cover. (Figures 28 and 29). Most areas with zero non-native cover on the seaward edge of the project footprint are on groomed beach outside of the current dune footprint (Figures 28 and 29). The 26-28 block outside of the project footprint was omitted from the vegetation mapping figure; however, field observations, aerial imagery, and cover surveys showed less iceplant and higher native cover, primarily consisting of beach bur. Part of this area is unvegetated from the bike path down to the beach and is used for vehicular access for LA County Lifeguards and other beach management operations. Additional species recorded in vegetation mapping included native annual Canadian horseweed (*Erigeron canadensis*) and non-native sow thistle (*Sonchus oleraceus*). Appendix 1 includes a full list of plant species encountered during field work.

Figure 24. Representative photograph of the project site along the bike path showing existing dunes dominated by non-native iceplant, with low density presence of native beach evening primrose (bottom).

Figure 25. Representative photo of the project site showing an unvegetated beach access pathway and existing dunes. The project site has a wide, groomed beach and a narrow strip of dunes with iceplant and scattered other non-native and native plants.

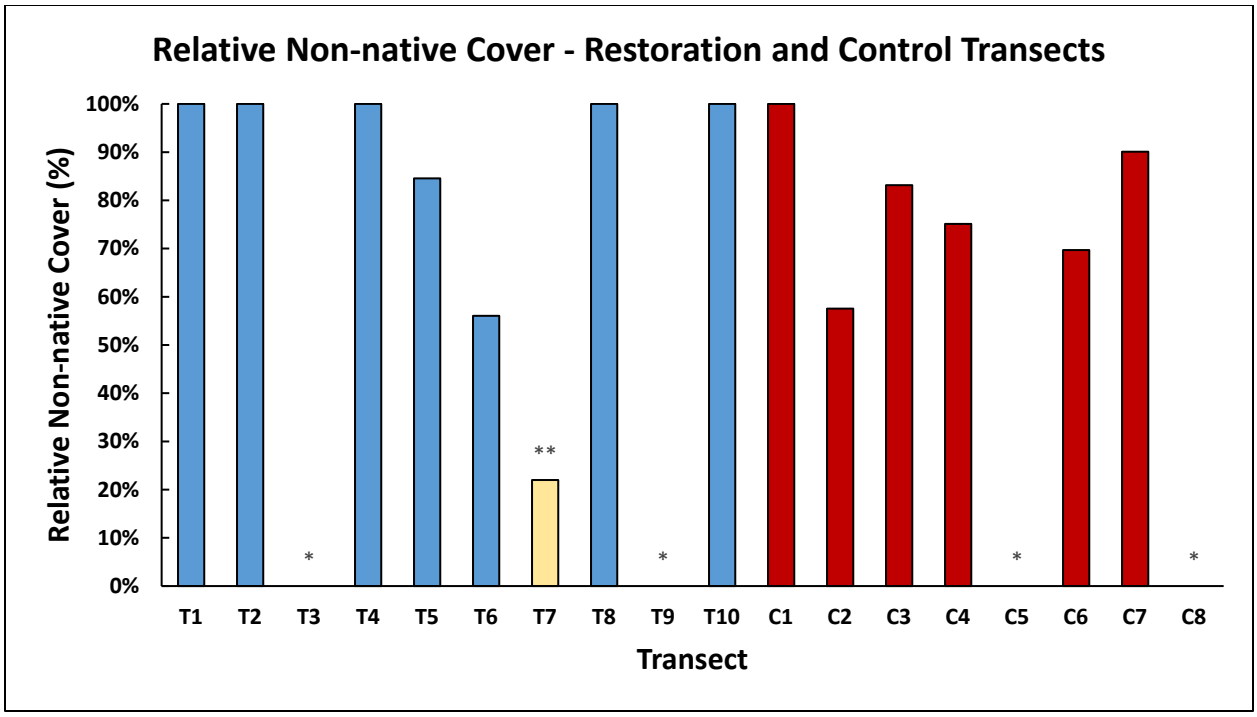

Figure 26. Relative non-native cover for all restoration (blue) and control transects (red) using the line-intercept method. A single asterisk (*) indicates an unvegetated beach access path. A double asterisk (**) indicates a transect with predominately native vegetation in the 26-28 block dune area outside of project footprint (yellow bar).

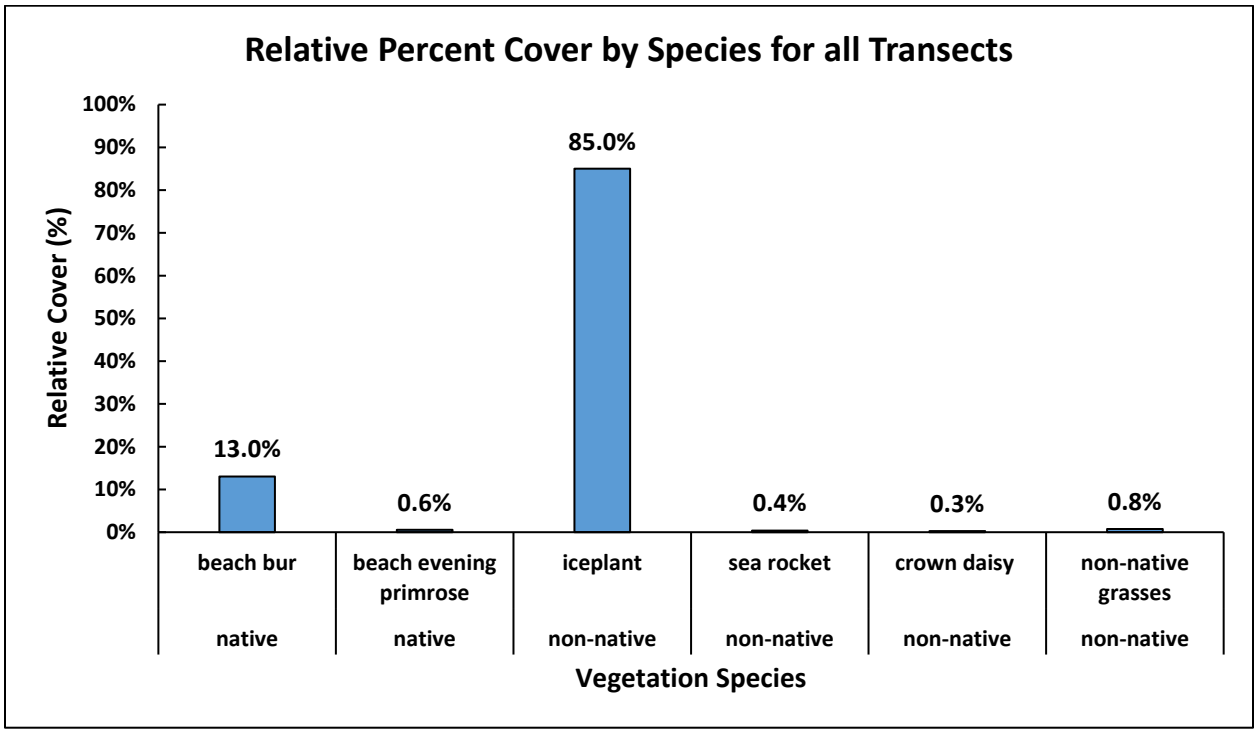

Figure 27. Relative percent cover by species for all transects using the line-intercept method.

Figure 28. Vegetation mapping results showing absolute percent non-native cover between 36th and 32nd Street (top) and between 32nd and 28th Street (bottom).

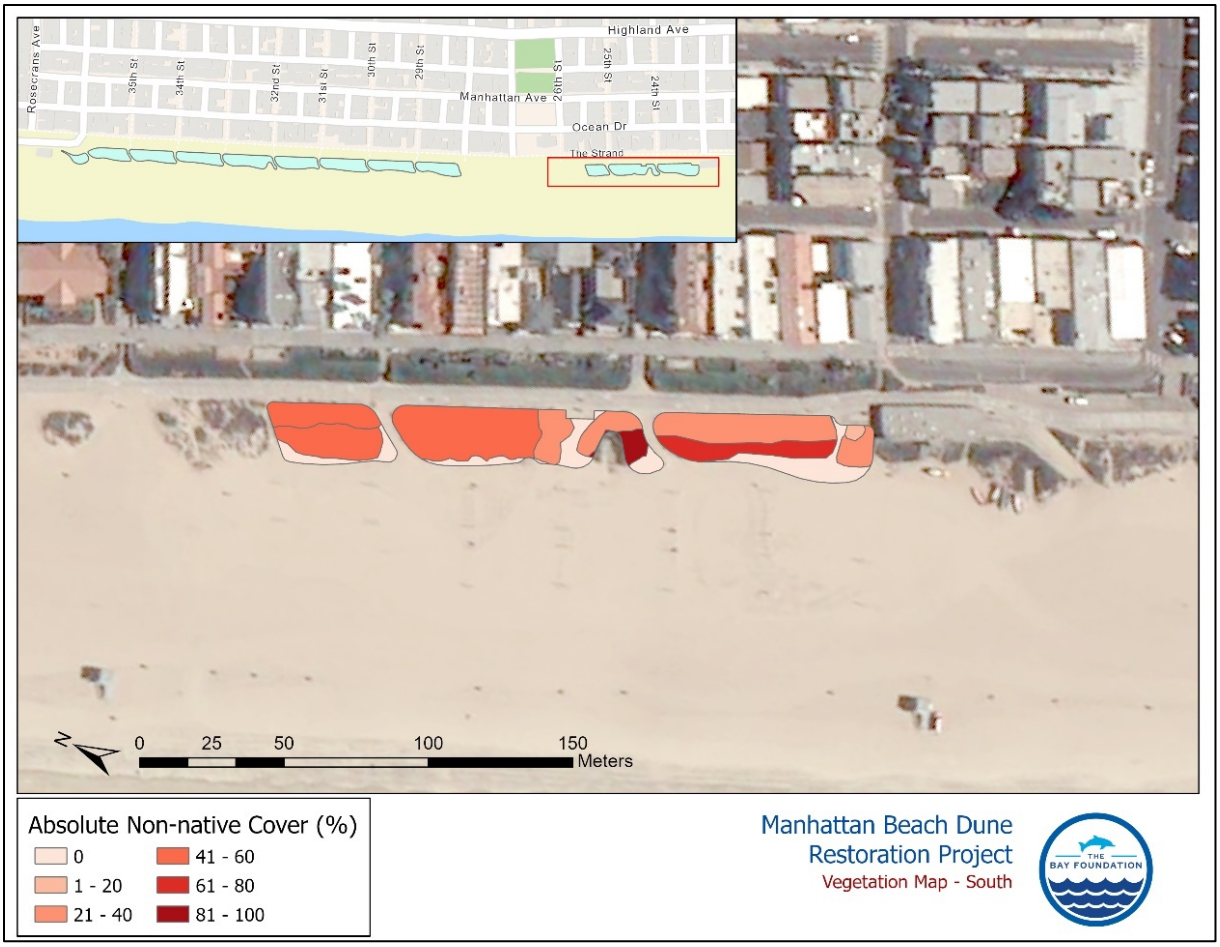

Figure 29. Vegetation mapping results showing absolute percent non-native cover between 23rd and 26th street.

Figure 30 and Figure 31 display beach elevation profiles for 30-meter transects running east to west from the bike path to the dune foot (Figure 30, top), 50-meter transects running north to south through existing dune area (Figure 30, bottom), 12-meter transects running east to west down access pathways (Figure 31, top), and approximately 120-meter transects running east to west from the bike path to the waterline (Figure 31, bottom). The 30-meter transects showed a steady decline in elevation, with varying dune topography, from the bike path to the dune toe and flattened out at the sandy beach. Control transects displayed a steeper decline than transects located within the project area (Figure 30 top). The 50-meter transects, oriented north to south in the existing dunes, showed an undulating topography in both restoration and control transects (Figure 30 bottom). Transects located down access pathways exhibited a relatively flat and steady decline down from the bike path to the sandy beach (Figure 31 top). The lack of topography is consistent with the unvegetated and heavily foot-trafficked nature of the pathways. Transects running from the bike path to the waterline displayed topography in the existing iceplant dominated dune area similar to the 30-meter transects. Once past the dune toe, the elevation profiles showed a steady decline seaward, with a steeper drop off at the berm down to the water line (Figure 31 bottom).

Additional georeferenced photo point pictures of the project area can be found in Appendix 2. Photos support results of the vegetation cover and elevation surveys, depicting existing degraded dunes dominated by invasive iceplant with some intermittent patches of native cover.

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, one crustacean, four fish, 16 insects, 12 mammals, one mollusk, seven reptiles, 68 vascular plants, and six terrestrial vegetation communities. 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.

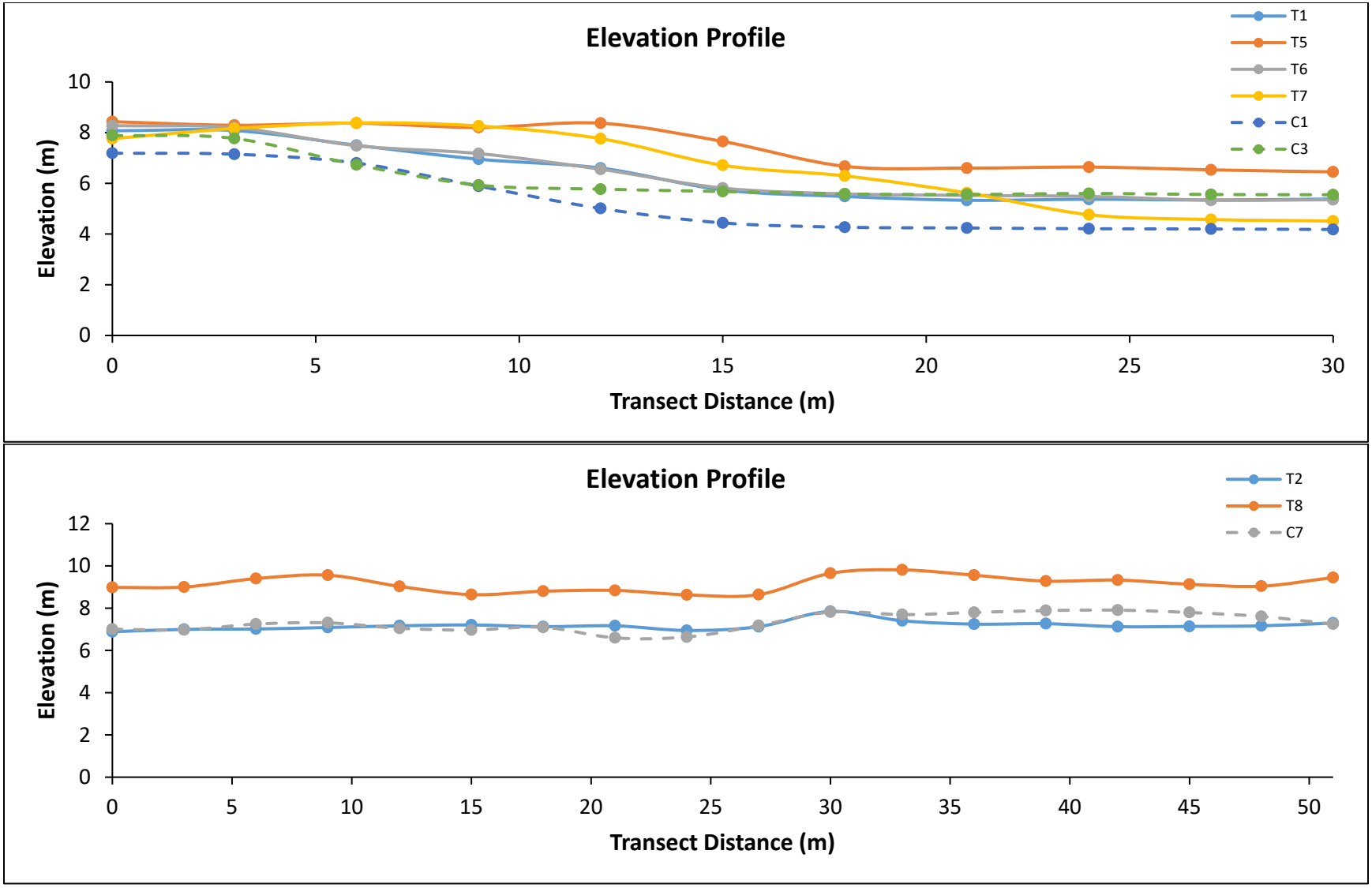

Figure 30. Elevation profiles for 30-meter transects running perpendicular to the shoreline, east to west (top) and 50-meter transects running parallel to the shoreline, north to south (bottom). The solid line indicates restoration transect and dotted line indicates a control transect (Elevation in NAVD88). Note variable x- and y-axis ranges.

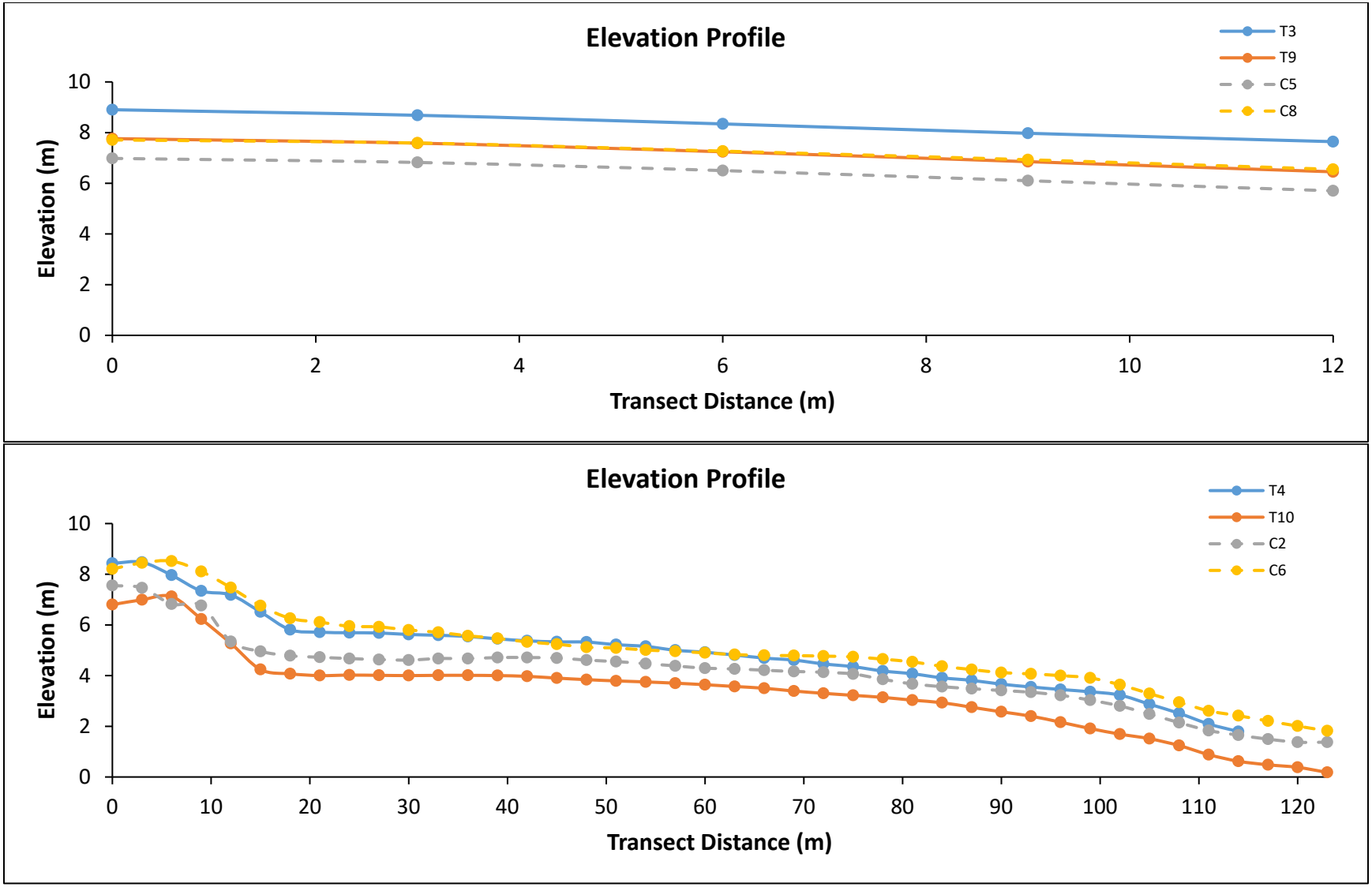

Figure 31. Elevation profiles for 12-meter transects running down current access pathways (top) and transects running east to west all the way to water's edge (approximately 120 meters; bottom). The solid line indicates restoration transect and dotted line indicates a control transect (Elevation in NAVD88. Note variable x- and y-axis ranges.

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, adjacent 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 SLR and coastal storm erosion. Identification of these 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:

- The beach does not appear to be sand-starved, which suggests that there will be sufficient sand available for dune-building processes.
- The existing stabilized dune provides some initial resilience to SLR.
- The multi-habitat project, comprised of stabilized back dune and beach area, offers an opportunity for more diversity within the restoration footprint.
- The presence of some existing native coastal strand species on the dunes suggests native vegetation has the potential to thrive and that a native seed bank may be present in some capacity.
- Dune restoration in the form of seacliff buckwheat (*Eriogonum parvifolium*) offers the opportunity to provide potential habitat for the federally endangered El Segundo Blue Butterfly.
- Dune restoration may support additional birds and wildlife, including those with special status.
- The heavily recreated area offers educational opportunities on wildlife, coastal resiliency, and SLR.
- Restored dunes will offer an opportunity for visitors to learn about natural habitats on beaches and the pathways throughout the site will encourage organized site use, while minimizing disturbance.
- The site provides an opportunity for engagement of Tribal representatives for traditional ecological knowledge and restoration advising.

Site Constraints:

- Lifeguard access to facilities needs to be maintained.
- The site requires a minimum distance to be left between the restoration footprint and volleyball courts to allow for grooming, which limits the restoration area.
- The site is restricted by development; it is bordered by a paved bike path directly inland of the project site, volleyball courts directly seaward, and facilities upcoast and downcoast.
- There is a need to maintain access to maintenance hole covers within project site (extra pathways and entrances).
- There are two existing stormwater outfalls immediately adjacent to project site, which will require maintenance with heavy equipment.
- There is high cover of invasive iceplant along the existing dune that will need to be carefully removed to avoid erosion and disturbance to existing native species.
- The existing native plants present will need to be protected when removing non-native plants.
- The site is heavily recreated and adaptive management strategies (i.e., fence removal) will need to be considered.

Project Description

The project aims to restore 3.15 acres of impacted beach and dune habitat into a healthy living shoreline that will provide rare coastal habitat, ecosystem services, and adaptation measures for coastal storms and SLR (Figure 32). 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 implementation 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, SLR. Intact and native dune systems are more resilient to disturbance than degraded systems.

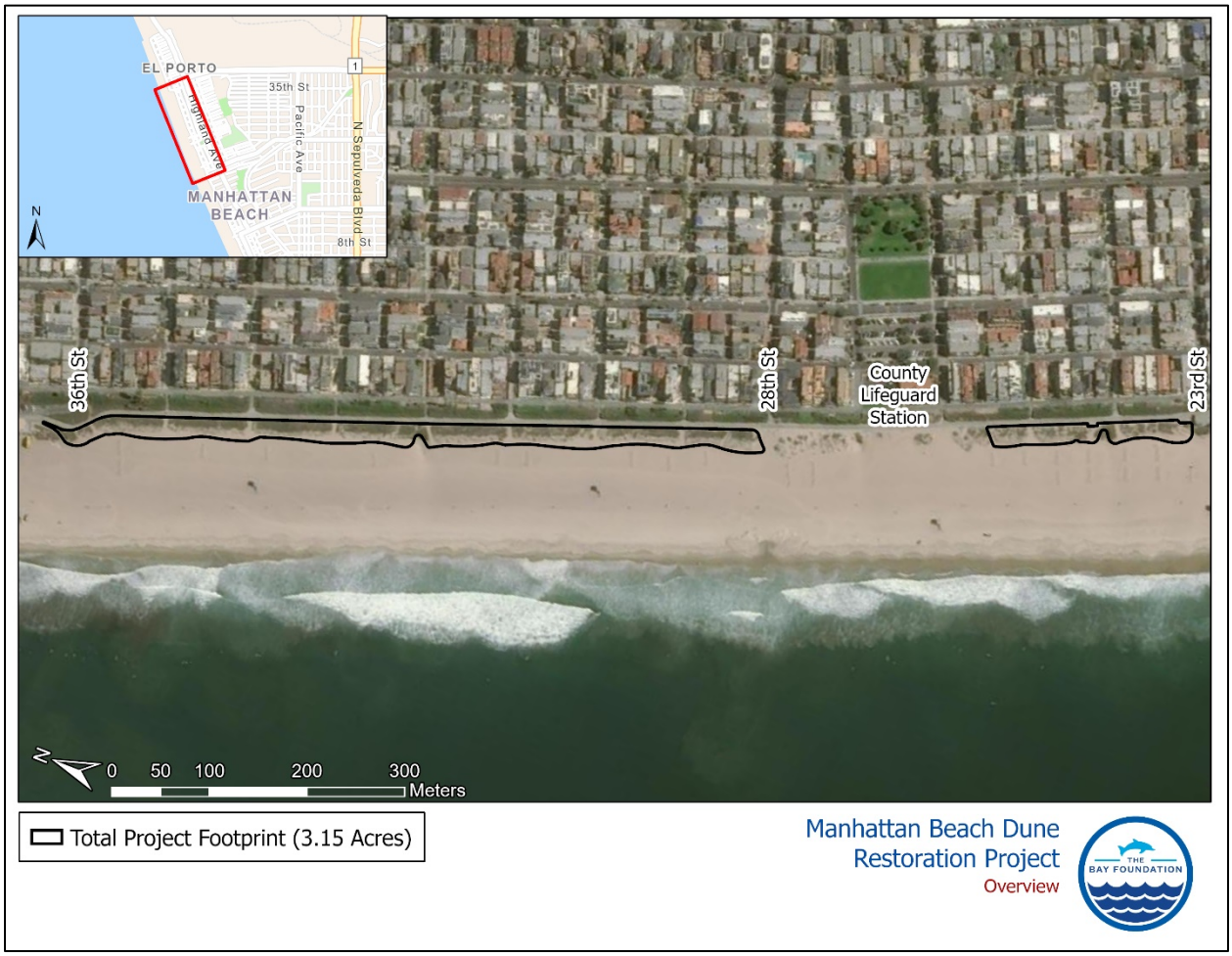

Figure 32. Overview of project area from 36th Street (north) to 23rd Street (south).

The proposed restoration site in Manhattan Beach has good potential for supporting more natural coastal habitats because they retain relatively intact coastal processes, e.g., wind transport, space, sediment flux. The existing degraded dunes are currently under pressure from non-native vegetation, mechanized grooming, and other impacts. However, the removal of non-native vegetation, replacement with native dune species, and restricting of grooming within the project area is likely to restore functioning dune processes.

This subsection contains summary information related to the project description for the restoration area, including the existing dunes, the proposed extension of the dunes seaward, and the access pathways. In addition, artistic perspective renderings of the site post-restoration are included in this section. Detailed implementation methods are outlines in the following report subsection.

Project Area and Restoration Approach Description

The existing dunes are currently predominantly covered in a monoculture of non-native iceplant, which is relatively sparser in the foredune area and grows denser toward mid-dune and back dune areas (Figure 33). Native species and other non-natives are also sparsely scattered throughout the site. The proposed project footprint includes an expanse seaward past the existing dune toe and vegetation line in a portion of the beach that is currently groomed (Figure 33). Furthermore, the site includes beach access pathways that perpendicularly cut through the site, which will be maintained for beach access. Restoration actions will include removal of iceplant and other non-natives, maintaining any existing native cover, planting and seeding of native foredune and back dune species, installation of sand fencing and biomimicry stakes (wooden slats) to promote dune growth in targeted areas, preserving all existing beach access pathways, and delineating pathways and dune restoration perimeters with symbolic post and rope fencing. A 5-ft grooming buffer and minimum 25-ft clearance for grooming equipment (30 feet total) will be left between the seaward post and rope edge and the volleyball courts. Additionally, access to maintenance holes will be maintained through accessible portions of post and rope fencing and unvegetated pathways (8-ft wide). Post and rope fencing will also wrap up and around, as to not include or restrict access to the two stormwater outfalls. A minimum width of 25 feet will be left between the north and south post and rope borders to allow access for equipment necessary for outfall maintenance needs.

TBF plans to engage the LACC and community volunteers in some components of the on-the-ground restoration. Community volunteers will only be engaged pending COVID-19 restrictions lifting by local and state agencies and the allowing of community events. Following 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 Manhattan Beach Botanical Garden. Photos showing the current conditions and artistic perspective renderings of the site post-restoration can be found in Figures 34 – 38, created by RIOS. Please see “Restoration Plan” section for more implementation specifics and detailed Site Plan.

Figure 33. Representative photos of the existing dunes on site.

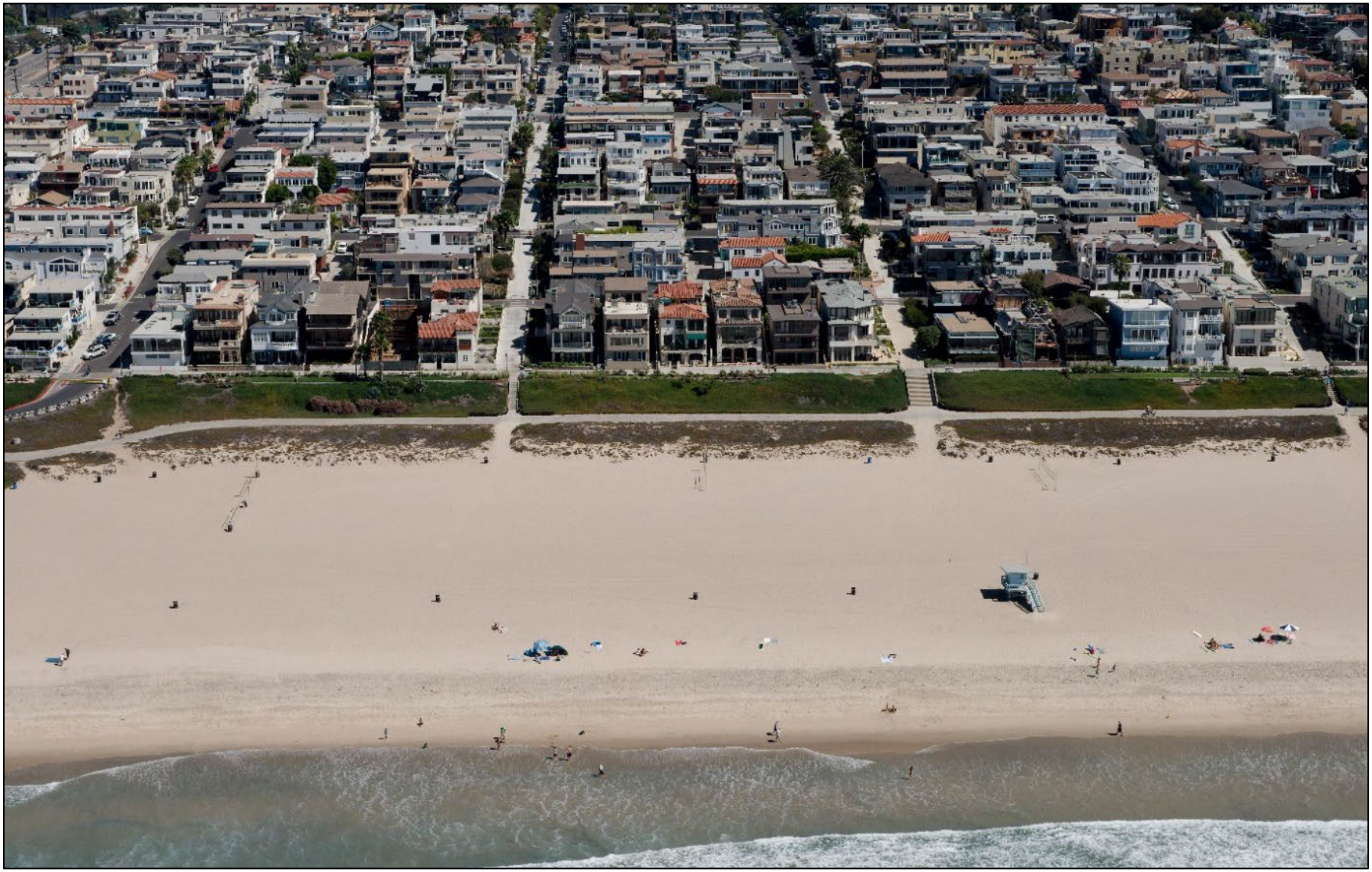

Figure 34. Aerial photograph of northern portion of the MBDR project area showing current conditions (courtesy CA Coastal Records Project).

Figure 35. Artistic rendering of northern portion of the MBDR project area five years post-restoration (credit: RIOS).

Figure 36. Photograph of project area (top) and artistic rendering five years post-restoration (bottom, credit: RIOS).

Figure 37. Photograph of project area (top) and artistic rendering five years post-restoration (bottom, credit: RIOS).

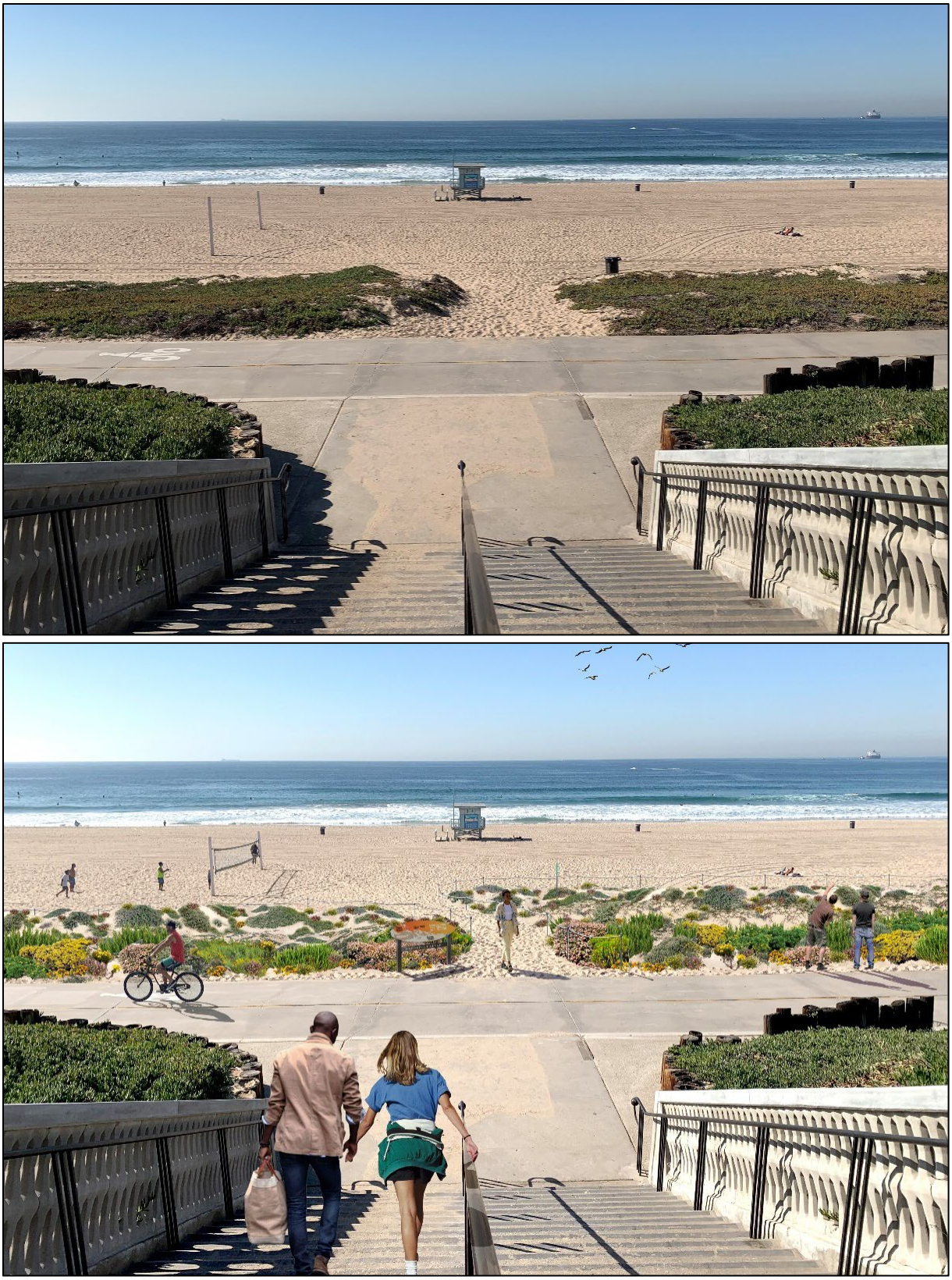

Figure 38. Photograph of project area (top) and artistic rendering five years post-restoration (bottom, credit: RIOS).

Coastal Processes

The seeded and planted specialized foredune vegetation will help to promote sand accretion and form dunes over time. Wind-driven sand will be trapped by the vegetation. Where plants capture sand, the surface will build up in elevation over time. In the early stages, this will create hummocks (mounds of sand under the plants). Eventually the hummocks may form larger consolidated dunes. Because coastal dunes build topography at rates that will exceed projected SLR in the near future, they can provide coastal resilience to SLR. This dune formation 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 areas of California, such as the Surfer's Point restoration project in Ventura County and the Santa Monica Beach Restoration Pilot Project in Los Angeles County.

Other important coastal processes, such as wave energy, vary seasonally and drive cycles of beach erosion and accretion. In southern California, higher wave energy contributes to erosion during the winter months. 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, like Manhattan Beach, have the capacity to regenerate vegetation cover and then re-build dunes by trapping wind-blown sand.

Permitting and Outreach

TBF, in coordination with City of Manhattan Beach and LACDBH, will obtain the necessary permits to implement the MBDR project. This document is part of TBF's application through the City of Manhattan Beach (in partnership with LACDBH) for a Coastal Development Permit (CDP) issued by the City of Manhattan Beach, and appealable by the California Coastal Commission. TBF will act as the Authorized Agent on the CDP application and LACDBH will act as the lead applicant, and TBF will be responsible for fulfillment of the CDP conditions. This project fits within City of Manhattan Beach's Local Coastal Program. While this project is California Environmental Quality Act (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 an 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 LACFCD permit through Public Works, due to the maintenance holes located within the project boundary and stormwater outfalls directly adjacent. This document will be an integral component of both the ROE permit amendment and LACFCD permit applications.

TBF and project partners have meaningfully engaged stakeholders and members of the public throughout the restoration planning process and coordination is ongoing to identify future outreach opportunities. Three webpages were created for the MBDR project, including the main project page on TBF's website, a Frequently Asked Questions page on TBF's website, and a page on the City of Manhattan Beach's website associated with their climate vulnerability and adaptation strategies. TBF and project partners have engaged the public, students, stakeholders, and other project partners through over 25 presentations at public meetings, several on site tours, remote workshops, conferences, and podcasts (Figures 39 and 40). Public meetings have included several presentations and updates at Manhattan Beach City Council meetings and committees, such as the Sustainability Task Force and the LA County Beach Commission.

To solicit project feedback during a time of COVID-19 restrictions on in-person events, TBF initiated and released an innovative remote community engagement tool — an interactive community video survey – in collaboration with Tank Brain Productions, where community members were asked what they cherished about Manhattan Beach and for their perspectives on the importance of protecting and restoring beaches in the face of sea level rise and climate change (Figure 41). A summary of video responses from the 31 participants is available here. In addition, TBF hosted two Virtual Public Workshops, where the 34 participants learned about the project through a brief presentation and had the opportunity to ask questions and provide feedback. Comments included suggestions for the plant palette that were later incorporated into the restoration design elements and one of the primary questions asked was, "How can the community get involved?" The project received 100% public support across both workshops and through the video response tool in response to a poll question asking if attendees "…support the idea of the Manhattan Beach Dune Restoration project to improve coastal resiliency". Both workshop participants and those who used the video tool provided valuable feedback that was incorporated into project planning and restoration design elements (e.g., plant palette, suggestions for interpretive signage, recreational and partner needs, etc.).

TBF also engaged a Tribal consultant, Robert Dorame, who is the Tribal Chair and Most Likely Descendant of the Gabrielino Tongva Indians of California, to help inform the planning and design elements. The project has also been featured by local news outlets and on social media by TBF and the City. Collaborations and meetings with key project partners (e.g., SCC, City of MB, LACDBH), scientific advisors (e.g., UCSB, USC, Coastal Restoration Consultants), stakeholders (e.g., Manhattan Beach Botanical Garden, Audubon Society, El Segundo Blue Butterfly Coalition), and the public will continue to finalize tasks necessary to successfully implement 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., California Coastal Commission, California State Coastal Conservancy, California State Parks, USFWS, US Environmental Protection Agency, California Department of Fish and Wildlife, etc.). All annual reports for this project will be made publicly available on The Bay Foundation's website: www.santamonicabay.org.

Figure 39. Announcement for the virtual public workshop that engaged 34 participants who shared valuable project feedback.

Figure 40. Manhattan Beach Dune Restoration project public tour (conducted in January 2020 prior to COVID-19 restrictions).

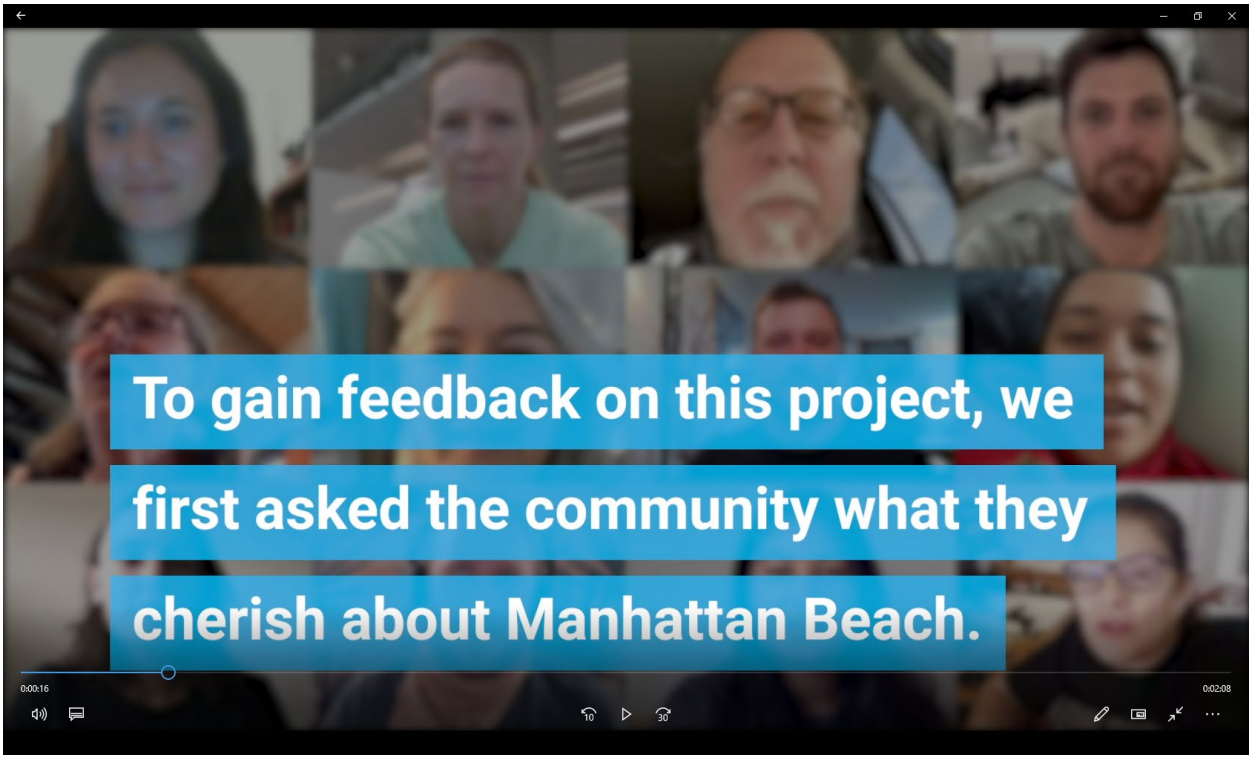

Figure 41. Screenshot from summary video of interactive community video survey comprised of public comment.

Restoration Plan

Through habitat restoration, interpretive signage and symbolic post and rope pathways, 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. Figure 42 displays the project's conceptual design and Figures 43 – 46 show a detailed site plan map with project implementation components. Sand fencing and biomimicry stake plots in the site plan are approximate in size, quantity, and location. Their final location will be dependent on in situ field conditions during implementation. 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 fall 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: Manhattan Beach Dune Restoration Project - The Bay Foundation (santamonicabay.org).

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

1. Increase the resiliency of the shoreline through the restoration of sandy beach and foredune habitat;
2. Implement nature-based protection measures against SLR and coastal storms; 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 iceplant and other non-native plants;
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 improved pedestrian pathways through dunes; and
5. Engage the public through interpretive signage and educational tours.

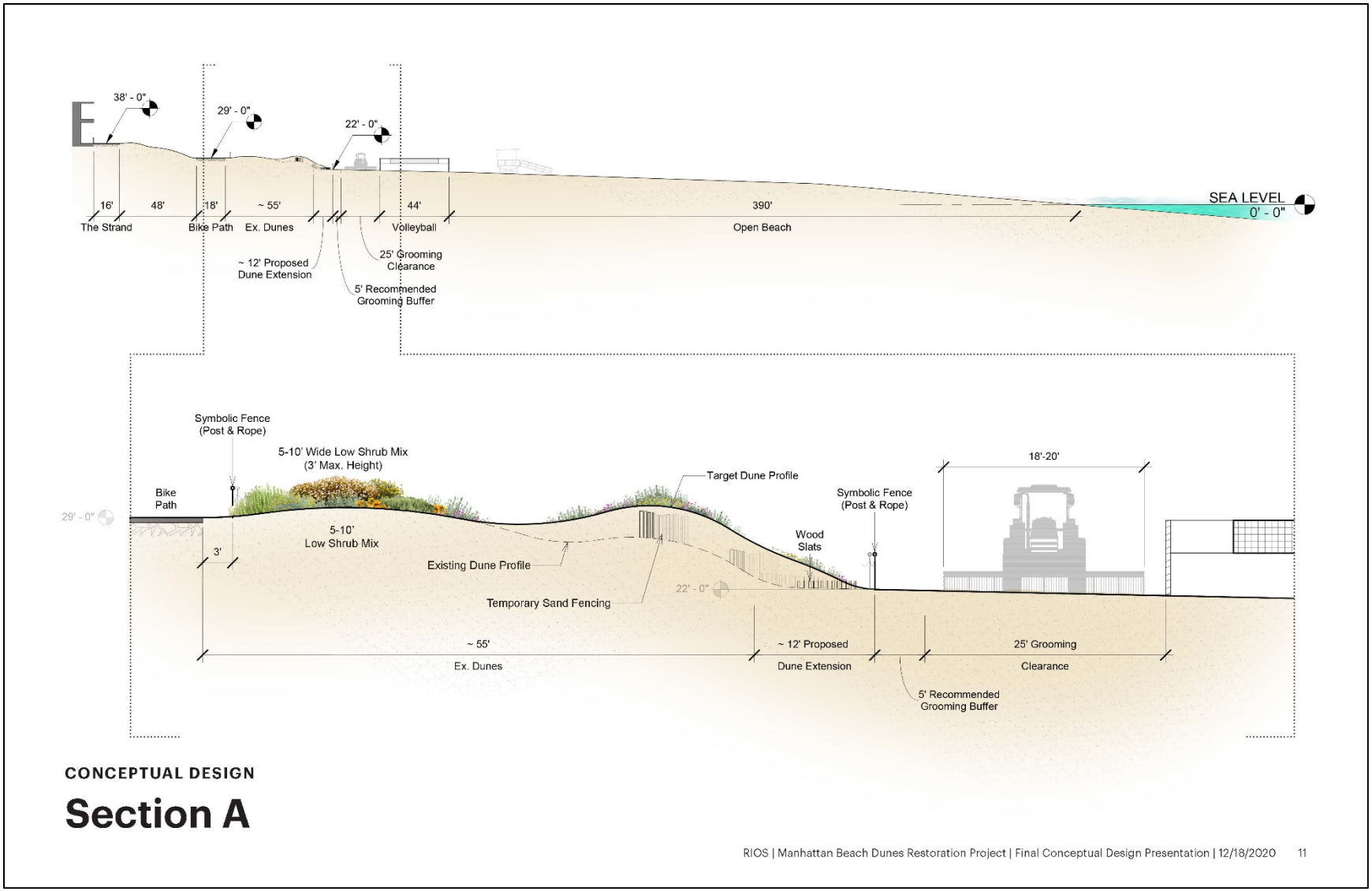

Figure 42. Conceptual design of the project (RIOS and CRC 2020).

Figure 43. Project site plan (block 1 of 4) from 34th to 36th Street.

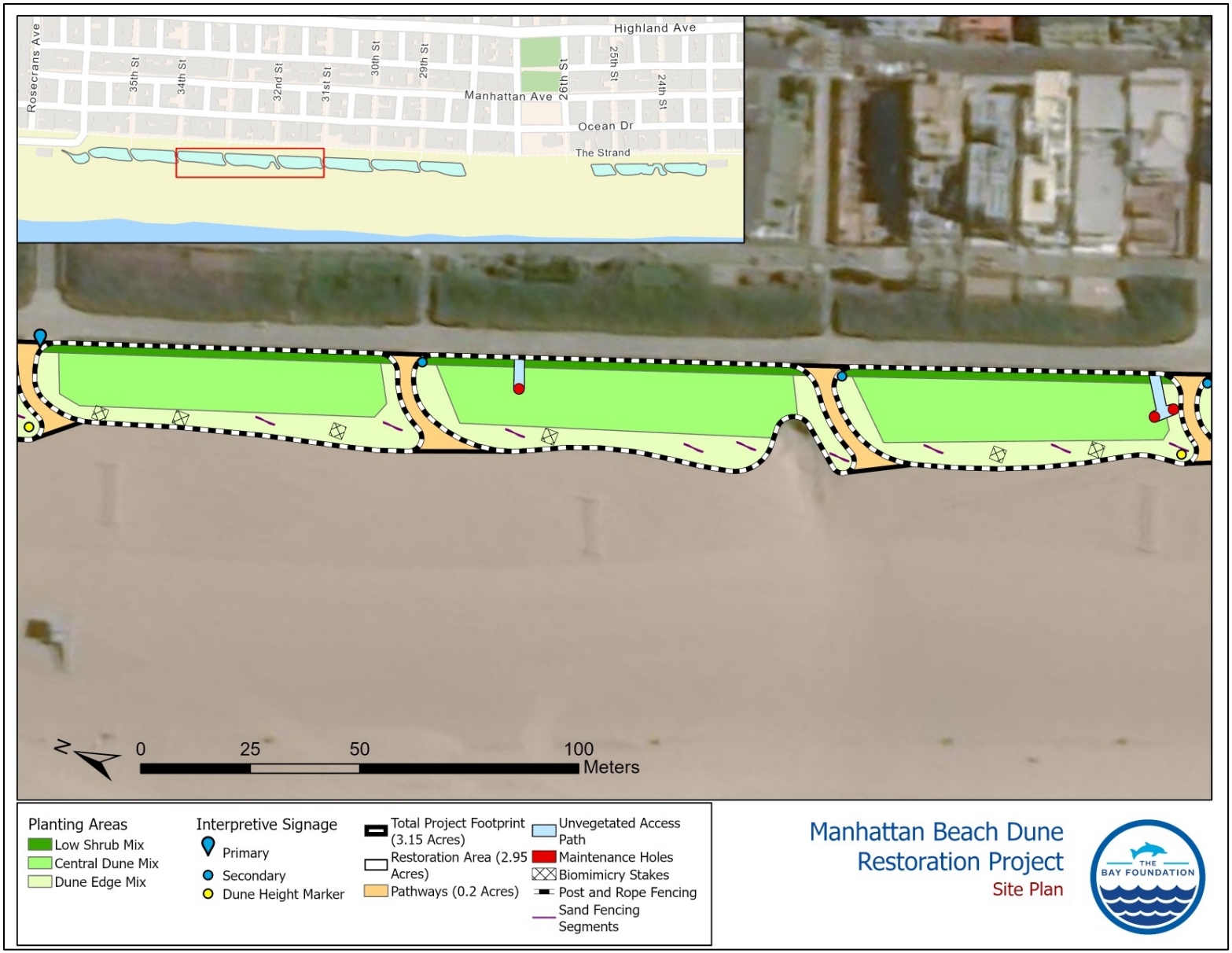

Figure 44. Project site plan (block 2 of 4) from 31st to 34th Street.

Figure 45. Project site plan (block 3 of 4) from 28th to 31st Street.

Figure 46. Project site plan (block 4 of 4) from 23rd to 26th Street.

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 MBDR project site in mind. Approaches include symbolic perimeter fencing and pathways, beach 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 and Symbolic Pathways

Boundaries will be defined at the site using symbolic fencing. Symbolic post and rope fence will be installed around the perimeter of the dune restoration area and will also delineate beach access pathways. This perimeter establishment will serve several purposes, including delineating areas to be restricted from mechanical grooming, encouraging safe recreational activities, and minimizing excessive disturbance to the dune areas, especially during establishment. A 3-ft buffer will be left between the bike path and landward post and rope edge, so the public can safely stand to the side to enjoy the project area. Additionally, a 5-ft grooming buffer and minimum 25-ft clearance for grooming equipment (30 feet total) will be left between the seaward perimeter and the volleyball courts to avoid constraints on grooming activities. The post and rope fence will be no more than three feet in height to improve visibility and designed to be removable in the event of significant storm events or emergencies. The fenced area will be consistent with project permits, goals, and management objectives.

Interpretive Signage

Interpretive signs or exhibits offer stories that are designed to stimulate visitors' interest while challenging their imaginations, and present new perspectives on familiar topics. Interpretive signage will be installed at the project site and have been designed by the project design consultant team, comprised of RIOS and Coastal Restoration Consultants (e.g., Figure 47). Interpretive signage has been designed with guidance from the City of Manhattan Beach's style guide. Signage includes: one primary sign with a general overview of the project and dune ecology (content for the primary sign also includes a Spanish translation); small secondary signs to be situated adjacent in the site to major perpendicular streets with a description of various native flora relevant to the project and street numbers to be used as a navigational aid; and dune height indicators designed as an interactive element to allow beach visitors to track dune height over time. A minimum of one primary sign and four secondary signs will be installed, and others will be included pending funding availability. Signs were developed specifically for use in the MBDR restoration area to help engage the public with the site and to facilitate a unique opportunity for education and recreation on their way to and from the beach. Interpretive signs went through external public review including during workshops and by project partner teams. The full interpretive signage package can be found in Appendix 4.

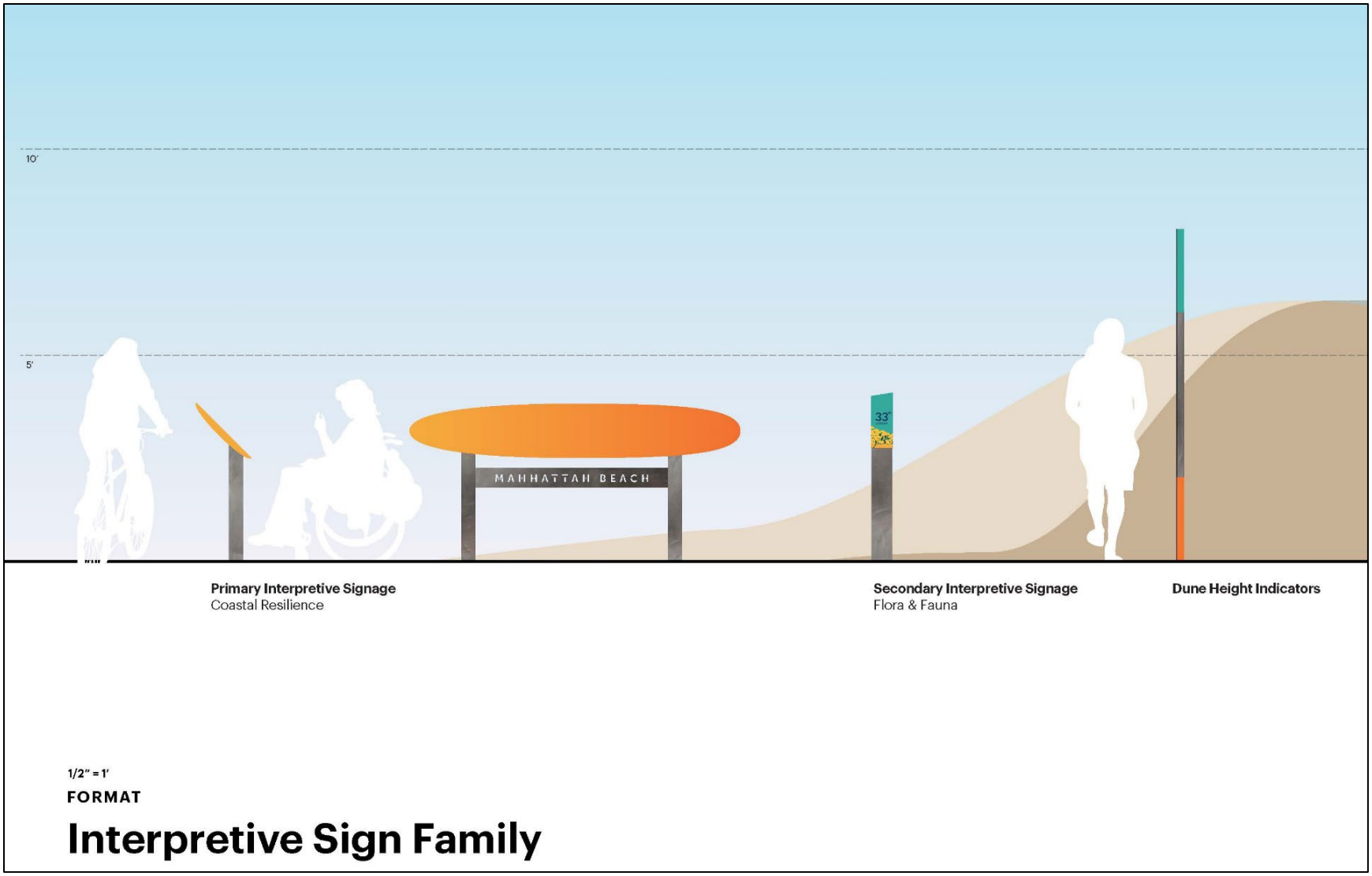

Figure 47. Interpretive signage overview. See Appendix 4 for full signage package.

Dune 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. Transforming the degraded system currently dominated by invasive iceplant into a functioning dune habitat will be achieved through a series of strategies. Additionally, 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 the Los Angeles Conservations Corps and volunteers.

1. Non-native vegetation removal. The 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. Non-native vegetation will be disposed of offsite at proper facilities, apart from a small amount of flipped and desiccated iceplant which may be left behind to prevent interim erosion in target areas while native vegetation establishes. Alternative removal methods were considered and are described below in the "Other Restoration Actions Considered" section below.

2. Re-vegetation of native foredune and back dune species. Native foredune plants are a great sustainable long-term choice for building coastal dunes in California when sand is available. California native foredune plants also benefit greatly from protection from driving and trampling, so directing foot and vehicle traffic around vegetated areas is important. Re-vegetation of foredune will occur throughout the central and foredune project area through seeding.

   Establishment of native back dune habitat along the bike path will serve to provide increased protection, prevent erosion and windblown sand on the bike path, and create potential habitat for rare and sensitive plants and wildlife. Re-vegetation will occur in the project area through a combination of native container stock planting and seeding. Planting will occur within one week of iceplant removal (sooner if possible).

3. Erosion control. Precautions will be taken to prevent erosion following iceplant removal. Erosion control measures will include a combination of container stock planting to re-establish vegetation cover, and may include 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 at a later date. Specific erosion control techniques will be dependent on vegetation cover, dune slope, and other variables and may differ across the site in different areas.

4. 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. 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 in targeted areas of lower elevation. 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. Segments of short sand fencing (2-3 ft in height maximum) may also be installed along the bikepath as an adaptive management strategy to restrict windblown sand, if it becomes problematic, but will be removed once vegetation establishes and nuisance sand is not greater than current pre-restoration conditions.

5. Wooden slats or "Biomimicry Stakes". Recently, groupings of wooden slats, or biomimicry stakes, have been used instead of fencing to build topography in degraded dunes. This technique had been shown to be preliminarily successful at TBF's Malibu Living Shoreline Project (MLSP), as well as the outer shore 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 in areas of lower elevation (currently groomed areas) 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 approximately 2-3 feet.

6. Irrigation. The back dune area may require supplemental irrigation in the first growing season to support initial plant establishment, 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. This may be repeated every 3-4 weeks as needed during the wet season if plants begin to desiccate, if rainfall does not occur (> 0.25 in), or until plants become fully established.

Native Plants: Seeding and Container Stock

TBF developed plant palettes and custom seed mixes, with input from partners and stakeholders, including but not limited to members from the community and the general public, Manhattan Beach Botanical Garden, El Segundo Blue Butterfly Coalition, City of Manhattan Beach, LACDBH, and a Tribal consultant. The project site was divided into three different planting areas: central dune, dune edge, and low shrub or back dune (Figure 43-46). These areas are approximate and are intended to integrate with one another over time, rather than be fixed within distinct zones.

The central dune mix includes native foredune species and was designed to maximize potential dune growth (Table 2). Sea scale (*Atriplex leucophylla*) and red sand verbena (*Abronia maritima*) were specifically recommended by the project's Tribal consultant and beach evening primrose was included as recommended by the City of Manhattan Beach (official City flower) and a species typical of coastal strand habitat. The central dune area will be seeded at a rate of 21.1 lbs/acre with native foredune species.

The dune edge mix includes a subset of the central dune mix and is comprised of several flowering foredune species (Table 3). Beach bur was omitted from the dune edge mix, under the recommendation of several members of the public, as to avoid the spikey seeds of the plant accumulating on the pathways and becoming a nuisance for barefoot beachgoers. The dune edge area will be seeded at a rate of 21.1 lbs/acre with native foredune species.

The low shrub area, situated along the bike path, will be planted with container stock and supplemented with seeding (Table 4 and Table 5). This area, comprised of low-lying shrubs and herbs, was strategically constructed to stabilize the back dune area, keep sand from blowing onto the adjacent bike path, and allow recreators on the bike path and further inland to maintain their scenic view of the beach and ocean. Low shrub species were intended to provide biodiversity while also considering aesthetic qualities. The inclusion of seacliff buckwheat was at the request of USFWS (United States Fish and Wildlife Service), Manhattan Beach Botanical Garden, and the El Segundo Blue Butterfly Coalition, and it will create vital potential habitat for the endangered El Segundo Blue Butterfly (*Euphilotes battoides allyni*). Silver dune lupine (*Lupinus chamisssonis*) and others were also recommended by the public during one of the virtual public workshops.

Seed and container stock will be sourced from a vendor who has experience supplying regionally sourced seed/plants, such as S&S Seeds, Inc. or Tree of Life Nursery. Tables 2 – 4 display the custom seed mix, seeding rates, and number of pure live seeds per pound for the central dune, dune edge, and low shrub mix. Table 5 includes the container stock plant palette for the low shrub area.

Table 2. Custom seed mix design for the central dune area.

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	sea scale	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 3. Custom seed mix design for the dune edge area.

Species Name	Common Name	Lbs / Acre	Number of Pure Live Seeds / Lb.
Abronia maritima	red sand verbena	21.08	2,415
Abronia umbellata	pink sand verbena	-	*
Camissoniopsis cheiranthifolia	beach evening primrose	.02	2,074,850

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

Table 4. Custom seed mix for the low shrub mix.

Species Name	Common Name	Lbs / Acre	Number of Pure Live Seeds / Lb.
Ericameria ericoides	mock heather	13.00	35,000
Eschscholzia californica var. maritima	coast California poppy	1.60	308,000
Lupinus bicolor	miniature lupine	6.50	85,000

Table 5. Container stock plant list for the low shrub mix.

Species Name	Common Name
Dudleya pulverulenta	chalk dudleya
Encelia californica	bush sunflower
Ericameria ericoides	mock heather
Erigeron glaucus	sea fleabane/seaside daisy
Eriogonum parvifolium	sea cliff buckwheat
Eriophyllum confertiflorum	golden yarrow
Isocoma menziesii	coastal goldenbush
Leptosyne gigantea	giant coreopsis
Lupinus chamisssonis	Silver dune lupine

Each of the central dune 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.

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 48). Beach evening primrose is also Manhattan Beach's official city flower.

Figure 48. 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. Sand verbena is a mat-like herb growing under one foot, with fleshy leaves, and clustered pink to purple flowers which bloom in the spring and summer (Figure 49). 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. It was also recommended specifically by the Tribal Nations consultant.

Figure 49. Red sand verbena [CalFlora: G.A. Monroe 2010 (Left) and L. Watson 2007 (right)].

Pink sand verbena (*Abronia umbellate)* 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 50). 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 50. 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 51). Beach bur sage has a high salt tolerance, low water requirement, and is conducive for sand stabilization and dune formation. It will not be seeded in the dune edge mix at the request of the public, but some beach bur already exists along current pathways and those individuals will be protected and not removed.

Figure 51. Beach bur [CalFlora: N. Kramer 2008 (left) and M. Bors 2008 (right)].

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 52).

Figure 52. Sea scale [CalFlora: (left) and Z. Akulova 2015 (right)].

Other Considerations

Several maintenance holes are located in the back dune area of the site. Access to maintenance holes will be preserved through 8-ft wide primarily unvegetated pathways. Additionally, a carabiner clip will be attached on the post and rope segment adjacent to the pathways for easy accessibility to the maintenance holes. In addition, there are two stormwater outfalls located directly outside the project boundary. Post and rope fencing will wrap up and around the stormwater outlets as to not restrict access and will allow 25-ft wide clearance for maintenance equipment. In addition, there are multiple volleyball courts seaward of the project area. A minimum of 30 feet will be left between the post and rope edge and volleyball courts, allowing for a 25-foot clearance for grooming equipment and a 5-foot buffer to maintain vehicle access, recreational access, and space for beach grooming equipment (Figure 42).

Other Restoration Actions Considered

Other restoration actions were considered to remove iceplant from the site before opting for hand removal. Scientific advisors first recommended treating the iceplant with an herbicide application. This technique was considered the most cost-effective method due to the large amount of iceplant on-site and to prevent interim erosion. Through discussions with project partners and feedback from stakeholders, this method was removed from consideration due to potential unintentional effects of herbicide application, and at the request of City staff and local residents. TBF also explored use of organic herbicides; however, after discussions with external advisors and restoration experts, this technique was considered to be potentially less effective overall due to the density of the iceplant present. Lastly, solarization was considered as a way to treat the iceplant through desiccating it. This technique would have entailed tarping the iceplant for approximately three months during the hot summer and drying out the vegetation into a layer of mulch. This method has been effective at similar projects in the area. However, solarization was ultimately rejected due to stakeholder feedback and concerns related to potentially impaired aesthetics and the use of plastic associated with tarping.

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. Native plants will be left in place and protected. 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 El Segundo blue butterfly is endemic to coastal sand dunes that support its obligate host plant, sea cliff buckwheat. Although El Segundo blue butterflies are present in LA County and have been observed north 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 (*Anniella stebbinsi*) and coast horned lizard (*Phrynosoma blainvillii*) 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). Pre-restoration biological surveys will be conducted to identify any sensitive animal species present within the project site. Additional listed species have been seen in surrounding areas along beaches adjacent to the project site such as the western snowy plover (*Charadrius nivosus nivosus*) and the California least tern (*Sterna antillarum browni*). These species may have the potential to flyover or possibly forage within the project area once restored, though it is not their preferred habitat. Any listed species will be avoided and will halt restoration activities.

The following Conservation Measures (CM) will be applied to the project to avoid and minimize adverse effects to the El Segundo blue butterfly, southern California legless lizard, coast horned lizard, and other wildlife. Recommendations from USFWS and others contributed to the CMs listed below.

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 the beach or dunes in Manhattan Beach.

CM 2. The project sites will be kept as clean as possible to avoid attracting predators. 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. Habitat restoration work/maintenance within the coastal 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 dune restoration activities.

CM 4. All workers will avoid stepping within a 2-foot diameter around each coast buckwheat once fully established and mature, and will only cut weeds, not pull weeds, within this zone to protect El Segundo blue butterfly individuals that have pupated within the leaf litter below the coast buckwheat plants.

CM 5. Workers will endeavor to minimize erosion when working in the restoration site. Erosion control measures will be used based on the restoration descriptions above.

CM 6. Non-native plants that have been pulled/cut will be removed from the project sites and disposed of within the proper facilities (apart from portions of the site with flipped and desiccated iceplant, which may be left behind to prevent interim erosion in target areas while native vegetation establishes and may serve as mulch to retain moisture and prevent non-natives from recurring).

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. No 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. 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. Appendix 3 contains a full list of CNDDB species in the 9-quad area, notes on their presence in the area, and Conservation Measures by species.

Lastly, care will be taken to avoid erosion once iceplant is removed. Erosion control installation will occur within one week of iceplant removal, sooner if possible. Erosion control measures may include installation of jute matting, straw wattle, and/or straw mulch.

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 City of Manhattan Beach. 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. If success criteria are not being met, adaptive management restoration activities such as non-native vegetation removal, additional native plantings or seeding may occur. Vegetation may also need to be removed from the maintenance hole access pathways to keep them unvegetated and cleared for access. Adaptive management and monitoring will also identify appropriate timing for the lifting and eventual removal of the sand fencing and wooden stakes.

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, City of Manhattan Beach, 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 LMU's 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 buffer SLR. 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 SLR.

A rigorous scientific monitoring plan will allow for the evaluation of completed restoration activities. Table 6 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 6 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 for up to five years 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. 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 webinars and before the Manhattan Beach City Council.

Table 6. 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 adapted 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 refers to the organic material (algae, sea grasses, some invertebrates) that have washed ashore. Wrack surveys will be conducted to determine the percent cover, composition by species, and average depth of macrophyte wrack in the swash 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 swash zone directly in front of the restoration site and two transects in the swash zone of the control areas (outside the project area). These transects will also record any trash, oil/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 swash zone is a dynamic area, therefore, exact transect locations may vary across surveys. As beach topography varies considerably between summer and winter weather conditions, semi-annual surveys will be timed at minimum during those seasons. Though the swash zone is outside the project area, wrack can provide an important food subsidy for invertebrates and shorebirds.

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 prior to restoration activities and semi-annually thereafter 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 the Audubon Society and USFWS, though they are not known to use the dunes currently. 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 Manhattan Beach from NOAA weather, if available (closest weather station Los Angeles International Airport). Precipitation data from LA County Department of Public Works Manhattan Beach station are also available (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

Site checks will be conducted more frequently directly following the implementation phase of the MBDR project than the minimum semi-annual basis specified in Table 6. 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 qualitatively at a minimum of semi-annually. This 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 within the project area, 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 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 7). The 5-year targets are separated out into the "back dune" or area immediately adjacent to the bike path, which will require a higher density of vegetation to retain sand and stabilization, and "central and foredune" target which is intended as the rest of the site.

Table 7. Success criteria for the MBDR Project.

Criteria Parameter	Quantifiable Metric	5-Year Back Dune Target	5-Year Central and Foredune 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 determined by CalIPC)	Same as back dune
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 30%	Increase in native cover and species richness (total) within restoration areas compared to baseline and controls; minimum absolute native cover of 10-15%
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 as back dune
Topography change	Change in elevation profiles and dune heights along restoration transects	Stable dune system over time without substantial erosion	Same as back dune
Community participation	Number of volunteers (and hours) during restoration or outreach events and public meeting participation	Minimum of 50 people directly engaged annually for five years (> 250 total)	

Maintenance

Site visits will be conducted semi-annually (at minimum) for a period of no less than five years to 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. 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 progress towards meeting defined success criteria over time and compare the restoration site to “control site” conditions in adjacent areas that have had no restoration actions.

Annual Reports will be published on The Bay Foundation’s website: www.santamonicabay.org, and submitted to the California Coastal Commission, City of Manhattan Beach, 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.

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LIST OF APPENDICES

Appendix 1 – Plant Species List

Native Plants	**Common name**
Ambrosia chamissonis	Beach bur
Camissoniopsis cheiranthifolia	Beach evening-primrose
Erigeron canadensis	Canada horseweed

Non-Native Plants	**Common Name**
Bromus spp	Brome grass
Carpobrotus edulis	Iceplant
Cynodon dactylon	Bermuda grass
Cakile maritima	Sea rocket
Glebionis coronaria	Crown daisy
Sonchus oleraceus	Sow thistle

Appendix 2 – Photo Point

Photo Points T1 (top, left), T2 (top, right), T3 (bottom, left), and T4 (bottom, right) taken on 5 August 2020.

Appendix 2 – Photo Point

Photo Points T5 (top, left), T6 (top, right), T7 (bottom, left), and T8 (bottom, right) taken on 5 and 11 August 2020.

Appendix 2 – Photo Point

Photo Point T9 (left) and T10 (right) taken on 11 August 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
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

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
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
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	-	possible on or adjacent to habitat, no nests found; sightings at Hermosa Beach	Pre-restoration bird survey
Birds	*Charadrius montanus*	mountain plover	None	None	SSC	-	possible forage, no nesting habitat; sightings at Dockweiler Beach	Pre-restoration bird survey
Birds	*Mycteria americana*	wood stork	None	None	SSC	-	not appropriate habitat	Pre-restoration bird survey
Birds	*Coccyzus americanus occidentalis*	western yellow-billed cuckoo	Threatened	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
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 forage, no nesting habitat	Pre-restoration bird survey
Birds	*Spinus lawrencei*	Lawrence's goldfinch	None	None	-	-	possible flyover and/or roost	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	Pre-restoration bird survey
Birds	*Agelaius tricolor*	tricolored blackbird	None	Threatened	SSC	-	possible flyover; sightings at El Porto	Pre-restoration bird survey
Birds	*Xanthocephalus xanthocephalus*	yellow-headed blackbird	None	None	SSC	-	possible flyover; sightings at El Porto	Pre-restoration bird survey
Birds	*Icteria virens*	yellow-breasted chat	None	None	SSC	-	possible flyover; sightings at El Porto	Pre-restoration bird survey
Birds	*Lanius ludovicianus*	loggerhead shrike	None	None	SSC	-	possible forage, no nesting habitat	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

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
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	-	possible flyover and/or roost; no recent records	Pre-restoration bird survey
Birds	*Thalasseus elegans*	elegant tern	None	None	WL	-	present (roosting) adjacent to site	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	Pre-restoration bird survey
Birds	*Setophaga petechia*	yellow warbler	None	None	SSC	-	possible flyover	Pre-restoration bird survey
Birds	*Aimophila ruficeps canescens*	southern California rufous-crowned sparrow	None	None	WL	-	possible flyover	Pre-restoration bird survey
Birds	*Ammodramus savannarum*	grasshopper sparrow	None	None	SSC	-	possible flyover	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	-	present (roosting) adjacent to site	Pre-restoration bird survey
Birds	*Spizella breweri*	Brewer's sparrow	None	None	-	-	possible flyover; records of individuals in fall at El Porto	Pre-restoration bird survey
Birds	*Pelecanus occidentalis californicus*	California brown pelican	Delisted	Delisted	FP	-	possible flyover and/or roost; recent records adjacent to site	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
Birds	*Phalacrocorax auritus*	double-crested cormorant	None	None	WL	-	possible flyover and/or roost	Pre-restoration bird survey
Birds	*Sphyrapicus ruber*	red-breasted sapsucker	None	None	-	-	possible flyover; rare records at El Porto	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); no recent records	Pre-restoration bird survey
Birds	*Athene cunicularia*	burrowing owl	None	None	SSC	-	not appropriate habitat	Pre-restoration bird survey
Birds	*Plegadis chihi*	white-faced ibis	None	None	WL	-	possible flyover; closest record at El Porto	Pre-restoration bird survey
Birds	*Calypte costae*	Costa's hummingbird	None	None	-	-	possible flyover; closest record at El Porto	Pre-restoration bird survey
Birds	*Selasphorus rufus*	rufous hummingbird	None	None	-	-	possible flyover; closest record at El Porto	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
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; closest record at El Porto; possible flyover and/or roost	Pre-restoration bird survey
Birds	*Contopus cooperi*	olive-sided flycatcher	None	None	SSC	-	possible flyover and/or roost	Pre-restoration bird survey
Birds	*Empidonax traillii*	willow flycatcher	None	Endangered	-	-	possible flyover; closest record at El Porto	Pre-restoration bird survey
Birds	*Empidonax traillii extimus*	southwestern willow flycatcher	Endangered	Endangered	-	-	not appropriate habitat	Pre-restoration bird 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; rare flyover records at El Porto	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

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
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	-	-	habitat appears appropriate; observed in Manhattan Beach	Careful hand removal of invasive vegetation
Insects	*Cicindela gabbii*	western tidal-flat tiger beetle	None	None	-	-	habitat appears appropriate	Careful hand removal of invasive vegetation
Insects	*Cicindela hirticollis gravida*	sandy beach tiger beetle	None	None	-	-	habitat appears appropriate	Careful hand removal of invasive vegetation
Insects	*Cicindela senilis frosti*	senile tiger beetle	None	None	-	-	habitat appears 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 within project area	* See Conservation Measure Narrative; careful removal of invasive vegetation
Insects	*Glaucopsyche lygdamus palosverdesensis*	Palos Verdes blue butterfly	Endangered	None	-	-	habitat may be appropriate; observations only south of 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
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	-	-	flyovers likely to occur	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 Los Angeles region	Careful hand removal of invasive vegetation
Insects	*Aglaothorax longipennis*	Santa Monica shieldback katydid	None	None	-	-	not sufficient information; unlikely to occur; no sightings	Careful hand removal of invasive vegetation
Insects	*Eucosma hennei*	Henne's eucosman moth	None	None	-	-	not sufficient information; unlikely to occur; no sightings	Careful hand removal of invasive vegetation
Mammals	*Perognathus longimembris pacificus*	Pacific pocket mouse	Endangered	None	SSC	-	not appropriate habitat	Pre-restoration wildlife survey
Mammals	*Lepus californicus bennettii*	San Diego black-tailed jackrabbit	None	None	SSC	-	not appropriate habitat	Pre-restoration wildlife survey
Mammals	*Eumops perotis californicus*	western mastiff bat	None	None	SSC	-	site within range of species; possible flyover	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

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
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
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	-	possible to occur on site, though no sightings at project location; sightings at El Porto	* See Conservation Measure Narrative; careful removal of invasive vegetation; pre-restoration wildlife survey
Reptiles	*Diadophis punctatus modestus*	San Bernardino ringneck snake	None	None	-	-	site within range of species; unlikely to occur; no appropriate habitat	Pre-restoration wildlife survey
Reptiles	*Emys marmorata*	western pond turtle	None	None	SSC	-	no appropriate aquatic habitat	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
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; identified as present at LAX Dunes	* See Conservation Measure Narrative; careful removal of invasive vegetation; pre-restoration wildlife survey
Reptiles	*Aspidoscelis tigris stejnegeri*	coastal whiptail	None	None	SSC	-	site within range of species; unlikely to occur	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	No measures needed
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	-	-	potentially appropriate habitat	
Terrestrial Community	*Southern Sycamore Alder Riparian Woodland*	Southern Sycamore Alder Riparian Woodland	None	None	-	-	none identified on site	No measures needed

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
Vascular Plant	*Eryngium aristulatum var. parishii*	San Diego button-celery	Endangered	Endangered	-	1B.1	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Spermolepis lateriflora*	western bristly scaleseed	None	None	-	2A	site not within extant California range	Pre-restoration plant 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

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
Vascular Plant	*Isocoma menziesiiis var. decumbens*	decumbent goldenbush	None	None	-	1B.2	potentially appropriate habitat; none identified on site	Pre-restoration plant 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	potentially appropriate habitat; none identified on site	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	potentially appropriate habitat; none identified on site	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

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
Vascular Plant	*Erysimum insulare*	island wallflower	None	None	-	1B.3	potentially appropriate habitat; none identified on site	Pre-restoration plant 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
Vascular Plant	*Suaeda esteroa*	estuary seablite	None	None	-	1B.2	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
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; closest observed location in West Carson	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 cymosa 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
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

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
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
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	not appropriate habitat	Pre-restoration plant survey
Vascular Plant	*Calochortus catalinae*	Catalina mariposa-lily	None	None	-	4.2	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
Vascular Plant	*Calochortus clavatus var. gracilis*	slender mariposa-lily	None	None	-	1B.2	not appropriate habitat	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
Vascular Plant	*Calandrinia breweri*	Brewer's calandrinia	None	None	-	4.2	potentially appropriate habitat; none identified on site	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	not appropriate habitat	Pre-restoration plant survey
Vascular Plant	*Abronia maritima*	red sand-verbena	None	None	-	4.2	appropriate habitat; none identified on site	Pre-restoration plant survey; protected in place during hand removal of invasive species
Vascular Plant	*Camissoniopsis lewisii*	Lewis' evening-primrose	None	None	-	3	appropriate habitat; none identified on site	Pre-restoration plant survey

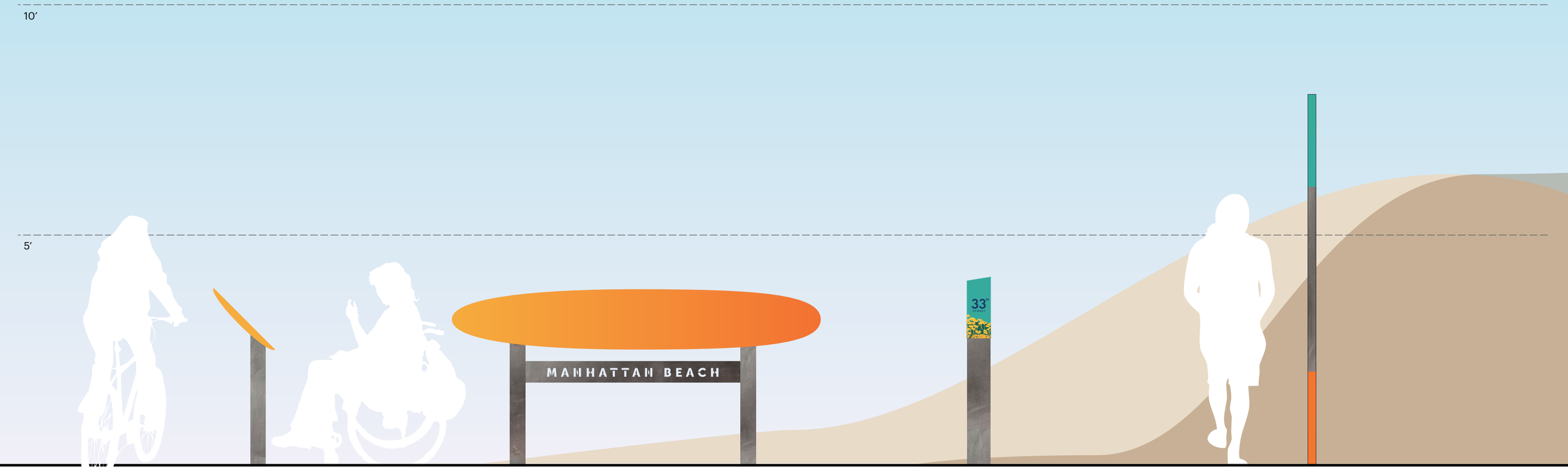
Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
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
Vascular Plant	*Orcuttia californica*	California Orcutt grass	Endangered	Endangered	-	1B.1	not appropriate habitat	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	not appropriate habitat	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	not appropriate habitat	Pre-restoration plant survey
Vascular Plant	*Galium cliftonsmithii*	Santa Barbara bedstraw	None	None	-	4.3	not appropriate habitat	Pre-restoration plant 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

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
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



Primary Interpretive Signage
Coastal Resilience

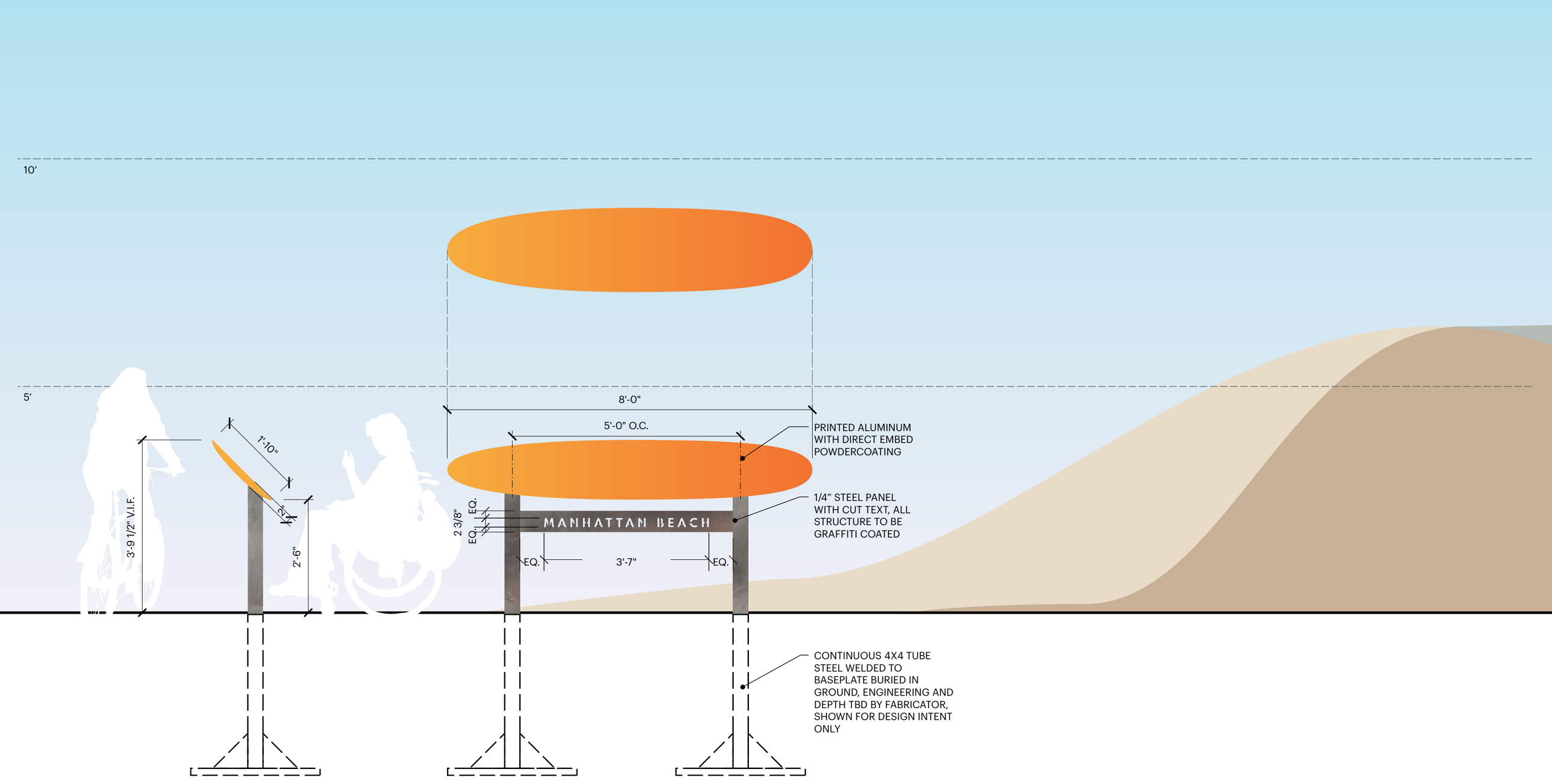
Secondary Interpretive Signage
Flora & Fauna

Dune Height Indicators

1/2″ = 1′

FORMAT

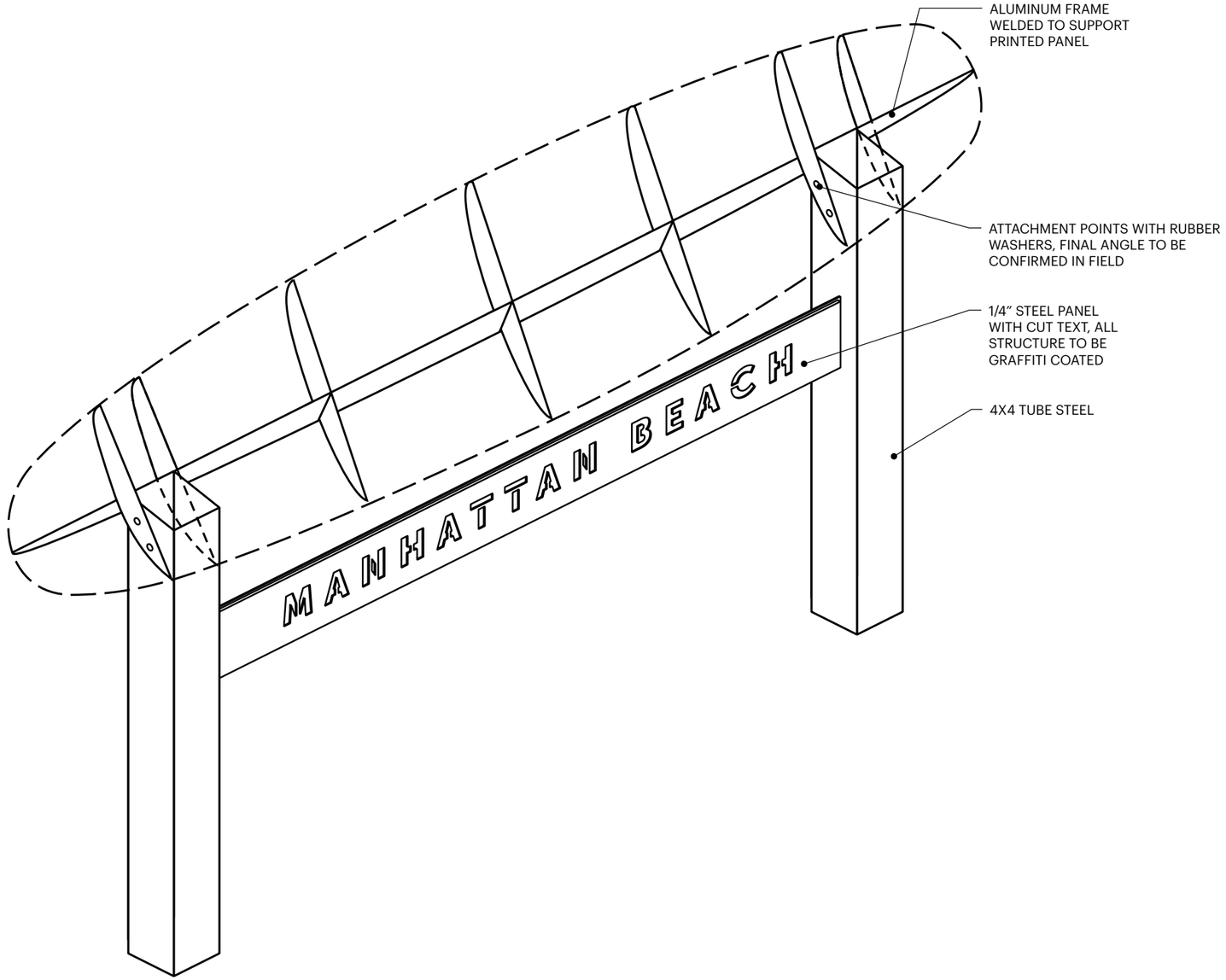
Interpretive Sign Family



1/2" = 1'

FORMAT

Interpretive Signage: Long Board



FORMAT

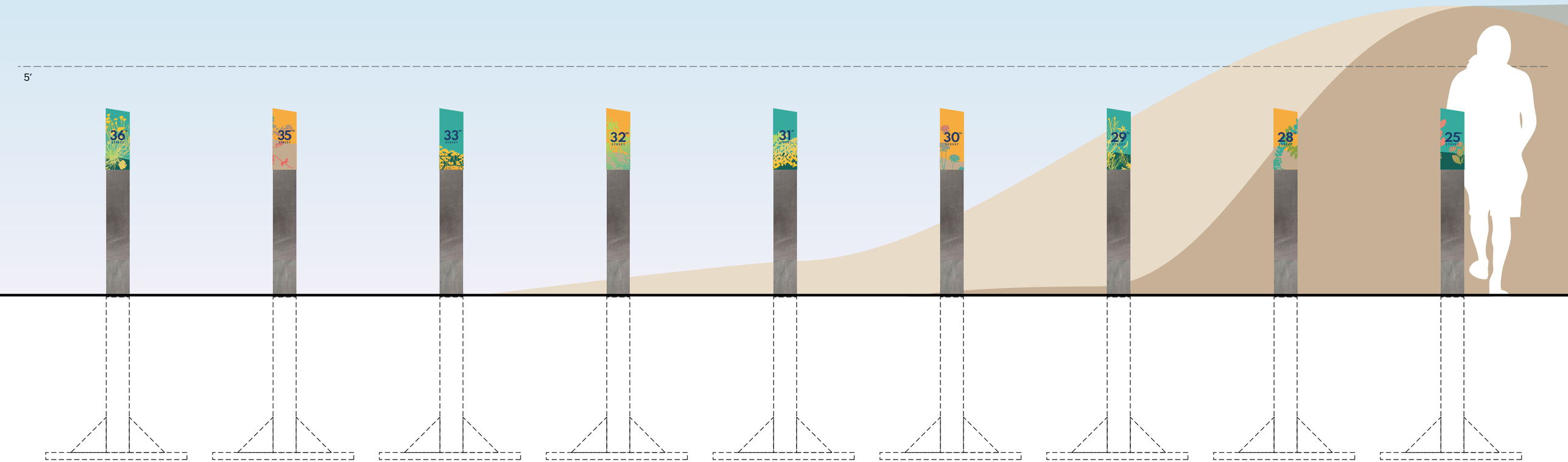
Interpretive Signage: Long Board

LAYOUT

Interpretive Signage: Long Board Layout

10′

5′



GOLDEN YARROW
Eriophyllum Confertiflorum

PINK SAND VERBENA
Abronia Umbellata

GIANT COREOPSIS
Leptosyne Gigantea

BEACH BUR
Ambrosia chamissonis

BEACH EVENING PRIMROSE
Camissoniopsis Cheiranthifolia

SEA CLIFF BUCKWHEAT
Eriogonum parvifolium

MOCK HEATHER
Ericameria ericoides

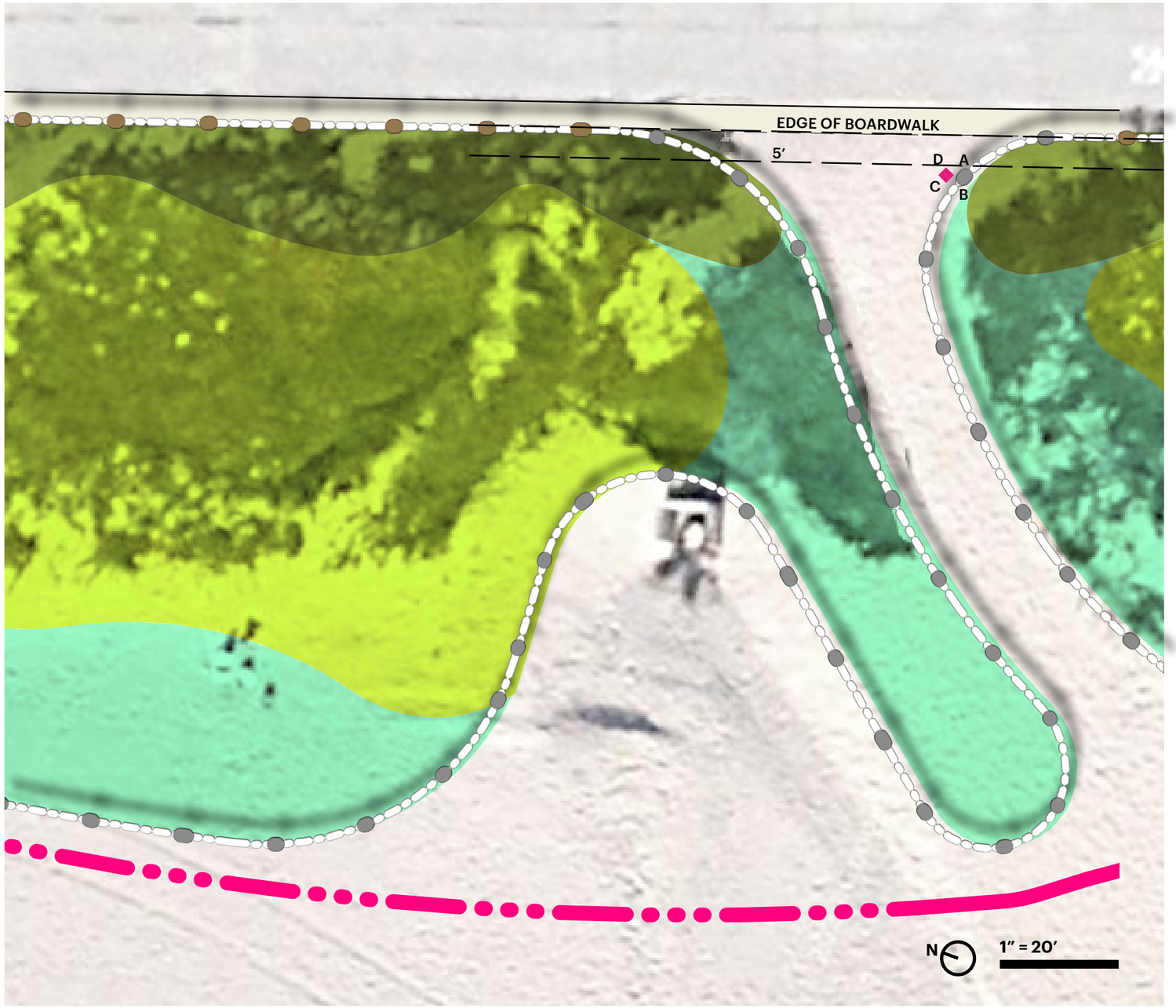
BEACH SALT BUSH
Atriplex leucophylla

RED SAND VERBENA
Abronia Maritima

1/2” = 1′

SERIES

Interpretive Signage: Secondary



- Signage always placed on the south side of the path entry
- Minimum 5′ from boardwalk
- Angle in line with adjacent fencing

TOP

SIDE A SIDE B SIDE C SIDE D

Typical Sign Format shown as example

SERIES

Interpretive Signage: Secondary Placement

GOLDEN YARROW

Eriophyllum Confertiflorum

This native plant can be found from San Francisco Bay all the way to Baja California, and is pollinated by butterflies and bees.

3" = 1'

CONTENT

Interpretive Signage: 36th Street Layouts

PINK
SAND VERBENA

Abronia Umbellata

Native to the western US, Pink Sand Verbena blooms on the sand dunes throughout most of the year. It is pollinated by moths and butterflies.

3″ = 1′

CONTENT

Interpretive Signage: 35th Street Layouts

GIANT COREOPSIS

Leptosyne Gigantea

This coast-loving plant is found throughout Central and Southern California, including the Channel Islands and Guadalupe Island, Mexico. It can grow up to two meters tall, and may appear dry in the summer but blooms the remainder of the year.

3″ = 1′

CONTENT

Interpretive Signage: 33rd Street Layouts

BEACH BUR

Ambrosia chamissonis

A type of ragweed, each tiny flower of the Ambrosia develops into a small, spiked bur from which it gets its name. Living on beaches up and down the West Coast, the Beach Bur supports moth and butterfly communities.

3″ = 1′

CONTENT

Interpretive Signage: 33nd Street Layouts

BEACH EVENING PRIMROSE

Camissoniopsis Cheiranthifolia

The low form and swinging stems of the Beach Evening Primrose make it particularly suited to the windy conditions of coastal dunes. The four-petalled blooms may close at night, but open again every morning.

3" = 1'

CONTENT

Interpretive Signage: 31st Street Layouts

SEA CLIFF BUCKWHEAT

Eriogonum parvifolium

Found on both bluffs and dunes throughout California's costs, these tiny flowers play an important role in California's ecosystem by hosting a wide variety of pollinating butterflies, including endangered species.

3" = 1'

CONTENT

Interpretive Signage: 30th Street Layouts

MOCK HEATHER

Ericameria ericoides

This shrub may look like heather, but it prefers our sandy dunes to garden soil. Also known as California Goldenbush for its colorful blooms, Mock Heather attracts bees and butterflies as it blooms into the fall.

3" = 1'

CONTENT

Interpretive Signage: 29th Street Layouts

BEACH SALT BUSH

Atriplex leucophylla

The flowers of this low-lying plant develop into fruits containing small seeds, which are snapped up by birds, moths, and butterflies. Also known as Seascale, the saltbush spreads throughout California's dunes.

3" = 1'

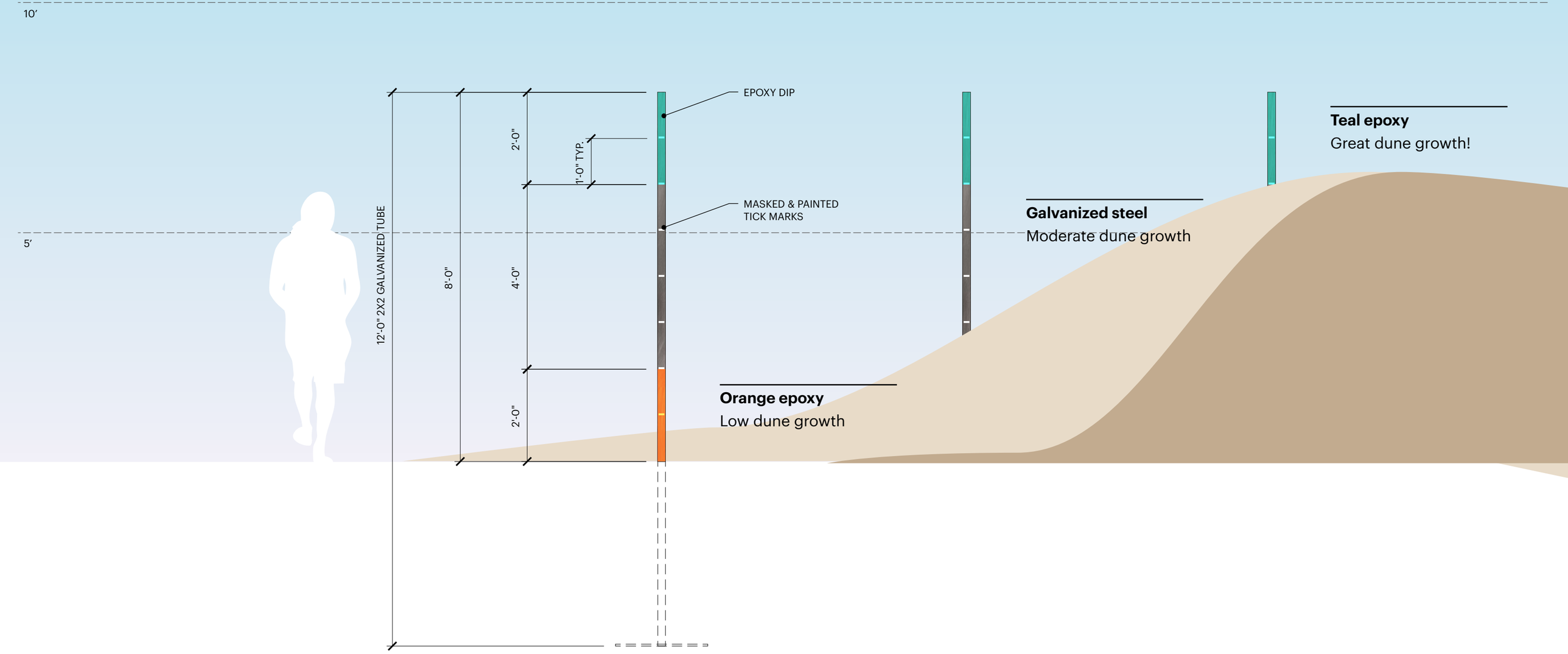
CONTENT

Interpretive Signage: 28th Street Layouts

3″ = 1′

CONTENT

Interpretive Signage: 25th Street Layouts



1/2" = 1'

FORMAT

Dune Height Indicators