Point Dume and Zuma Beach, Malibu, CA

County of Los Angeles – Department of Beaches and Harbors

Coastal Resilience Project Implementation

Phase 1: Feasibility Study – Final Report

DRAFT

Coastal Frontiers Corporation
882A Patriot Drive
Moorpark, CA 93021
(818) 341-8133 | www.coastalfrontiers.com

COUNTY OF LOS ANGELES – DEPARTMENT OF BEACHES AND HARBORS

COASTAL RESILIENCE PROJECT IMPLEMENTATION

PHASE 1: FEASIBILITY STUDY – FINAL REPORT

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Executive Summary

As part of the first phase of the LACDBH Resilience Project Implementation, a feasibility study was conducted to evaluate projects proposed as part of the 2023 Coastal Resilience Study at three sites: Zuma Beach & Point Dume Beach, Dockweiler State Beach, and Redondo Beach.

Project Development and Selection

The concepts outlined in the 2023 Coastal Resilience Study were used to develop a proposed project and two project alternatives at each site. The anticipated performance of each project was evaluated to estimate the relative benefits to recreation, public access, and dune habitat. These benefits, along with the cost of design, construction, and monitoring, were used to select a preferred project for each site, summarized below:

Zuma Beach and Point Dume Beach: Beach nourishment of 500,000 cubic yards (cy) at Zuma Beach. Creation of dune habitat (4.1 acres) along Zuma Beach and enhancement of the existing dune habitat at Zuma Creek and Point Dume Beach (4.5 acres). Renourishment events are expected to be necessary about every five years. The project will be monitored to determine when renourishment is needed. Costs for renourishment have not been included.

Dockweiler State Beach: Construction of a 700-ft long low sand barrier between the existing dune system and the bike and pedestrian path. Active management of dune habitat (2.8 acres) through installation of four designated beach access paths, sand fencing to encourage deposition within the dune field, installation of boundary fencing along the border, removal of non-native species, and seeding with native species.

Redondo Beach: Beach nourishment of 300,000 cubic yards (cy) between Topaz Groin and Redondo Beach Pier. Creation of dune habitat (0.5 acres) fronting County facilities near Topaz Groin. Renourishment is not expected to be necessary for at least 20 years.

Sand Source

The projects at Zuma/Point Dume Beach and Redondo Beach will require a substantial quantity of beach nourishment (300,000 to 500,00 cy). Potential sand sources were evaluated, including those from harbor maintenance dredging, offshore borrow sites, and inland sources. Offshore borrow sites are the most favorable, particularly the site offshore of Dockweiler State Beach investigated as part of the Broad Beach Restoration Project in 2011. Based on the 2011 investigation, it is estimated that over 3,000,000 cy of sand with a median grain size of about 0.5 mm may exist at the site. This is coarser than the average median grain size at each of the receiver beaches (0.23 mm at Zuma, 0.46 mm at Redondo), which is preferred to extend the project life.

Economic Considerations

The probable cost of construction was estimated based on recent experience with similar projects in southern California. The costs include those for design, planning, permitting, monitoring, and construction. A 25% contingency on the construction and monitoring costs is included.

Zuma Beach and Point Dume Beach:	$49,008,525 (does not include renourishment)
Dockweiler State Beach:	$2,311,367
Redondo Beach:	$27,163,031

Recreational benefits were estimated using nonmarket value based on spending estimates from recent survey data. The Zuma/Point Dume and Dockweiler projects had no impact or a small negative impact on recreational benefits, respectively. However, value generated from other sources, such as storm damage reduction, environmental benefits, and mitigation were not considered and should be evaluated as part of the next project phase. The Redondo Beach project had a significant positive impact on recreation, with a benefit-to-cost ratio of 7.45 for the selected alternative.

Next Steps

The next two phases of the project are Preliminary Engineering and Design (Phase 2) and Environmental Review and Permitting (Phase 3). To expedite the permitting process, we recommend conducting these two phases in tandem.

Areas of particular emphasis will be the evaluation of economic benefits other than recreation for the Zuma/Point Dume Project and Dockweiler Project, development of detailed design drawings (90%), and preparation of a Sampling and Analysis Plan (SAP) to support dredging at the Dockweiler Borrow Site. We also recommend engaging a firm with expertise in graphic design and public communication to develop informational materials that will support public engagement and ownership of each project.

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Acronyms

ASBS	Areas of Special Biological Significance
BBGHAD	Broad Beach Geologic Hazard Abatement District
BBRP	Broad Beach Restoration Project
BMP	Best Management Practice
CCC	California Coastal Commission
CCSTWS	Coast of California Storm and Tidal Wave Study
CDIP	Coastal Data Information Program
CDP	Coastal Development Permit
CDPR	California Department of Public Resources
CES4	CalEnviroScreen 4.0
CESA	California Endangered Species Act
CFC	Coastal Frontiers Corporation
CFGC	California Fish and Game Code
CNDDB	California Natural Diversity Data Base
CNPS	California Native Plant Society
COPC	California Ocean Protection Council
CPSMP	Coastal Pelagic Species Fishery Management Plan
CRC	Coastal Restoration Consultants
CRHR	California Register of Historical Resources
ECDP	Emergency Coastal Development Permit
EFH	Essential Fish Habitat
FE	Federally Endangered
FESA	Federal Endangered Species Act
FT	Federally Threatened
GMP	Groundfish Management Plan
HAPC	Habitat Areas of Particular Concern
HTL	High Tide Line

HUC	Hydraulic Unit Code
LACDBH	Los Angeles County Department of Beaches and Harbors
LACFCD	Los Angeles County Flood Control District
LARIAC	Los Angeles Region Imagery Acquisition Consortium
LiDAR	Light Detection and Ranging
PCH	Pacific Coast Highway
PDO	Pacific Decadal Oscillation
MBTA	Migratory Bird Treaty Act
MF	Managed Fisheries
MHHW	Mean Higher High Water
MHTL	Mean High Tide Line
MLMA	Marine Life Management Act
MMPA	Marine Mammal Protection Act
MOP	California Coastal Wave Monitoring and Prediction System
MPA	Marine Protected Areas
MSL	Mean Sea Level
NCMP	National Coastal Mapping Program
NHD	National Hydrography Dataset
NMV	Nonmarket Value
NOAA	National Oceanic Atmospheric Administration
NRCS	Natural Resource Conservation Service
NWI	National Wetlands Inventory
O&M	Operation and Maintenance
PII	Personally Identifiable Information
RBSP	Regional Beach Sand Projects
RWQCB	Regional Water Quality Control Board
SANDAG	San Diego Association of Governments
SAP	Sampling and Analysis Plan

SCOUP	Sand Compatibility and Opportunistic Use Program
SLR	Sea Level Rise
SMCA	State Marine Conservation Area
SMR	State Marine Reserve
SSC	Species of Special Concern
STR	Short-Term Rental
SWRCB	State Water Resources Control Board
TOT	Transient Occupancy Tax
USACE	U.S. Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WEAP	Worker Environmental Awareness Program
WRDA	Water Resources Development Act
WTO	Water Table Outcrop

COASTAL RESILIENCE PROJECT IMPLEMENTATION

PHASE 1: FEASIBILITY STUDY – FINAL REPORT

1 Introduction

1.1 Background

In December 2023, the Los Angeles County Department of Beaches and Harbors (LACDBH) completed a *Coastal Resilience Study* (Moffatt & Nichol, 2023) designed to identify areas threatened by coastal erosion, enhance climate resilience, and advance equitable coastal access to the 18 beaches owned or maintained by the County. As part of the study, three adaptation strategies were proposed at sites deemed to be most vulnerable and of significant value to the community:

- **Zuma Beach & Point Dume Beach**
  Increase sediment supply and expand habitat through beach nourishment and dune creation.

- **Dockweiler State Beach**
  Enhance dune habitat through (1) the installation of sand fencing to promote sand deposition and expansion of the existing dune field, and (2) construction of a low barrier to prevent sediment transport from the dunes into adjacent improved areas (bike path, sidewalk, parking lot).

- **Redondo Beach**
  Increase beach widths and create habitat between Topaz Groin and Redondo Pier through beach nourishment and dune creation. Investigate feasibility to construct an eco-friendly sand retention device at Redondo Pier to enhance sediment retention.

Implementation of these projects is best achieved using a phased approach (Figure 1-1), beginning with this feasibility study and progressing through design and engineering, environmental review and permitting, construction, and project monitoring. This approach is modeled after the successful Regional Beach Sand Projects (RBSP I and II) conducted on behalf of the San Diego Association of Governments (SANDAG) in 2001 and 2012 and is similar to that currently being used for RBSP III.

Figure 1-1. Coastal Resilience Project Implementation Phases

1.2 Feasibility Study Objectives

The objectives of the Phase 1 Feasibility Study are to (1) outline the steps needed for project implementation, (2) develop the proposed resilience concepts, (3) evaluate project alternatives, (4) estimate project costs and potential economic benefits, (5) identify the preferred alternative, and (6) provide clear and concise communication to facilitate public understanding and ownership.

1.3 Project Team

The multi-disciplinary project team assembled for this project is comprised of firms with extensive experience in all six project phases and a track record of successful collaboration. The team includes Coastal Frontiers Corporation (CFC), Moffatt & Nichol, Rincon Consultants, Summit Environmental, Ceto Consulting, and Coastal Restoration Consultants.

1.4 Report Scope

The purpose of this report is to summarize the results of Phase 1 (Feasibility Study), and document feedback obtained as part of stakeholder meetings held on September 23, 2024, January 29, 2025, and April 16, 2025 (*stakeholder input obtained on April 16 to be added to draft report following meeting*). The conditions at each site are described in Section 2, while related projects and prior lessons learned are summarized in Section 3. The project concepts and alternatives are presented in Section 4, followed by their expected performance and potential sand sources in Sections 5 and 6. Estimated construction costs and potential economic benefits are presented in Section 7. Section 8 describes the alternatives analysis and the selected project at each site. A summary of stakeholder feedback and planned work for the remaining project phases follow in Sections 9 and 10.

2 Site Conditions

The following section summarizes the primary factors that influence coastal processes, biological resources, dune habitat, and socio-economic activity at each of the three project sites.

2.1 Coastal Processes

2.1.1 Regional Overview

The Los Angeles County coast is generally divided into the three coastal regions shown in Figure 2-1: Malibu, Santa Monica Bay, and Palos Verdes Peninsula (Noble, 2016; Noble & Larry Paul, 2017).

The Malibu Region extends from the Los Angeles County - Ventura County line in the west to Topanga Canyon in the east, and generally consists of narrow, crescent-shaped beaches bounded by rocky headlands. For the most part, beaches in this 25-mile-long region face south and are relatively narrow compared to other LACDBH beaches, the primary exception being Zuma Beach.

The Santa Monica Bay region is 20 miles long and extends from Santa Ynez Canyon (immediately east of Topanga Beach) in the northwest to the Palos Verdes Peninsula in the southeast. Beaches in this area generally face southwest and are backed by cliffs at both the north and south ends. Past projects, including beach nourishment, harbor construction, and the construction of sediment retention structures, have significantly impacted the shoreline in this region, resulting in artificially wide beaches in most areas (Leidersdorf *et al.*, 1994).

The Palos Verdes Peninsula Region is approximately 16 miles long and extends from the south end of Torrance Beach to the Port of Long Beach. The shoreline in this area consists of narrow, rocky, pocket beaches backed by cliffs that are up to 150-ft high (Noble, 2016). Shoreline changes in this region tend to be small and related to landslides emanating from the cliffs, rather than from oceanographic processes.

As shown in Figure 2-1, the Zuma Beach / Point Dume Resilience Project is located in the Malibu Region, while the Dockweiler and Redondo Beach Projects are located in the Santa Monica Bay Region.

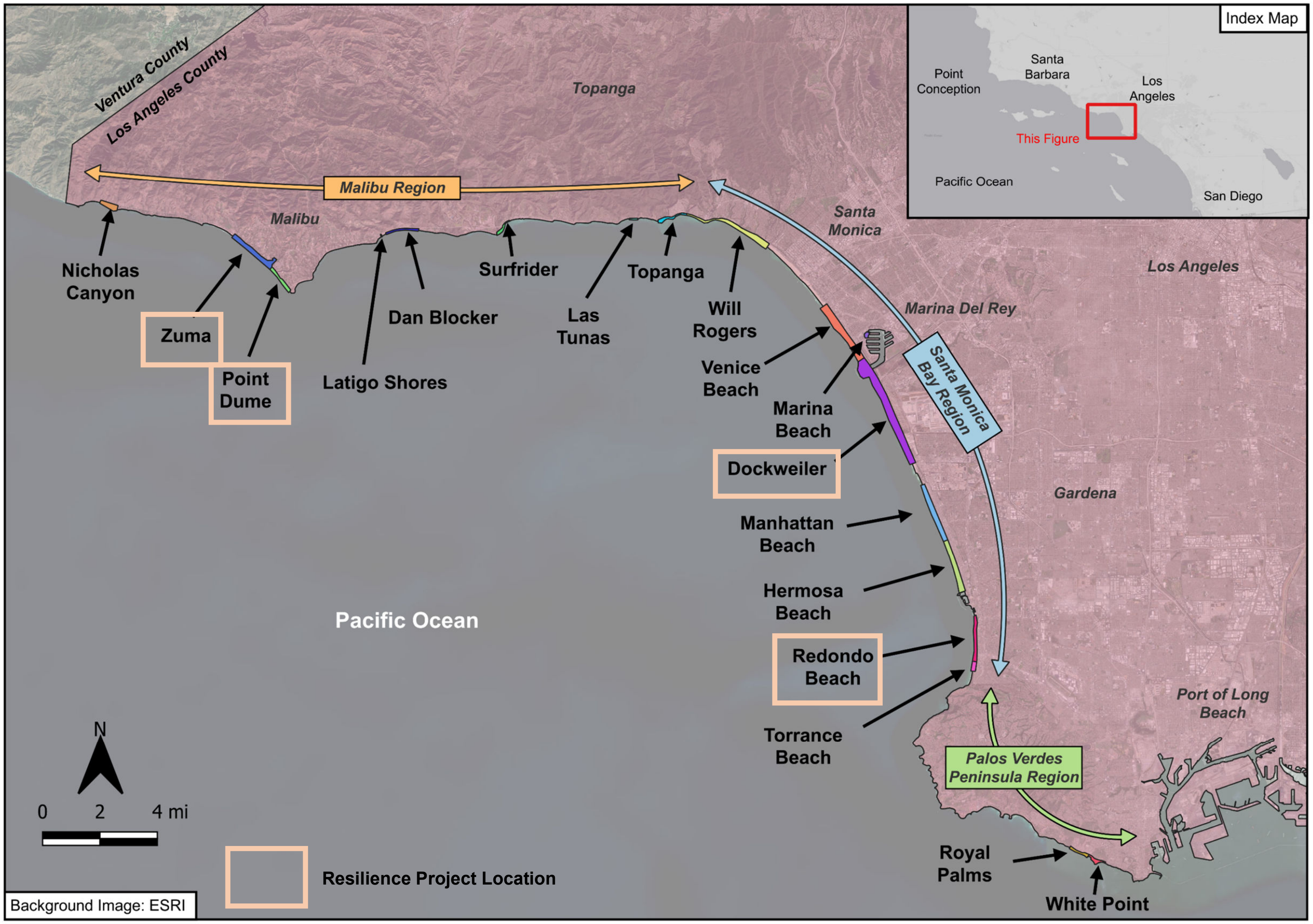

Figure 2-1. Los Angeles County-Operated & Maintained Beaches, Coastal Regions, and Resilience Project Locations

2.1.2 Littoral Processes

The quantification of coastal processes and sediment transport (sand movement) along the California coast is based primarily on the concept of littoral cells, or beach compartments, which provide a valuable beach and shoreline planning framework. A littoral cell is a closed coastal compartment or physiographic unit that contains sediment sources, transport paths, and sediment sinks (Inman and Chamberlain, 1960). A budget of sediment typically is developed for a littoral cell to evaluate and interpret coastal sedimentation and overall shoreline stability. This conceptual model applies the principle of conservation of mass to the fluxes of sediment into and out of the littoral cell. Accretion occurs if the balance is positive (*i.e.*, more sand is entering the littoral cell than leaving it), while erosion occurs if the balance is negative (*i.e.*, more sand leaving the littoral cell than entering it).

Figure 2-2 illustrates the littoral cells in the project area, based on work by Griggs and Patsch (2018). As shown in the figure, the region encompassing the three resilience projects (between Malibu and Redondo Beach) is comprised of two littoral cells: the Zuma Littoral Cell and the Santa Monica Littoral Cell.

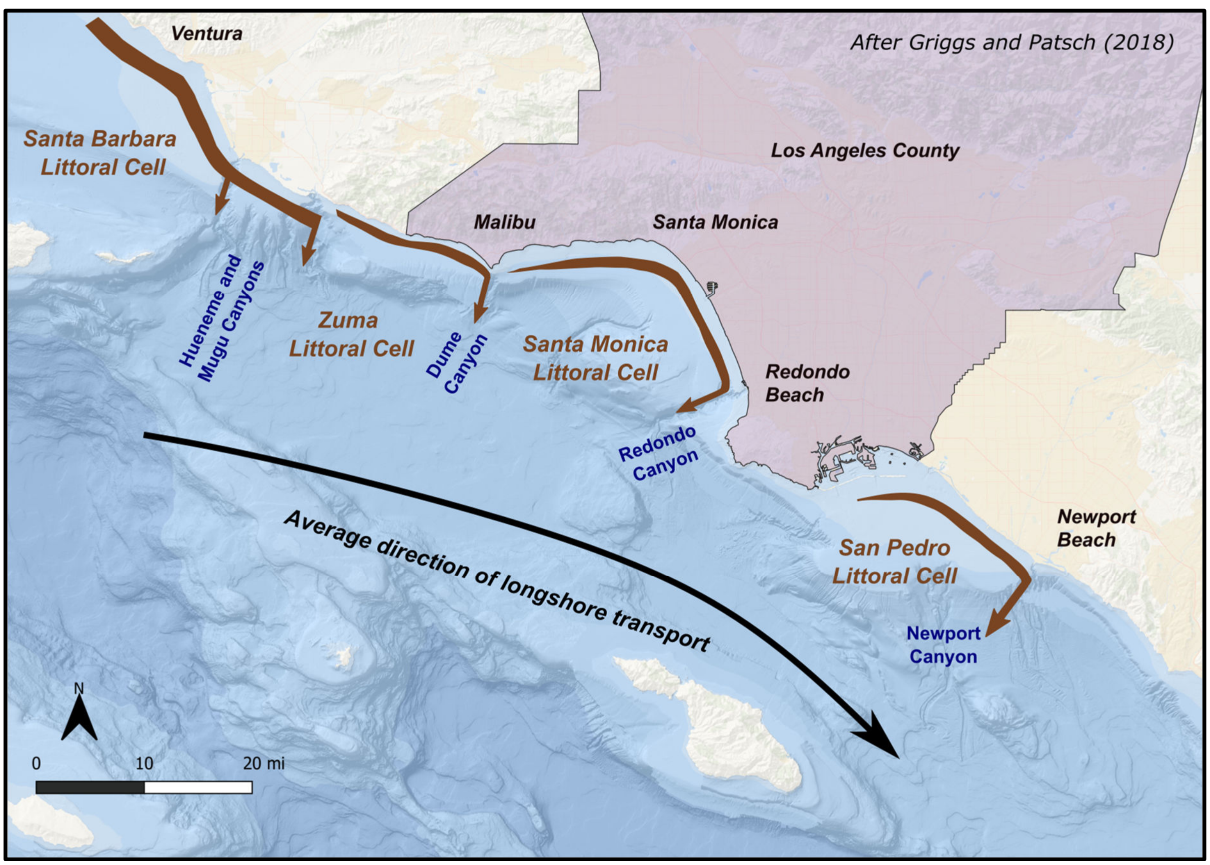

Figure 2-2. Regional Littoral Cells, Ventura to Newport Beach

Longshore sediment transport in both the Zuma and Santa Monica Littoral Cells is bidirectional and varies in accordance with seasonal changes in swell direction. The net direction of sediment transport is from west to east in the Zuma Littoral Cell and from northwest to southeast in the Santa Monica Littoral Cell (Patsch and Griggs, 2007). As described below, an exception occurs in the region south of the Redondo Submarine Canyon where the net direction of sediment transport is from south to north due to the distinct change in shoreline orientation from southwest-facing to west-facing.

Zuma Littoral Cell

The Zuma Littoral Cell begins at the Mugu Submarine Canyon and extends east to the Dume Submarine Canyon. Griggs & Patsch (2018) estimate that the primary sources of sediment within the cell are runoff from small streams and creeks (~34,000 cubic yards per year; cy/yr) and contributions from bluff erosion (~5,000 cy/yr). Prior to the late 1990's, a portion of the sediment travelling from west to east in the Santa Barbara Littoral Cell was able to bypass the head of Mugu Canyon and enter the Zuma Cell. However, Griggs & Patsch (2018) note that onshore migration of the canyon head has effectively blocked all sediment input along the western boundary of the Zuma Cell, leading to a deficit of sediment.

The primary sediment sinks within the Zuma Cell are material lost into Dume Canyon and material transported around Point Dume into the Santa Monica Littoral Cell. While investigators agree that Point Dume acts as a partial barrier to longshore sediment transport, they have not yet reached consensus regarding the percentage of material transported into the canyon versus that which is transported around Point Dume into the Santa Monica Littoral Cell (Inman, 1986; Orme, 1991; Knur & Kim, 1999; Everts & Eldon, 2005; Normark *et al.*, 2009; Everts, 2012; Griggs & Patsch, 2018, George *et al.*, 2018). For the purpose of this study, we have adopted the conclusions presented by Everts (2012), summarized below, as they are directly related to beach nourishment placed upcoast of Point Dume (Broad Beach), and the likelihood that such material will benefit downdrift beaches in Santa Monica Bay.

> *If artificially placed at Broad Beach, sand, with the appropriate size distribution (and, of course, taken from outside any littoral zone) will initially benefit Broad Beach. Over time, it will move east thereby temporarily benefiting Zuma and Westward Beaches. But in due course, almost all of it will pass Point Dume and most of it will pass Malibu. It will eventually end up at Santa Monica and Venice. Its behavior as it moves east will be the same as that of sand that entered the coastal stream in the past from as far away as Port Hueneme.*

Beach widths within the Zuma Littoral Cell are generally characterized by short-term periods of erosion during intense storm events and decadal changes that vary in accordance with the Pacific

Decadal Oscillation (PDO). During warm phases of the PDO, beaches within the Zuma Cell tend to erode, while beaches tend to accrete during the cool phase (Griggs and Patsch, 2018).

Santa Monica Littoral Cell

The Santa Monica Littoral Cell begins at Point Dume and ends at the Redondo Submarine Canyon (Figure 2-2). As noted above, the Point Dume Submarine Canyon acts only as a partial barrier to sediment transport, and we have assumed that almost all the sediment moving east through the Zuma Littoral Cell will enter the Santa Monica Littoral Cell. Presently, the only additional natural source of sediment within the Santa Monica Cell is that which is contributed through bluff erosion. Sediment delivery from creeks and streams has largely been eliminated by dams constructed within the Malibu Creek Watershed, with the Rindge Dam being the largest (Griggs and Patsch, 2018). This reduction in natural sediment delivery caused beaches in the northwestern portion of the Santa Monica Cell to become narrow, and sand retention structures, including 33 groins, were built to stabilize the shoreline along the Topanga Beach and Will Rogers section of western Santa Monica Bay. Many of these structures are now either buried, severely damaged, or destroyed (Patsch and Griggs, 2007). The Will Rogers groin field is an exception, as it continues to retain sand and artificially widen an otherwise narrow stretch of coast.

East and south of Will Rogers, beaches are much wider, reflecting the significant quantities of sand that have been delivered to the coast via beach nourishment projects. Since 1926, over 31 million cubic yards of sand has been placed on Santa Monica Bay beaches (Leidersdorf *et al.,* 1994), most of which was derived from major coastal infrastructure construction projects, such as the Hyperion Sewage Treatment Facility and Pacific Coast Highway (PCH). In recent decades, the absence of similar large-scale public infrastructure projects has led to a significant decrease in the frequency and volume of beach nourishment activities in Santa Monica Bay.

The net direction of sediment transport in the Santa Monica Littoral Cell is from west to east between Point Dume and Santa Monica, and from north to south between Santa Monica and King Harbor, which lies immediately north of the Redondo Submarine Canyon. South of the Redondo Submarine Canyon, in the area where the Redondo Beach Resilience Project is proposed, the net direction of sediment transport is from south to north due to the distinct change in shoreline orientation from southwest-facing to west-facing. Per Patsch and Griggs (2007), the *Redondo Submarine Canyon is the confluence of the southern and northern trending alongshore transport of sand established in the Santa Monica Littoral Cell. With its head located within 200 yards of the shoreline, Redondo Submarine Canyon serves as an effective sink for this cell.*

2.1.3 Wave Climate

In general, waves that occur along the southern California coast can be categorized as North Pacific swell, southern swell, or locally generated seas. North Pacific swell is generated by extratropical storms that form in the northern hemisphere during the winter months and approach the coast from the west and northwest. Southern swell typically occurs in the summer and fall when intense storms form in the southern hemisphere and eastern Pacific. Locally generated seas can occur year-round and typically approach from the west and southwest; however, pre-frontal seas can be generated from the southeast in winter. Figure 2-3 illustrates the wave exposure windows at the three project sites.

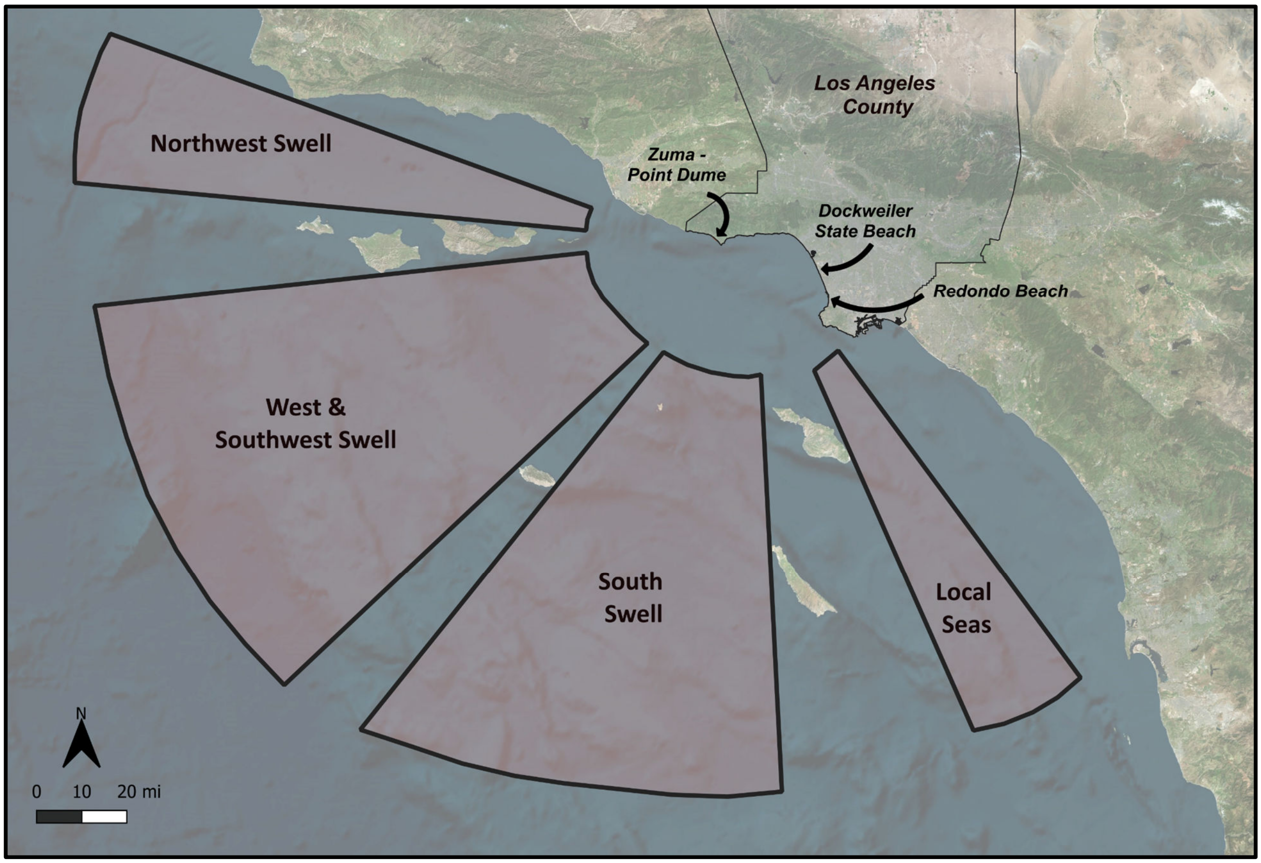

Figure 2-3. Wave Exposure Windows at Project Sites

2.1.4 Sea Level Rise

Planning decisions related to any development within the coastal zone must consider the potential impacts of future sea level rise (SLR). In California, the currently accepted planning guidance for SLR is provided in the California Ocean Protection Council's (COPC) *State of California Sea-Level Rise Guidance: 2024 Science and Policy Update* (COPC, 2024).

The COPC guidance includes several projections that differ based on the greenhouse gas emissions scenario selected. The "low risk aversion" scenario is specifically recommended for living shoreline projects (COPC, 2024); however, the intermediate-low scenario has been adopted for this study in the interest of conservatism. For the purposes of evaluating the impacts of SLR, the design life of each project is assumed to be 20 years, with a base year of 2030. Table 2-1 delineates the COPC SLR projections for Santa Monica in years 2030 through 2050 under the intermediate-low risk aversion scenario.

Table 2-1. Projected Sea Level Rise for Santa Monica

Year	Sea Level Rise (ft) Intermediate-Low Risk Aversion Scenario
2030	0.3
2040	0.4
2050	0.6

Source: COPC, 2024

2.1.5 Shoreline Configuration

This section presents information related to the shoreline configuration at each of the three project sites, including relevant short- and long-term shoreline changes.

Zuma Beach & Point Dume Beach

Zuma Beach and Point Dume Beach are adjoining sites located in the City of Malibu, northwest of Santa Monica Bay (Figure 2-4). Zuma Beach is the widest and longest continuous beach in north LA County, with 1.8 miles of beach frontage and 105 acres of property, making it a popular destination for visitors and nearby residents. It is bound by Broad Beach to the northwest and Point Dume Beach to the southeast. Cell-phone derived visitation data for the Zuma Beach area, including the contiguous areas of Broad Beach and Point Dume Beach, indicate that approximately 1.4 million people visit the area annually (Ceto, 2025).

Shoreline changes in this area were studied in detail as part of the Broad Beach Geologic Hazard Abatement District's (BBGHAD) Broad Beach Restoration Project (Coastal Frontiers Corporation, 2023). As part of the project, CFC conducted 26 beach profile surveys between 2009 and 2023, documenting the shoreline configuration at up to 16 sites between Lechuza Point and Point Dume. The surveys were conducted in the Fall (October) or Spring (May), corresponding to the beginning and end of the winter wave season, respectively. Figure 2-5 illustrates representative beach profiles obtained at Broad Beach, Zuma Beach, and Point Dume Beach between October 2013 and October 2023, as well as the envelope of profiles obtained between May 2002 and November 2022. As shown in the figure, the above-water portion of Zuma Beach is considerably wider than that at Broad Beach and Point Dume Beach. In addition, the nearshore slope tends to be flattest at Broad Beach and steepest at Point Dume Beach.

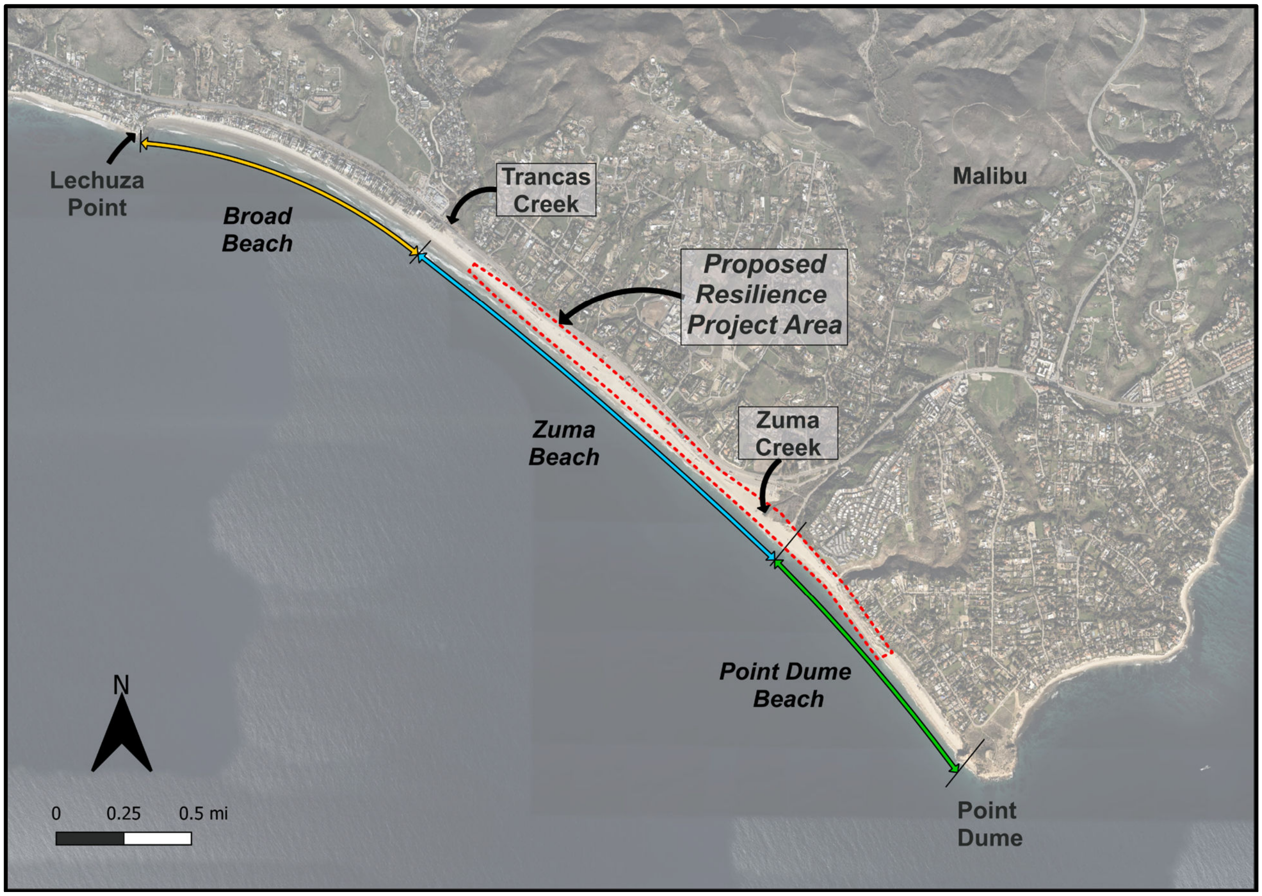

Figure 2-4. Zuma Beach and Point Dume Project Location

Figure 2-6 shows the average Fall Mean Sea Level (MSL) beach width measured during the past decade at Broad Beach, Zuma Beach, and Point Dume Beach. Between 2013 and 2019, Broad Beach was considerably narrower than both Zuma Beach and Point Dume Beach. Since that time, Broad Beach and Zuma Beach have gradually widened, while Point Dume Beach has gradually narrowed. At the time of the most recent survey (Fall 2023), the average beach width at Zuma Beach (268 ft) was almost twice that at Broad Beach (133 ft) and Point Dume Beach (158 ft).

One of the critical issues that the proposed resilience project seeks to address is the vulnerability of Westward Beach Road, which serves as the only access point to Point Dume Beach. In Summer 2021, the road was undermined, requiring emergency repairs and shore protection. Storms in winter 2022-23 damaged the emergency shore protection and threatened portions of the road and a restroom on the west end of Point Dume Beach. To prevent loss of the road and damage to facilities (including potential environmental impacts), additional rock was imported and used to construct the revetment shown in Photo 2-1.

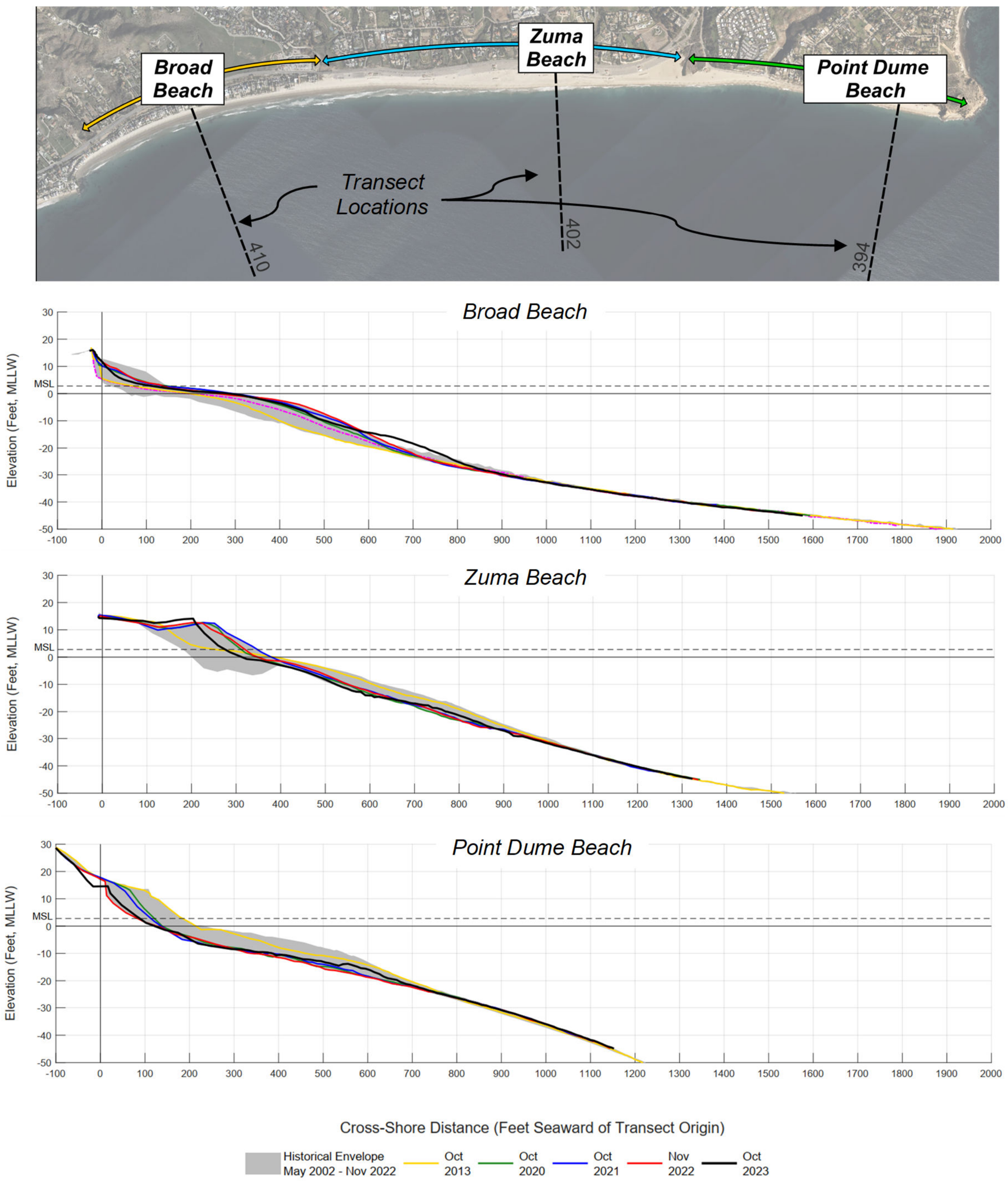

Figure 2-5. Representative Beach Profiles at Broad Beach, Zuma Beach, and Point Dume Beach

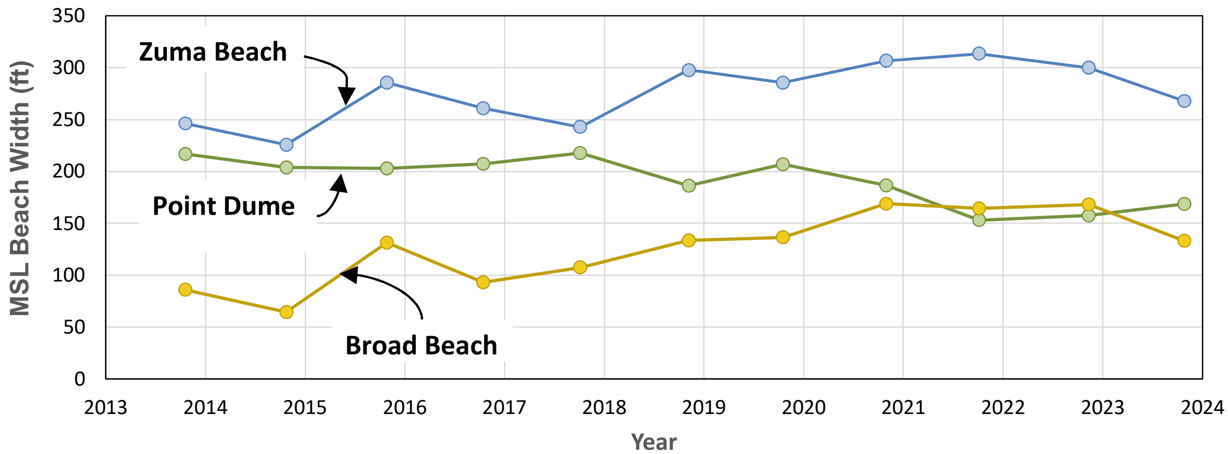

Figure 2-6. Average MSL Beach Widths at Broad Beach, Zuma Beach, and Point Dume

Photo 2-1. Point Dume Beach and Westward Beach Road (March 16, 2023)

Dockweiler State Beach

Dockweiler State Beach is located in the southeast portion of Santa Monica Bay, south of Marina del Rey (Figure 2-1), in the Playa del Rey neighborhood of Los Angeles. The west-facing beach is approximately four miles long, with amenities that include fire rings, volleyball nets, a youth center, bike path, and hang glider facilities. It is a popular destination for residents and visitors, garnering an average of 1.9 million visits per year (Ceto, 2025).

Figure 2-7 illustrates the southern portion of Dockweiler State Beach, near the site of the proposed resilience project. The area consists of a wide, sandy beach stabilized by rock groins, and has historically benefitted from sand bypassed from Marina del Rey Harbor during maintenance dredging events (Section 3.1.10). The surplus of sediment, however, can be driven by wind onto landward amenities, such as the Marvin Braude Bike Trail and parking lots, creating a hazard to public safety. The proposed resilience project aims to reduce this hazard through construction of a low sand barrier and active maintenance of the dune system that fronts the bike path (Moffatt & Nichol, 2023).

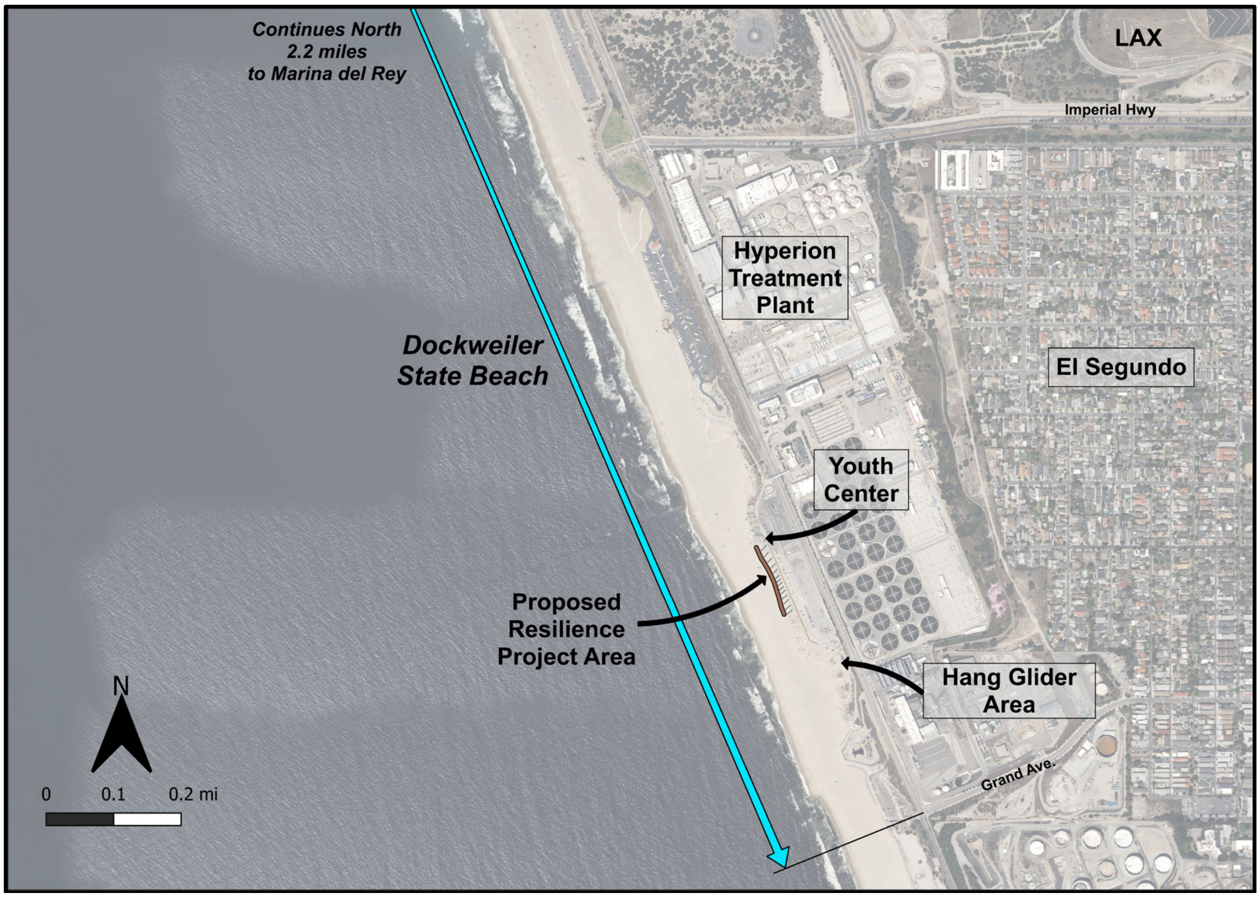

Figure 2-7. Dockweiler State Beach Project Location

Figure 2-8 illustrates representative beach profiles obtained approximately 1 mile north of the proposed resilience project. The profiles were obtained in June 2002 and June 2005 on behalf of the U.S. Army Corps of Engineers (USACE), and in May 2024 on behalf of LACDBH as part of the County's Sand Compatibility and Opportunistic Use Program (SCOUP). As noted above, and shown in the figure, the beach is very wide. Based on the available profile data, the site is relatively stable, with only minor differences evident between the three profiles.

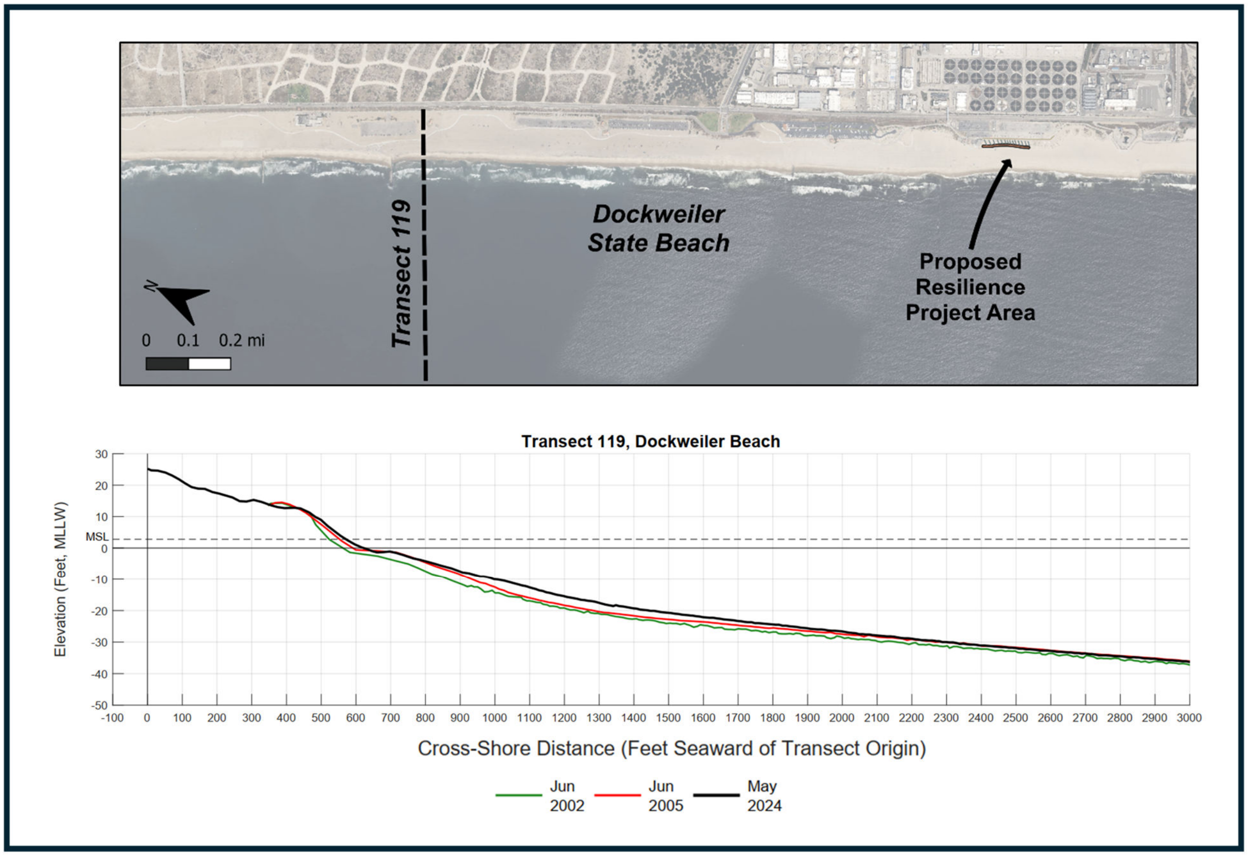

Figure 2-8. Representative Beach Profiles at Dockweiler State Beach

Redondo Beach

Redondo Beach is located near the southeast end of Santa Monica Bay, in the City of Redondo Beach (Figure 2-1). The entire beach is over a mile and a half long, beginning at the Redondo Beach Pier and ending at Miramar Park and Torrance Beach (Figure 2-9). While not as large as the beaches at Zuma and Dockweiler, it is a popular destination, receiving approximately 750,000 annual visitors (Ceto, 2025).

The beach consists of two primary regions, separated by Topaz Groin. South of the groin, the beach is relatively wide and stable, due to the retention of sediment travelling along the coast from south to north (Section 2.1.2). Patsch and Griggs (2007) note that much of the sand placed in the area as part of a large beach nourishment project in 1968 and 1969 still exists along this stretch of coast. North of the groin, the beach is narrow due to the reduction in sediment supply caused by the groin, as well as the loss of sediment into the Redondo Submarine Canyon and King Harbor.

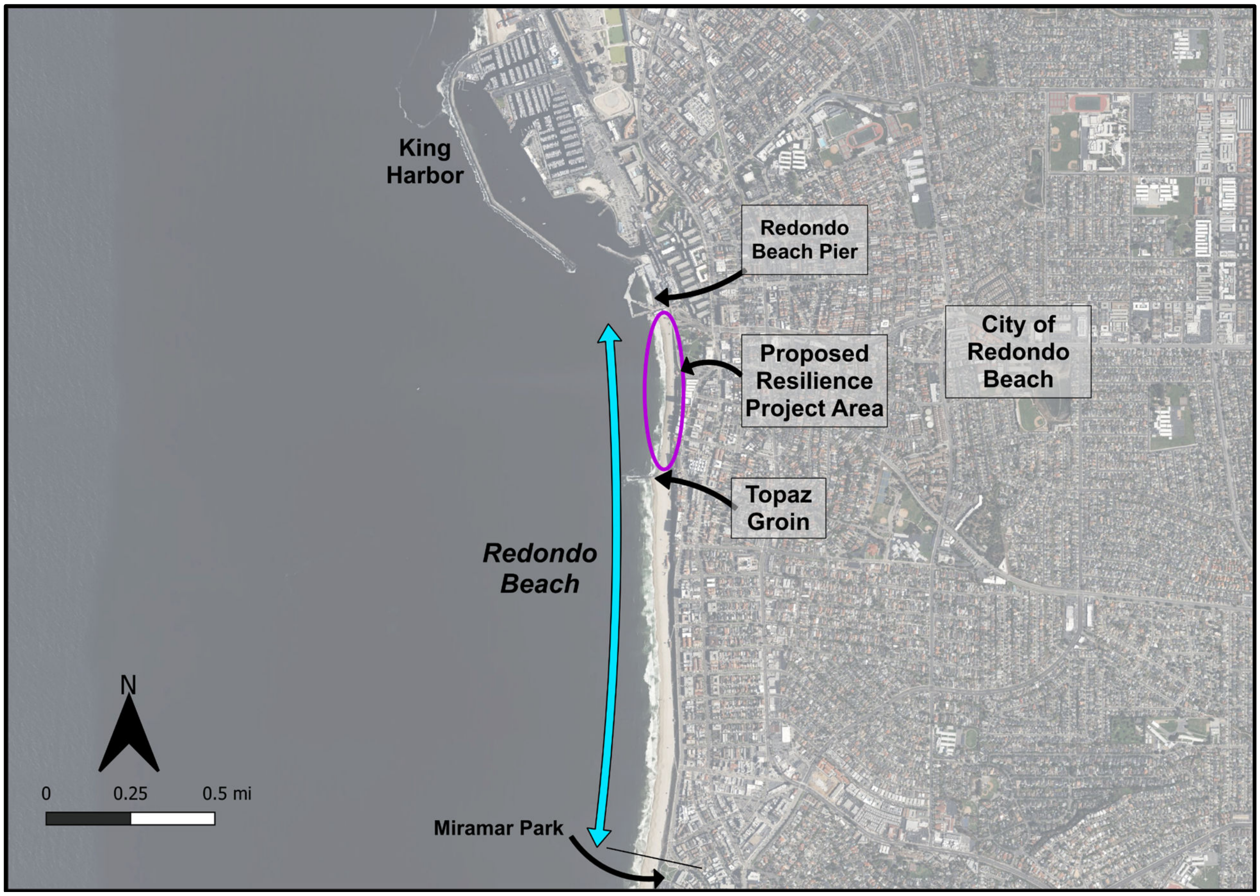

Figure 2-9. Redondo Beach Project Location

Figure 2-10 illustrates representative beach profiles obtained on the north and south sides of Topaz Groin in June 2002, June 2005, and May 2024. As shown in the figure, the beach north of the groin (Transect 028) is considerably narrower and steeper than that to the south (Transect 016), given the proximity of the northern monitoring transect to the Redondo Submarine Canyon. Both areas appear to be relatively stable based on the limited profile data available.

The area north of Topaz Groin has been used as a beach nourishment receiver site on several occasions. In spring 2000, approximately 300,000 cy of beach quality sand dredged from Marina del Rey was placed in the region between Topaz Groin and the Pier (Ryan, 2024). Twelve years later (2012), 75,000 cy of sand from the same source was placed in the region between Topaz Groin and Pearl Street (Ryan, 2024).

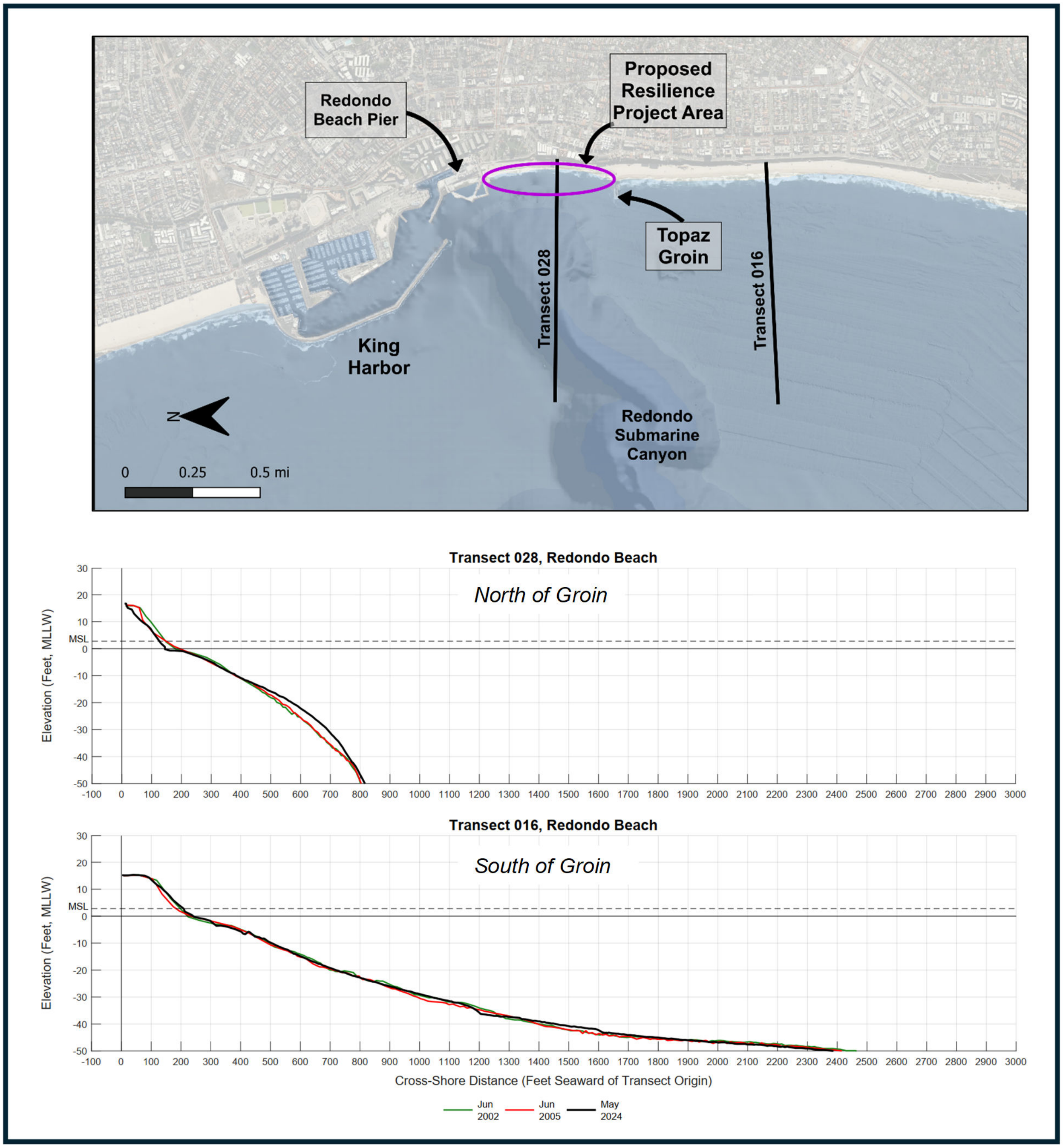

Figure 2-10. Representative Beach Profiles at Redondo Beach

2.1.6 Sediment Size

Table 2-2 summarizes the median grain size at each of the three project sites. The samples at Zuma Beach were obtained in Spring 2016 as part of the Broad Beach Restoration Project (data provided courtesy of BBGHAD), while those at Dockweiler State Beach and Redondo Beach were obtained in Spring 2024 as part of the LACDBH SCOUP Project. Figure 2-11 through Figure 2-13 illustrate the envelope of grain sizes. As shown in both the table and figures, the sediments at Zuma and Dockweiler State Beach were similar in size, while those at Redondo Beach tended to be coarser.

Table 2-2. Median Grain Size Distribution, Resilience Project Sites

Elevation (ft, MLLW)	D_{50} (mm)					
	Zuma Beach		Dockweiler State Beach		Redondo Beach	
	Transect 402	Transect 406	Transect 119	Transect 115	Transect 028	Transect 016
+12	0.31	0.32	0.35	0.37	0.55	0.45
+6	0.53	0.29	0.28	0.33	0.75	0.36
0	0.20	0.20	0.21	0.24	1.08	0.38
-6	0.37	0.22	0.25	0.24	0.44	0.27
-12	0.20	0.19	0.22	0.20	0.31	0.24
-18	0.18	0.17	0.11	0.17	0.19	0.16
-24	0.14	0.13	0.11	0.16	0.16	0.14
-30	0.14	0.12	0.10	0.11	0.21	0.13

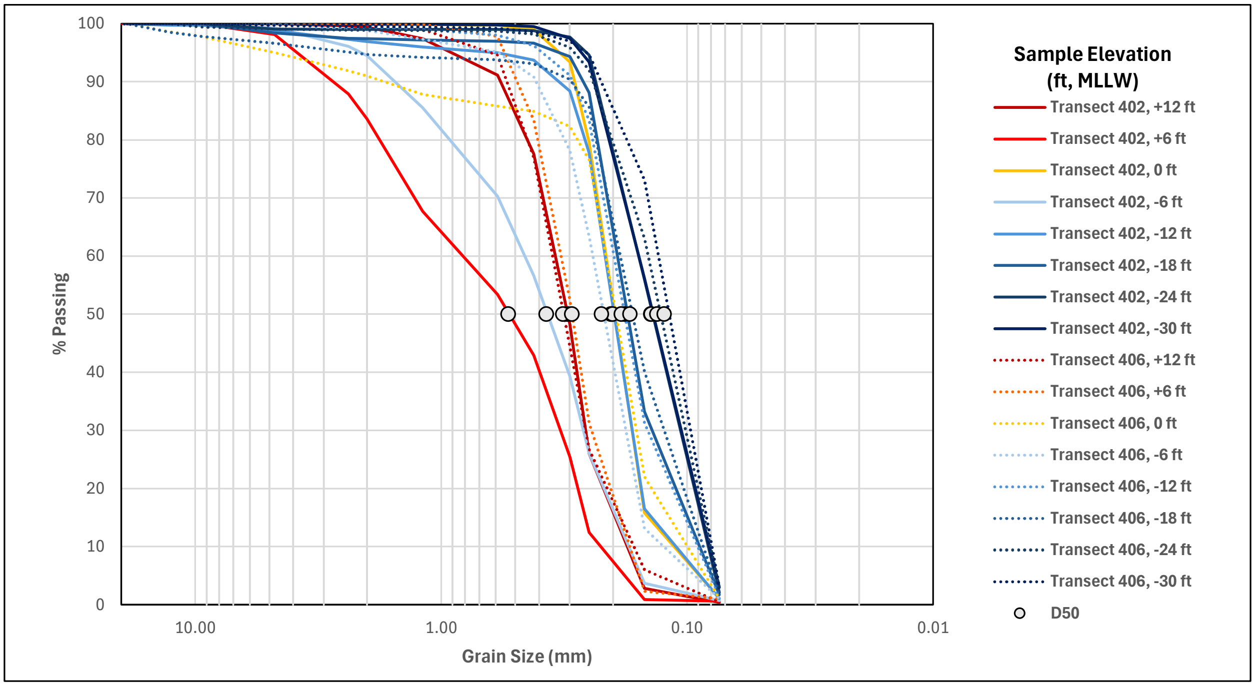

Figure 2-11. Envelope of Grain Sizes, Zuma Beach

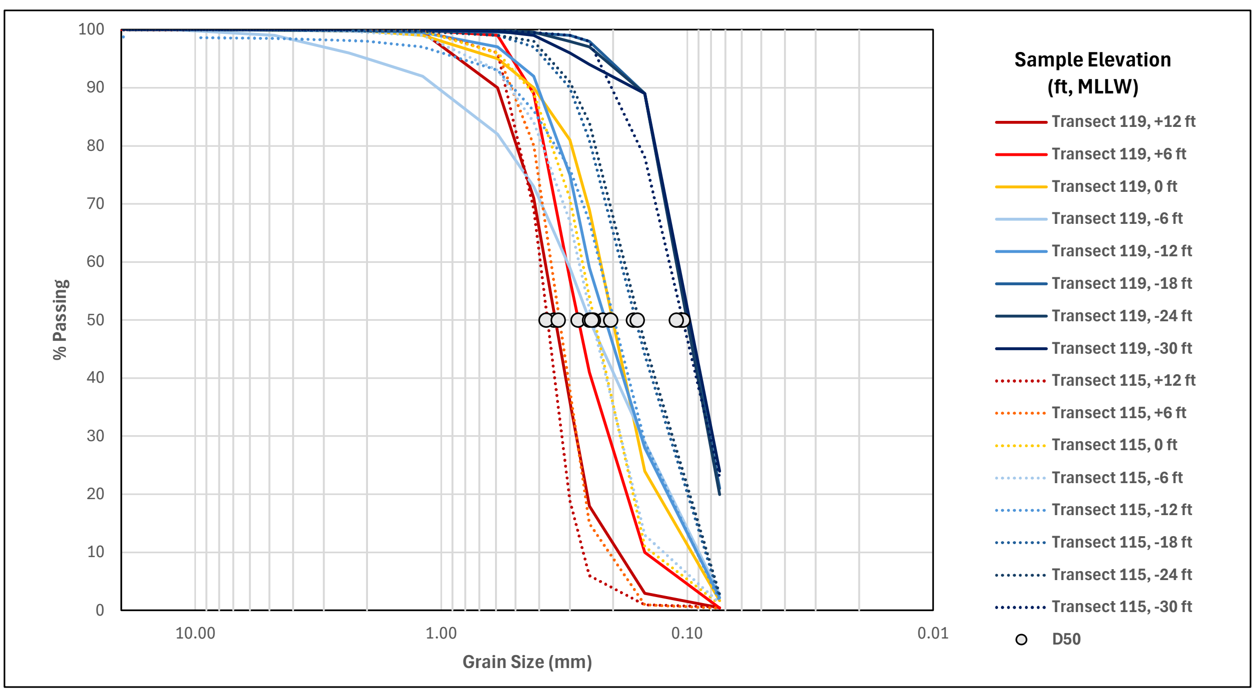

Figure 2-12. Envelope of Grain Sizes, Dockweiler State Beach

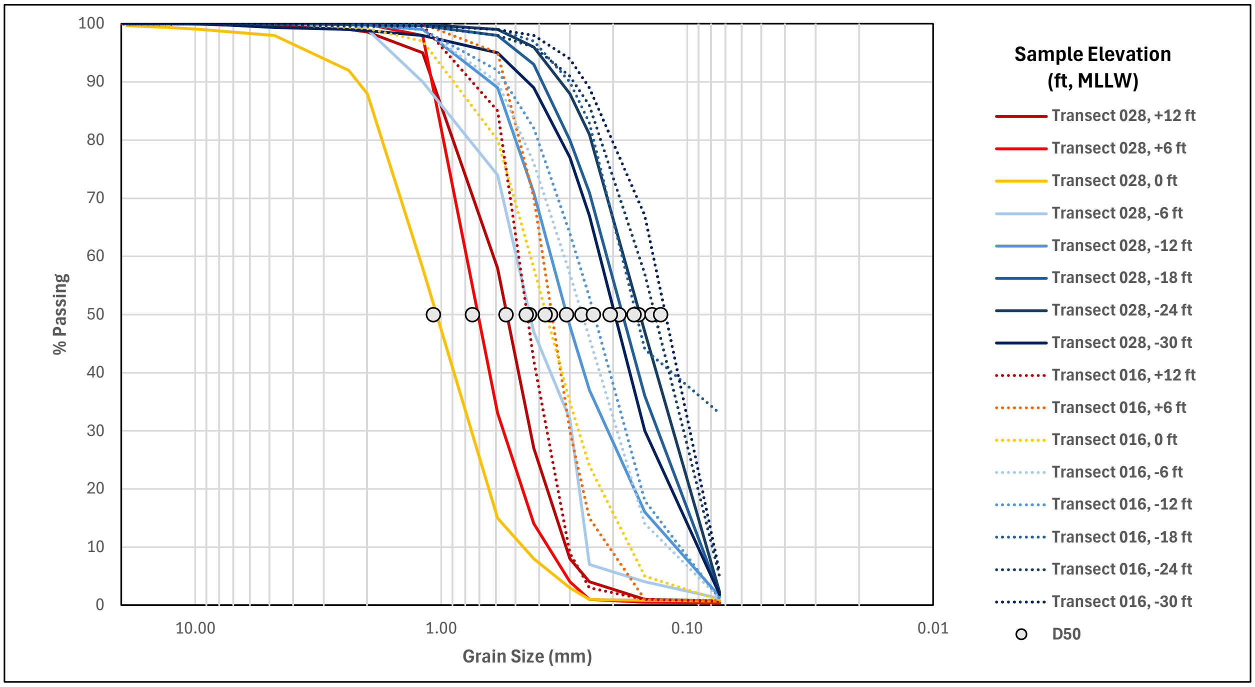

Figure 2-13. Envelope of Grain Sizes, Redondo Beach

2.2 Biological Resources

The subsections that follow summarize the regulated or sensitive biological resources relevant to the three project locations. The summary was prepared by Rincon Consultants (2024).

2.2.1 Data Sources

A variety of literature was reviewed to obtain baseline biological information at the three project sites. The literature review included information from standard biological reference materials and regionally applicable regulatory guiding documents, including (but not limited to) the following:

- Los Angeles Department of Beaches and Harbors Coastal Resiliency Study (Moffatt & Nichol, 2023)
- Sand Compatibility and Opportunistic Use Program for Los Angeles County Beaches – Planning Study & Framework Report (Coastal Frontiers Corporation, 2023)
- Los Angeles County Public Beach Sea-Level Rise Vulnerability Assessment (Noble, 2016)
- California Regional Sediment Management Plan, Los Angeles County Coast (Noble, 2012)

Other sources of information included aerial photographs, topographic maps, bathymetric charts, geologic maps, climatic data, and project plans. The results of database queries from the California Natural Diversity Data Base (CNDDB; CDFW, 2024a), United States Fish and Wildlife Service (USFWS) Information, Planning, and Conservation System (USFWS, 2024b), species managed by the National Oceanic Atmospheric Administration (NOAA, 2024b & 2024c), and the California Native Plant Society (CNPS, 2024) were recently compiled for the LACDBH SCOUP Project, which included a review of the three project site locations. The preliminary list of special status species for the SCOUP Project was used to evaluate which species may have a potential to occur within the three project sites. The evaluation included 83 terrestrial special-status plant species and 80 terrestrial and marine/anadromous special-status wildlife species.

Queries were conducted of several relevant scientific databases which provide information about regulated or sensitive biological resources, including the USFWS Critical Habitat Portal (USFWS, 2024a), the USFWS National Wetlands Inventory (NWI; USFWS, 2024c), the National Hydrography Dataset (NHD; United States Geological Survey [USGS], 2024), the United States Department of Agriculture National Cooperative Web Soil Survey (USDA, 2024a), the Natural Resource Conservation Service (NRCS) List of Hydric Soils (USDA, 2024b), and the Essential Fish Habitat (EFH) Mapper (NOAA, 2024a).

In addition to the literature review and databases mentioned above, team staff reviewed state Marine Protected Areas (MPAs), which have been established to protect ecosystems and/or sustain fisheries production, as well as specific species regulated through the goals, objectives, policies, and mandates of the Marine Life Management Act (MLMA) and Areas of Special Biological Significance (ASBS), which were created in order to help maintain natural water quality within some of the most pristine and biologically diverse sections of California's coast.

2.2.2 Regulated Biological Resources

Special-Status Species

Special-status species include those listed, proposed for listing, or candidates for listing as threatened, endangered or species of concern by the USFWS or NOAA under the Federal Endangered Species Act (FESA); those listed or proposed for listing as rare, threatened, or endangered by the CDFW under the California Endangered Species Act (CESA); animals designated as "Fully Protected" and Species of Special Concern (SSC) by the CDFW; and species on the Special Animals List. Additionally, special-status resources include those protected under the Marine Mammal Protection Act (MMPA) and sensitive aquatic communities, such as eelgrass beds (*Zostera* spp.) or managed fisheries (MF) such as California grunion (*Leuresthes tenuis*).

No special-status plants are expected to occur within the project sites based on the absence of suitable habitat types and/or soils and being located outside the known range for these species. The following special-status terrestrial and marine/anadromous wildlife species have potential to occur at the three project sites.

- El Segundo blue butterfly (*Euphilotes battoides allyni*) (Federally Endangered [FE]) – Dockweiler State Beach
- California grunion (MF) – Zuma Beach & Point Dume Beach, Dockweiler State Beach, Redondo Beach
- Green sea turtle (*Chelonia mydas*) (Federally Threatened [FT]) – Zuma Beach & Point Dume Beach, Dockweiler State Beach, Redondo Beach
- Western snowy plover (*Charadrius nivosus nivosus*) (FT/ SSC)– Zuma Beach & Point Dume Beach and Dockweiler State Beach
- California brown pelican (*Pelecanus occidentalis*) (Federally and State Delisted) – Zuma Beach & Point Dume Beach, Dockweiler State Beach, Redondo Beach
- California least tern (*Sterna antillarum browni*) (FE/State Endangered) – Dockweiler State Beach and Redondo Beach
- Gray whale (*Eschrichtius robustus*) (FE/MMPA) – Zuma Beach & Point Dume Beach, Dockweiler State Beach, Redondo Beach
- Harbor seal (*Phoca vitulina*) (MMPA) – Zuma Beach & Point Dume Beach, Dockweiler State Beach, Redondo Beach
- Common bottlenose dolphin (*Tursiops truncatus*) (MMPA) – Zuma Beach & Point Dume Beach, Dockweiler State Beach, Redondo Beach
- California sea lion (*Zalophus californianus*) (MMPA) – Zuma Beach & Point Dume Beach, Dockweiler State Beach, Redondo Beach

Invertebrates

The El Segundo blue butterfly resides in the El Segundo sand dunes near Dockweiler State Beach and has been observed foraging in areas with their natural food source, coast buckwheat (*Eriogonum latifolium*). There is a low potential for the species to occur in the vegetated areas near the project site and they are not expected to occur due to lack of their food source.

Fish

The California grunion spawns on sandy beaches in southern California. Immediately following high tides from mid-March through August, grunion may come ashore to lay eggs in the sand near the High Tide Line (HTL). The eggs are incubated in the sand until the following series of high tide conditions, when the eggs hatch and are washed into the ocean. The Zuma Beach and Redondo Beach project sites occur on the subtidal sand overlapping the HTL and therefore have the potential to impact incubating eggs if project activities occur during their spawning season.

The project should be designed to be constructed outside of the spawning season or incorporate grunion monitoring measures, such as those provided in Section 3.3.3.

Green Sea Turtle

The green sea turtle is common in southern California bays, lagoons, and other nearshore waters close to coastal inlets. Individuals would not be expected at the project site but could occur foraging or transiting through Santa Monica Bay in warm water years. The project activities could temporarily alter nearshore water quality but the potential for substantial impacts is relatively low. The project should be designed to limit the discharge of sediment or material into the nearshore waters and develop a water quality monitoring plan, as described in Section 3.3.5.

Birds

The western snowy plover exhibits strong fidelity to overwintering sites, which provide connectivity for dispersal between breeding sites. Breeding western snowy plovers have not been observed at the Redondo Beach project site since 2020 but they may occur at Zuma Beach and Dockweiler State Beach. While the beach within the project sites may provide important overwintering habitat, the sites are frequently disturbed by public use and the species is likely accustomed to ambient disturbance. If the species were present during project activities, potential direct impacts could include mortality or injury of individuals. Potential indirect impacts to the species may include increased noise and displacement of food; however, these indirect impacts to habitat are anticipated to be temporary and will not affect the long-term quality of overwintering, foraging, or nesting habitat.

The California least tern is not known to nest at the project sites but could be found in the nearshore waters foraging; therefore, direct impacts are not expected. Project activities have the potential to indirectly impact foraging individuals if present during active working periods.

The California brown pelican is present at the project sites. However, suitable nesting habitat does not exist within the project area. Should the species be present during the project, potential direct impacts could include mortality or injury of individuals. Potential indirect impacts to the species may include increased noise and displacement of food.

The project should be designed to be constructed outside of the nesting bird season or incorporate western snowy plover monitoring and nesting bird survey measures, as described in Section 3.3.4.

Marine Mammals

The offshore waters of the project sites are relatively shallow (< 40-ft Mean Lower Low Water) reducing the potential for cetaceans (*e.g.*, gray whale) to occur. The common bottlenose dolphin, California sea lion and harbor seal have a moderate to high potential to occur. Noise from project implementation is not expected to cause disturbance to marine mammals since no underwater sound is proposed. Increased turbidity may temporarily alter foraging or migration patterns but the potential for substantial impacts is relatively low.

To minimize disturbance to special-status marine mammals, the general guidelines set forth in Section 3.3.5 should be implemented. Project activities are not expected to have direct impacts on marine mammals if these guidelines are followed. Indirect impacts to marine mammals could include alteration or disturbance of foraging or haul-out habitat.

Nesting Birds

To avoid disturbance to nesting and special-status birds, including raptor species protected by the Migratory Bird Treaty Act (MBTA) and California Fish and Game Code (CFGC) 3503, activities related to the project including, but not limited to, vehicle traffic, foot traffic, and demobilization, should occur outside of the bird breeding season for migratory birds (generally February 1 through September 15), if practicable. Should any birds nest on or near the project sites, project activities could directly impact breeding by destroying the nest or disrupting normal biological behaviors. Indirect impacts could include disturbance of breeding habitat. The loss of a nest or disturbance of nesting habitat during the breeding season due to construction activities would be a violation of the MBTA and CFGC Section 3503.

To minimize the possibility of disturbance to nesting birds, the guidelines set forth in the Section 3.3.4 should be implemented.

Watershed and Drainages

The Zuma Beach & Point Dume site is in the Zuma Canyon-Frontal Pacific Ocean watershed within Hydraulic Unit Code (HUC 12-180701040203), which drains directly into the Pacific Ocean (USGS, 2024). The south face of the Santa Monica Mountains drains to the Pacific Ocean through several small simple watersheds draining a few hundred to a few thousand acres. The streams and coastal bluffs contribute sand sources into the Santa Monica littoral cell, which extends from Mugu Canyon in Ventura County to Palos Verdes Peninsula in Los Angeles County.

Five ephemeral drainages which originate in residential areas direct stormwater under the Pacific Coast Highway and terminate at a culvert outlet along the back beach (USGS, 2024). Zuma Creek, an intermittent creek, is located west of Point Dume. The creek originates in the Santa Monica Mountains and flows through Zuma Canyon before terminating at the Pacific Ocean.

Dockweiler State Beach is located along the Manhattan Beach-Frontal Santa Monica Bay watershed within Hydraulic Unit Code (HUC 12-180701040500), which drains directly into the Pacific Ocean. No other drainages occur on the project site.

Redondo Beach is in the Manhattan Beach-Frontal Santa Monica Bay watershed within Hydraulic Unit Code (HUC 12-180701040500), which drains directly into Santa Monica Bay. The NHD identifies two ephemeral drainages channeling stormwater flows from the residential areas west of the project site.

The nearshore Pacific Ocean is regulated by the USACE, Regional Water Quality Control Board (RWQCB) & State Water Resources Control Board (SWRCB), and California Coastal Commission (CCC). Temporary direct impacts to waters of the US/State/Coastal Waters will occur during project activities at Zuma Beach & Point Dume Beach and at Redondo Beach. Potential impacts include altered turbidity, salinity, pH, light transmittance, total suspended solids, and other constituents during beach placement operations. Potential indirect impacts from project activities could occur if sediment or pollutants were allowed to enter the Pacific Ocean through stormwater runoff.

No culverts or other drainages occur at the project sites and therefore the project will not result in a diversion, diking, or filling of the culverts and will not alter the existing flow of stormwater.

Designated Critical Habitat

The Zuma Beach & Point Dume Beach project site is located within designated critical habitat for the western snowy plover and tidewater goby (*Eucyclogobius newberryi*). The Dockweiler State Beach project site is located within designated critical habitat for western snowy plover. The Redondo Beach project site is approximately 1.1 miles south of designated critical habitat for the species. The primary constituent elements (PCEs) essential to western snowy plover include the following (NOAA, 2012):

- Sandy beaches, dune systems immediately inland of an active beach face, salt flats, mud flats, seasonally exposed gravel bars, artificial salt ponds and adjoining levees, and dredge spoil sites, with:
    - Areas that are below heavily vegetated areas or developed areas and above the daily high tides;

  - Shoreline habitat areas for feeding, with no or very sparse vegetation, that are between the annual low tide or low water flow and annual high tide or high water flow, subject to inundation but not constantly under water, that support small invertebrates, such as crabs, worms, flies, beetles, spiders, sand hoppers, clams, and ostracods, which are essential food sources;
  - Surf- or water-deposited organic debris, such as seaweed (including kelp and eelgrass) or driftwood located on open substrates that supports and attracts small invertebrates for food, and provides cover or shelter from predators and weather, and assists in avoidance of detection (crypsis) for nests, chicks, and incubating adults; and
  - Minimal disturbance from the presence of humans, pets, vehicles, or human-attracted predators, which provide relatively undisturbed areas for individual and population growth and for normal behavior.

Project activities are not expected to permanently impact or adversely modify critical habitat. Temporary impacts to these areas could include changes to water quality (*e.g.,* turbidity, pH, dissolved oxygen), increased noise, temporary removal of foraging habitat, and other increased human activity during project activities.

On July 19, 2023, NMFS issued a *Proposed Rule to Designate Marine Critical Habitat for Six Distinct Population Segments of Green Sea Turtles*. “CA04: San Onofre to Santa Monica Bay” is proposed and overlaps the Dockweiler State Beach and Redondo Beach project sites. Under the FESA, critical habitat designations are finalized at the same time the final listing rule is complete. For this report, we have assumed the Final Rule will include the Dockweiler State Beach and Redondo Beach project sites, which would extend from the HTL to 20-meter depth. This area is considered an essential foraging/resting area for green sea turtle.

Essential Fish Habitat/ Habitat Areas of Particular Concern

The offshore portion of each project site is designated as EFH for two Fishery Management Plans (FMPs): Pacific Fishery Management Council’s Groundfish Management Plan (GMP) and the Pacific Fishery Management Council’s Coastal Pelagic Species Fishery Management Plan (CPSMP; NOAA, 2024a). EFH is defined as those waters and substrate necessary to fish for spawning. Substrate includes the sediment, hard bottom, structures underlying the waters and the associated biological communities. Several species regulated by the plans include:

- Pacific sanddab (*Citharichthys sordidus*); lingcod (*Ophiodon elongatus*); leopard shark (*Triakis semifasciata*): GMP regulated

- Pacific sardine (*Sardinops sagaz*); northern anchovy (*Engraulis mordax*); Pacific mackerel (*Scomber japonicas*); krill species (*Thysanoessa spinifera, Euphausia pacifica*, and other krill species) and jack mackerel (*Trachurus symmetricus*): CPSMP regulated

Habitat Areas of Particular Concern (HAPC) are a subset of EFH that exhibit one or more of the following traits: rare, stressed by development, provide important ecological functions for federally managed species, or are especially vulnerable to anthropogenic (or human impact) degradation. The rocky reefs HAPC includes those waters, substrates and other biogenic features associated with hard substrate (bedrock, boulders, cobble, gravel, etc.) to the Mean Higher High Water (MHHW) Line. In general, these areas support a diverse assemblage of algae, invertebrates and fish species. Surfgrass is also common in the intertidal rocky reef.

The canopy kelp HAPC includes those waters, substrate, and other biogenic habitat associated with canopy-forming kelp species (*e.g., Macrocystis pyrifera* [giant kelp]). Kelp beds are not only important spawning areas for fishes, but they are important as nursery areas for juveniles. Kelp beds in southern California have fluctuated in extent over the past three decades. Kelp beds are susceptible to turbidity, grazing, sedimentation, displacement by storm surge, and lack of growth related to high temperatures and low nutrients associated with El Niño events.

Dockweiler State Beach borders Marina del Rey harbor. The estuaries present within the harbor are classified as HAPC. Estuary HAPCs include nearshore areas such as bays, sounds, inlets, river mouths and deltas, pocket estuaries, and lagoons influenced by ocean and freshwater. Because of tidal cycles and freshwater runoff, salinity varies within estuaries and results in great diversity, offering freshwater, brackish and marine habitats within close proximity. Such areas tend to be shallow, protected, nutrient rich, and are biologically productive, providing important habitat for marine organisms.

Project activities may temporarily alter EFH and HAPCs or interfere with the movement of fish or wildlife species and could temporarily impede the use of wildlife nursery sites. However, project activities are not expected to have any significant impact on these habitats, populations or the fisheries that depend on them. The project, as designed, will help preserve natural habitats and reduce erosion in the nearshore zone, providing additional soft bottom habitat suitable for foraging. Temporary impacts to these areas could include changes to water quality (*e.g.,* turbidity, pH, dissolved oxygen), increased noise, and other increased human activity during construction.

Marine Protected Areas

The Marine Life Protection Act of 1999 directs the state to redesign California's system of MPAs to function as a network to increase coherence and effectiveness in protecting the state's marine life and habitats, marine ecosystems, and marine natural heritage, as well as to improve recreational, educational and study opportunities provided by marine ecosystems subject to minimal human disturbance. Zuma Beach is located within the Point Dume State Marine Conservation Area (Point Dume SMCA). The Point Dume SMCA extends four miles along the coast and is adjacent to the Point Dume State Marine Reserve (SMR) that extends around Point Dume. The Point Dume SMR has the more restrictive regulations. Take of all living marine resources is prohibited in this area.

Take pursuant to beach nourishment and other sediment management activities is allowed inside the SMCA pursuant to any required federal, state and local permits, or as otherwise authorized by the CDFW (California Code of Regulations Title 14, Section 632). Indirect impacts may occur related to increased turbidity and burial of benthic infauna.

Areas of Special Biological Significance

The California State Water Resources Control Board created ASBS to help maintain natural water quality within some of the most pristine and biologically diverse sections of California’s coast. No pollutants are allowed to be discharged within these protected areas. Malibu is home to the largest ASBS, Number (No.) 24, which was designated in 1974. ASBS No. 24 stretches 24 miles along the coast from Latigo Point to Laguna Point near Point Mugu, covering about half of the Malibu coast. The Zuma Beach & Point Dume site is located within this ASBS.

The project will not result in direct impacts, such as wastewater and pollutant discharges. However, indirect impacts due to increased turbidity or a change in other water quality standards may occur.

2.3 Dune Habitat and Restoration Opportunities

Subaerial dunes (vegetated ridges or mounds of wind-blown sand that form on the back beach in many coastal areas) serve a wide range of beneficial purposes, including sand storage, biological habitat, and flood protection. They are dynamic “self-repairing” systems, whereby the seaward extent, or “foredune,” is expected to erode rapidly during severe storm events, then gradually recover through the natural processes of sediment deposition and revegetation.

Restoration of dune habitat is increasingly seen as a way to support both coastal resilience and the ecological function of sandy coastlines. As part of the present project, it is being considered as an approach to protect infrastructure from wave damage, preserve sandy beach areas for recreation, and provide ecological co-benefits. The following subsections summarize the present condition of each of the project sites, along with the feasibility of creating and/or restoring dune systems in these areas. They are based on analyses and memoranda prepared by Coastal Restoration Consultants (CRC, 2024a) as part of this project.

2.3.1 Shoreline Assessment

CRC has developed a shoreline assessment methodology that provides a quantitative basis for determining the potential for dune restoration on sandy beaches at a scale that can inform restoration project planning and implementation. The approach is applicable throughout southern California and is based primarily on measurements of ecological zone widths (Table 2-3).

Table 2-3. Typical Ecological Zones on Southern California Beaches

Ecological Zone	Limits of the Zone	Field Indicator of Upper Limit	Typical Plants	Physical Drivers
Swash	Below the water table outcrop (WTO)	Saturated sand (WTO)	None	Waves and tides
Wet Sand	WTO to the high tide line (HTL)	Highest recent wrack	None	Waves and tides
Dry Sand	HTL to toe of vegetation	Dry sand without vegetation	None	High waves and king tides
Coastal Strand	Toe of vegetation to toe of the foredunes	Highest seasonal wrack or vegetation	Sea rocket, beach salt bush, red sand verbena	High waves, king tides, and aeolian sand transport
Foredune	Toe of foredunes to first dune ridge	Hummocky dunes & vegetation	Sea rocket, beach salt bush, red sand verbena, beach bur	High waves and aeolian sand transport
Dunes	First dune ridge to development or non-dune habitat	Active dunes & vegetation	Red sand verbena, beach bur, beach evening primrose	Extreme waves and aeolian sand transport

CRC measured the existing ecological zone widths at Zuma Beach in September 2024 and measured those at Point Dume Beach, Dockweiler State Beach, and Redondo Beach in October 2024. The zone widths were measured in contiguous segments (along the shoreline), each representing a length of the coast characterized by a single back beach type (revetment, bluff, lagoon, building, parking lot, etc.) or a consistent width. Additional observations included the beach composition, plant species present, typical cobble size, and beach face slope.

Given that the measurements were obtained at the beginning of fall when beaches in southern California typically are widest, seasonal shoreline changes derived from aerial photos and/or shoreline monitoring data were used to adjust the ecological zone widths to those that are likely to prevail following the winter storm season.

At Zuma Beach and Point Dume, beach profile data obtained by CFC between 2012 and 2017 were used to estimate the magnitude of seasonal shoreline changes in the area and adjust the fall zone widths to those more representative of a winter condition. In comparison to the fall condition, the shoreline at the end of a “typical winter” was taken to be 75 ft narrower on the north end of Zuma Beach and 25 ft narrower on the south end of Zuma Beach, while those following an “El Niño winter” were taken to be between 110 and 75 ft (north to south) narrower than the fall condition. At Point Dume Beach, the seasonal changes included both erosion on the north end and accretion on the south end. As a result, “typical winter” zone widths at the north end of Point Dume Beach were assumed to be 20 ft narrower than in fall, while those on the south end were assumed to be 20 feet wider. During an “El Niño winter,” the winter condition was assumed to be 60 ft narrower than the fall condition on the north end and 30 feet wider than the fall condition on the south end.

Seasonal beach profile data were not available at Dockweiler and Redondo Beach, and as a result, seasonal shoreline changes were derived from aerial photos obtained between 2014 and 2024. The aerial photos indicate that the beach near the Dockweiler site typically erodes by about 30 ft over a “typical winter”, with a maximum value of about 50 ft during an “El Niño winter.” Similar analyses of the Redondo Beach site indicate that seasonal erosion typically does not occur, and at most is limited to about 20 ft.

2.3.2 Results

All the beaches evaluated were sandy and no gravel or cobbles were observed. The beaches are heavily used for recreation and driving by public safety officials was evident at all sites. Evidence of grooming was observed at all sites, except for the narrowest stretches of Point Dume Beach.

Zuma Beach & Point Dume Beach

Zuma Beach was divided into 24 segments (Figure 2-14), the majority of which (19), are backed by a low concrete wall located just seaward of a paved pedestrian path. Trancas Creek Lagoon and some degraded dunes (somewhat impacted by ongoing construction of the PCH bridge) are located beyond the northwest end of the wall. Zuma Creek Lagoon is located at the south end of the wall and contains dune habitat to the north (in front of the wall) and to the south (in front of upland habitat and a bathroom). Excepting the area in front of Trancas Creek, most of the beach was recently groomed from about the HTL to within 6 to 8 ft of the wall.

When adjusted to MSL, the beach widths measured by CRC in September 2024 were within the historic range, but narrower than the average values computed as part of the Broad Beach Restoration Project between 2012 and 2023 (Table 2-4). When all 24 segments are considered, beach widths in September 2024 ranged from 141 to 611 ft, with an average width of 248 ft (Figure 2-15; Table 2-5).

Figure 2-14. Beach Back Type for Zuma Beach

Table 2-4. Fall MSL Beach Width, Zuma Beach

Transect #	Fall MSL Beach Width (ft)				
	CRC	Coastal Frontiers Corporation[1] (2012 to 2023)			
	2024	2023	Average	Minimum	Maximum
400	263	263	290	263	318
402	221	282	298	249	354
404	246	272	269	198	321
406	216	254	234	168	287

Note: CRC widths derived from the segment in which the CFC transect is located.

[1] Broad Beach Restoration Project (Coastal Frontiers Corporation, 2023)

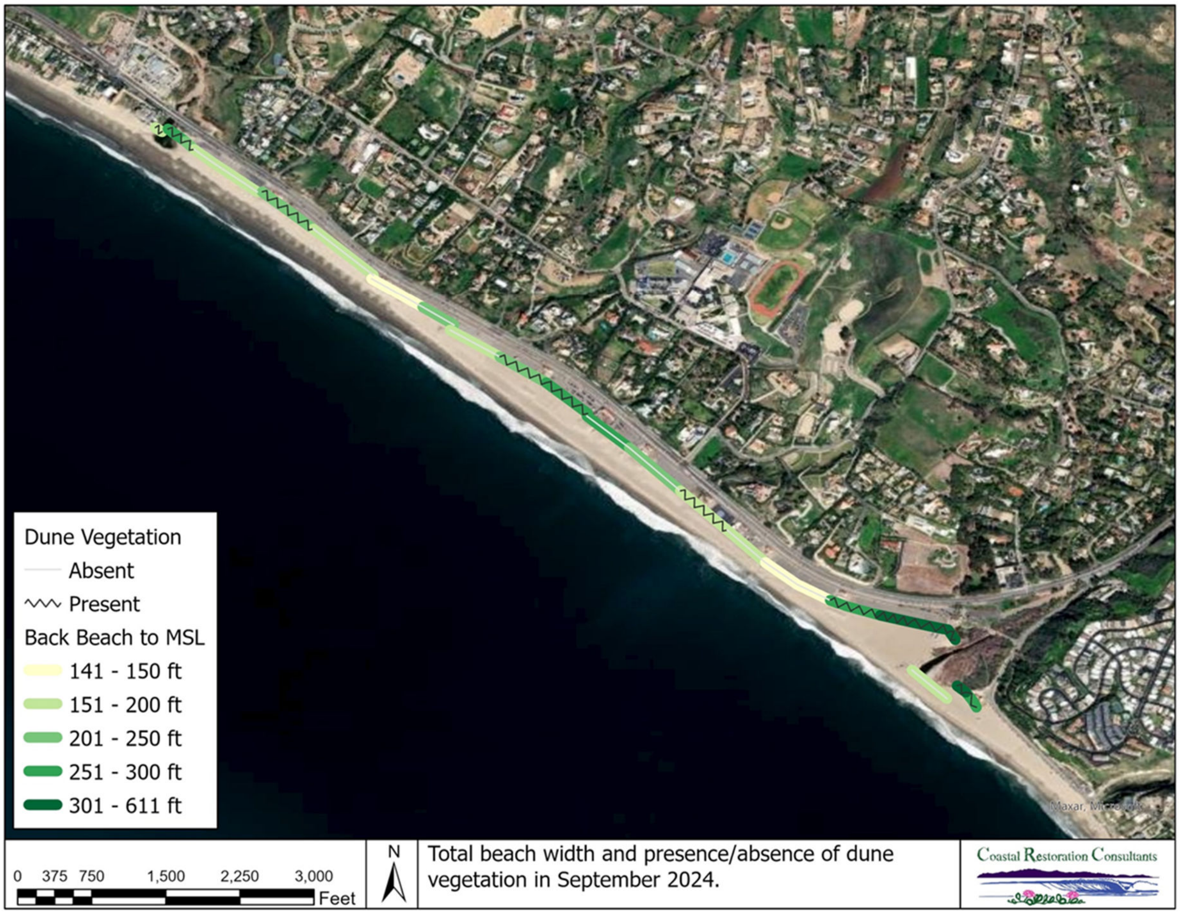

Figure 2-15. Measured MSL Beach Widths, Zuma Beach

Table 2-5. MSL Beach Width at Zuma Beach during Typical and El Niño Winters

Value	MSL Beach Width (ft)		
	September 2024	Typical Winter	El Niño Winter
Minimum	141	70	35
Maximum	611	536	501
Average	248	190	146

Note: Data derived from all 24 segments at Zuma Beach.

Dune vegetation was found in 12 of 24 segments (Figure 2-15). Except in the above-noted dune areas around the lagoons, this vegetation consisted of one to just a few plants per segment, with sea rocket, beach evening primrose, beach bur, and seaside heliotrope being the only species found. All these plants were immediately in front of the wall in a zone that was not groomed.

Estimated winter MSL beach widths for each segment at Zuma Beach were computed and are shown in Table 2-5. The values range from 70 to 536 ft, with an average of 190 ft. Estimated minimum beach widths (*i.e.*, those occurring during an El Niño winter) ranged from 35 to 501 ft and averaged 146 ft. There was not a clear geographical trend in beach width.

Point Dume Beach was divided into 21 segments, the majority of which (11) were backed by a road or parking lot (Figure 2-16). Six segments were backed by a rock revetment and two by buildings. The two segments at the southern end of the reach were backed by natural bluff/upland habitats. Beach widths measured during the October 2024 field survey were within the historical range and similar to the average value computed from beach profile data obtained between 2012 and 2023 (Table 2-6). When all 21 segments are considered, beach widths in October 2024 ranged from 30 to 302 ft with an average width of 180 ft (Figure 2-17; Table 2-7).

Figure 2-16. Back Beach Type for Point Dume Beach

Table 2-6. Fall MSL Beach Width, Point Dume Beach

Transect #	Fall MSL Beach Width (ft)				
	CRC	Coastal Frontiers Corporation[2] (2012 to 2023)			
	2024	2023	Average	Minimum	Maximum
394	197	195	234	190	292
396	56	74	70	2	102
398	292	236	269	235	303

Note: CRC widths derived from the segment in which the CFC transect is located.

Figure 2-17. Measured MSL Beach Widths, Point Dume Beach

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[2] Broad Beach Restoration Project (Coastal Frontiers Corporation, 2023)

Table 2-7. MSL Beach Width at Point Dume Beach during Typical and El Niño Winters

Value	MSL Beach Width (ft)		
	October 2024	Typical Winter	El Niño Winter
Minimum	30	45	60
Maximum	302	317	331
Average	180	188	194

Note: Data derived from all 24 segments at Point Dume Beach.

Dune vegetation was found in 13 of 21 segments (Figure 2-17). Dune topography was found in 8 of the 21 segments, mostly in front of the parking lot towards the southern end of the site. Vegetation consisted of sea rocket, beach evening primrose, beach bur, pink sand verbena, and red sand verbena. Most of the dune areas were part of a restoration project implemented by the Bay Foundation over the last few years, though vegetation cover and plant diversity were low.

Estimated winter beach widths for each segment at Point Dume Beach were computed and are shown in Table 2-7. The values ranged from 45 to 317 ft (averaging 188 ft) for typical winter conditions and from 60 to 331 ft (averaging 194 ft) for El Niño winter conditions.

Dockweiler State Beach

The project area at Dockweiler State Beach was divided into four segments, three of which were backed by a bike path and one that was backed by buildings (Figure 2-18). The beach widths measured in October 2024 ranged from 328 to 574 ft (Figure 2-19) with an average width of 419 ft.

Dune vegetation and topography were found in three of four segments (Figure 2-19). Vegetation consisted of sea rocket, beach evening primrose, beach bur, seaside buckwheat, and iceplant. The dune habitat was located on a steep slope between the fairly flat upper beach and the bike path and considerable trampling through the dunes was evident.

Estimated typical winter beach widths for each segment at Dockweiler State Beach ranged from 298 to 544 ft, with an average value of 389 ft. Estimated minimum beach widths during El Niño winters ranged from 278 to 524 ft and averaged 369 ft.

Figure 2-18. Back Beach Type for Dockweiler State Beach

Figure 2-19. Measured MSL Beach Widths, Dockweiler State Beach

Redondo Beach

The project area at Redondo Beach was divided into nine segments, seven of which were backed by a bike path, one was backed by a building and one by a wall/staircase (Figure 2-20). The beach widths measured in October 2024 ranged from 105 to 177 ft (Figure 2-21) with an average width of 136 ft.

Figure 2-20. Back Beach Type for Redondo Beach

Figure 2-21. Measured MSL Beach Widths, Redondo Beach

Dune vegetation was found in two segments (Figure 2-21) and consisted of a patch of iceplant next to a bathroom and a sea rocket plant at the mouth of a storm drain. No dune topography was observed.

Estimated typical winter beach widths at Redondo Beach ranged from 105 to 177 ft, with an average value of 136 ft. Estimated minimum beach widths during El Niño winters ranged from 85 to 157 ft and averaged 116 ft.

2.3.3 Implications for Nature-Based Solutions

Current state guidance (Newkirk *et al.,* 2018) recommends that dunes restored as a nature-based solution for protecting inland areas from flooding should be at least 50 ft wide and 100 ft long, with 100 to 200 ft of fronting beach (Figure 2-22). It is assumed that the recommended beach width applies to summer/fall (maximum width) conditions, although this is not explicit. Additionally, this guidance is meant to apply to all of California, including northern California beaches where wave energy is significantly higher. Based on this guidance and the measurements noted above, the minimum recommended beach width fronting dunes is taken to be 100 ft at Zuma, Point Dume, and Dockweiler Beaches and 50 ft at Redondo Beach.

From Newkirk *et al.* (2018)

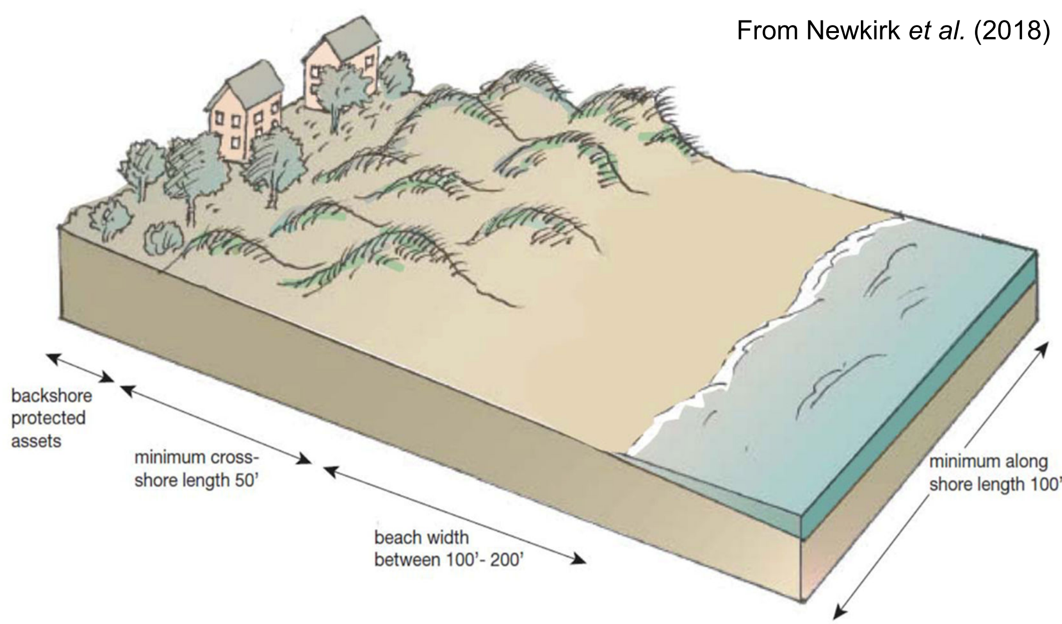

Figure 2-22. Current Design Guidance for Dune Use in Nature-Based Adaptation Strategies

Assuming that the restored dunes are at least 50 ft wide, beach segments that were at least 150 ft wide at the time of the September and October 2024 field measurements at Zuma, Point Dume, and Dockweiler Beaches are considered to be potential candidates for restoration of sustainable, self-repairing dunes. The potential was categorized as "marginal" if the segment was between 150 to 200 ft wide, "high" if the segment was 200 to 300 ft wide, and "sufficient" if the segment was more than 300 ft wide. The categories used at Redondo Beach were 50 ft narrower than those at Zuma, Point Dume, and Dockweiler to account for the reduction in seasonal shoreline erosion at that site.

Zuma Beach and Point Dume Beach

Figure 2-23 illustrates the 24 Zuma Beach segments categorized using the criteria above. As shown in the figure, two regions were identified as being too narrow to accommodate healthy, self-repairing dunes (beach width less than 150 ft); one just west of the entrance to Zuma Beach and one near the restrooms at the west end.

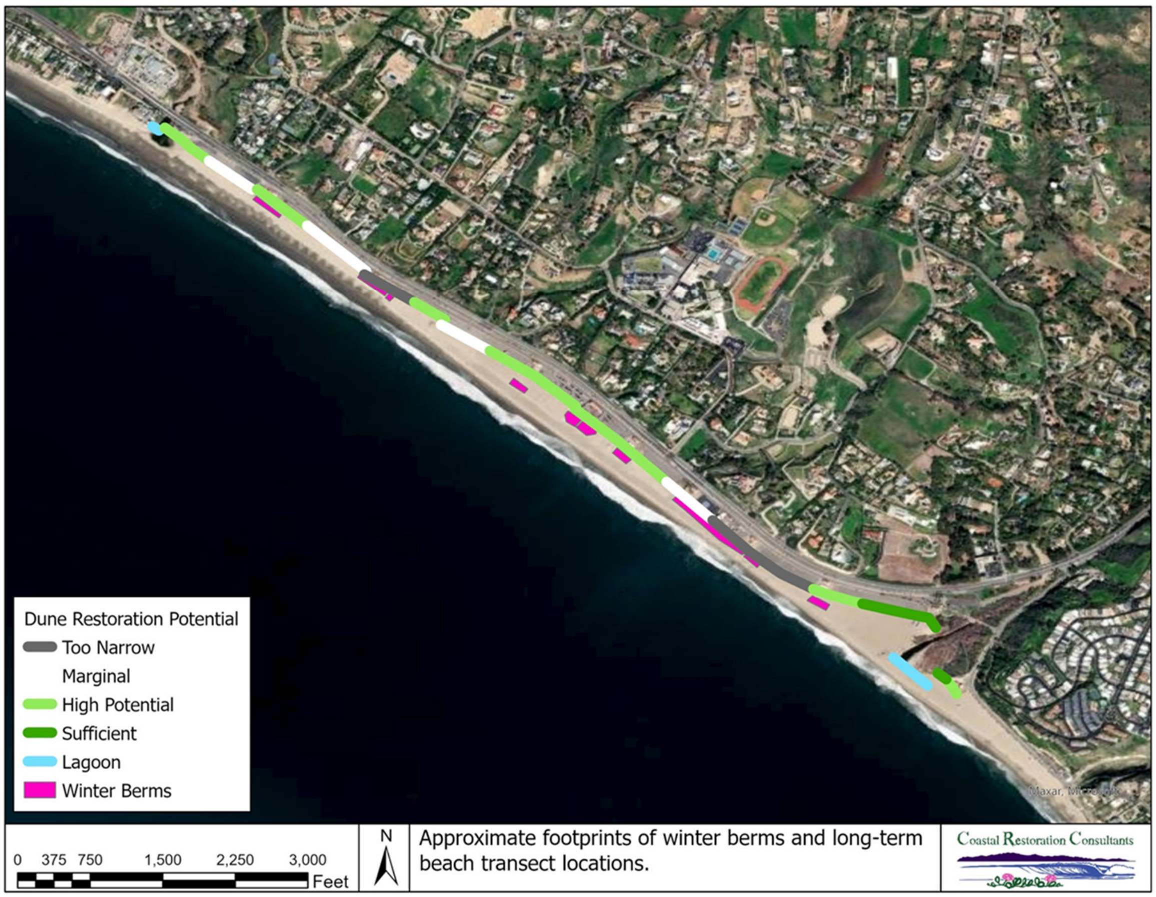

Figure 2-23. Potential for Restoring Self-Sustaining Dunes at Zuma Beach

Four additional areas were identified as marginal, most of which were located along the west half of the beach. The remaining areas were considered to have high potential or to be sufficient to support a self-sustaining dune system. All segments identified having as marginal, high potential, or sufficient were greater than 100 ft long and therefore exceeded the minimum length (100 ft) specified by Newkirk *et al*. (2018).

Figure 2-24 illustrates the potential for the 21 Point Dume Beach segments to support self-sustaining dunes. As shown in the figure, one small area was identified as being too narrow and two adjacent areas were identified as marginal. All three areas were located adjacent to the newly constructed revetment near the north end of the Point Dume Beach parking lot. The remaining segments were considered to have high potential or to be sufficient to support a self-sustaining dune system.

Figure 2-24. Potential for Restoring Self-Sustaining Dunes at Point Dume Beach

Dockweiler State Beach

Given that beach widths measured at Dockweiler State Beach in Fall 2024 exceeded 300 ft, the entire project site is sufficiently wide to support self-sustaining dunes (Figure 2-25). In addition, the existing dunes at the stie could be enhanced by reducing trampling, seeding with native dune species, and removing non-native vegetation.

Figure 2-25. Potential for Restoring Self-Sustaining Dunes at Dockweiler State Beach

Redondo Beach

Despite the relatively narrow beach at this site, the absence of significant seasonal changes in beach width indicate that this site could support a narrow self-sustaining dune field throughout most of the reach (Figure 2-26). If the beach is nourished and that sand is retained, the beach would be wide enough to support a dune system along with considerable recreation space.

Figure 2-26. Potential for restoring self-sustaining dunes at Redondo Beach

2.4 Socio-Economic Characteristics

The following subsections include socio-economic profiles of beach users at each of the proposed resilience sites. The profiles were prepared by Ceto Consulting (2024) and are based on the California Coastal Commission Coastal Access Database (Patsch and Reineman, 2024).

Zuma Beach & Point Dume Beach

Zuma and Point Dume Beach are characterized by wide, sandy shorelines. Zuma Beach serves as a heavily frequented site for recreational activities such as swimming, surfing, and beach sports, and is supported by infrastructure including lifeguard stations, restrooms, showers, and parking facilities. Point Dume Beach is less developed than Zuma Beach, while still offering amenities such as restrooms, showers, lifeguards, and restaurants in close proximity (Figure 2-27). This area has four known access points, over a dozen amenities, more than 2,000 paid parking spaces, and a little over 500 free parking spaces.

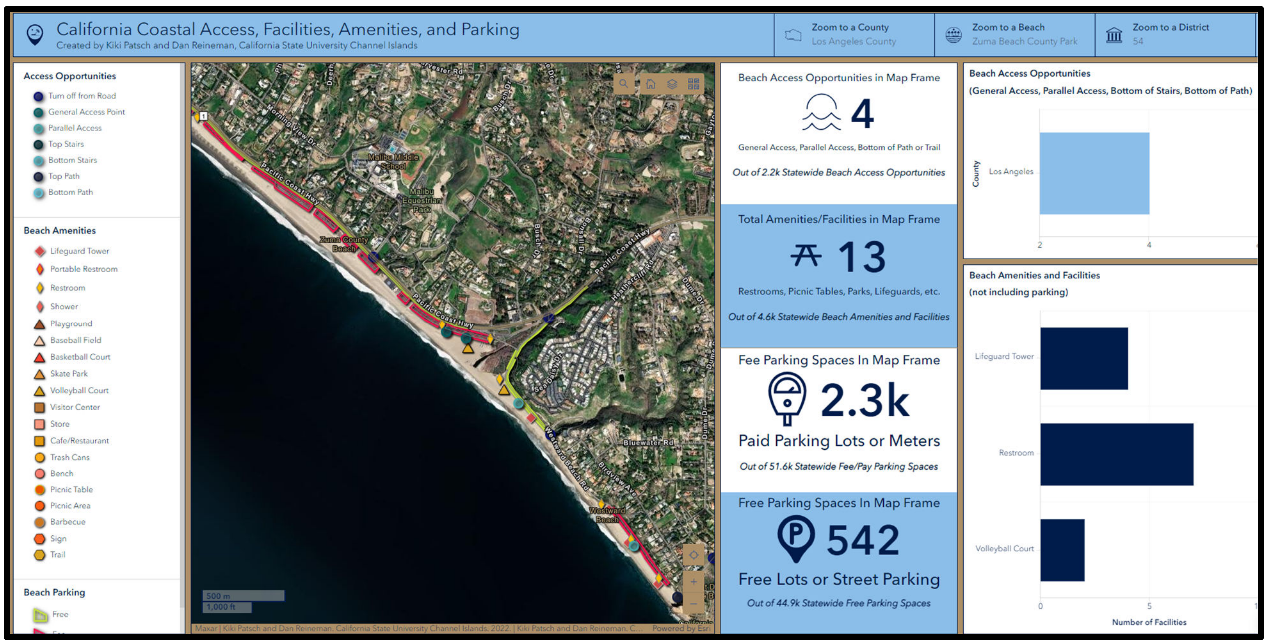

Figure 2-27: Snapshot of Coastal Access Dashboard, Zuma and Point Dume Beach

Utilizing the network analysis tool in esri's ArcGIS Pro software, service area buffers were constructed around the Zuma Beach Access Point delineating the areas that are within 1, 10, 25, 50, and 100 km (Figure 2-28). In Los Angeles County, depending on the time of day and year, drive times over these distances will range from several minutes to several hours, but are considered a reasonable distance that people will travel to go to the beach. Once generated, demographic and socioeconomic data were summarized using the Enrich Tool in ArcGIS Pro.

Information gleaned using this methodology was used to characterize the population that theoretically has access to Zuma Beach. Table 2-8, Figure 2-29, and Figure 2-30 characterize the 11 million potential visitors to Zuma Beach, as well as the demographic and socioeconomic snapshot of the region. Moving away from the coast, the population tends to get more diverse, housing prices drop, the median age of the population drops, and the area considered to be vulnerable per CalEnviroScreen 4.0 (CES4) increases with distance from the coast (State of California Office of Environmental Health Hazard Assessment, 2024).

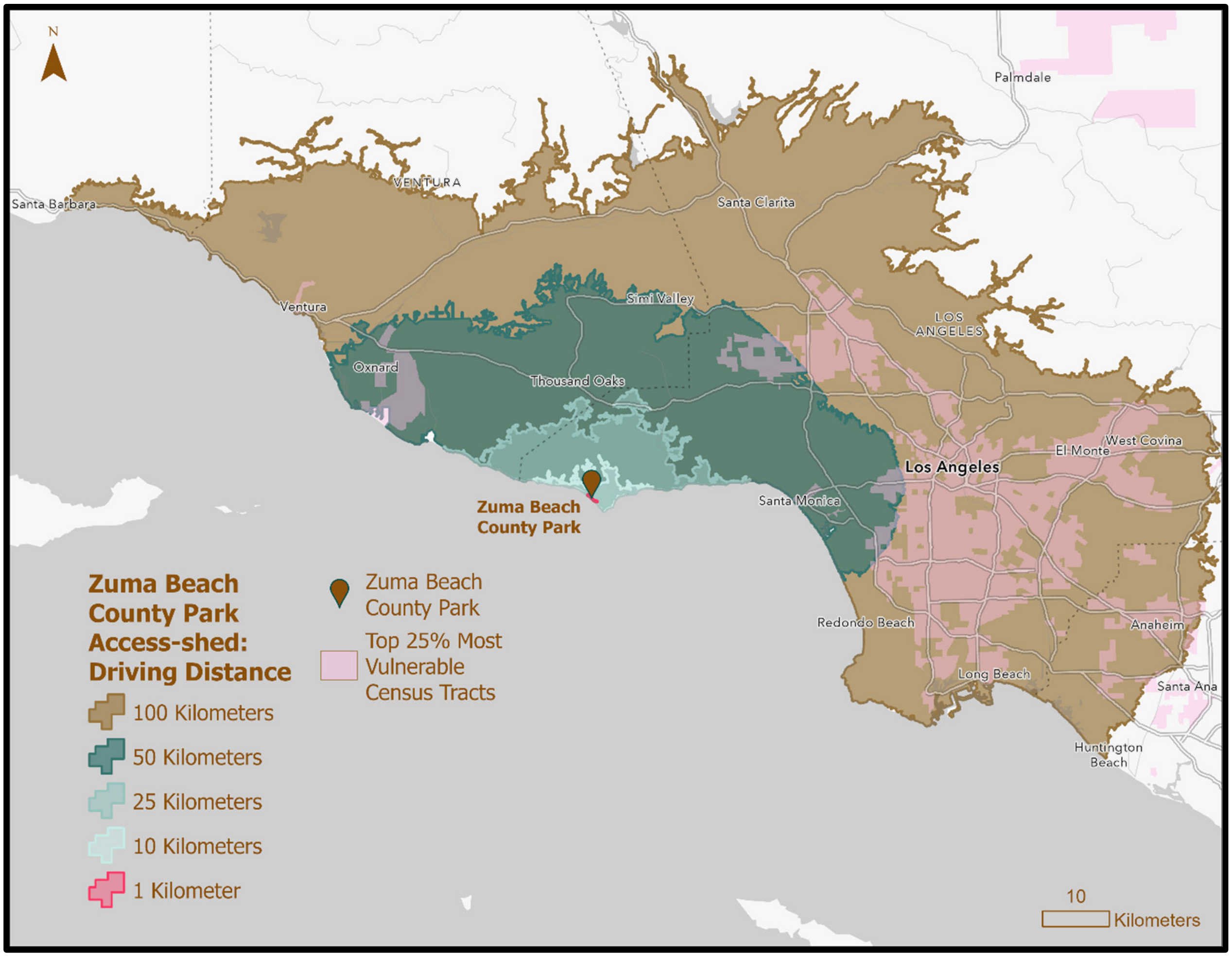

Figure 2-28. Access-Sheds, Zuma Beach

Table 2-8. Socioeconomic Information, Zuma Beach's Access-Sheds

Zuma Beach: Access-shed Statistics								
Driving Distance Buffer	Total Population (2020)	Population over 65 (2020)	Median Age (2020)	Total Households (2020)	Median Home Value (2024)	Average Home Value (2024)	Median Household Income	Mean Census Diversity Index (2020)
1 km	39	10	48.3	4	$ 2,000,001	$ 1,916,667	$ 200,001	2
10 km	6,230	1,583	51.0	2,537	$ 2,000,001	$ 1,860,591	$ 189,324	18
25 km	33,979	7,610	46.4	12,419	$ 1,468,490	$ 1,535,574	$ 178,687	33
50 km	2,200,582	363,827	39.0	858,451	$ 1,005,804	$ 1,212,620	$ 109,479	46
100 km	11,405,265	1,697,230	37.9	3,886,505	$ 865,350	$ 999,202	$ 90,955	49

The mean Census Diversity Index measures the likelihood that two randomly chosen individuals in a given area will belong to different racial or ethnic groups, with values ranging from 0 (no diversity) to 100 (complete diversity).

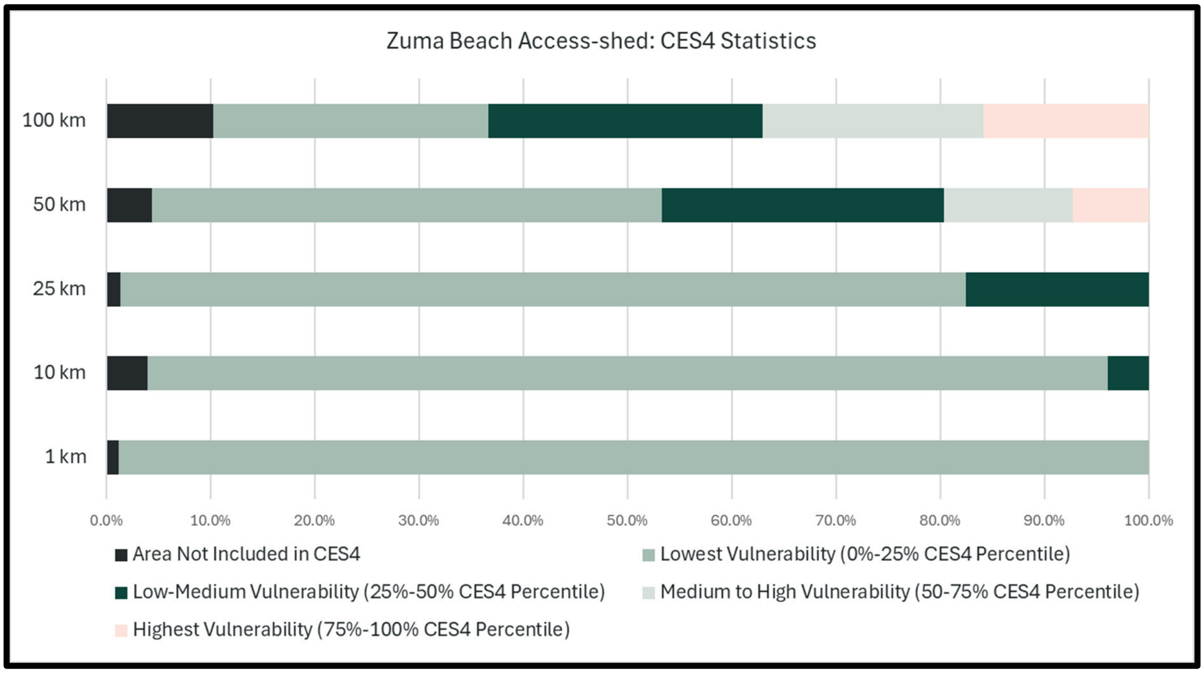

Figure 2-29. CES4 Assessment of Vulnerability, Zuma Beach Access-Sheds

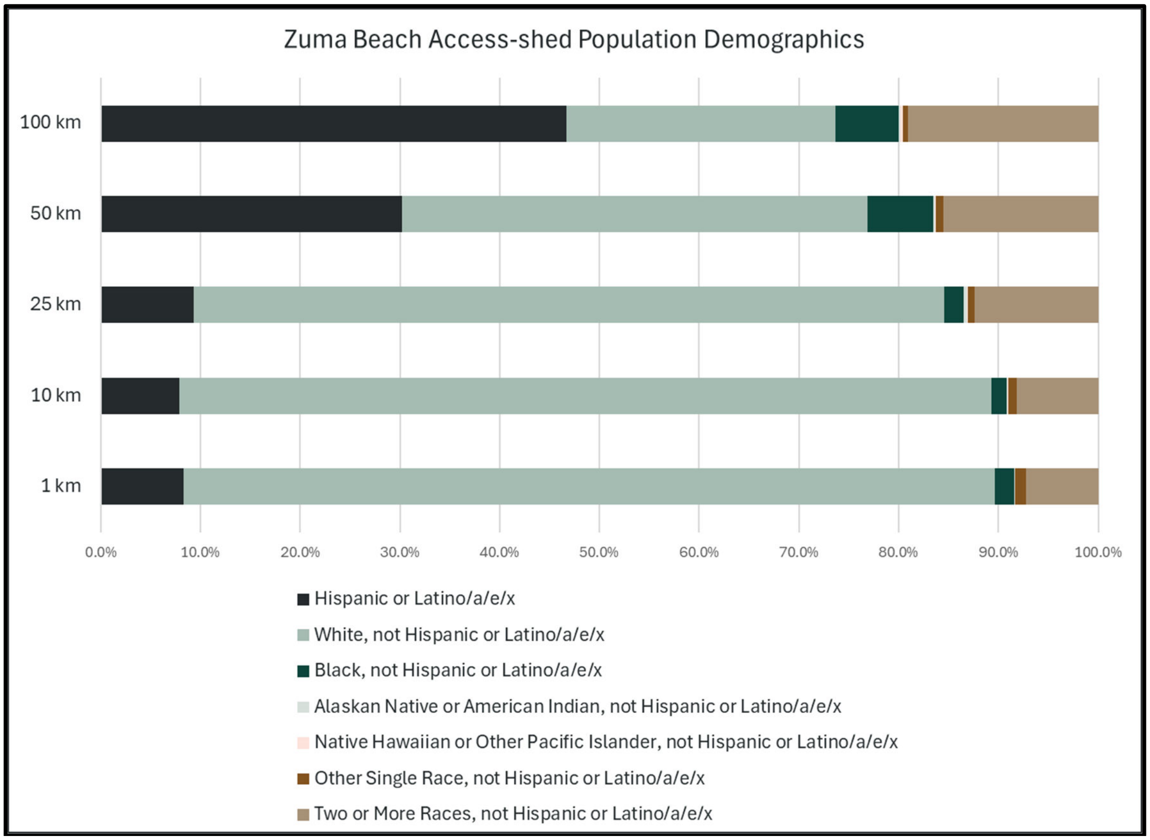

Figure 2-30. Race and Ethnicity, Zuma Beach Access-Sheds

Dockweiler State Beach

Dockweiler State Beach has over 30 areas to access the beach with a variety of amenities, including cafes, restaurants, lifeguards, picnic areas, playgrounds, restrooms, showers, and volleyball courts (Figure 2-31). There are over 2,000 paid parking spaces and over 150 free parking spaces. Figure 2-32 delineates the access-sheds for Dockweiler State Beach within driving distances of 1, 10, 25, 50, and 100 km. With more than 14.5 million people with reasonable access to this beach, the region is diverse, both in terms of its vulnerability classification as well as race and ethnicity (Figure 2-33 and Figure 2-34), with a diversity index of 52 (Table 2-9). Home values average nearly $1 million dollars in this area with a median age in the upper 30s.

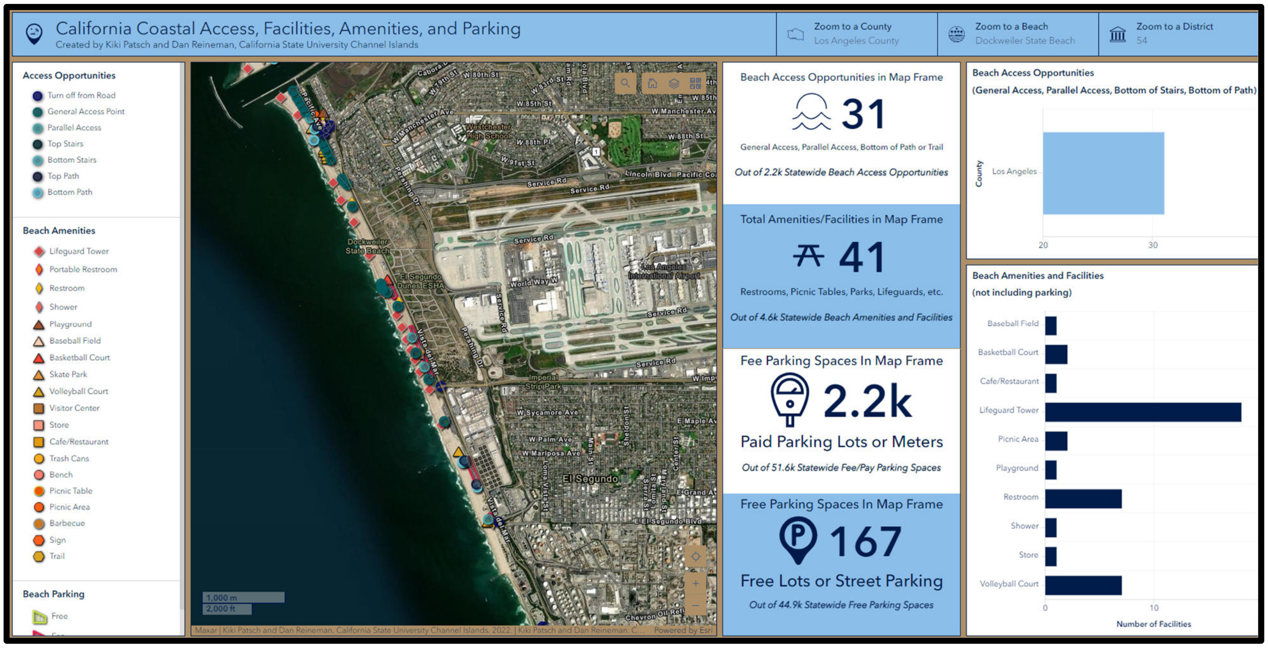

Figure 2-31. Snapshot of Coastal Access Dashboard, Dockweiler State Beach

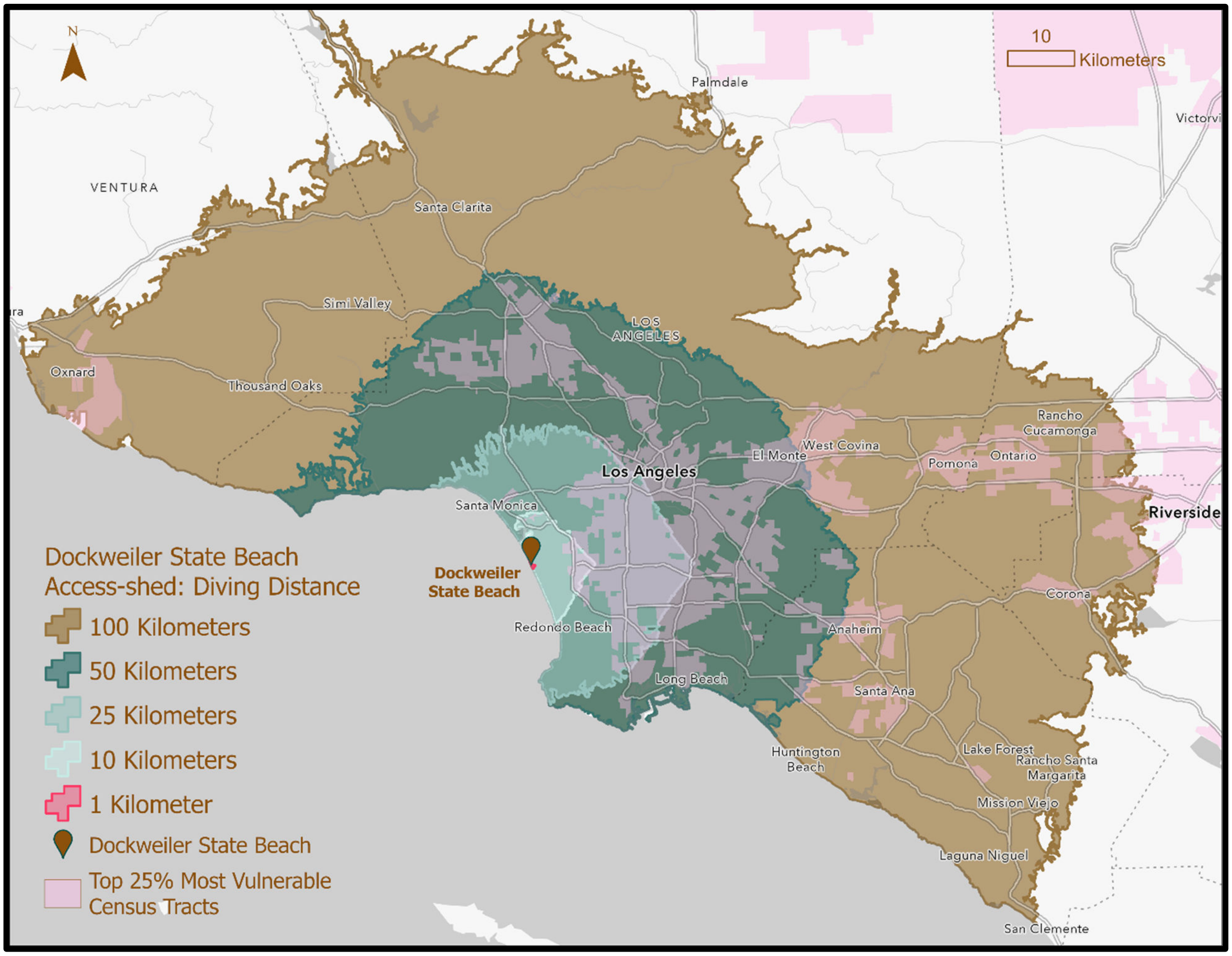

Figure 2-32. Access-Sheds, Dockweiler State Beach

Table 2-9. Socioeconomic Information, Dockweiler State Beach's Access-Sheds

Dockweiler Beach: Access-shed Statistics								
Driving Distance Buffer	Total Population (2020)	Population over 65 (2020)	Median Age (2020)	Total Households (2020)	Median Home Value (2024)	Average Home Value (2024)	Median Household Income (2024)	Mean Census Diversity Index (2020)
1 km	-	-	-	-	$ -	$ -	$ -	2
10 km	285,044	38,975	37.8	112,925	$ 1,335,513	$ 1,413,904	$ 121,208	55
25 km	3,070,585	419,701	36.5	1,111,578	$ 962,939	$ 1,162,205	$ 85,484	49
50 km	8,741,467	1,274,558	37.6	3,036,662	$ 883,845	$ 1,035,382	$ 86,821	50
100 km	14,632,094	2,159,387	37.9	4,934,406	$ 860,103	$ 989,806	$ 96,367	52

**The mean Census Diversity Index measures the likelihood that two randomly chosen individuals in a given area will belong to different racial or ethnic groups, with values ranging from 0 (no diversity) to 100 (complete diversity).*

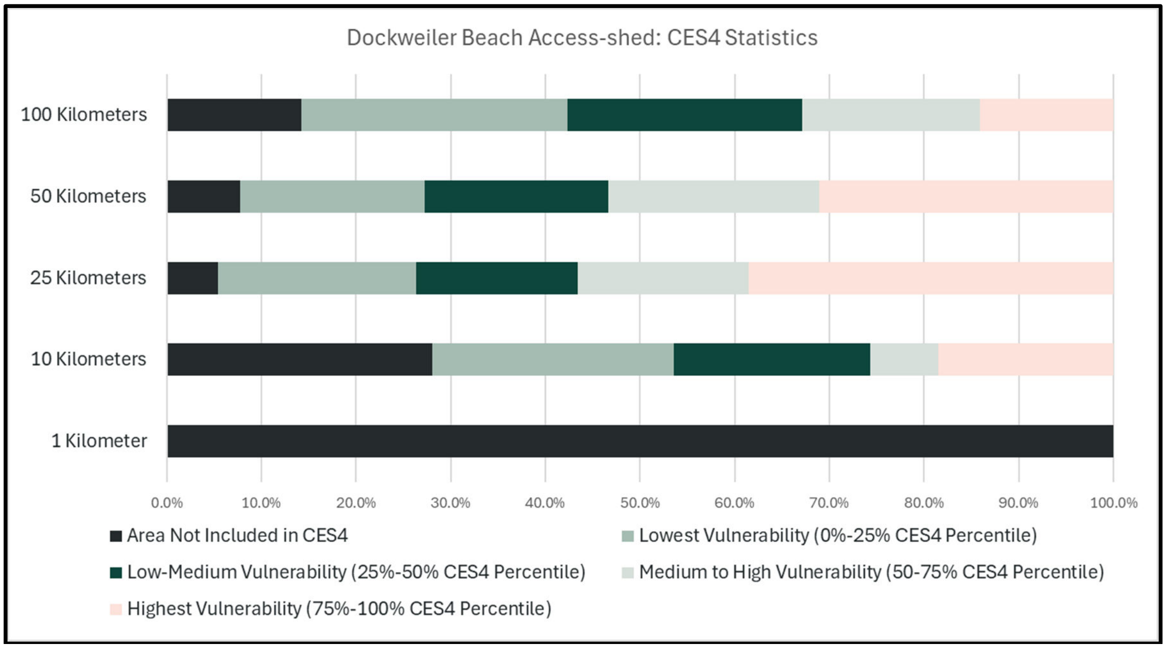

Figure 2-33. CES4 Assessment of Vulnerability, Dockweiler State Beach Access-Sheds

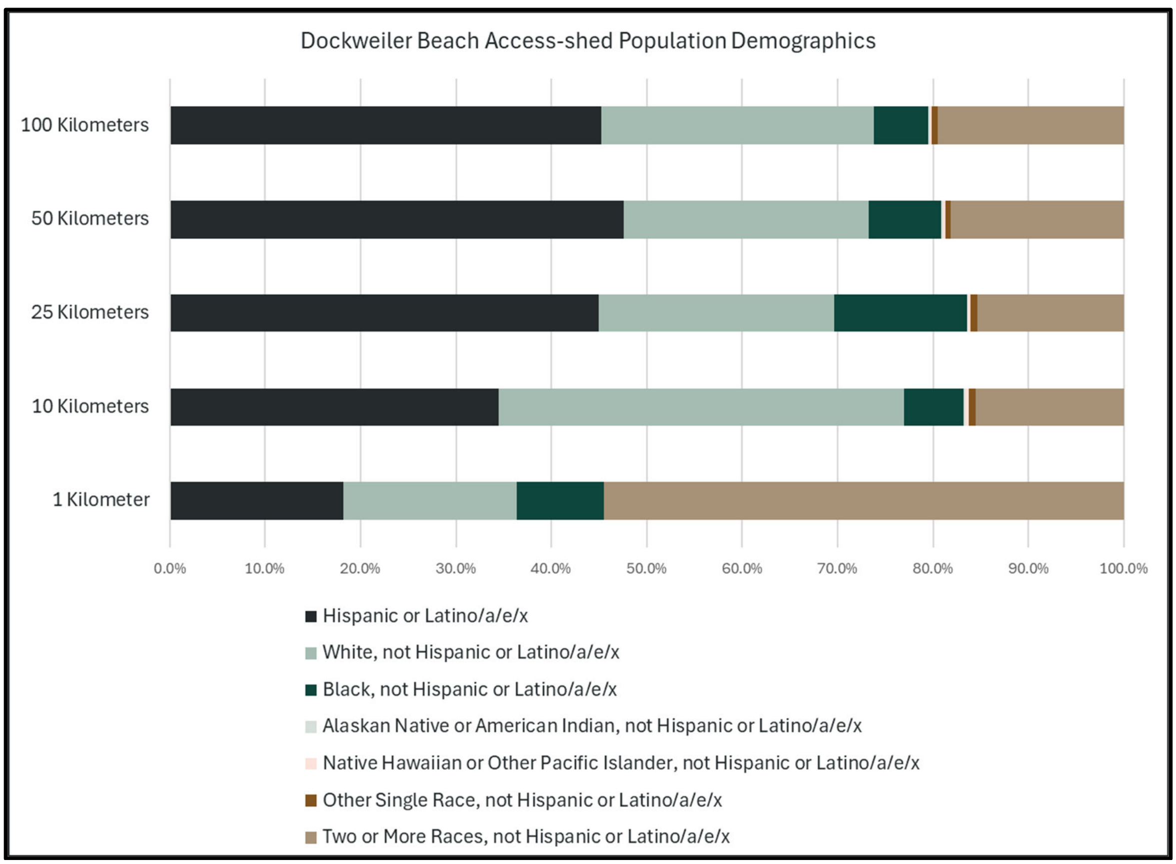

Figure 2-34. Race and Ethnicity, Dockweiler State Beach Access-Sheds

Redondo Beach

Redondo Beach is a highly developed coastal area featuring a mix of recreational spaces, a pier, and residential properties. The beach is popular for swimming, surfing, volleyball, and other water activities, with amenities such as restrooms, parking, and lifeguard stations (Figure 2-35). Parking can be challenging in this area with only a little over 800 spaces for paid parking. With more than 14.5 million people with reasonable access to this beach (Figure 2-36), the region is diverse both in terms of its vulnerability classification as well as race and ethnicity (Figure 2-37 and Figure 2-38), with a diversity index around 50 (Table 2-10). Home values average nearly $1 million dollars in this area and the median age is in the upper 30s to lower 40s.

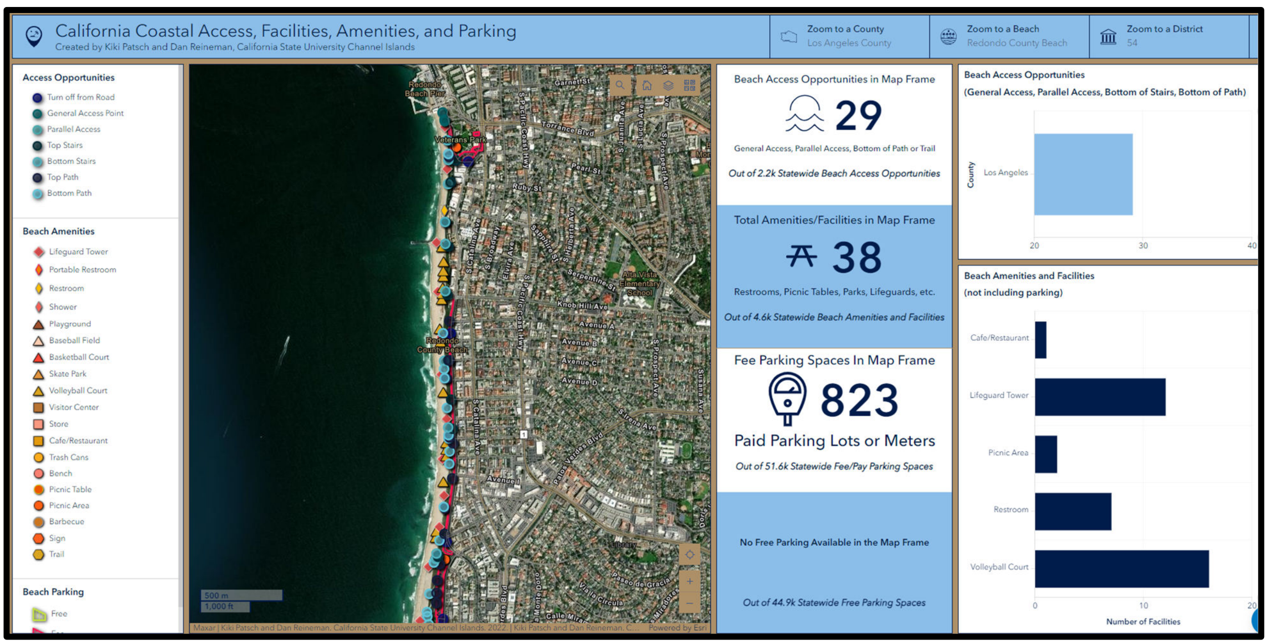

Figure 2-35. Snapshot of Coastal Access Dashboard, Redondo Beach

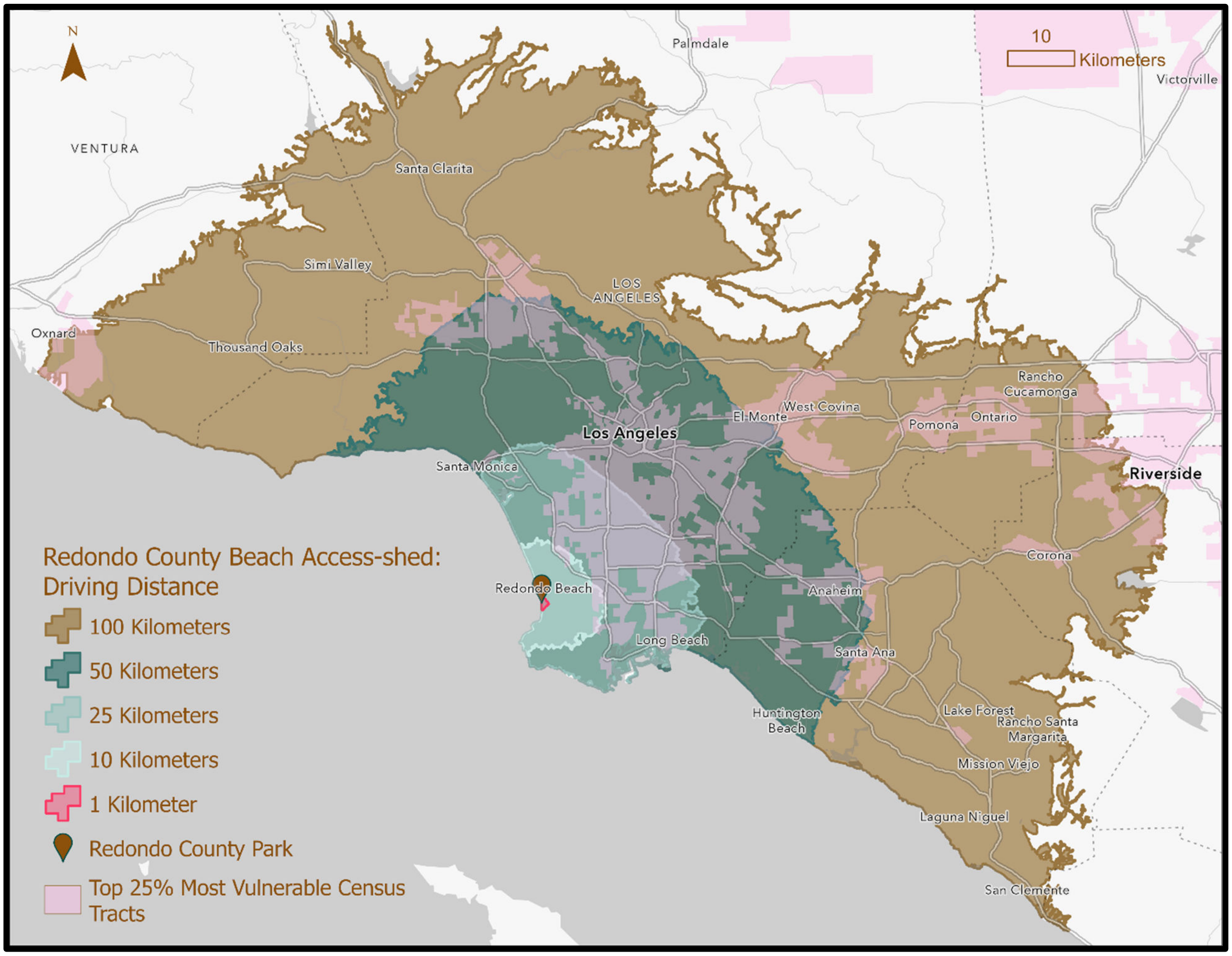

Figure 2-36. Access-Sheds, Redondo Beach

Table 2-10. Socioeconomic Information, Redondo Beach's Access-Sheds

Redondo Beach: Access-shed Statistics								
Driving Distance Buffer	Total Population (2020)	Population over 65 (2020)	Median Age (2020)	Total Households (2020)	Median Home Value (2024)	Average Home Value (2024)	Median Household Income (2024)	Mean Census Diversity Index (2020)
1 km	6,691	1,314	46.6	3,464	$ 1,437,870	$ 1,533,340	$ 124,757	35
10 km	396,587	67,418	41.9	151,593	$ 1,155,374	$ 1,286,169	$ 124,507	57
25 km	2,421,998	331,424	37.0	836,514	$ 872,708	$ 1,023,993	$ 86,917	56
50 km	8,406,714	1,208,177	37.4	2,913,349	$ 882,837	$ 1,031,788	$ 85,823	51
100 km	14,496,499	2,141,554	38.0	4,897,425	$ 863,194	$ 994,606	$ 96,474	51

**The mean Census Diversity Index measures the likelihood that two randomly chosen individuals in a given area will belong to different racial or ethnic groups, with values ranging from 0 (no diversity) to 100 (complete diversity).*

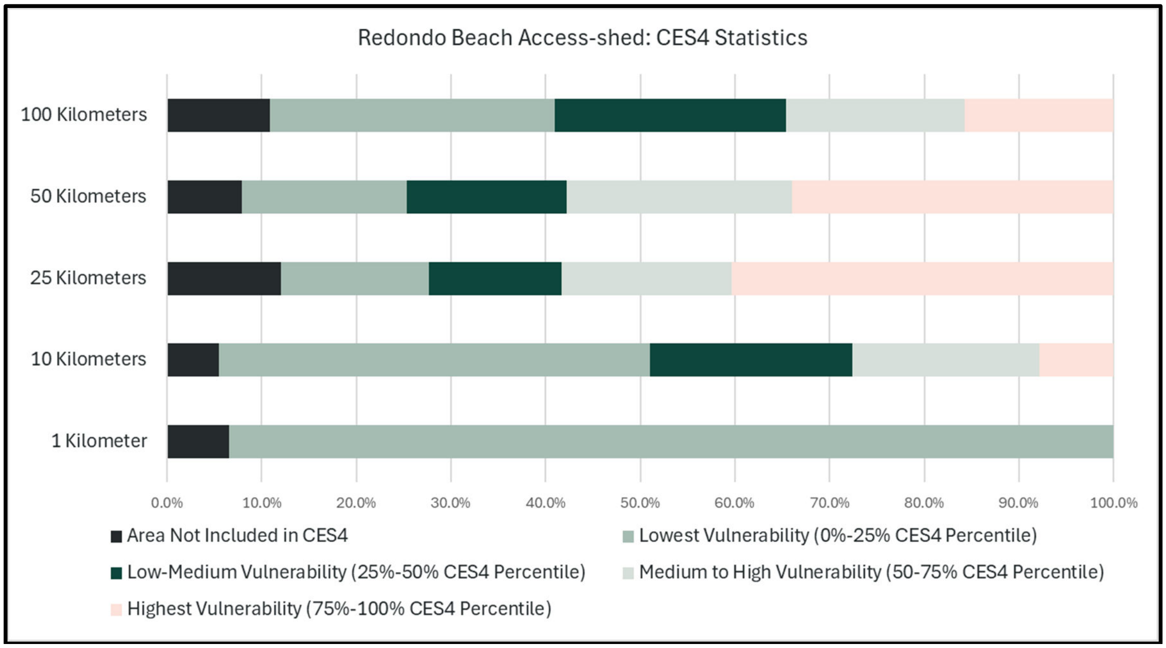

Figure 2-37. CES4 Assessment of Vulnerability, Redondo Beach Access-Sheds

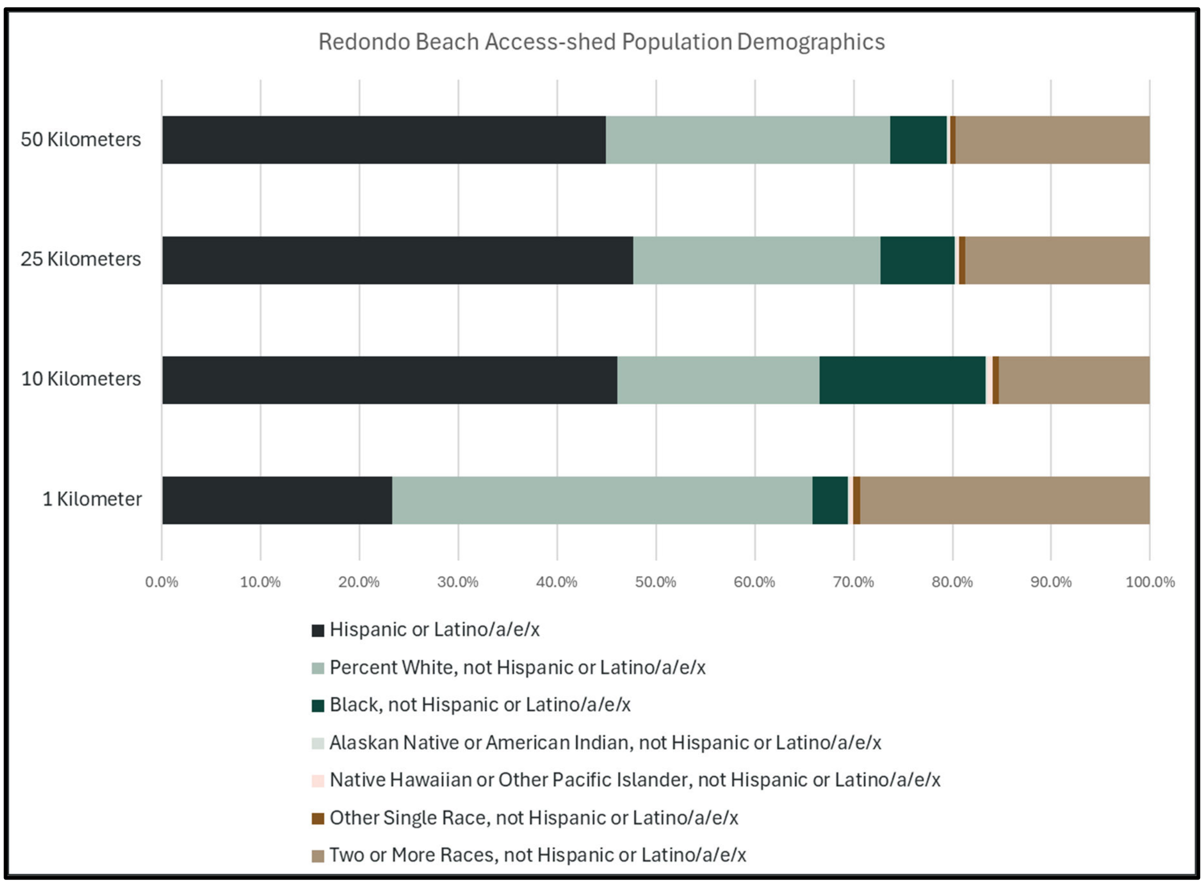

Figure 2-38. Race and Ethnicity, Redondo Beach Access-Sheds

3 Related Projects and Lessons Learned

Numerous projects with elements similar to those proposed herein have been constructed in Southern California in the recent past. These projects have been reviewed to identify best practices and lessons learned that can be inform the current work.

3.1 Related Projects

3.1.1 San Diego Regional Beach Sand Projects (RBSP)

The San Diego Association of Governments (SANDAG) has conducted two Regional Beach Sand Projects (RBSP): RBSP I in 2000 and RBSP II in 2012.

RBSP I was intended to serve as a pilot project to demonstrate that regional nourishment can benefit the coast without causing significant environmental impacts. As part of the project, 2.1 million cy of sand was placed at 12 beaches. Beach width gains and economic benefits were documented throughout the project and found to be significant.

Lessons learned as part of RBSP I were used to inform the design of RBSP II, namely relatively coarse-grained sand was placed at the receiver sites to extend the longevity of benefits and avoid environmental impacts. As part of the project, 1.5 million cy of sand was placed at eight beaches, all of which were included in RBSP I. Shoreline and economic monitoring conducted following construction indicate that the project was very beneficial and an improvement on RBSP I.

3.1.2 USACE Coast of California Storm and Tidal Wave Study

The USACE Coast of California Storm and Tidal Wave Study for the Los Angeles Region (CCSTWS-LA) was an extensive effort by the federal agency authorized to present an assessment of existing conditions, areas of concern, and determine the need for any actions. This study presents the shoreline history, its position over time and trends, beach profiles, longshore sediment transport, sand sources and sinks, maintenance dredging, beach nourishment, structures, particularly unique areas and/or sensitivities, and any specific needs for shoreline protection.

3.1.3 Los Angeles County Public Beach - Sea Level Rise Vulnerability Assessment

Noble Consultants (2016) prepared an assessment of the vulnerability of Los Angeles County public beach facilities to future SLR. The study includes an overview of the shoreline conditions, separated into three general regions: Malibu, Santa Monica Bay, and Palos Verdes Peninsula. An inventory of facility assets for each of the County-operated beaches is provided, including parking lots, restroom buildings, concessions, lifeguard safety stations, maintenance yards, utilities, and other recreational amenities.

The report summarizes the state of SLR science at that time. Vulnerability of the public beach assets to coastal hazards was assessed using their ground elevation, proximity to the shoreline, and exposure to beach erosion, wave runup, and inundation. Results from the USGS CoSMoS 3.0 model (Barnard *et al.*, 2018) were used to estimate the potential percentage of shoreline loss for SLR scenarios of 100 cm and 200 cm. Impacts on beach assets were evaluated for several SLR scenarios concurrent with a 100-yr storm event.

Finally, a public beach asset management strategy was presented. Future planning included implementation of the *Los Angeles County Coastal Regional Sediment Management Plan* (Noble Consultants & Larry Paul and Associates, 2017), which cites beach nourishment as the primary strategy. Longer term strategies of retreat, elevate, and/or protect are also discussed.

3.1.4 Mugu Submarine Canyon Sand Bypassing Project

The USACE commissioned a study of submarine canyons for the purpose of assessing possible approaches to preventing sand loss. As part of the study, Moffatt & Nichol (2009) presented a strategy to dredge the nearshore zone upcoast of the canyon and pump the sand south of Mugu Rock. This action would allow sand to continue its travel path south from Ventura County to Los Angeles County, thus restoring the historical sand supply to LA County beaches.

3.1.5 Broad Beach Restoration Project

This project is particularly relevant to the Zuma Beach and Point Dume resilience project based on comparable project features and proximity. The following summary is derived from public documents available on the Broad Beach Geologic Hazard Abatement District (BBGHAD) website (http://www.bbghad.com).

The Broad Beach Restoration Project (BBRP) is located immediately west of Zuma Beach, between Lechuza Point and Trancas Creek. The purpose of the BBRP is to protect residences from coastal erosion by creating and maintaining a wide sandy beach backed by a restored dune system similar to that which historically existed along this reach of coastline. Key relevant project features include (1) beach nourishment of up to 300,000 cy approximately every five years; (2) restored dune habitat; (3) sand backpassing designed to prolong nourishment; and (4) retaining the emergency rock revetment constructed in 2010 as a permanent feature.

3.1.6 Westward Beach Living Shoreline Project

This project is located within the Zuma Beach and Point Dume Beach resilience project area. As noted previously, severe coastal erosion occurred adjacent to Westward Beach Road during Summer 2021. A portion of the road was undermined, and a water line and drainage pipe were damaged. An emergency revetment was constructed to prevent further damage to the access road. In winter 2022-2023, additional coastal erosion resulted in the need to extend the emergency revetment east to protect the road and a restroom at Point Dume Beach.

CFC prepared a draft coastal engineering study in summer/fall 2022 to evaluate a range of solutions, including nature-based elements. Currently, CFC is assisting LACDBH in a long-term solution to protect Westward Beach Road and impacted public beach facilities. The coastal resilience project at Zuma Beach and Point Dume Beach supports the overall goal of reducing the magnitude of present and future coastal erosion threats at this location and may serve as a mitigation measure for the loss of sandy beach habitat at Point Dume Beach.

3.1.7 Malibu Creek Ecosystem Restoration Project (Rindge Dam Removal)

The Malibu Creek Ecosystem Restoration Project entails the removal of Rindge Dam, which is situated approximately three miles upstream of Malibu Lagoon, and eight smaller dams upstream of the main one. Dam removal would restore ecological integrity to Malibu Creek and the lagoon by reestablishing the fluvial connection of lower and upper Malibu Creek with Malibu Lagoon, and its oceanic outlet. The dam has significantly inhibited natural sand replenishment from upstream Malibu Creek to the coastline and associated nearshore habitats and presents a barrier to the endangered Southern Steelhead Trout. There are approximately 780,000 cy of impounded sediment behind Rindge Dam that would otherwise flow downstream and reach the coastline. The Project is assessing the suitability for the 170,000 cy of gravel and 280,000 cy of sandy materials to be used for inshore habitat creation and littoral zone nourishment, respectively. The proposed placement strategy supports existing subtidal hard-bottom habitat for benthic species or creates new habitat (*e.g.,* a rubble field that promotes the recruitment of and successful attachment for kelp species). Excavated sandy material is being considered for beneficial reuse at nearby nearshore locations and/or via direct beach placement to nourish the littoral cell and enhance the resiliency of the nearby coastline. Direct beach placement would likely occur on the beach to the east of Malibu Pier and nearshore placement would occur at a location near the end of the pier. This sediment would then feed downcoast beaches to the east of the placement site. Recent discussions with the project team have indicated that Zuma Beach also may be a candidate receiver site.

3.1.8 Topanga Lagoon Restoration Project

The Topanga Lagoon Restoration Project seeks to expand the existing habitat area and return the lagoon to its historic footprint. Construction of the surrounding segments of PCH and the bridge that spans the lagoon obstructed the natural fluvial and tidal flushing of the lagoon habitat and artificially impounded sediments that constrict the lagoon, decreasing roughly 93% of the natural habitat area from the original historic lagoon footprint. By lengthening the existing 79-ft long PCH bridge that spans the lagoon and removing up to approximately 256,000 cy of sediment from the site, this project will create up to 10 acres of valuable coastal wetland habitat. Excavated sediment from the project has been approved for beneficial reuse at a nearby nearshore location to nourish the littoral cell. The sediment will be pumped to a location offshore of Topanga Point. This type of nearshore placement will allow natural processes to push sandy material onto the beaches while disbursing finer clays and silts offshore, leaving any rocks in the placement footprint. This will enhance the resilience of surrounding beaches and benefit the system by adding locally-sourced sediment to the littoral cell.

3.1.9 Santa Monica Beach Living Shoreline Project

The Santa Monica Beach Living Shoreline Project was constructed in 2016 by The Bay Foundation to restore approximately three acres of coastal dune habitat on Santa Monica Beach. A living shoreline was constructed by installing sand fencing and seeding native vegetation to encourage vegetated dune growth. Vegetated dunes not only provide essential coastal habitat but also increase coastal resilience to SLR, coastal flooding, and erosion. Integrated beach pathways and interpretive signs were installed to accommodate beach goers and provide educational opportunities on native plants and living shorelines. Scientific monitoring of this pilot project is being used to inform other living shoreline projects throughout southern California.

3.1.10 Marina del Rey Maintenance Dredging Projects

Marina del Rey is a small craft harbor located in Santa Monica Bay. While the harbor is managed by LACDBH, maintenance of the ocean entrance navigation channel is under the authority of the USACE, Los Angeles District, as part of their civil works mission. Sediment accumulates in both the north and south ocean entrance channels of the marina. The source of sediment trapped in the north entrance channel is littoral transport from the northwest and is comprised of beach sand from within the littoral system. Conversely, the source of sediment trapped in the south entrance channel is Ballona Creek. Sediments discharged at the mouth of Ballona Creek are generally too fine for beach nourishment and contain contaminants.

Since 1969, the average shoaling rate at the north entrance to the marina is approximately 80,000 cy/yr (Ryan, 2025). The material is typically dredged and placed downdrift at Dockweiler

State Beach. Material is occasionally dredged and placed updrift at Venice Beach or placed further downdrift in a nearshore placement site near Redondo Beach (Section 6.1.2).

3.1.11 Manhattan Beach Living Shoreline Project

The Manhattan Beach Living Shoreline Project aims to enhance three acres of existing dunes along Manhattan Beach from 36th to 23rd Street. The Bay Foundation, along with the City of Manhattan Beach, LACDBH, and California State Coastal Conservancy implemented this project in 2022 which consists of the removal of non-native vegetation, seeding and planting of native vegetation, installation of temporary sand fencing to promote dune and vegetation growth, and installation of educational features and interpretive signage. The overall objective is to increase resiliency of the shoreline by implementing green infrastructure for protection against SLR, coastal flooding, and erosion.

3.1.12 Hermosa Beach Resilience Project and Living Shoreline Project

The City of Hermosa Beach conducted a feasibility study that included installing a living shoreline at the north end of the City near the boundary with Manhattan Beach. Project objectives were to install a pilot resilience project, create additional habitat, and manage sand from blowing onto the pedestrian/bicycle pathway at the Strand. The conceptual designs consisted of two alternative layouts with sand dune habitat along the northern City boundary, toward the back beach. The site was positioned to provide resilience and sand management opportunities, minimize interference with public recreation such as beachgoing and volleyball, and prevent conflicts with two existing storm drainage outfalls along the City's northern boundary.

3.2 Lessons Learned

The Project Team has led successful local and regional beach enhancement projects throughout Southern California. Lessons learned as part of these projects are summarized below and used to develop recommendations for implementation. The lessons learned and recommendations encompass planning and environmental concerns, project design, construction, permitting, public outreach, and pre- and post-project monitoring.

3.2.1 Planning/Environmental Concerns

- Identify multiple suitable borrow sites to provide back-up sand sources during construction in the event that the primary borrow sites contain lower sand quality or quantity than expected.
- Consider retention devices for receiver beaches that demonstrate a tendency to be naturally narrow or those where the beach fill disperses quickly.

- Incorporate nature-based restoration elements to broaden the range of benefits.
- Planning documents (namely air and water quality) should anticipate possible equipment needs, such as a dredge similar in size/capacity to the *Liberty Island* owned by Great Lakes Dredge and Dock Company, which was used to build RBSP II in 2012 (hopper capacity of 5,000 cy). Due to the larger volume of discharge from the *Liberty Island,* as compared with the small hopper dredge used for RBSP I in 2001, turbidity plumes were, at times, relatively large. However, they were temporary and were not prohibitive given the 401 permit conditions.
- Future planning documents should consider beach access and safety, construction areas, and horizontal access. For reference, the RBSP II construction area (length of beach affected) generally exceeded 500 ft, and horizontal access across the beach was only restricted during active construction or pumping. Active construction or pumping lasted an hour to an hour and a half per cycle, with between 4 to 6 cycles per day. Sand discharge points, and thus access restrictions, moved progressively along the beach each day.
- Plan maintenance activities to grade scarps that can form on the seaward edge of receiver sites. These features can form early in a nourishment project as the beach is equilibrating and can present hazards to beach users, particularly at night when visibility is limited.

3.2.2 Permitting

- Coordinate with agencies in advance and understand what to expect regarding permit conditions. Meetings for RBSP II commenced a year and a half before construction. Some of the information obtained during the meetings was used in the contractor solicitation and provided the client with possible monitoring requirements and costs.
- Review grunion conditions with the California Coastal Commission to identify potential construction impacts for work occurring in spring and summer.
- Work with the RWQCB to maintain similar monitoring requirements for construction as were applied to RBSP I and RBSP II.

3.2.3 Project Design

- Grain size is critical to the longevity of the beach fill; coarser-than-native grained sand should be used as fill to extend benefits.
- Locate borrow sites as close to shore as possible while remaining within the target dredge area. This should maximize the coarse sand fraction and reduce the amount of silt covering the existing seabed.

- Consider larger borrow site footprints to allow the dredging contractor more flexibility during construction.
- Consider larger receiver site footprints to allow some flexibility in construction.
- Grade the surface of the beach fill berm to slope slightly toward the ocean to minimize or reduce ponding on the newly placed material; a slope of 1% is sufficient.
- Consider/analyze access routes used by the contractor from coastal ingress points.

3.2.4 Construction

- Weekly meetings should start one month prior to construction; this was critical during the planning process and mobilization period for RBSP I and II.
- Target construction later in the season to avoid potential issues with grunion, birds, and the public. Because of the later-than-anticipated start of RBSP II, there was a reduction in environmental monitoring costs (on the order of several hundred thousand dollars) and potential construction delays and change orders were avoided.

  Regarding recreational users, a late summer start date reduced (but did not eliminate) the number of interactions. If construction were to occur during the summer (upon which some cities had placed restrictions), greater vigilance would be required to ensure public safety. Coordination with City public safety officers (*i.e.,* lifeguards) was critical in maintaining public safety during construction.
- Develop transit routes for the dredge that minimize conflicts with fishermen and recreational boaters. While the routes may not be necessary for support vessels (crew boats and tugs), the contractor should reinforce a “good neighbor” philosophy to avoid conflicts.

  Since RBSP I and II construction overlapped the commercial lobster season (typically October to mid-March), the construction schedule was adjusted to minimize impacts to fishable areas, especially in the first part of the season, by constructing in areas where there was limited fishing (*e.g.,* Oceanside) or closed areas (*e.g.,* Swamis MPA). Weekly updates were posted at the commercial fisherman docks in Oceanside, Mission Bay, and San Diego Bay.
- Require daily construction management oversight to verify that plans (*e.g.,* safety, spill prevention, BMPs, etc.) are followed.

3.2.5 Public Outreach

- Public meetings should occur prior to construction to provide information to everyone, regardless of stakeholder affiliation.
- Coordinate with Cities and other focused stakeholder groups in advance.
- Focused stakeholder groups should include the lobster fishing industry, the Surfrider Foundation or other local surfing groups dedicated to sites near construction, homeowners near construction areas, public agencies affected by construction, and other environmental groups (*e.g.*, Heal the Bay, Sierra Club, Audubon Society, the Bay Foundation).
- Outreach should continue right up to the time of construction to alert stakeholders to the upcoming work. Provide a contact name and number at the agency responsible for the project so that the public can ask questions and submit comments or concerns.
- A press contact should be provided to represent the owner in interviews and status reports.
- Web postings should occur early in the planning process and continue through construction and post-construction monitoring. This provides transparency and limits misinformation.

3.2.6 Pre- and Post-Project Monitoring

- Conduct beach profile surveys early to establish pre-construction conditions, including the natural range in beach width and any hard-bottom coverage.
- Continue profiling during construction as the construction activities progress along the shoreline.
- Consider implementing a program similar to the 2002 Nearshore Inventory Program to map biology prior to a project.
- Pre-construction rocky subtidal and intertidal habitat reef surveys are critical in identifying potential pipeline corridors; corridors should be sited between or away from rocky habitat.
- Partner with a group, such as Surfrider Foundation or Surfline, to conduct and/or participate in surf monitoring.

3.3 Recommended Avoidance and Minimization Measures

The following avoidance and minimization measures are recommended to be incorporated into the project design.

3.3.1 Worker Environmental Awareness Program

Prior to initiation of project activities (including staging and mobilization), all personnel associated with project construction should attend a Worker Environmental Awareness Program (WEAP) training, conducted by a qualified biologist, to aid workers in recognizing special-status terrestrial and marine species, native birds, and other biological resources that may occur on the project site. The specifics of this program should include identification and habitats of special-status species with potential to occur at the project site, a description of the regulatory status and general ecological characteristics of sensitive resources, and review of the limits of construction and mitigation measures required to reduce impacts to biological resources within the work areas. A fact sheet conveying this information should be prepared for distribution to all contractors, their employers, and other personnel involved with construction. All employees should sign a form provided by the trainer indicating they have attended the WEAP and understand the information presented to them.

3.3.2 General Best Management Practices

The following Best Management Practices (BMPs) should be followed by project personnel to ensure pollution prevention and minimize the introduction of pollutants into coastal waters.

- During construction, heavy equipment should be operated in accordance with standard BMPs. All equipment should be properly maintained such that no leaks of oil, fuel, or residues will take place. Provisions should be made to remediate any accidental spills. Materials should be stored and equipment fueled at least 100 ft from water features, as feasible, or equipment should utilize secondary containment.

- Spill prevention and control measures should be implemented to ensure the proper handling and storage of petroleum products and other construction materials; including a designated fueling and vehicle maintenance area with appropriate protection to prevent spillage of gasoline or related petroleum products or contact with runoff.

- All food-related trash should be disposed of in closed containers and removed from the project site each day during the construction period. Project personnel should not feed or otherwise attract wildlife to the project site.

- All work should occur during daylight hours. Lighting of the beach and water area should be prohibited.

- Construction work or equipment operations below Mean Lower Low Water should be minimized to the extent feasible, and, where possible, limited to times when tidal waters have receded from the authorized work area.
- Any spillage of material should be stopped if it can be done safely. The contaminated area should be cleaned, and any contaminated materials properly disposed.
- Adequate spill prevention and response equipment should be maintained on site and be readily available to implement to ensure minimal impacts to the aquatic and marine environments.
- A 50-ft long spill containment boom and absorbent pads should be kept on-site and deployed in the event there is a release of fluids into the water.
- Fire suppression equipment should be provided at the worksite. A fire extinguisher should be available in every 3,000 square feet of construction area, no more than 100 feet away from heavy equipment. Heavy equipment operators should attend a training session on appropriate responses to fire suppression during the pre-construction meeting.

3.3.3 Grunion Surveys

The project should avoid placing material or conducting any work on the beach below the Mean High Tide Line (MHTL) during the seasonally predicted grunion run and egg incubation period of March 14 through August 31. If project activities must occur during an expected grunion run, a grunion survey should be conducted in accordance with the expected grunion runs provided by CDFW. Project activities should proceed only in areas where no grunion spawning was observed.

3.3.4 Western Snowy Plover and Nesting Bird Monitoring

To avoid disturbance of nesting birds and special-status birds, including western snowy plover and California least tern, protected by the FESA, CESA, MBTA, and CFGC 3503, activities related to the project should occur outside of the breeding season for migratory birds (generally February 1 through August 31), as feasible.

If project activities must occur during the breeding season, then full-time monitoring should be conducted during all beach activities requiring the use of heavy machinery. Reduced monitoring or clearance surveys may be suitable depending on the activity. A qualified monitor should walk ahead of vehicle(s) and equipment to help ensure that western snowy plover and California least tern are out of harm’s way before the vehicle(s) or equipment can proceed. If birds do not move out of vehicle traffic path, the monitor should attempt to guide vehicle(s) on an alternate path to avoid grounding birds and walk ahead of vehicle(s) to ensure the path is cleared while maintaining a minimum 150-ft buffer.

If nests are found, an avoidance buffer (dependent upon the species, the proposed work activity, and existing disturbances associated with land uses outside of the site) should be determined and demarcated by the biologist with bright orange fencing, flagging, or other means to mark the boundary. All project personnel should be notified as to the existence of the buffer zone and to avoid entering the buffer zone during the nesting season. No project activities should occur inside this buffer until the avian biologist has confirmed breeding/nesting is completed, and the young have fledged the nest. Encroachment into the buffer should occur only at the discretion of the qualified biologist.

3.3.5 Marine Mammal and Sea Turtle Avoidance

All project personnel should adhere to the guidelines set forth in the Marine Mammal Protection Act (MMPA). If a stranded or hauled out marine mammal or sea turtle is observed, all project equipment and personnel should remain at least 100 yards (300 ft) away from whales and 50 yards (150 ft) from dolphins, porpoises, seals and sea lions. The Marine Mammal Care Center should be notified if the animal appears sick or injured. Work should cease within the buffer area until the animal has been allowed to leave without harm.

3.3.6 ESHA Avoidance

During the project, ESHA should be clearly delineated in the field to prevent direct impacts outside of the designated project boundary. All sensitive species and sensitive species' habitats, including ESHA, located within 100 ft of project activities should be delineated with specific sensitive species labeling (*e.g.,* signage stating, "No Entry – Environmentally Sensitive Habitat" attached to temporary fencing). Since the project is temporary, orange snow fencing would be sufficient for the duration of the project. In areas that are separated by existing chain-link fencing, signage should be secured to the existing fencing.

3.3.7 Water Quality Monitoring

A Water Quality Monitoring Plan should be prepared to avoid and minimize potential adverse effects to water quality (*e.g.,* increased turbidity, altered pH, decreased dissolved oxygen levels). The plan should establish water quality thresholds consistent with the SWRCB Ocean Plan and include measures for water quality monitoring up current and down current of the project site. If water quality thresholds established in the Ocean Plan are exceeded, the monitor should inform the project manager and be granted the authority to temporarily halt project activities until monitoring indicates the constituent measurements are within the Ocean Plan thresholds.

3.3.8 Unanticipated Discovery of Cultural Resources

In the event archaeological resources are unexpectedly encountered during ground-disturbing activities, work within 50 feet of the resource find shall halt and an archaeologist meeting or exceeding the Secretary of the Interior's Professional Qualifications Standards for Archeology (NPS 1983) shall be contacted immediately to evaluate the resource. If the resource is determined by the qualified archaeologist to be prehistoric, a Native American representative shall also be contacted to participate in the evaluation of the resource. If the qualified archaeologist and/or Native American representative determines it to be appropriate, archaeological testing for California Register of Historical Resources (CRHR) eligibility shall be completed. If the resource is determined to be eligible for the CRHR and significant impacts to the resource cannot be avoided via proposed project redesign, the qualified archaeologist shall prepare a data recovery plan tailored to the physical nature and characteristics of the resource, per the requirements of CCR Guidelines Section 15126.4(b)(3)(C). The data recovery plan shall identify data recovery excavation methods, measurable objectives, and data thresholds to reduce any potential significant impacts to the resource. Pursuant to the data recovery plan, the qualified archaeologist and Native American representative, as appropriate, shall recover and document the scientifically consequential information that justifies the resource's significance. The Los Angeles County Department of Beaches and Harbors (LACDBH) shall review and approve the treatment plan and archaeological testing, as appropriate, and the resulting documentation shall be submitted to the regional repository of the CHRIS, per CCR Guidelines Section 15126.4(b)(3)(C).

3.3.9 Unanticipated Discovery of Tribal Cultural Resources

In the event that archaeological resources of Native American origin are identified during implementation of the proposed project, ground-disturbing activities within 50 feet of the find shall be temporarily suspended or redirected until an archaeologist has evaluated the nature and significance of the find as a cultural resource and an appropriate local Native American representative is consulted. If the County, in consultation with traditionally and culturally affiliated Native American group(s), determines the resource is a tribal cultural resource and thus significant under CEQA, a mitigation plan shall be prepared and implemented in consultation with traditionally and culturally affiliated Native American group(s). The plan shall include measures to ensure the find is treated in a manner that respectfully retains, to the degree feasible, the qualities that render the resource of significance to the local Native American group(s). Examples of appropriate mitigation for tribal cultural resources include, but are not limited to, avoidance, protecting the cultural character and integrity of the resource, protecting traditional use of the resource, protecting the confidentiality of the resource, or heritage recovery.

4 Project Concepts and Alternatives

The *Coastal Resilience Study* (Moffatt & Nichol, 2023) provided conceptual descriptions of the proposed projects at Zuma Beach and Point Dume, Dockweiler State Beach, and Redondo Beach. Each project was developed to proactively preserve and enhance LA County Beaches, including infrastructure and facilities, recreational open space, natural and cultural resources, and habitat for sensitive species. These concepts were used as a framework to develop a proposed project and two alternatives for each site. The subsections that follow summarize the objectives of each project, opportunities and constraints that are present the sites, and the proposed projects and alternatives.

4.1 Zuma Beach and Point Dume

The concept proposed at Zuma Beach and Point Dume as part of the *Coastal Resilience Study* included widening Zuma Beach via beach nourishment and creating or enhancing dune habitat at both Zuma and Point Dume Beach. The objectives of the project are to:

- Expand public access and recreational opportunities for LA County residents and visitors;
- Increase protection of coastal infrastructure;
- Increase and enhance sensitive sandy beach and dune habitat; and
- Expand local and regional economic benefits.

4.1.1 Opportunities and Constraints

Opportunities

Opportunities that can be leveraged as part of the resilience project include:

- Sediment placed at Zuma Beach is expected to widen vulnerable portions of Point Dume Beach, where direct placement of sand is prohibited (see constraints, below), via natural processes.
- Beach nourishment within the Zuma Littoral Cell is expected to nourish downdrift beaches within Santa Monica Bay, further leveraging the economic benefits.
- The existing emergency revetment located along portions of Westward Beach Road may require some form of mitigation for impacts to the sandy beach. Two revetment segments were approved and constructed under emergency coastal development permits (ECDPs) from the CCC and will ultimately require a standard coastal development permit (CDP). The beach nourishment could provide in-kind impact mitigation for any permanent

shoreline protective device included as part of the long-term Westward Beach Road shore protection project.

- CRC identified significant portions of the Zuma Beach shoreline as having potential for self-sustaining dunes (Section 2.3), including areas where winter sand dikes are constructed.

Constraints

The primary constraints warranting careful consideration in the project planning stage are related to the existence of regulated or sensitive biological resources, as noted in Section 2.2 and summarized below:

- The regions below the Mean High Tide Line (MHTL) at Zuma Beach and Point Dume Beach are located within the Point Dume State Marine Conservation Area (Point Dume SMCA) and Point Dume State Marine Reserve (SMR), respectively (Figure 4-1). An important difference between these two areas, as it relates to this study, is that beach nourishment is permitted within the Point Dume SMCA (*i.e.,* Zuma Beach), but is not allowed in the Point Dume SMR (*i.e.,* Point Dume Beach).

  California Code of Regulations Title 14, Section 632 specifically states the following:

  Point Dume SMCA

  Beach nourishment and other sediment management activities are allowed inside the conservation area pursuant to any required federal, state and local permits, or as otherwise authorized by the department.

  Point Dume SMR

  In a state marine reserve, it is unlawful to injure, damage, take, or possess any living, geological, or cultural marine resource, except under a scientific collecting permit issued by the department pursuant to Section 650 or specific authorization from the commission for research, restoration, or monitoring purposes.

Figure 4-1. Pt. Dume State Marine Conservation Area & Pt. Dume State Marine Reserve

- The project site is located within designated critical habitat for the western snowy plover and tidewater goby. While project activities are not expected to permanently impact or adversely modify this habitat, temporary impacts could include changes to water quality, increased noise, temporary removal of foraging habitat, and other increased human activity during project activities.
- The offshore portion of the site is designated as EFH. Project activities may temporarily alter EFH and HAPCs or interfere with the movement of fish or wildlife species and could temporarily impede the use of wildlife nursery sites; however, they are not expected to have any significant impacts on these habitats, populations, or the fisheries that depend on them. The project will help preserve natural habitats and reduce erosion in the nearshore zone, providing additional soft bottom habitat suitable for foraging. Temporary impacts to these areas could include changes to water quality, increased noise, and other increased human activity during construction.
- The Zuma Beach & Point Dume site is located within ASBS No. 24. The project will not result in direct impacts, such as wastewater and pollutant discharges. However, indirect impacts due to increased turbidity or a change in other water quality standards may occur.
- The site is located on the sandy beach and subtidal sand overlapping the HTL. Project activities have the potential to impact incubating grunion eggs if activities occur during their spawning season.

Additional constraints include:

- Recreational beach area ("towel space") will be reduced in areas where dunes are created.
- Vertical access through dune areas must be provided for and managed.
- Dunes may impact view corridors and should be considered in project planning.

4.1.2 Proposed Project and Alternatives

Key components of the proposed project and the project alternatives are provided in Table 4-1 and described in detail below.

Table 4-1. Key Elements of Proposed Project & Alternatives, Zuma Beach & Point Dume

Project	Beach Nourishment	Renourishment Interval	New Dune Habitat	Enhanced Dune Habitat
Proposed	500,000	5 years	4.1 acres	4.5 acres
Alternative 1	500,000	5 years	8.3 acres	4.5 acres
Alternative 2	750,000	8 years	4.1 acres	4.5 acres

Proposed Project

The Proposed Project includes an initial beach nourishment of 500,000 cubic yards (cy) at Zuma Beach, with renourishment events of the same magnitude approximately every five years. New dune habitat (4.1 acres) will be created along Zuma Beach where sand dikes are constructed each winter and the existing dunes at Zuma Creek and Point Dume Beach will be enhanced or expanded (4.5 acres).

Figure 4-2 conceptually illustrates all project elements, while Figure 4-3 provides a detailed plan view and cross-section of the beach fill construction template and dune element at Zuma Beach. The beach fill template is 5,900 ft long with a 190 to 360 ft wide berm at an elevation of +12 ft (MLLW) and a foreshore slope of 1:5 (V:H). The dunes at Zuma Beach will be constructed on the back beach in areas typically occupied by winter berms used to reduce flooding at County facilities. The dunes will be approximately 100 ft wide, 6 ft high, and vegetated with native dune plants (*e.g.*, beach sand verbena, beach primrose, coast woolley heads). A post and rope barrier will be placed on the perimeter to discourage trespassing, with informational signage for the public as an educational/interpretive opportunity.

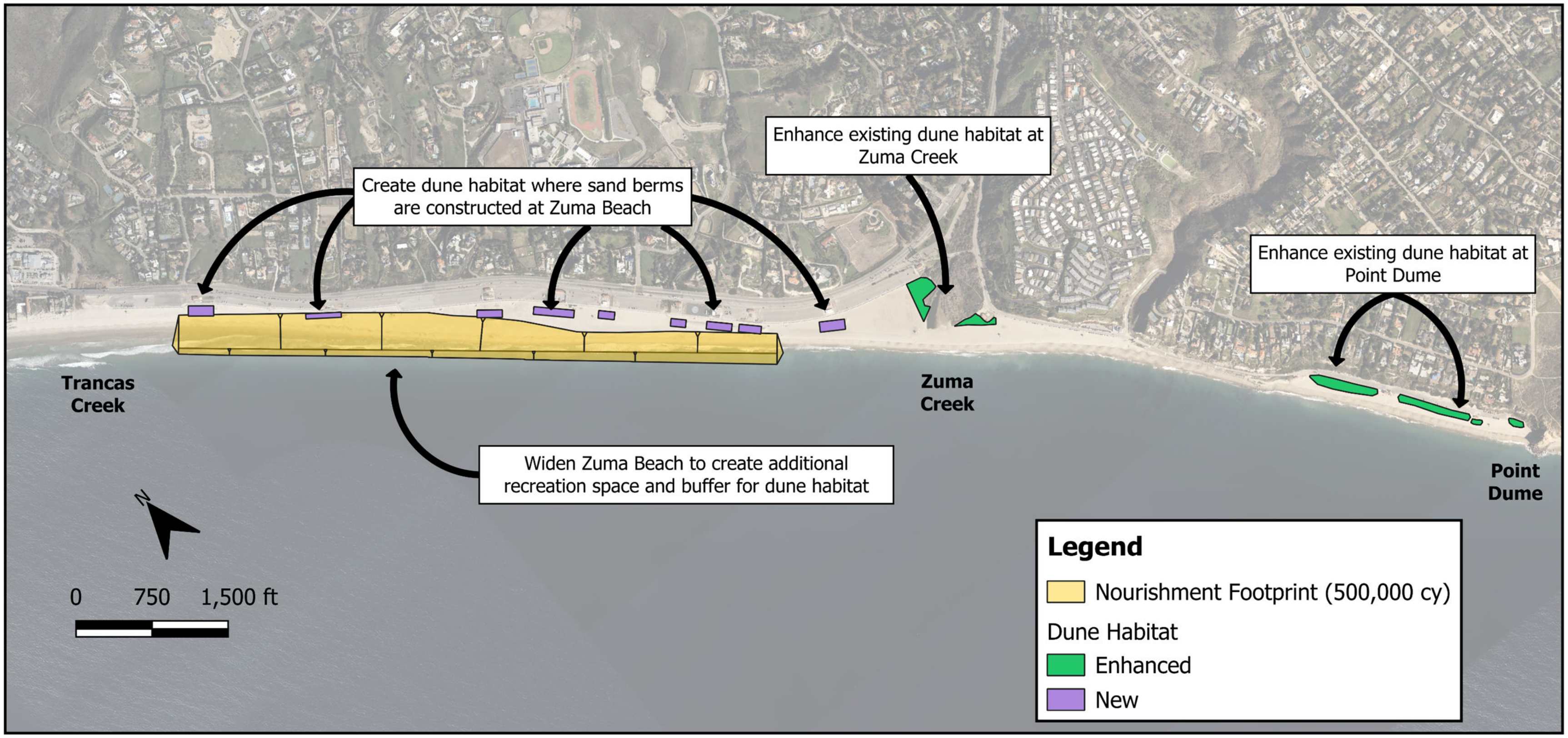

Figure 4-2. Proposed Project at Zuma Beach and Point Dume Beach

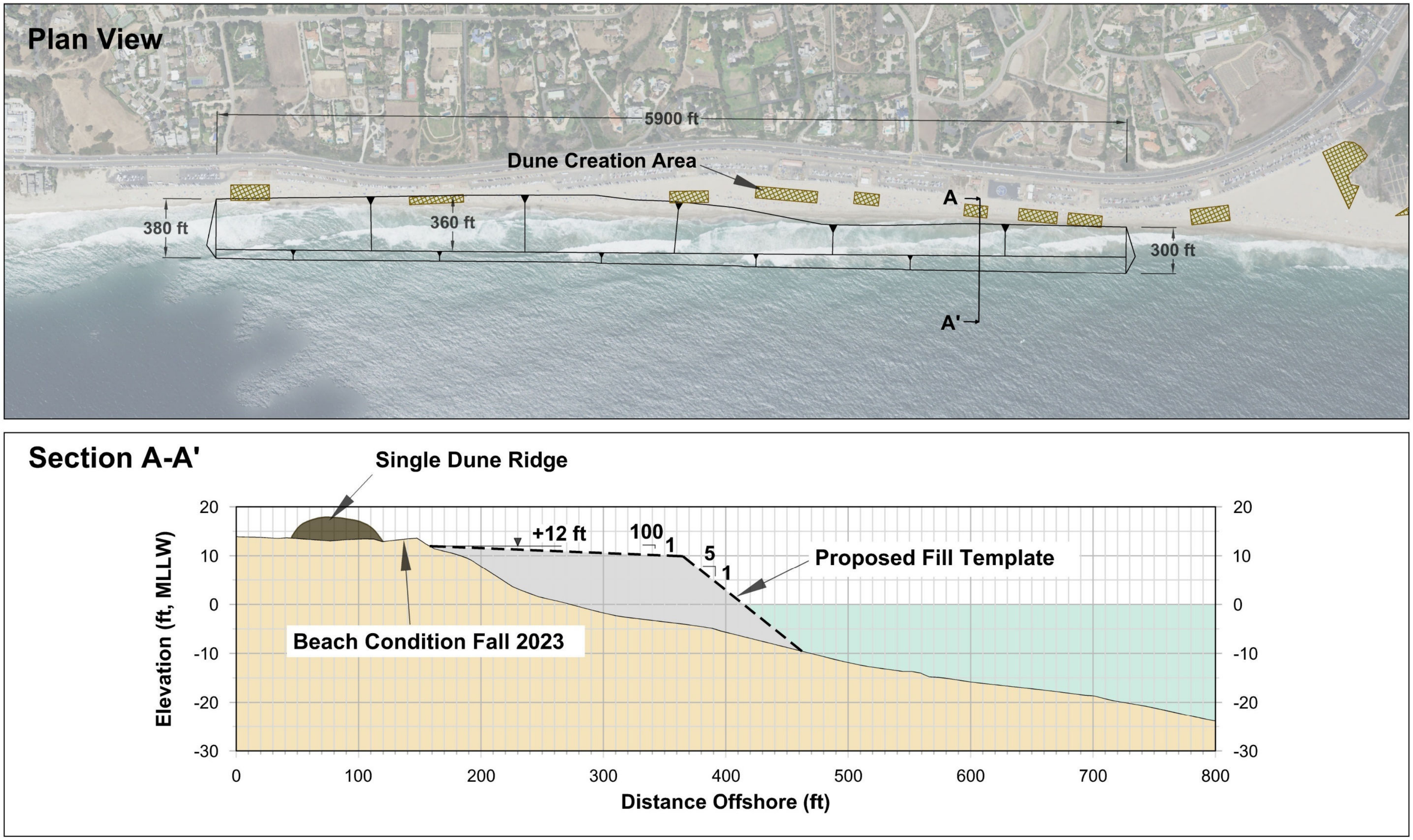

Figure 4-3. Beach Nourishment and Dune at Zuma Beach, Proposed Project

At Zuma Creek and Point Dume, the existing dunes will be enhanced or expanded. The County will partner with and build upon the Malibu Living Shoreline Project currently being conducted by The Bay Foundation in both areas (The Bay Foundation, 2024). At Zuma Creek, the surface of the dunes will consist of randomly positioned small mounds ("hillocks") interspersed with swales. The hillocks will be vegetated with native dune plants and designated paths will be provided to reduce trampling by foot traffic. Figure 4-2, prepared as part of the Malibu Living Shoreline Project (Rios Clemente Hale Studios and Coastal Restoration Consultants, 2019), provides an artistic rendering of the dunes at Zuma Creek following completion of the project.

Figure 4-4. Artistic Rendering of Dunes at Zuma Creek following Project Completion

At Point Dume, the existing dune system will be enhanced by removing non-native species, seeding with native species, and creating designated corridors to the beach, thereby reducing trampling by foot traffic. The dune height will be such that sight lines to the beach are not obscured and sand collection fencing will be installed to encourage dune growth and limit deposition in unwanted areas, such as the parking lot. Figure 4-5 provides an artistic rendering of the dune concept (CRC, 2024b).

It is likely that sediment used for the project will be dredged from an offshore borrow site within Santa Monica Bay and hydraulicly pumped onto the beach from offshore (Section 6). Prior sand source investigations (Coastal Frontiers Corporation, 2012) have located high quality sand offshore in Santa Monica Bay that is compatible with the native sediments at the site.

Source: Coastal Restoration Consultants, 2024b

Figure 4-5. Artistic Rendering of Dunes at Point Dume Beach following Project Completion

Alternative 1

Alternative 1, illustrated in Figure 4-6, includes all the elements of the Proposed Project along with an additional 4.2 acres of new dune habitat along Zuma Beach, resulting in a total of 8.3 acres of new dune habitat and 4.5 acres of enhanced dune habitat. As was the case at Point Dume, designated corridors to the beach will be provided through the dune system and sand collection fencing will be installed to encourage dune growth. Given that the nourishment element is identical to the Proposed Project, refer to Figure 4-3 for the plan view and representative cross section of the beach fill.

Alternative 2

As part of Alternative 2, the volume of the beach nourishment and renourishment events are increased to 750,000 cy and the renourishment frequency is increased to 8 years. The dune creation and enhancement areas are identical to the Proposed Project. Figure 4-7 conceptually illustrates all project elements, while Figure 4-8 provides a detailed plan view and cross-section of the beach fill construction template and dune element at Zuma Beach. The beach fill is template is 8,000 ft long with a 200 to 380 ft wide berm at an elevation of +12 ft (MLLW) and a foreshore slope of 1:5 (V:H).

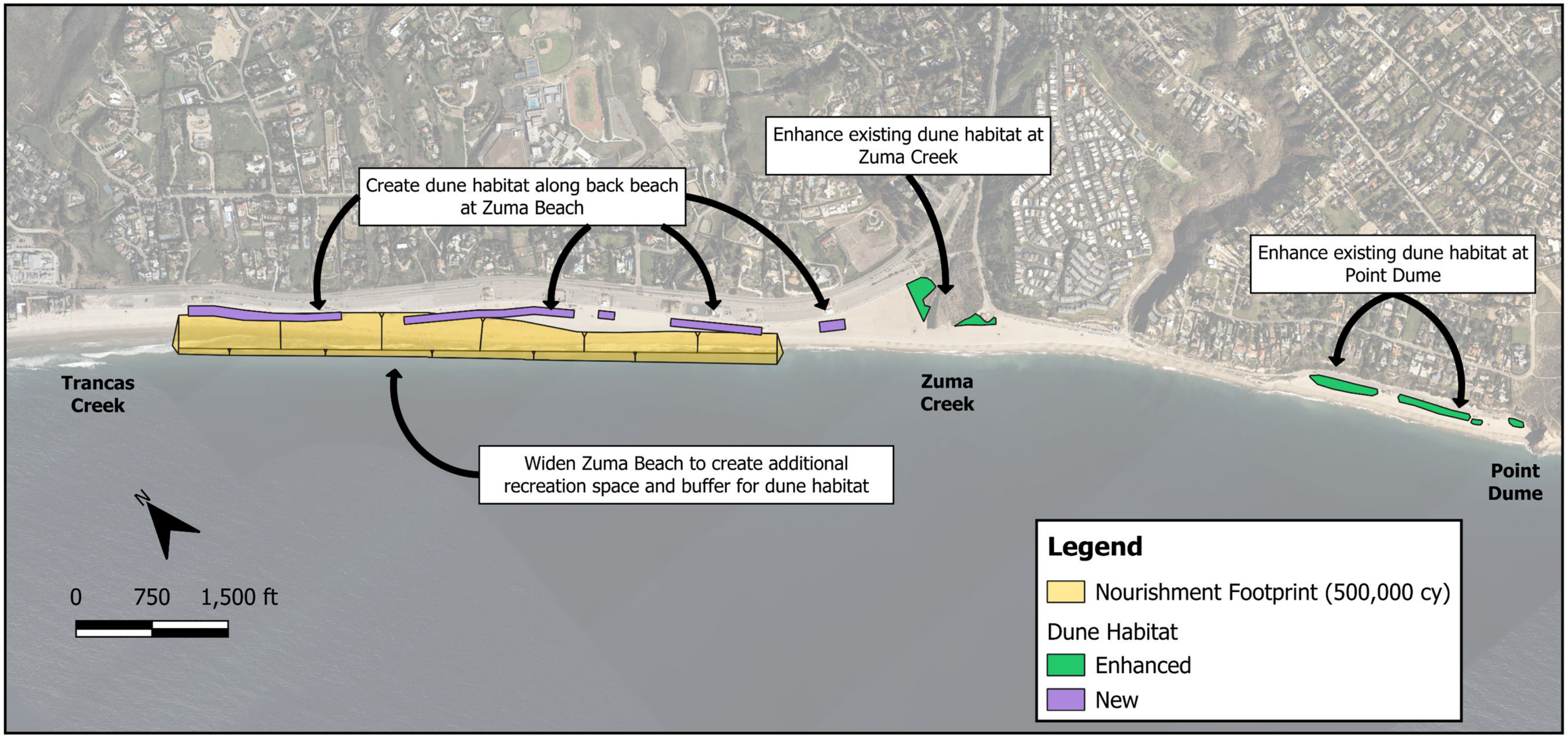

Figure 4-6. Project Alternative 1 at Zuma Beach and Point Dume Beach

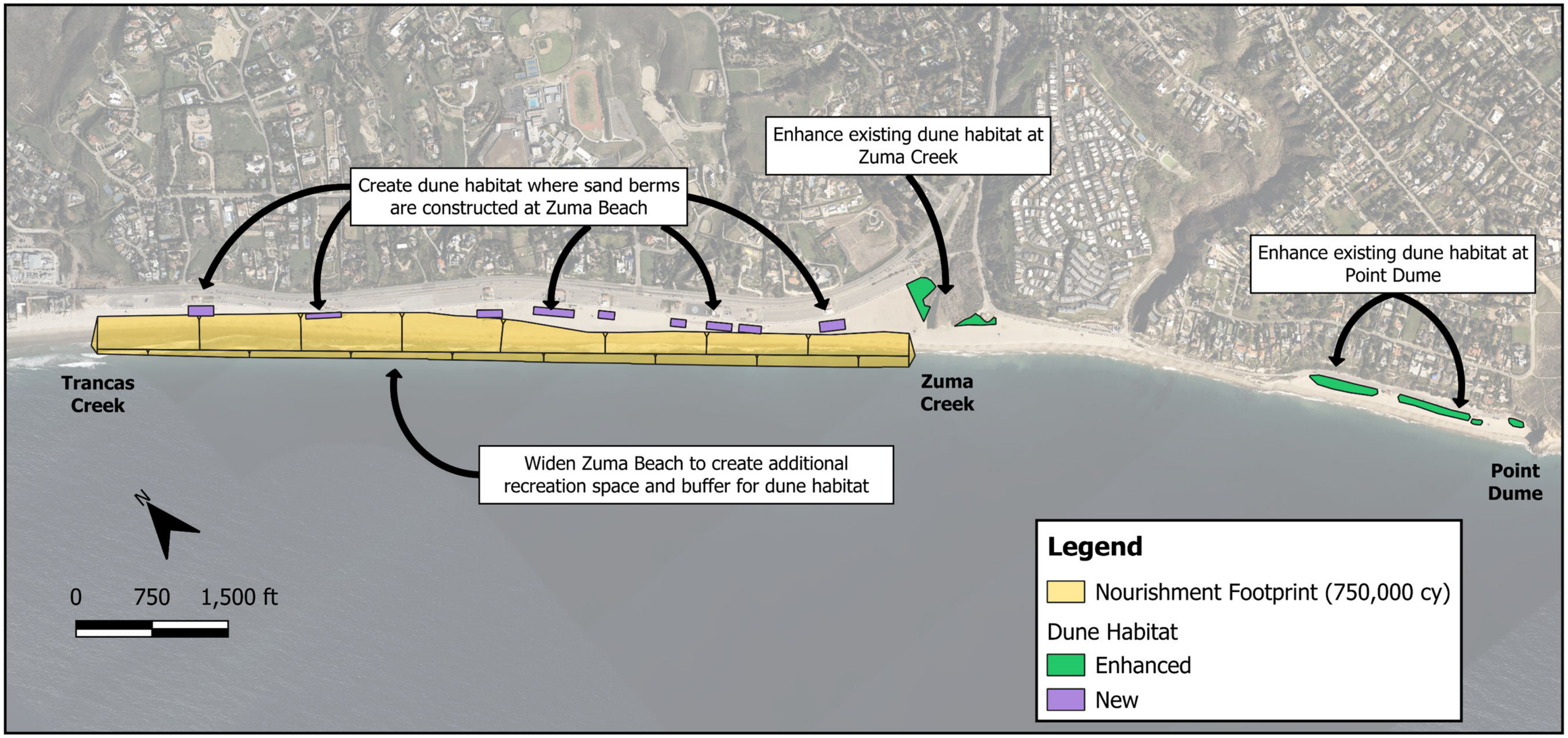

Figure 4-7. Project Alternative 2 at Zuma Beach and Point Dume Beach

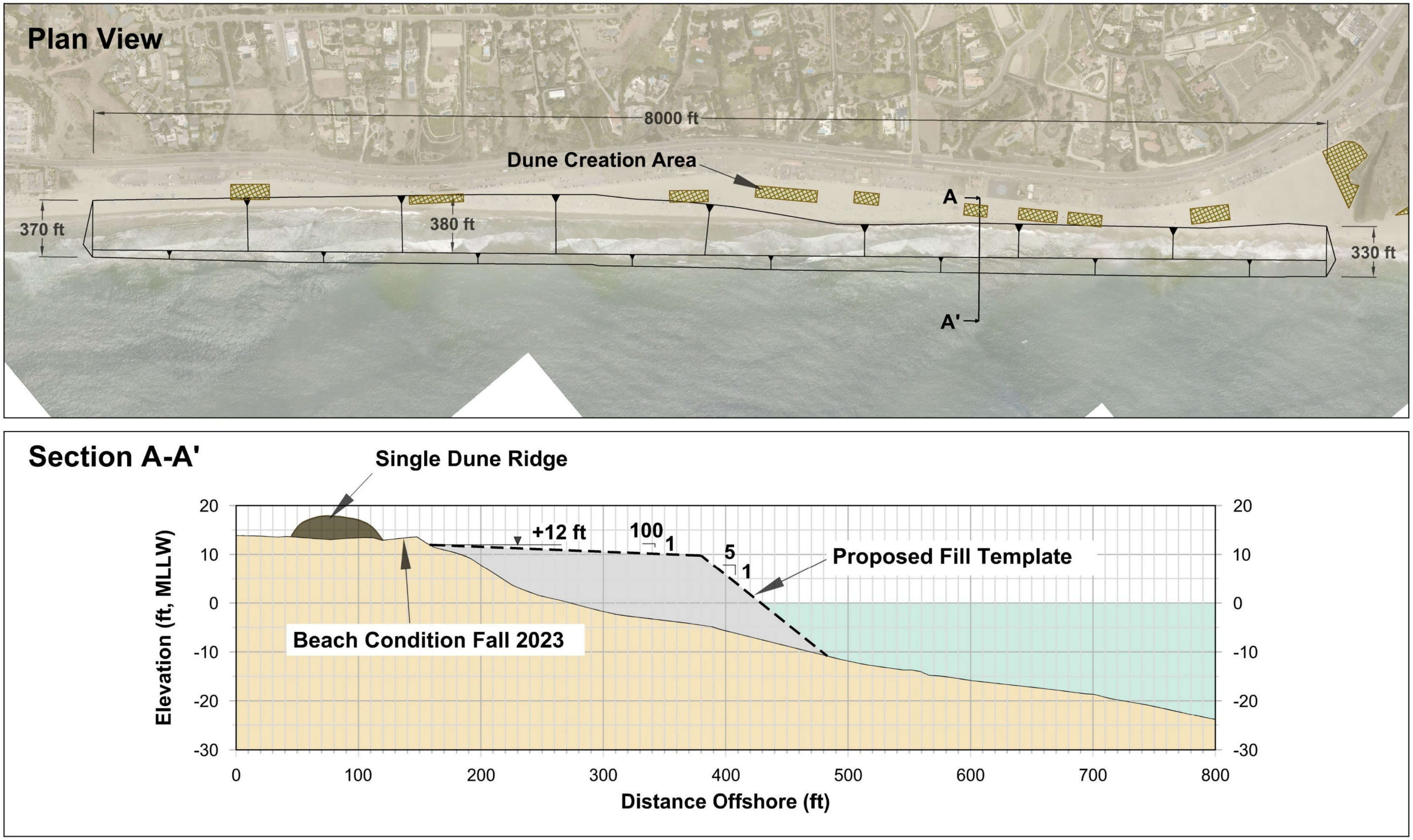

Figure 4-8. Beach Nourishment and Dune at Zuma Beach, Alternative 2

4.2 Dockweiler State Beach

The concept presented at Dockweiler State Beach as part of the *Coastal Resilience Study* (Moffatt & Nichol, 2023) included two elements: (1) installation of a sediment barrier along the bicycle and pedestrian path and parking lot, and (2) active management of the existing dune system between the Youth Center and the Hang Glider area. The specific objectives of the project are to:

- Reduce the quantity of sediment that is blown onto the path and parking lot;
- Manage and expand the existing dune system at the site; and
- Provide educational information related to the role that dunes play in habitat creation, risk reduction, and resilience planning.

4.2.1 Opportunities and Constraints

Opportunities

Opportunities that can be leveraged as part of the resilience project include:

- Dunes presently exist at the site.
- Project scale is relatively small, thereby improving likelihood for funding and expedited construction.

Constraints

The primary constraints warranting careful consideration in the project planning stage are:

- Any barrier constructed to limit sediment transport onto the bike path should be low enough to allow a person of average height to easily cross while carrying beach gear and should utilize a narrow foundation to limit the footprint.
- Vertical access to the beach and horizontal access along the beach must be provided.
- Hang Gliding is a popular activity at the south end of the site. The project should not impact established takeoff points.
- The project site is located within designated critical habitat for the western snowy plover. While project activities are not expected to permanently impact or adversely modify this habitat, temporary impacts could include changes to water quality, increased noise, temporary removal of foraging habitat, and other increased human activity during project activities.
- The El Segundo blue butterfly resides in the El Segundo sand dunes near Dockweiler State Beach and has been observed foraging in areas with their natural food source, coast

buckwheat. There is a low potential for the species to occur in the vegetated areas near the project site and they are not expected to occur due to lack of food sources.

4.2.2 Proposed Project and Alternatives

Key components of the proposed project and the project alternatives are provided in Table 4-2 and described in detail below.

Table 4-2. Key Elements of Proposed Project & Alternatives, Dockweiler State Beach

Project	Enhanced Dune Habitat	Restored Dune Habitat	Length of Sand Barrier	Number of Beach Access Points
Proposed	1.3 acres	1.3 acres	850 ft	3
Alternative 1	1.3 acres	1.5 acres	850 ft	2
Alternative 2	1.3 acres	1.4 acres	700 ft	4

Proposed Project

The Proposed Project is illustrated in Figure 4-9. The primary components include a low barrier wall along the west edge of the bicycle path, enhancement and restoration of the existing dune field, and creation of established accessways between the parking lot and beach.

The barrier wall is intended to prevent wind-blown sand from reaching the bike path and parking lot and will be similar to that found at other County-managed beaches, such as Zuma Beach (Figure 4-10). There are two segments with a combined length of 850 ft, beginning at the Youth Center and ending east of the Hang Glider takeoff area. The wall is a little more than 2 ft tall with a base that is about 1 ft wide.

The existing dune system will be enhanced through active management that includes installation of sand fencing within the dune field, installation of boundary fencing along the border, removal of non-native species, and seeding with native species. In addition, sand and boundary fencing will be installed west (offshore) of the existing dune field in an effort to restore former dune habitat.

Public access to the beach will be provided at three locations: via the stairs on the south side of the Youth Center, along a designated path immediately south of the Youth Center, and at the Hang Glider takeoff area. Breaks in the barrier wall will be provided at all three locations.

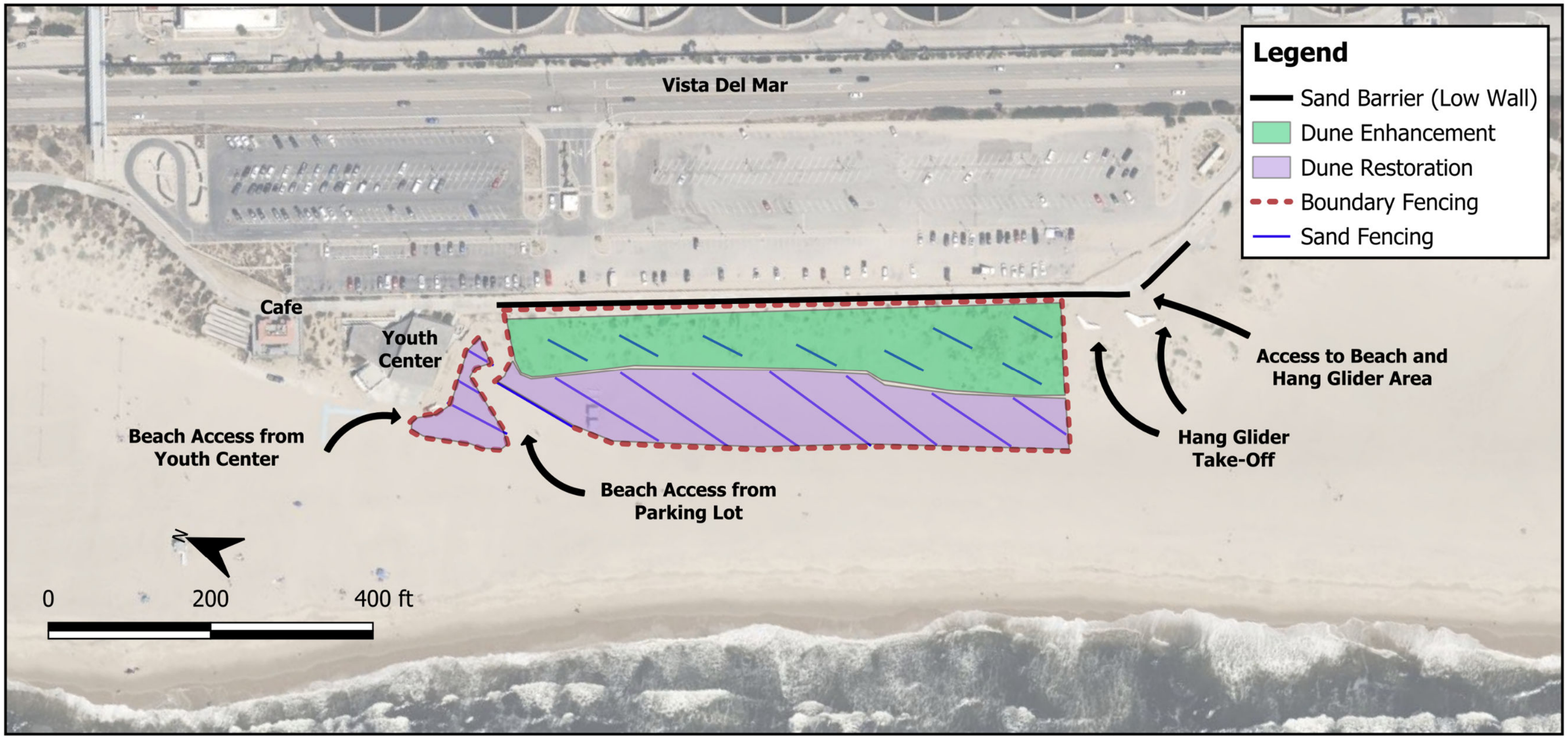

Figure 4-9. Proposed Project at Dockweiler State Beach

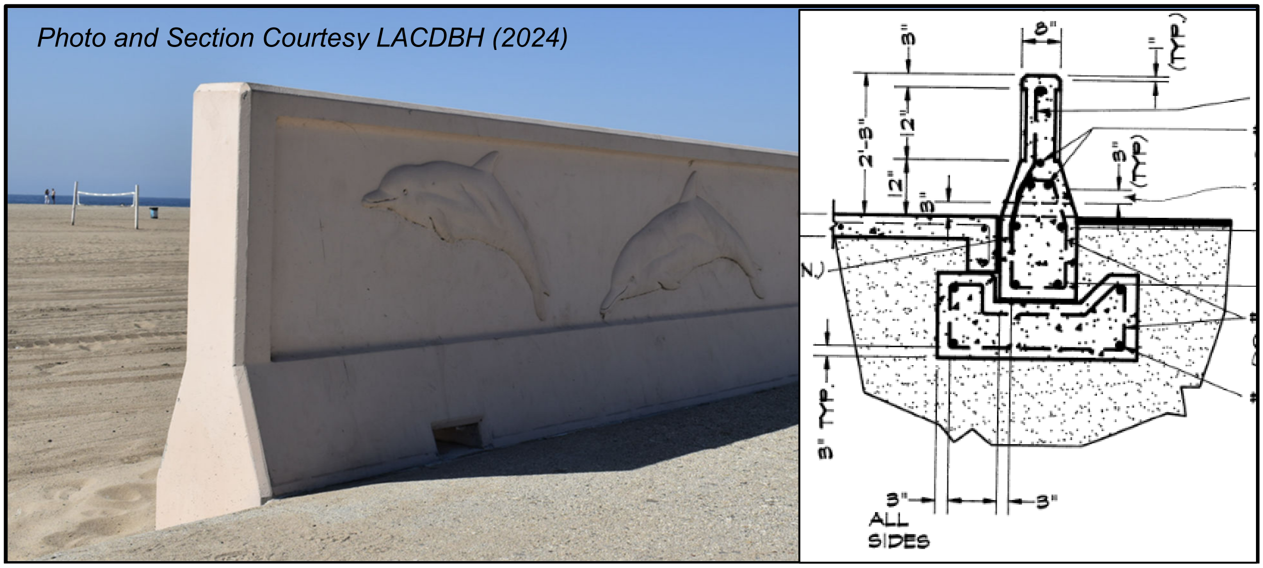

Figure 4-10. Photo and Cross Section of Low Sand Barrier at Zuma Beach

Alternative 1

Alternative 1 is illustrated in Figure 4-11. The barrier wall is identical to that in the Proposed Project. The beach access point immediately south of the Youth Center is removed, resulting in a continuous dune area from the Youth Center to the Hang Glider take-off area. Access to the beach is maintained at the Youth Center stairs and at the Hang Glider area. The enhanced dune area is identical to the Proposed Project (1.3 acres) and the restored dune area is slightly larger (1.5 acres).

Alternative 2

As part of Alternative 2, the barrier wall is terminated at the south end of the dune system, resulting in a single segment with a total length of 700 ft. As shown in Figure 4-12 the dune restoration area is expanded to the north and extends along the entire offshore edge of the Youth Center. Four beach access points are provided: at the base of the Youth Center, on the south side of the Youth Center, and immediately south of the Youth Center and at the Hang Glider area. The restored dune area is slightly larger than the Proposed Project (1.4 acres) and the enhanced dune area is identical (1.3 acres).

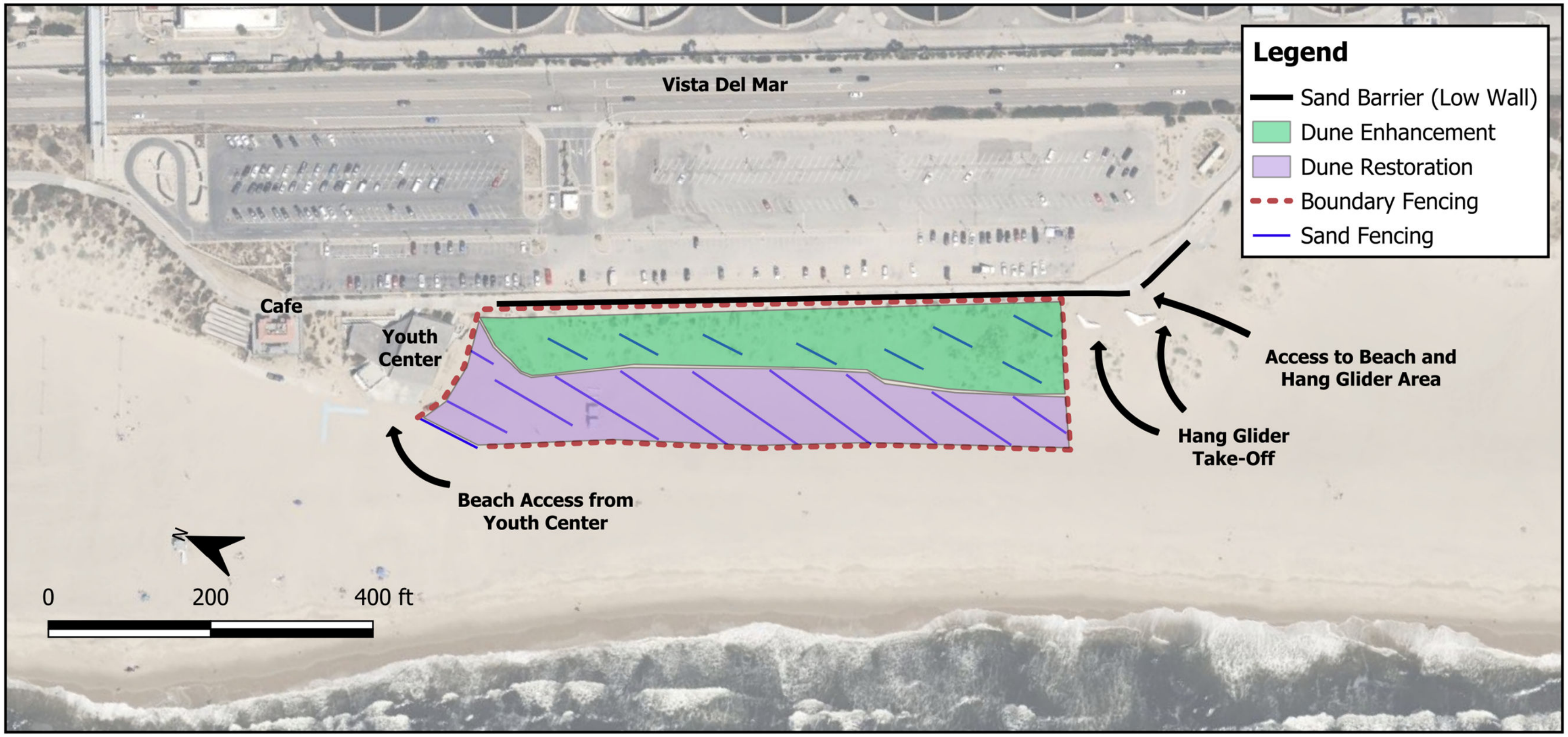

Figure 4-11. Project Alternative 1 at Dockweiler State Beach

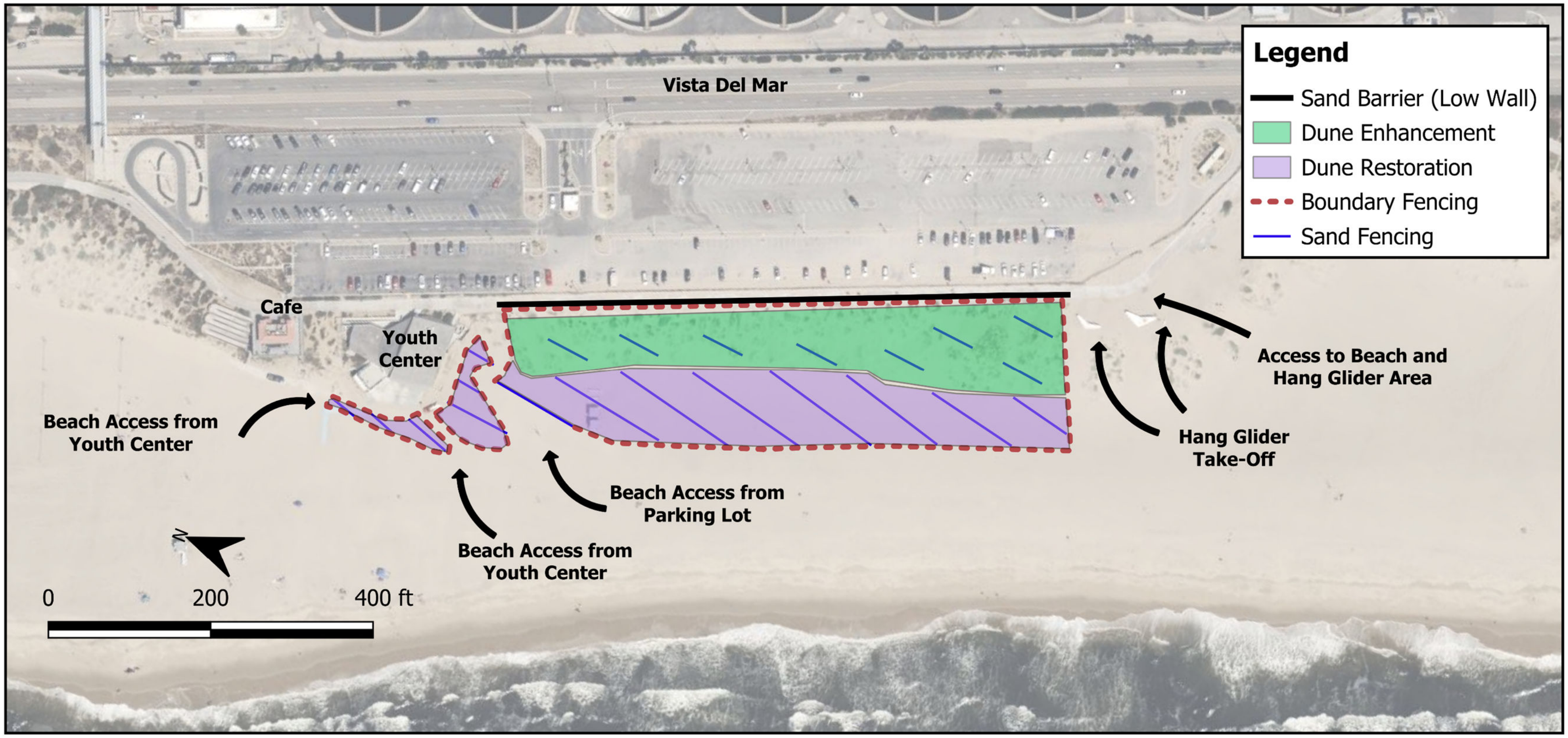

Figure 4-12. Project Alternative 2 at Dockweiler State Beach

4.3 Redondo Beach

The concept proposed at Redondo Beach as part of the *Coastal Resilience Study* (Moffatt & Nichol, 2023) included widening the beach via nourishment between Topaz Groin and Redondo Pier, installation of a sheet-pile groin at the Pier to retain the nourishment material, and creation of dune habitat in selected areas along the back beach. The objectives of the project are to:

- Expand public access and recreational opportunities for LA County residents and visitors;
- Increase protection of coastal infrastructure;
- Increase and enhance sensitive sandy beach and dune habitat; and
- Expand local and regional economic benefits.

4.3.1 Opportunities and Constraints

Opportunities

Opportunities that can be leveraged as part of the resilience project include:

- Prior use as a beach nourishment receiver site by the USACE.
- Pier structure provides an optimal location to add a non-intrusive sediment retention device.
- The Pier is adjacent to the entrance to King Harbor, resulting in no negative down-drift impacts from sediment retention device.

Constraints

The primary constraints warranting careful consideration in the project planning stage are:

- Recreational beach area (“towel space”) will be reduced in areas where dunes are created.
- Vertical access through dune areas must be provided for and managed.
- Dunes may impact view corridors and should be considered in project planning.
- The site is located on the sandy beach and subtidal sand overlapping the HTL. Project activities have the potential to impact incubating grunion eggs if activities occur during their spawning season.

4.3.2 Design Concept and Alternatives

Key components of the proposed project and the project alternatives are provided in Table 4-3 and described in detail below.

Table 4-3. Key Elements of Proposed Project & Alternatives, Redondo Beach

Project	Beach Nourishment	Renourishment Interval	Sediment Retention	New Dune Habitat
Proposed	300,000	None	Yes	0.5 acres
Alternative 1	300,000	None	No	0.5 acres
Alternative 2	150,000	None	Yes	0.5 acres

Proposed Project

The Proposed Project, shown in Figure 4-13, includes a one-time placement of 300,000 cy of sand between Topaz Groin and Redondo Beach Pier, construction of a sand retention device on the south side of Redondo Beach Pier, and creation of dune habitat fronting the County facility near Topaz Groin. Due to the relative stability of the shoreline in this area, renourishment is not expected to be needed for approximately 20 years.

The beach nourishment construction template (Figure 4-13) is comprised of a berm up to 265 ft wide with a crest elevation of +12 ft (MLLW) and a foreshore slope of 1:5 (V:H). The proposed sediment retention device consists of a sheet-pile groin, similar to that which currently exists on the north side of Seal Beach Pier. The sheet-pile structure has the benefits of a reduced footprint relative to a rock structure, and the ability to blend with the pier structure and reduce aesthetic impacts. Figure 4-14 illustrates the effectiveness of the Seal Beach Pier groin in retaining sediment travelling from south to north within the pocket beach between Seal Beach Pier and the Alamitos Bay north jetty.

Negative impacts typically associated with sediment retention devices, such as down-drift erosion, are not applicable at Redondo Beach, given that little to no beach presently exists between the pier and the harbor. In addition, the proposed structure will include a façade of ECOncrete, a patented product that encourages biological recruitment, increases carbon sequestration, and improves water quality (ECOncrete, 2024). Figure 4-15 provides a conceptual illustration of the proposed structure, a cross section and photo of the Seal Beach Pier Groin, and illustration of ECOncrete used at a pier in Spain. It is estimated that the structure will be approximately 180 ft long.

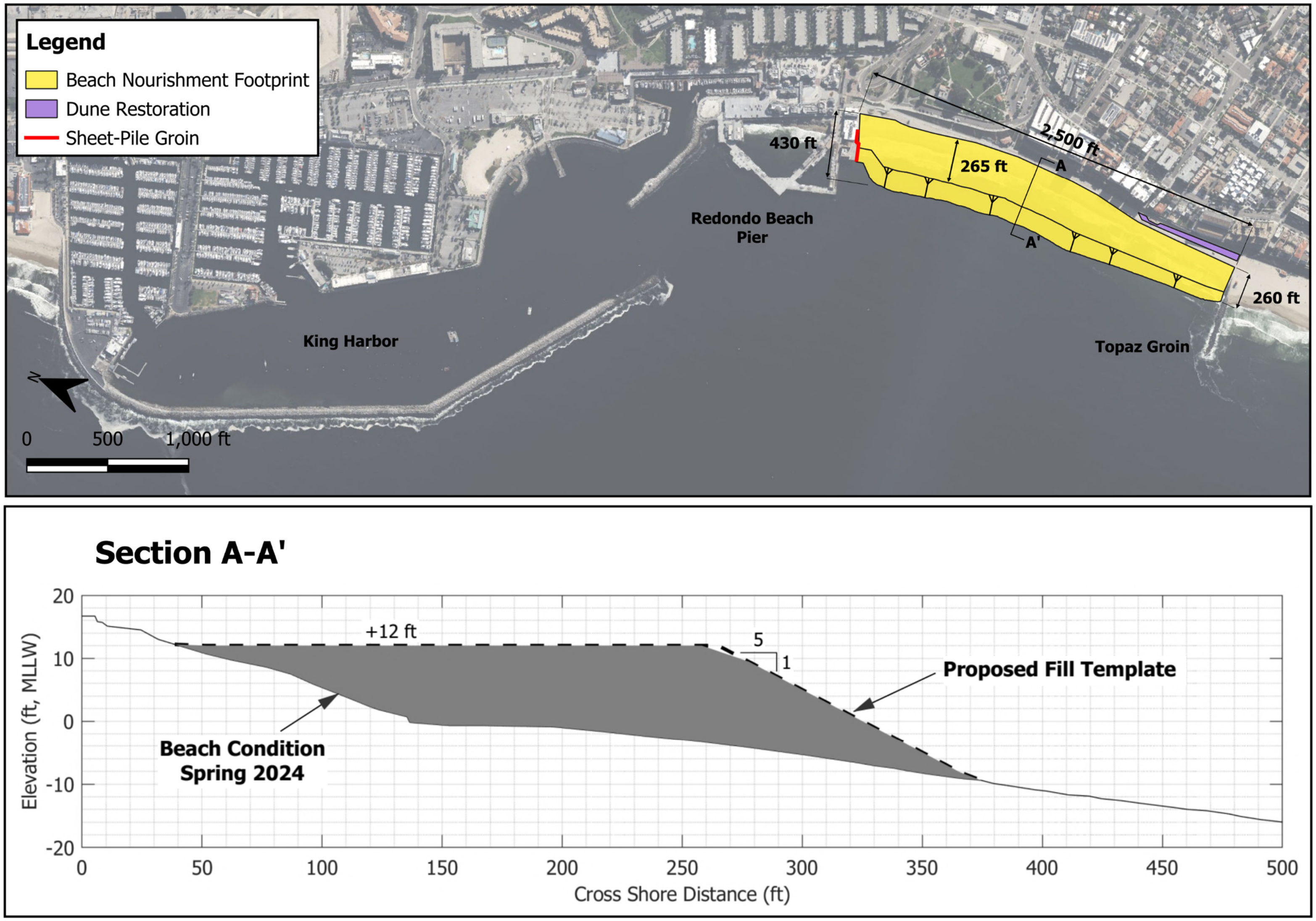

Figure 4-13. Proposed Project at Redondo Beach

Figure 4-14. Beach Retained by Sheet Pile Groin at Seal Beach Pier

Following placement of the beach fill, dunes will be constructed offshore and south of the County facility near Topaz Groin (Figure 4-13). This area was selected based on the location of the facility and the fact that it is distant from popular beach access points near the pier. The total dune area is 0.5 acres.

It is likely that sediment used for the project will be dredged from an offshore borrow site within Santa Monica Bay and hydraulicly pumped onto the beach from offshore. Potential sand sources are discussed in Section 6, and include a stockpile of sediment dredged from Marina del Rey and located just offshore of Topaz Groin.

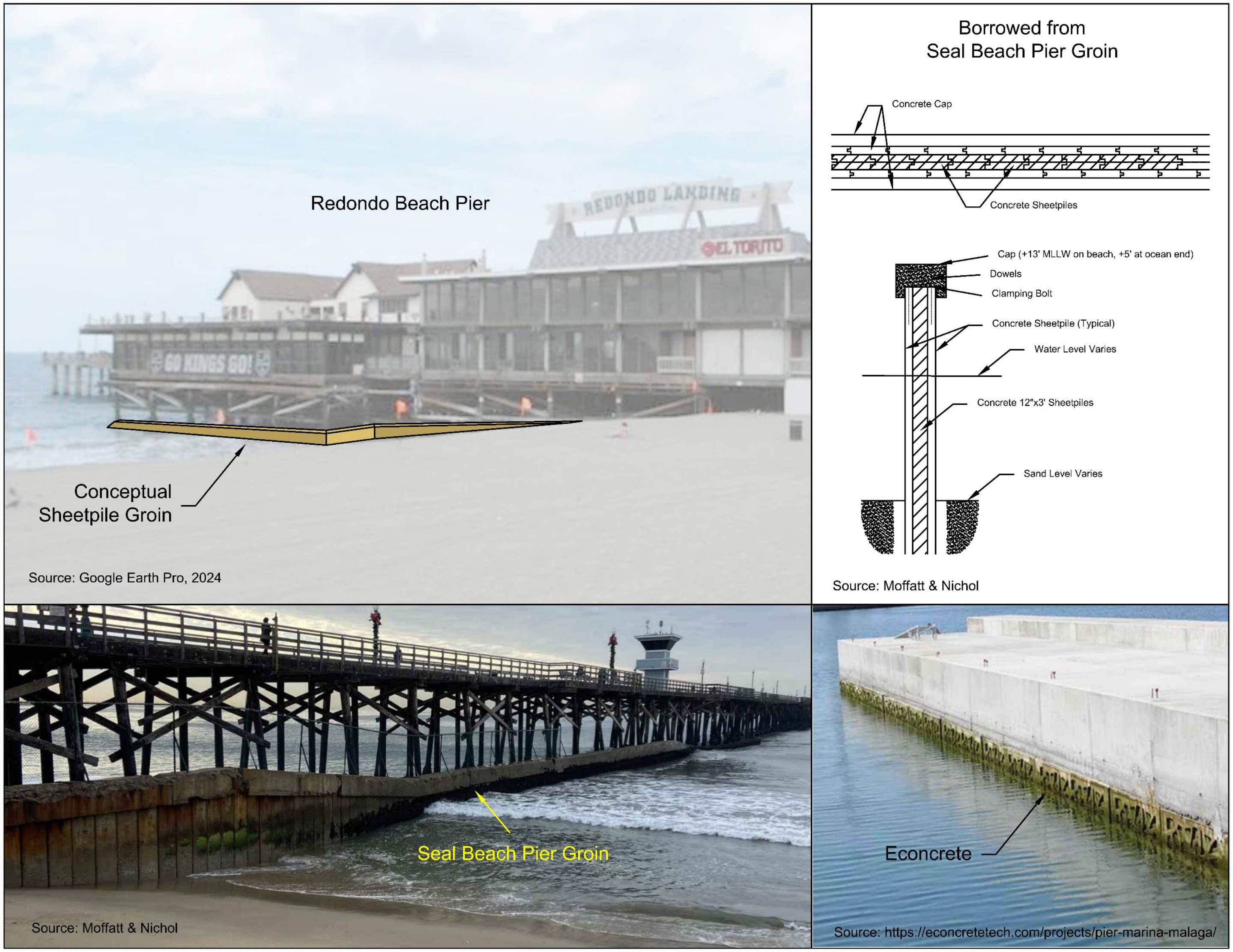

Figure 4-15. Conceptual Illustration of Proposed Sheet Pile Groin, Seal Beach Pier Groin, and ECOncrete Finish

Alternative 1

Alternative 1, shown in Figure 4-16, is identical to the Proposed Project, but without the sand retention structure at the pier.

Alternative 2

While the dune and sediment retention components of Alternative 2 are identical to the Proposed Project, the volume of sediment placed on the beach is reduced by 50% from 300,000 to 150,00 cy. Figure 4-17 illustrates the project components and provides a representative cross section through the beach nourishment construction template.

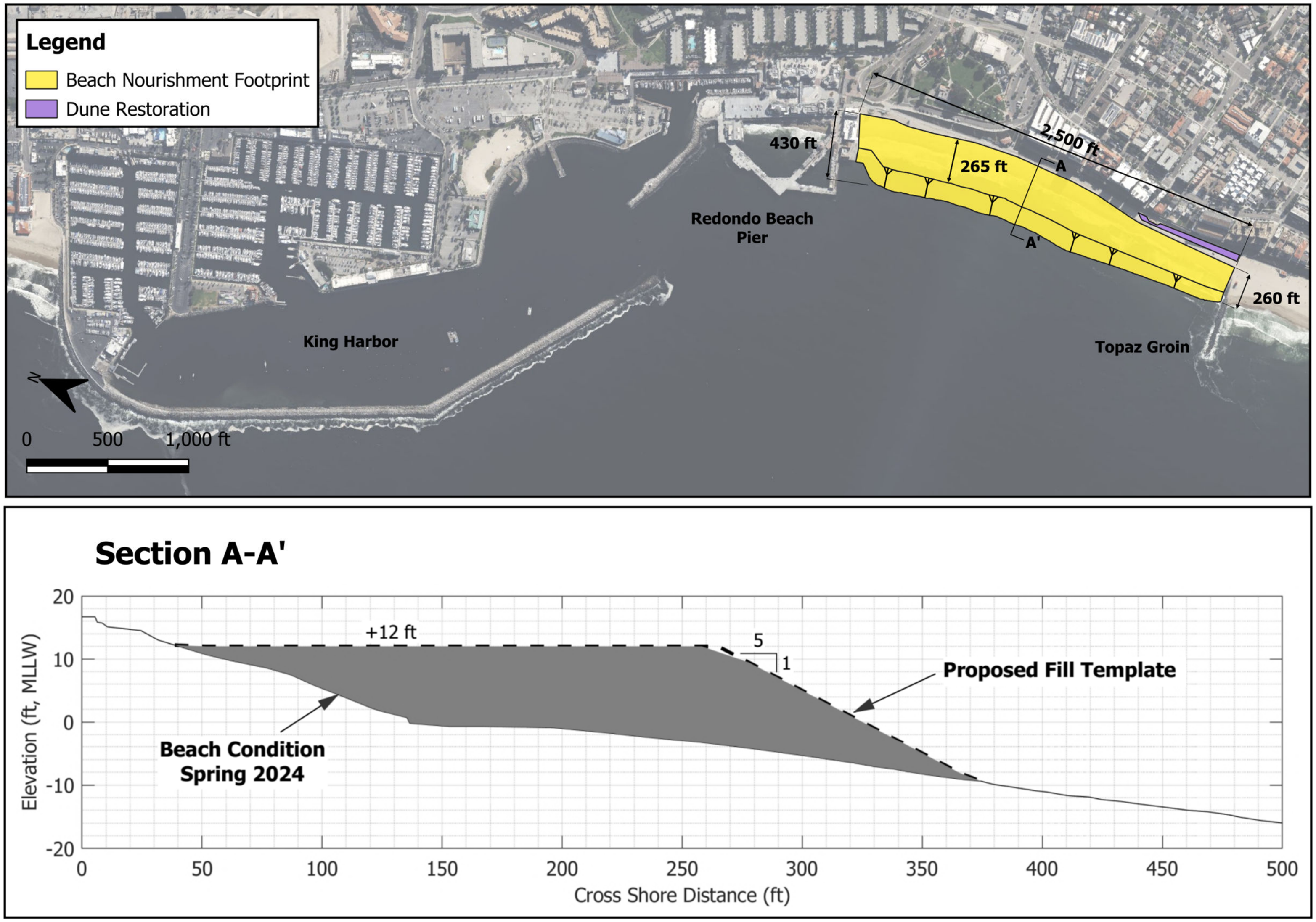

Figure 4-16. Project Alternative 1 at Redondo Beach

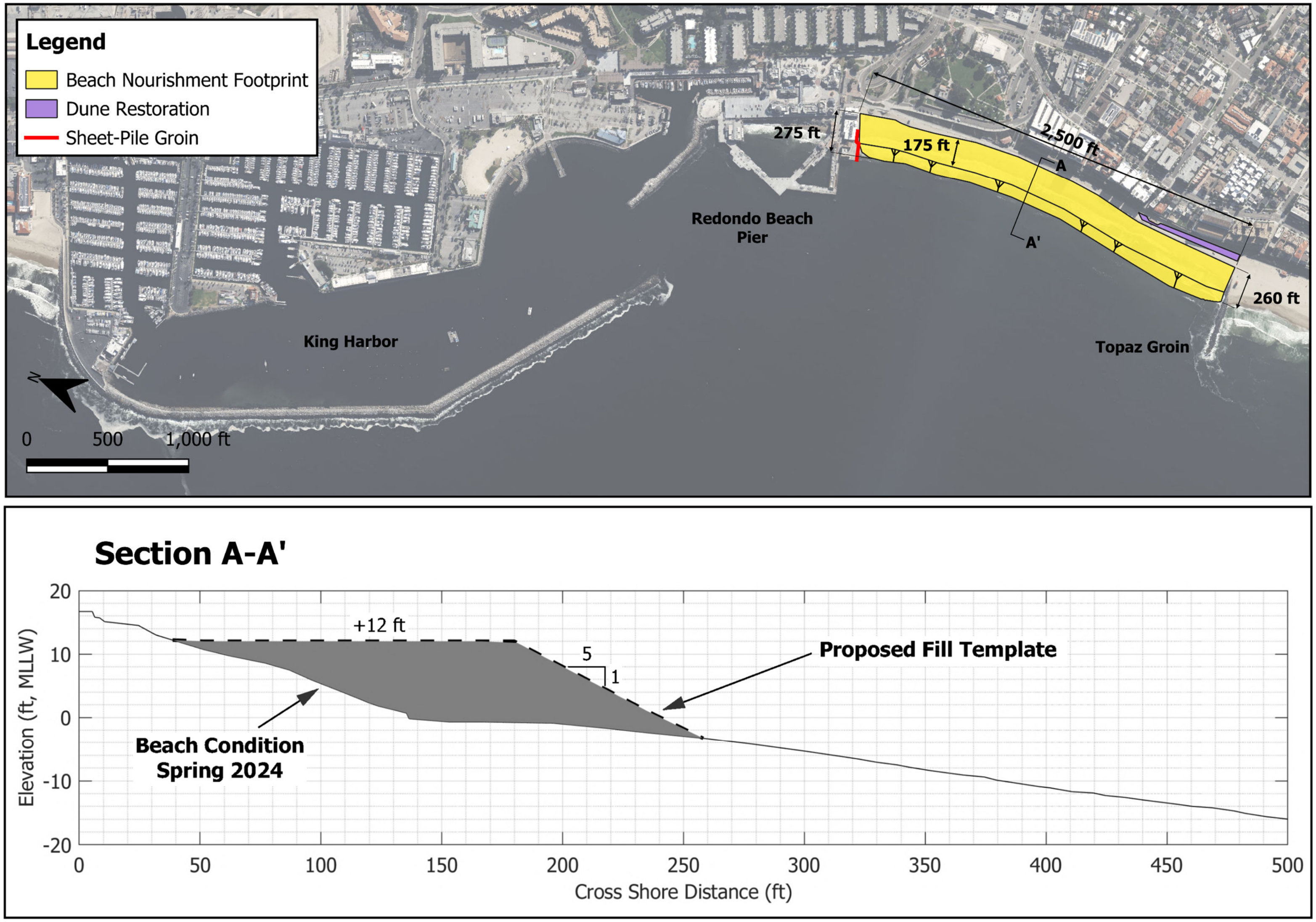

Figure 4-17. Project Alternative 2 at Redondo Beach

5 Anticipated Performance

This section summarizes analyses conducted to evaluate the anticipated outcome of the proposed projects and project alternatives.

5.1 Zuma Beach and Point Dume

As noted in Section 4, the primary components of the Zuma Beach and Point Dume Project are beach nourishment and dune creation or enhancement. An overview of the key elements is provided in Table 5-1.

Table 5-1. Overview of Key Project Elements, Zuma Beach & Point Dume

Project	Beach Nourishment	Renourishment Interval	New Dune Habitat	Enhanced Dune Habitat
Proposed	500,000	5 years	4.1 acres	4.5 acres
Alternative 1	500,000	5 years	8.3 acres	4.5 acres
Alternative 2	750,000	8 years	4.1 acres	4.5 acres

5.1.1 Shoreline Modeling

To assess the potential benefits and impacts related to the beach nourishment activities, numerical simulations of shoreline evolution were conducted using the GenCade model (Frey *et al.*, 2012) developed by the USACE. GenCade is a one-line model of shoreline change and wave-induced longshore sediment transport applicable to open coasts and inlets. Inputs to the model include the initial shoreline configuration, sediment characteristics, location of coastal structures (*e.g.,* seawalls, jetties, breakwaters, or groins), sediment sources (*e.g.,* contributions from rivers, bluffs, and beach nourishment), and sediment sinks (*e.g.,* harbors, submarine canyons, offshore losses, losses resulting from SLR). The model is driven by nearshore wave conditions and typically is calibrated using measured shoreline data obtained in the area of interest.

Beach Profile Equilibration following Nourishment

When beach nourishment projects are constructed, sand is initially placed high on the profile in a wide berm, as shown in Figure 4-3. This is done to maximize the recreational area for immediate benefit and to facilitate construction. The fill material, however, is quickly dispersed offshore and along the beach by nearshore waves and currents. As the material is redistributed, the beach undergoes a process of equilibration to a more natural condition. This condition, referred to as the “equilibrium beach profile”, is related to the sediment grain size, berm height, and nearshore wave conditions (Dean, 2002).

For example, the construction template for the Proposed Project at Zuma Beach shown in Figure 4-3 adds approximately 200 ft to the width of the berm. Following equilibration, it is estimated that the additional berm width may be reduced to as little as 50 ft, as is illustrated in Figure 5-1. This estimate is based on the assumption that the fill and native grain sizes are the same. As was noted in Section 3.2, however, coarser-than-native material can be used to increase the equilibrated beach width and extend the fill longevity. In the interest of conservatism, the analyses presented herein do not include such increases in width or longevity.

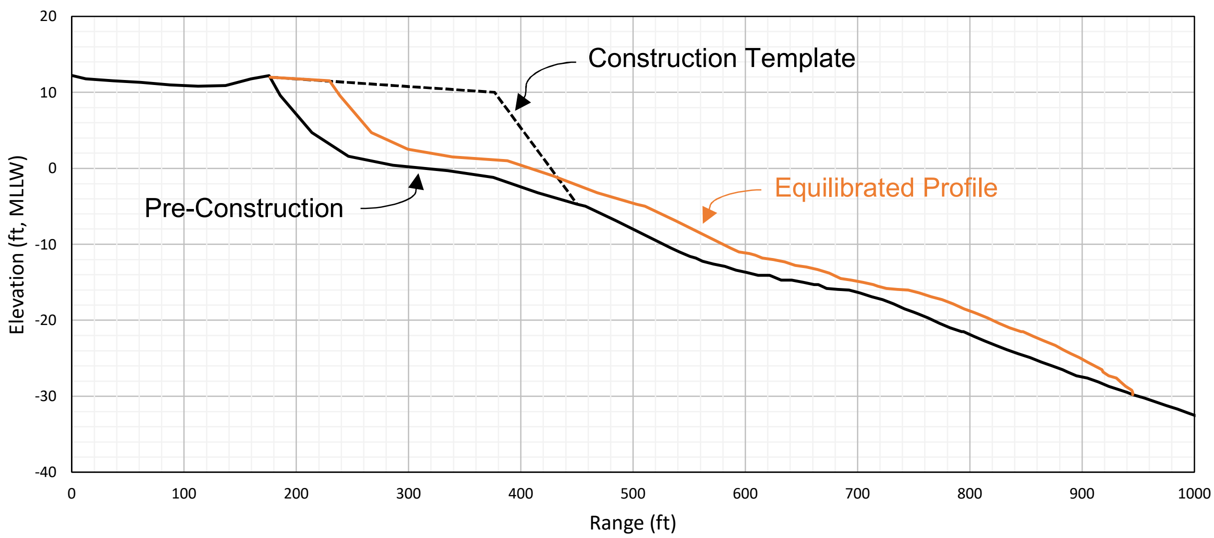

Figure 5-1. Pre-Construction, Construction Template, and Equilibrium Beach Profile

Model Configuration and Calibration

The domain selected for the numerical simulations is illustrated in Figure 5-2. It begins at Point Dume and extends west to Lechuza Point. Sediment characteristics were derived from the samples obtained at Zuma Beach in 2016 (Section 2.1.6), resulting in an average median grain size diameter of 0.23 mm. Beach profile data obtained between 2016 and 2023 (Coastal Frontiers Corporation, 2023a) were used to estimate the typical berm elevation (+9 ft, MHHW) and depth of closure (-34 ft, MHHW). Coastal structures included in the model consisted of revetments at Broad Beach and Westward Beach Road and those structures that limit landward migration of the beach, such as parking lots, coastal facilities, and roads.

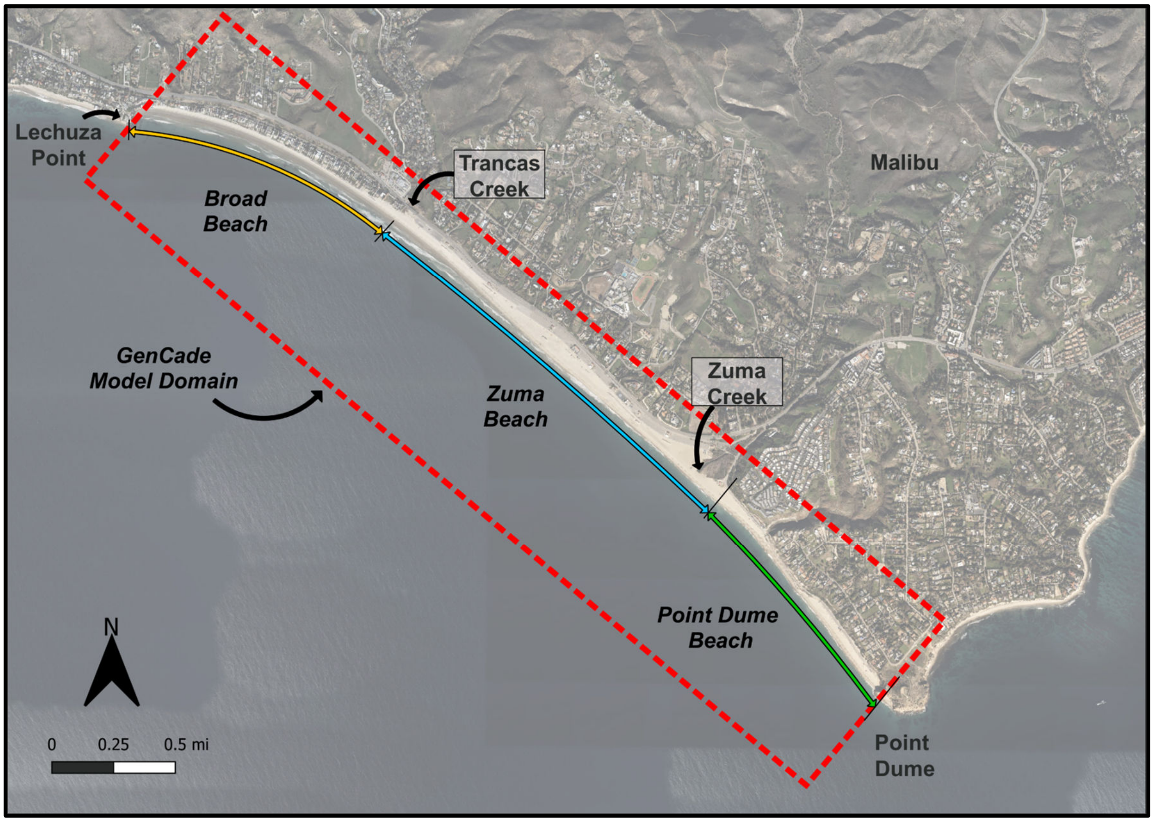

Figure 5-2. GenCade Model Domain

As noted in Section 2.1.2, sediment input to the Zuma littoral cell is derived primarily from local creeks and streams. For the purposes of the numerical simulations, two sources were used: 19,500 cy/yr at Trancas Creek and 19,500 cy/yr at Zuma Creek (total input of 39,000 cy/yr).

Wave conditions used to drive the model were obtained from the California Coastal Wave Monitoring and Prediction System (MOP; O'Reilly *et al.*, 2016) maintained by the Coastal Data Information Program (CDIP, 2024) and from wave conditions forecast as part of the USGS CoSMoS simulations (Barnard *et al.*, 2018).

Model calibration was performed between 2009 and 2016, a period during which high-resolution Light Detection and Ranging (LiDAR) shoreline data are available in the project area. The data were obtained by the USACE as part of the National Coastal Mapping Program (NCMP) and by Los Angeles County as part of the Los Angeles Region Imagery Acquisition Consortium (LARIAC). Given that the LiDAR data becomes less reliable near the water surface, the Mean Higher High Water (MHHW) elevation was used as the basis for the shoreline data. In the project area, MHHW lies 5.43 ft above MLLW (NOS, 2024).

The modeled 2016 shoreline position from GenCade agreed well with the 2016 shoreline position measured as part of the LARIAC LiDAR survey. The RMS error between the measured and modeled shorelines was 22 ft and the model skill, a measure of the model's accuracy, was 0.8. This value exceeds the threshold typically accepted by the USACE, 0.3, by a comfortable margin.

Model validation then was conducted by simulating shoreline changes from 2016 to 2023 and comparing the model results to beach profile data obtained in October 2023 (Coastal Frontiers, 2023a). While differences between the measured and modeled 2023 shorelines were greater than those observed during the calibration phase, the agreement was acceptable (RMS error of 77 ft).

Forecast Shoreline Simulations

The calibrated model was used to evaluate the Proposed Project and the two alternatives over the 20-year period beginning on January 1, 2030, and ending on January 1, 2050. This period was selected to provide ample time over which to assess both evolution of the beach fill and the appropriate renourishment frequency. The base year, 2030, corresponds to the SLR forecast scenario closest to the likely start of construction. To reach the base year (2030), the model was advanced from the most recent beach profile survey (October 26, 2023) to January 1, 2030.

Shoreline recession due to SLR was included in the forecast simulations (October 2023 to January 2050) based on the values presented in Section 2.1.4 and the Bruun Rule (Bruun, 1962). Given the relatively minor increase in sea level over this period (0.4 ft), the erosion due to SLR was only 26 ft over the nearly 26-year simulation.

Renourishment Interval and Added Beach Width

Figure 5-3 illustrates the additional beach width provided by the Proposed Project and Alternative 1 (500,000 cy) relative to the pre-nourishment condition (January 1, 2030) for the first five years of the project. The increase in beach width is greatest within the fill footprint initially, then spreads downcoast toward Point Dume as time progresses. By 2035 (year 5), most of the added material within the fill footprint has dispersed, indicating that a 5-year renourishment interval is necessary to maintain beach widths greater than or equal to the pre-project condition for the 500,000-cy beach nourishment.

Figure 5-4 illustrates the additional beach width provided by the 750,000-cy beach nourishment proposed as part of Alternative 2, relative to the pre-nourishment condition (January 1, 2030) for the first eight years of the project. As was the case for the Proposed Project and Alternative 1,

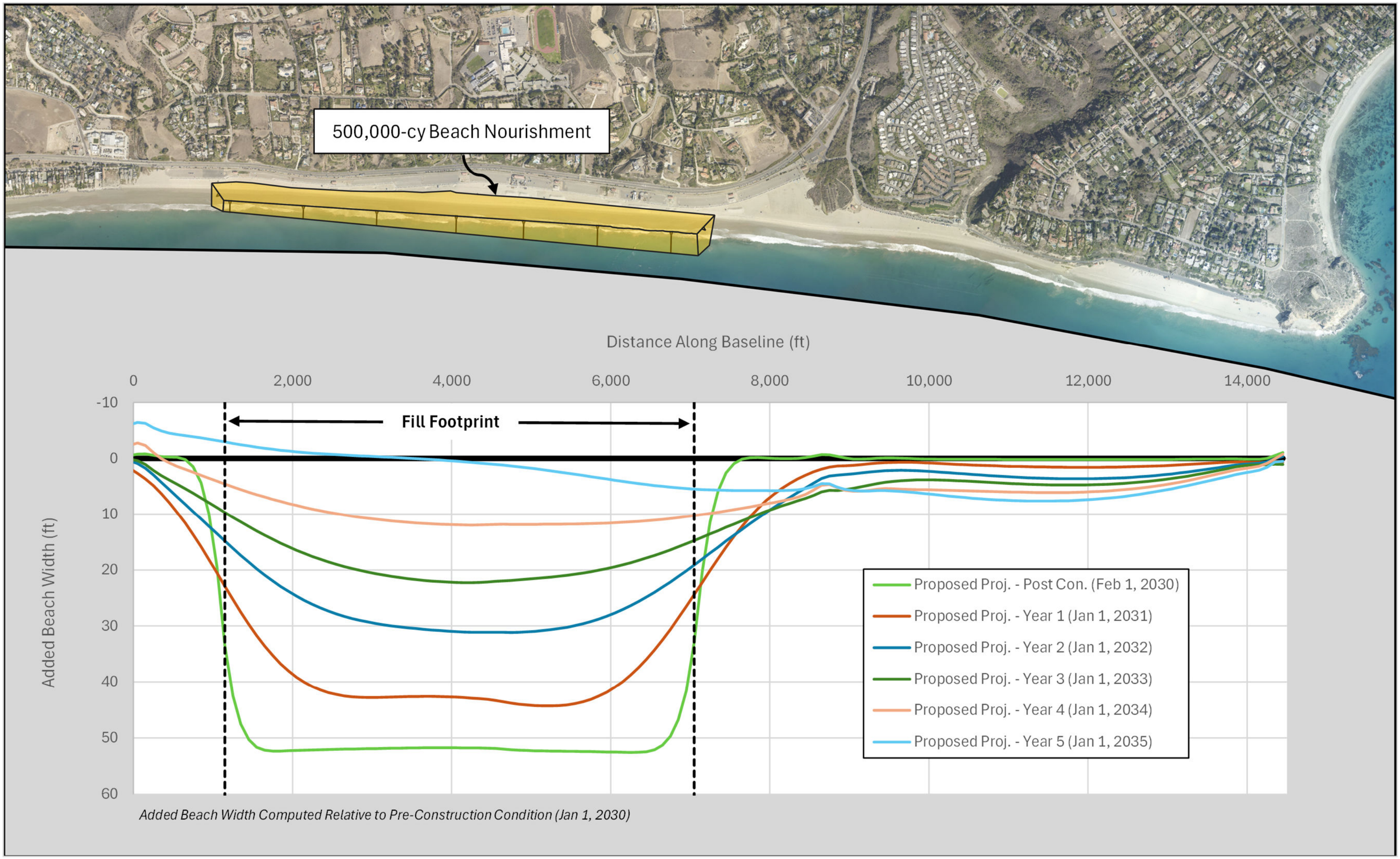

Figure 5-3. Added Beach Width relative to Pre-Nourishment Condition (Jan. 1, 2030), Proposed Project and Alternative 1

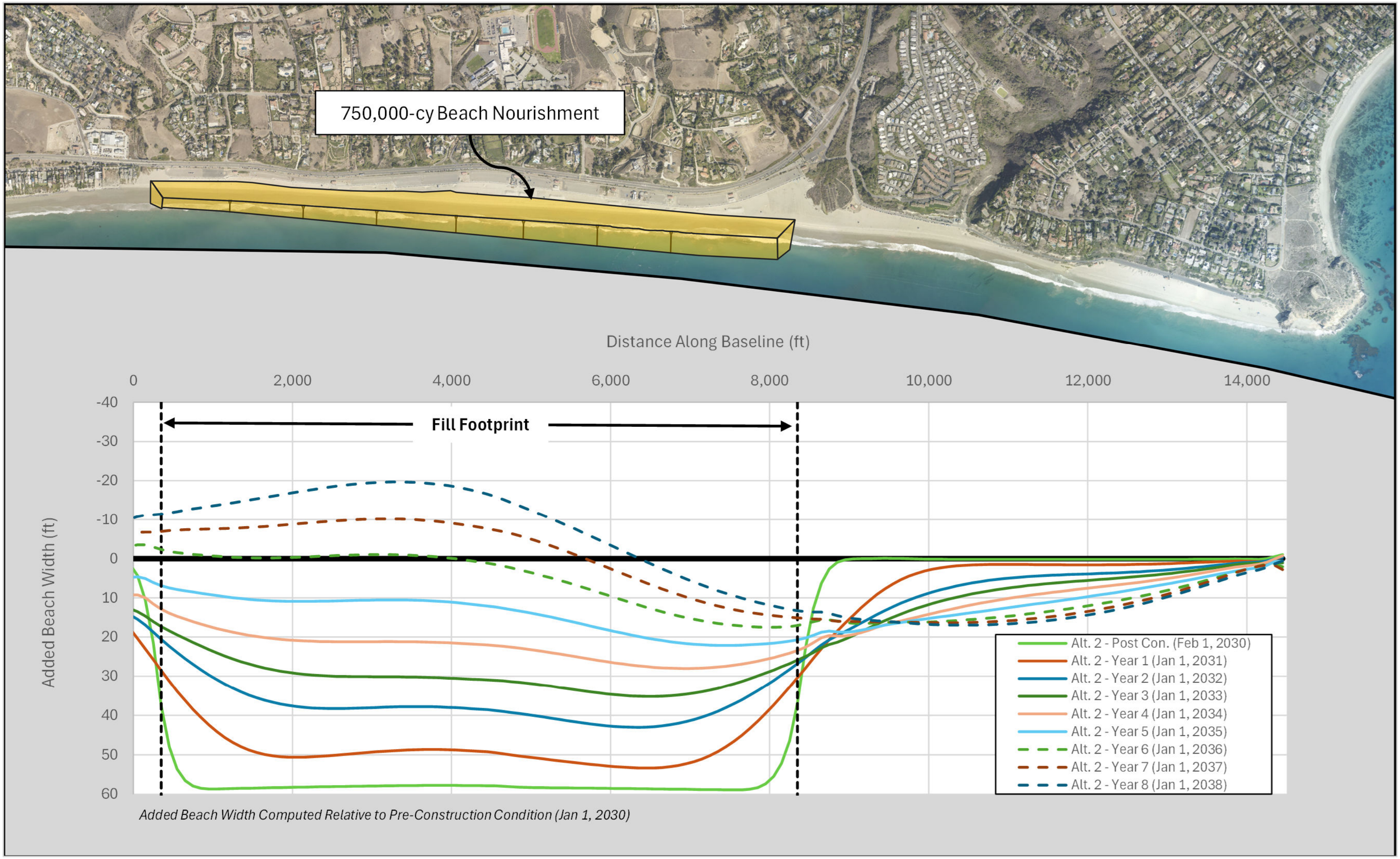

Figure 5-4. Added Beach Width relative to Pre-Nourishment Condition (Jan. 1, 2030), Alternative 2

the gains are greatest within the fill footprint and are dispersed downcoast (toward Pt. Dume) as time progresses. For this case, an eight-year renourishment interval is recommended based on the fact that, on average, the additional beach width gains are lost within the area of concern (Zuma Beach and Point Dume Beach).

5.1.2 Performance

The performance of the proposed project and each alternative was evaluated based on three factors, each of which are directly related to the project objectives identified in Section 4.1: recreation, public access, and dune habitat. In Section 8, these three factors, along with the cost of each project, will be used to select the preferred project for each site.

Recreation

Recreational benefits were quantified by computing the average increase in beach width relative to the pre-construction condition over the first renourishment cycle. For the Proposed Project and Alternative 1, both of which include a nourishment volume of 500,000 cy, the average increase in beach width between Trancas Creek and Point Dume is 12.5 ft over the first 5-year renourishment cycle. For Alternative 2, which includes a nourishment volume of 750,000 cy, the average increase in beach width in the same area is 16.4 ft over the first 8-year nourishment cycle.

Public Access

Potential impacts to public access are primarily related to the dune areas along the back beach, which will reduce, but not eliminate, opportunities for beach users to reach the beach from the parking lots. In an effort to quantify this impact, the total length (measured along the beach) of the new and expanded dune areas was computed for the Proposed Project and each alternative and compared to the total length of the beach from Trancas Creek to Point Dume (14,500 ft). Approximately 32% of the shoreline is impacted for the Proposed Project and Alternative 2, whereas 47% of the shoreline is impacted for Alternative 1 as a result of the additional dune area created at Zuma Beach.

Dune Habitat

Potential environmental benefits resulting from the creation of dune habitat were quantified using the area of dune habitat created or enhanced. As noted in Section 4.1, 8.6 acres of dune habitat are included as part of the Proposed Project and Alternative 2, whereas 12.8 acres of dune habitat are included in Alternative 1.

5.2 Dockweiler State Beach

The proposed project and project alternatives at Dockweiler State Beach were assessed based on the same criteria outlined for Zuma Beach, above: recreation, public access, and dune habitat. Key elements of the projects are provided in Table 5-2.

Table 5-2. Overview of Key Project Elements, Dockweiler State Beach

Project	Enhanced Dune Habitat	Restored Dune Habitat	Length of Sand Barrier	Number of Beach Access Points
Proposed	1.3 acres	1.3 acres	850 ft	3
Alternative 1	1.3 acres	1.5 acres	850 ft	2
Alternative 2	1.3 acres	1.4 acres	700 ft	4

5.2.1 Performance

Recreation

While the project at Dockweiler State Beach is not intended to influence the recreational beach area, it does provide a recreational benefit to users of the bike and pedestrian path by reducing the quantity of sand blown onto the path. To this end, the recreational benefit is directly related to the length of the path protected by the sand barrier. For the Proposed Project and Alternative 1, the barrier is 850 ft long, resulting in the greatest benefit, while a 700-ft long barrier is proposed for Alternative 2, slightly reducing the anticipated benefit.

Public Access

As noted in Section 2.3, the public presently accesses Dockweiler Beach via makeshift paths trampled through the existing dune system. By establishing clear, delineated pathways between the parking lot and the beach, the proposed resilience project will directly benefit the user experience. This benefit can be quantified via the number of established access points included as part of the Proposed Project and each alternative. As shown above, Alternative 2 results in the greatest benefit (4 access points), while Alternative 1 results in the least (2 access points).

Dune Habitat

The quantity of dune habitat for the Proposed Project and the two project alternatives is outlined in Section 4 (Table 5-2). While the total dune area is similar among the three proposals, the Alternative 1 includes the greatest dune area (2.8 acres), while the Proposed Project includes the least dune area (2.6 acres).

5.3 Redondo Beach

The primary components of the Redondo Beach Project are beach nourishment, sediment retention, and dune creation (Table 5-3). Potential benefits and impacts of each component have been evaluated and are summarized below.

Table 5-3. Overview of Key Project Elements, Redondo Beach

Project	Beach Nourishment	Renourishment Interval	Sediment Retention	New Dune Habitat
Proposed	300,000	None	Yes	0.5 acres
Alternative 1	300,000	None	No	0.5 acres
Alternative 2	150,000	None	Yes	0.5 acres

5.3.1 Shoreline Changes

Given the complex nearshore bathymetry, proximity to coastal structures, such as the King Harbor Breakwaters, and relatively short length of coastline, detailed numerical modeling such as that used at Zuma Beach is not appropriate at Redondo Beach. However, shoreline changes prior to and following nourishment projects conducted at the site in 2000 and 2012 (Section 2.1.5) serve as a reasonable proxy for the expected performance of the proposed beach fills, particularly due to the fact that the 2000 event was identical in size and location to that included in the Proposed Project and Alternative 1.

The shoreline data were derived from *CoastSat* (Vos et al., 2019), a web-based toolkit that derives global shoreline position from historic satellite imagery. Figure 5-5 illustrates the change in shoreline position between Topaz Groin and the Pier from 1985 to 2022. The influence of the two nourishment events is clear, with instantaneous increases in beach width in both 2000 and 2012, and similar rates of retreat following each event. Between 2000 and 2012, the erosion rate estimated using the available data was 2.6 ft/yr. A similar rate, 1.7 ft/yr, prevailed between 2012 and 2022.

Shoreline recession due to SLR was estimated using the Bruun Rule (Bruun, 1962). For the 20-year period from 2030 (the assumed base year) to 2050, the shoreline is expected to erode about 9 ft (0.5 ft/yr) as a result of the 0.3-ft rise in sea level. This is approximately a third of the expected recession at Zuma Beach due to the relatively coarse-grained material that predominates at Redondo (Section 2.1.6) and resulting decrease in width of the active shorezone.

For the purposes of this study, it is assumed that the rate of retreat following the proposed nourishment projects without sediment retention will be 2.5 ft/yr, roughly representing the average retreat rate following the two nourishment events (2.0 ft/yr) and the recession expected due to

SLR (0.5 ft/yr). With sediment retention, it is assumed that the rate of recession will be 1.5 ft/yr, based on a 50% reduction in shoreline recession derived from the shoreline changes between 2000 and 2022 (1 ft/yr), plus the expected recession due to SLR (0.5 ft/yr). While the 50% reduction is merely an assumption, it should not markedly influence the outcome, given the relatively modest rates of retreat.

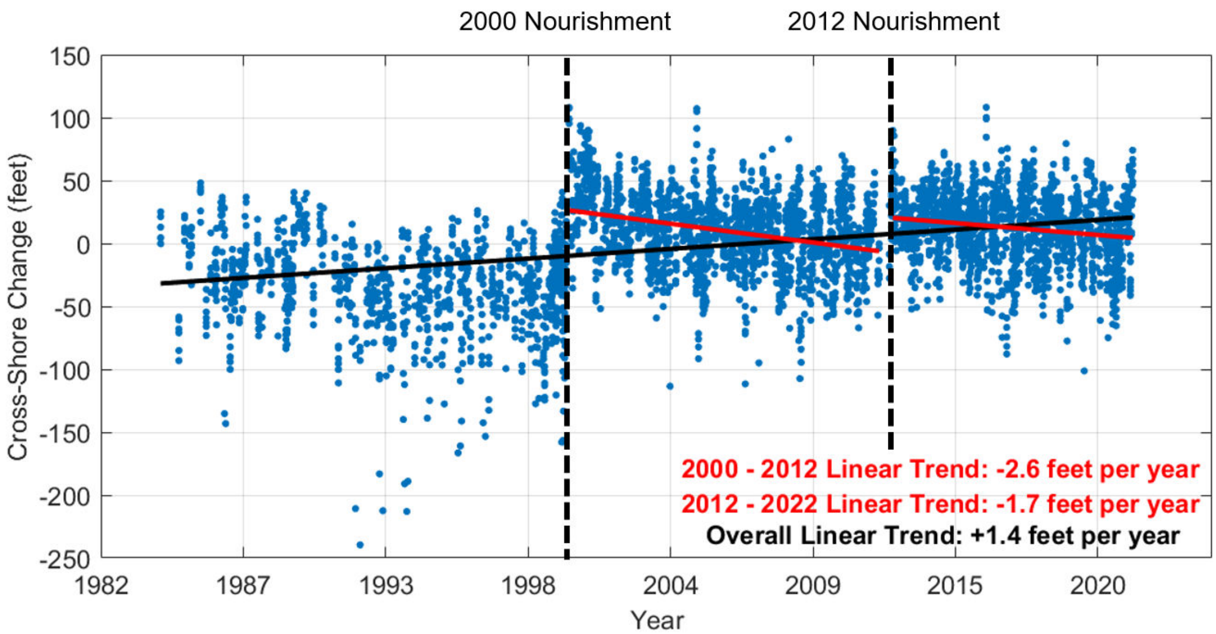

Figure 5-5. Historic Shoreline Changes at Redondo Beach (Topaz Groin to Pier)

Relative to the pre-construction condition, the 300,000-cy nourishment event included in the Proposed Project and Alternative 1 will initially (after the profile equilibrates) increase the beach width by approximately 90 ft. Alternative 2, which includes a 150,000-cy beach fill, will increase the pre-construction beach width by 45 ft (after the profile equilibrates).

Using the rates of retreat outlined above and an assumed 20-year project life, it is anticipated that approximately 60 ft of additional beach width (relative to the pre-construction condition) will remain for the Proposed Project, 40 ft will remain for Alternative 1, and 15 ft will remain for Alternative 2. Thus, no renourishment is needed.

5.3.2 Performance

The Proposed Project and alternatives were evaluated using the three criteria outlined for Dockweiler and Zuma/Point Dume: recreation, public-access, and dune habitat.

Recreation

Similar to the Zuma and Point Dume site, the recreational benefit of each Redondo Beach project was quantified using the average increase in beach width relative to the pre-construction condition. However, given that there is no renourishment in this case, a 20-year period (the assumed project life) was used to compute the average. The increase in beach width for the Proposed Project is expected to vary from 90 to 60 ft, resulting in an average value of 75 ft for the 20-year period. Alternative 1, which does not include sediment retention, will increase the pre-construction beach width by an average of 65 ft, and Alternative 2 is expected to increase the pre-construction beach width by 30 ft, on average.

Public Access

Potential impacts to public access are primarily related to lateral access impediments introduced by the sheet pile groin included in the Proposed Project and Alternative 1. Any public access issues introduced by the dune area will be equal among the three options, as the proposed dune habitat does not change.

Dune Habitat

The Proposed Project and both Alternatives include the addition of 0.5 acres of dune habitat.

6 Potential Sand Sources

Both the Zuma Beach / Point Dume and Redondo Beach projects include large-scale beach nourishment. The subsections below outline potential sediment sources, including harbor maintenance dredging, offshore borrow sites in Santa Monica Bay, and inland sites in Los Angeles County. Sediments of marine origin, such as those from harbor maintenance dredging and offshore borrow sites, typically are preferred for large-scale beach nourishment projects for reasons that include sediment compatibility, environmental impact, timing, and cost. Terrestrial (inland) sources are more likely to be suitable for smaller projects (less than 150,000 cy) and for periodic maintenance needs. Nevertheless, inland sources are described herein for completeness.

6.1 Harbor Maintenance Dredging

6.1.1 Marina del Rey

As noted in Section 3.1.10, beach quality sediment dredged from Marina del Rey as part of USACE navigation channel maintenance operations typically is returned to the littoral system via beach nourishment at Venice Beach, Dockweiler State Beach, or Redondo Beach. Based on dredging records beginning in 1969, it is anticipated that approximately 80,000 cy/yr of sediment is deposited in the entrance to the marina and available for beach nourishment (Ryan, 2025).

Section 125a of the Water Resources Development Act (WRDA) 2020 provides an opportunity for the USACE to share in the incremental cost of placement of dredged material for beneficial use during an Operation and Maintenance (O&M) Federal navigation project. The WRDA 2020 wording provides for the USACE to *use funds appropriated for construction or operation and maintenance of a project involving the disposal of dredged material when selecting a disposal method that is not the least cost option based on a determination that the incremental costs of the disposal method are reasonable in relation to the environmental benefits or the hurricane and storm or flood risk reduction benefits.* The non-Federal interest share of the incremental cost of beneficial use placement is 35%.

Discussions with USACE staff (Ryan, 2025) indicate that approximately 600,000 cy of sediment is slated for removal as part of the upcoming 2026-2027 maintenance cycle. Of that that, 300,000 to 400,000 cy is expected to be beach compatible. The USACE is in favor of partnering with the County to utilize these sediments for coastal resilience projects similar to those described herein, making this an attractive option.

6.1.2 King Harbor

The City of Redondo Beach maintains the navigation basins within King Harbor, while the USACE is responsible for maintenance of the breakwaters. Dredging records for King Harbor are relatively difficult to obtain, however, most sources indicate that the harbor has been dredged on four occasions (Patsch, 2025). In 1990, approximately 157,000 cy of material was removed from the harbor following storm-induced shoaling. In 2005 and 2024, approximately 60,000 cy was dredged from the harbor, and in 2020 a small amount of material (less than 10,000 cy) was removed. Most of the material is dredged in the north part of the harbor adjacent to the main breakwater. Sedimentation does not appear to impact the southern portion of the harbor (adjacent to Redondo Beach Pier and the south breakwater), as the volume of sediment removed has historically been relatively small. During the most recent dredging event (2024), only 2,000 cy were removed from the area (Trivedi, 2025). Given the relatively small and infrequent dredging events at the harbor, it is unlikely to support large-scale beach nourishment programs, such as those presented herein; however, the proximity of the site to Redondo Beach makes it a clear choice for opportunistic beach nourishment activities, when possible.

Both the City of Redondo Beach and the USACE have temporarily stored beach quality sediments dredged from Marina del Rey and King Harbor at a site located approximately 2,000 ft southwest of Topaz Groin (Figure 6-1). The quantity of material that presently exists at the site is not known and should be investigated to determine its viability to support the Redondo Beach resilience project.

6.2 Offshore Sand Sources

In 2011 and 2012, CFC and Moffatt & Nichol conducted an extensive search for beach quality sediment in Santa Monica Bay in support of the Broad Beach Restoration Project (BBRP; Section 3.1.5). Seven sites were considered: Broad Beach, Corral Canyon, Malibu Point, Santa Moncia, Venice Beach, Dockweiler State Beach, and Manhattan Beach. These sites were selected based on the findings of historical marine geology studies (Osbourne *et al.,* 1983 and Fischer *et al.*, 1983) and proximity to the project.

Both geophysical survey data and marine vibracores were obtained as part of the search and used to evaluate the sediment at each site. A geophysical survey was conducted in February 2011 and vibracore programs were conducted in June 2011, October 2011, and August 2012. Details regarding the field efforts can be found in reports prepared on behalf of the Broad Beach Geologic Hazard Abatement District (BBGHAD; Coastal Frontiers, 2011a, 2011b, 2012). Their use as part of the current project is greatly appreciated. A brief description of the geophysical and geological findings at each site is provided below.

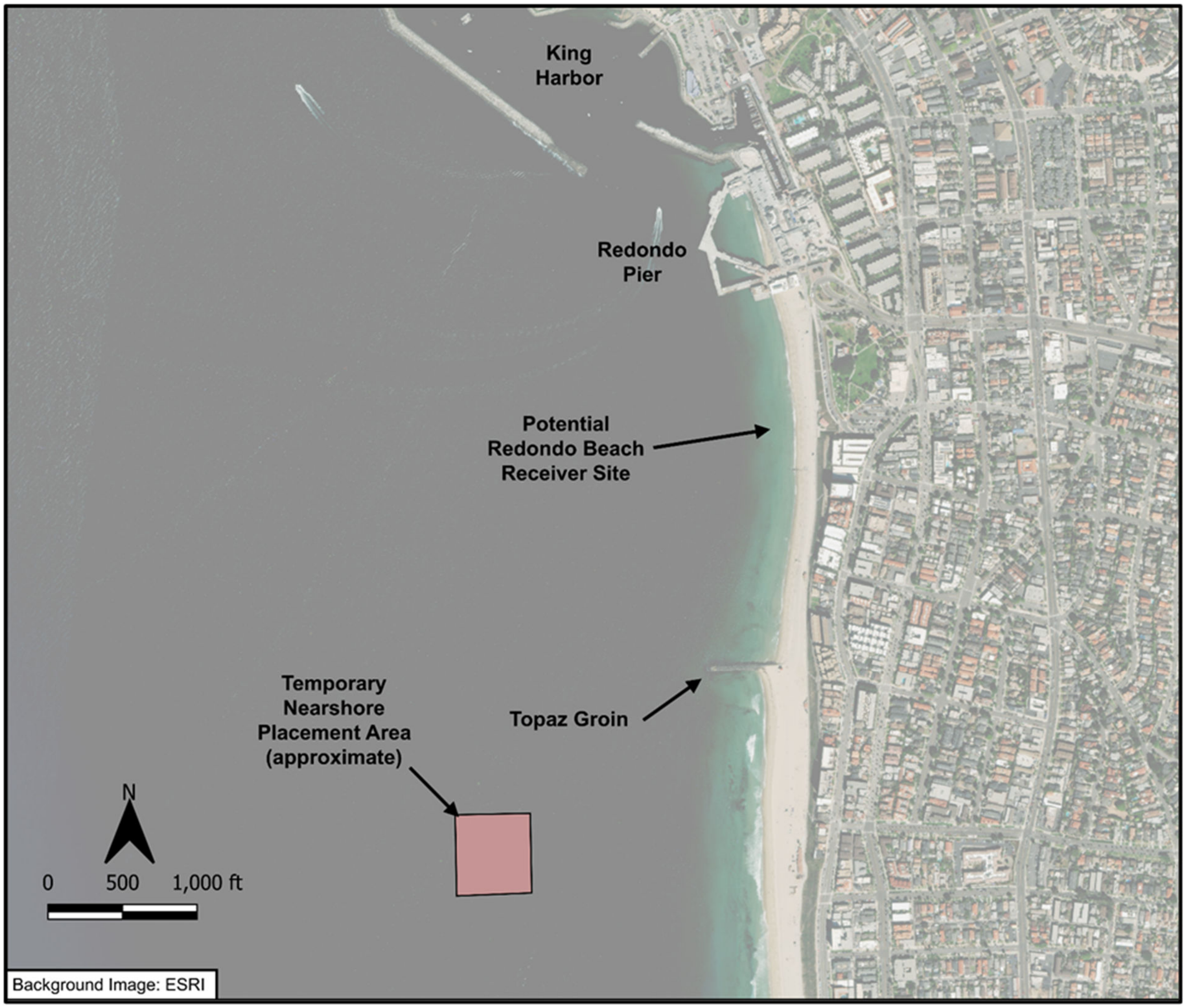

Figure 6-1. Temporary Nearshore Placement Area at Redondo Beach

6.2.1 Broad Beach-Zuma Beach

Based on geophysical and geological data obtained as part of the BBRP, an abundance of sediment is available off the coast of the Broad-Zuma Beach area; however, it is much finer than the native beach sand at both Zuma/Point Dume Beach and Redondo Beach. For example, the median grain sizes (D_{50}) derived from the 23 vibracores obtained in the area (Figure 6-2 and Figure 6-3) ranged from 0.10 to 0.16 mm, whereas the average median grain size at Zuma Beach and Redondo Beach is 0.23 and 0.46 mm, respectively (Table 2-2). As noted in Section 3.2.3, coarser-than-native fill material is almost always preferred, as it can extend the project life substantially.

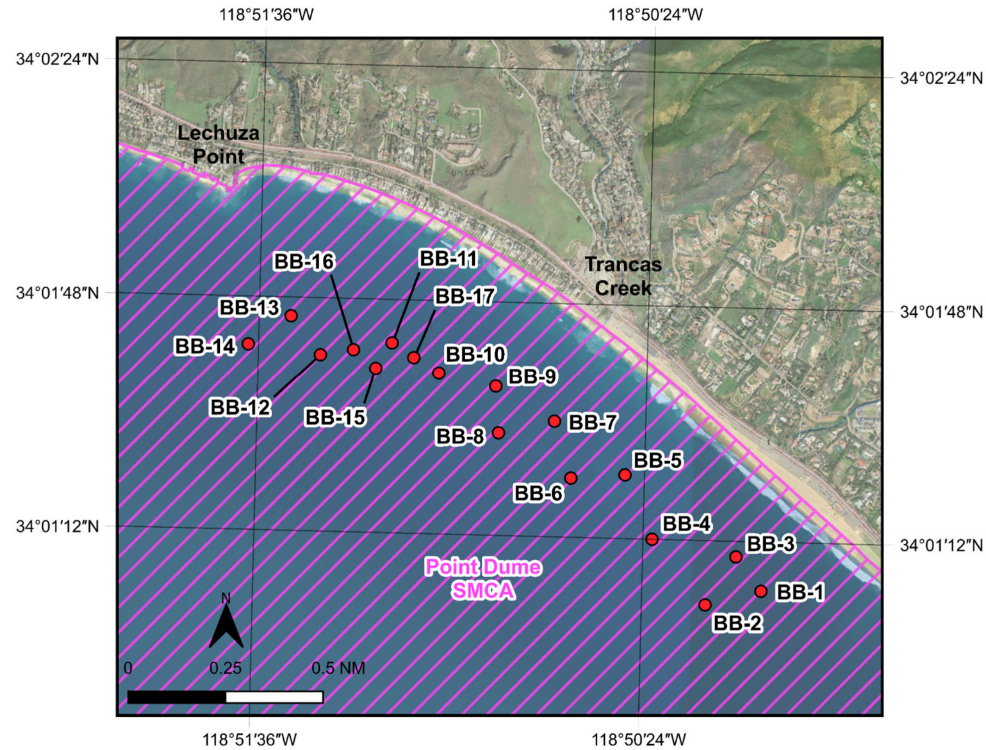

Figure 6-2. Vibracore Sites, Broad Beach

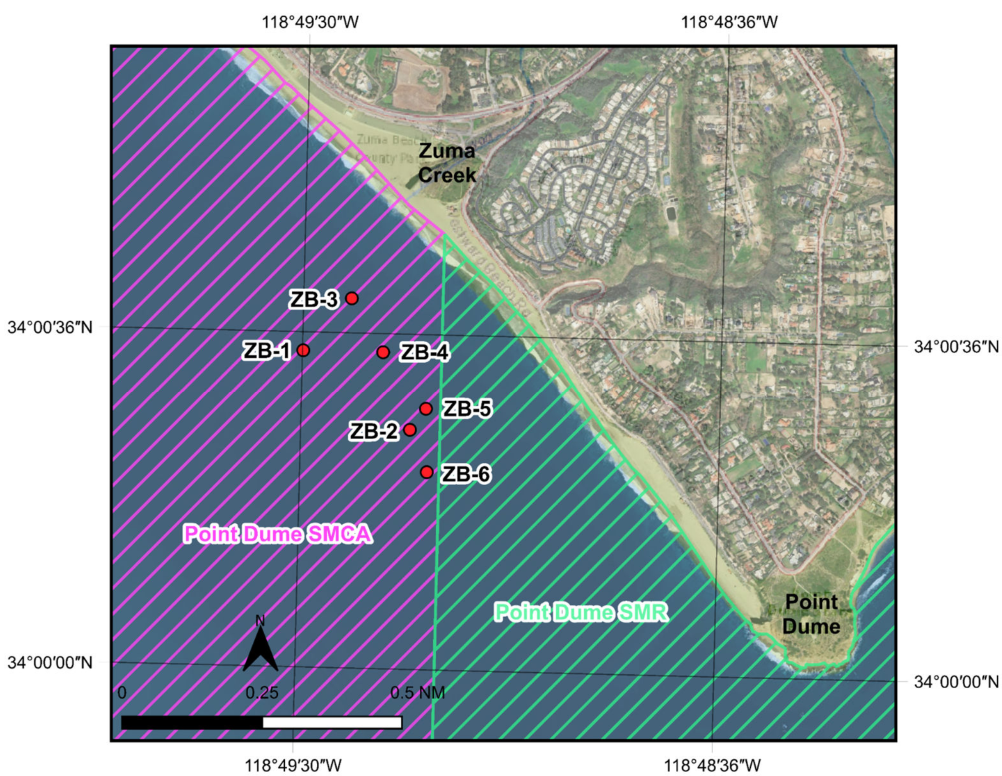

Figure 6-3. Vibracore Sites, Zuma Beach

6.2.2 Corral Canyon

In the early 1980s, sediment samples collected by the University of Southern California suggested that the sediment off Corral Canyon area are primarily silty sands. This was confirmed through collection of a single vibracore in 2011 (Figure 6-4), which revealed a very thick layer of sediment with a D_{50} of 0.10 mm, along with fine-grained silts and clays. As a result, material in this area is not anticipated to be suitable for beach nourishment at either coastal resilience site.

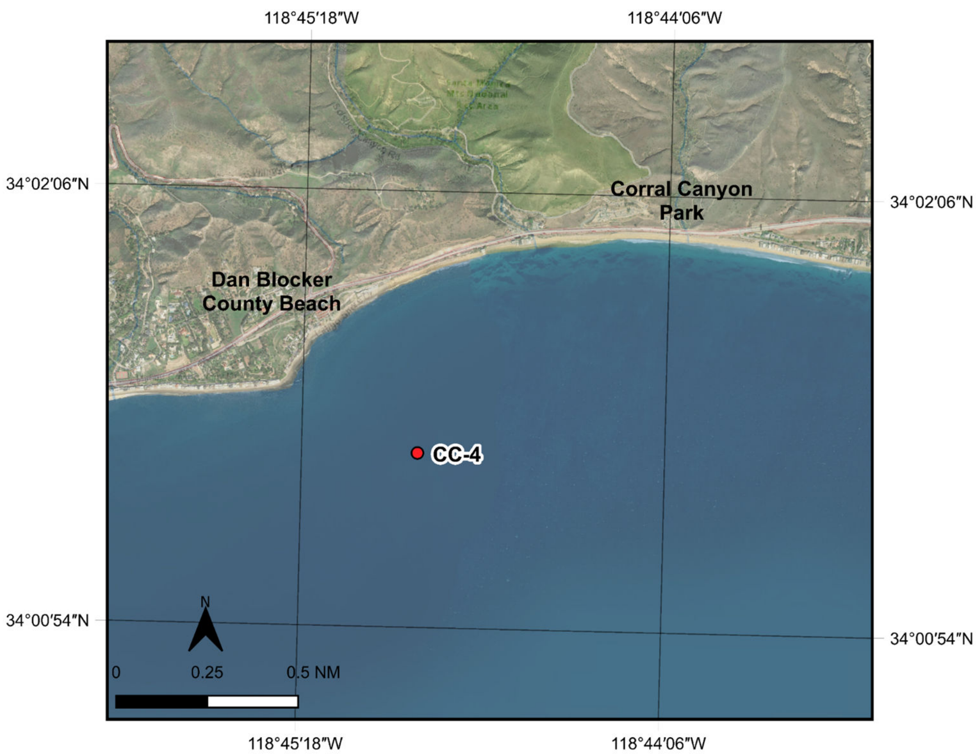

Figure 6-4. Vibracore Site, Corral Canyon

6.2.3 Malibu Point

While the region near Malibu Point was initially considered as a possible sand source, prior investigations indicated that the material is expected to be silty sand. In addition, the site's proximity to both Malibu Pier and the world-famous surfing location at Malibu Point, present challenges for conducting large-scale dredging activities. Geophysical data were obtained as part of the study but no vibracores were obtained in this area.

6.2.4 Santa Monica

Osborne *et al.* (1983) collected several vibracores around the Santa Monica survey area in the early 1980's. The material was classified as fine to very fine-grained sand, sandy silt, and greenish-black mud and clay, with estimated grain sizes ranging from 0.09 to 0.18 mm. While geophysical data were obtained as part of the BBRP, no vibracores were obtained in the area. The material is considered to be too fine for placement on Zuma/Point Dume or Redondo Beach.

6.2.5 Venice Beach

Osborne *et al.* (1983) identified a potential borrow area offshore of Venice Beach with an estimated sediment thickness ranging from less than 6 ft to 46 ft. However, vibracores obtained in the area at that time contained a high gravel content, rendering it an unlikely source for beach nourishment. No geophysical or vibracore data were obtained in this area as part of the BBRP.

6.2.6 Dockweiler State Beach

Geophysical and vibracore data obtained by Osbourne *et al.* in the early 1980's suggest that coarse sediment exists off Dockweiler State Beach. Eight vibracores were obtained in this region in 2011 (Figure 6-5) to confirm Osbourne's findings. No bedrock was encountered, and the vibracores were able to achieve penetration depths of 18 to 20 feet. The median grain sizes within the northern portion of the study area (sites DN-1 through DN-4) were all very close to 0.5 mm, and the cores contained a relatively small fines content. The sediments tended to be slightly finer in the southern portion of the study area (sites DS-1 through DS-4) with median grain sizes typically ranging from 0.42 to 0.49 mm and a fines content slightly above 1%. At the far south end, a 3-ft surface layer of stiff clay was noted at site DS-4. No contaminants were found in the study area.

Based on the foregoing, the sediment located off Dockweiler State Beach is well-suited for beach nourishment at either Zuma/Point Dume or Redondo Beach and it is estimated that the site could yield over 3,000,000 cy of suitable material (based on 15-ft dredge cut).

6.2.7 Manhattan Beach

A total of 21 vibracores were obtained in 2012 as part of the BBRP (Figure 6-6). In the southern and central areas (cores denoted CMW, CME, SMW and SME), visual inspection indicated that the sand was too fine to be used for effective beach nourishment. In the northern area, coarser sediments were found; however, it was confined to distinct strata that varied in grain size and layer thickness. Median grain sizes in the various layers ranged from 0.106 to 2.093 mm, with several layers in the acceptable range (about 0.3 to 0.6 mm). However, the complexity involved in targeting the layers of interest, while avoiding those that are less desirable makes this site an unlikely candidate for beach nourishment.

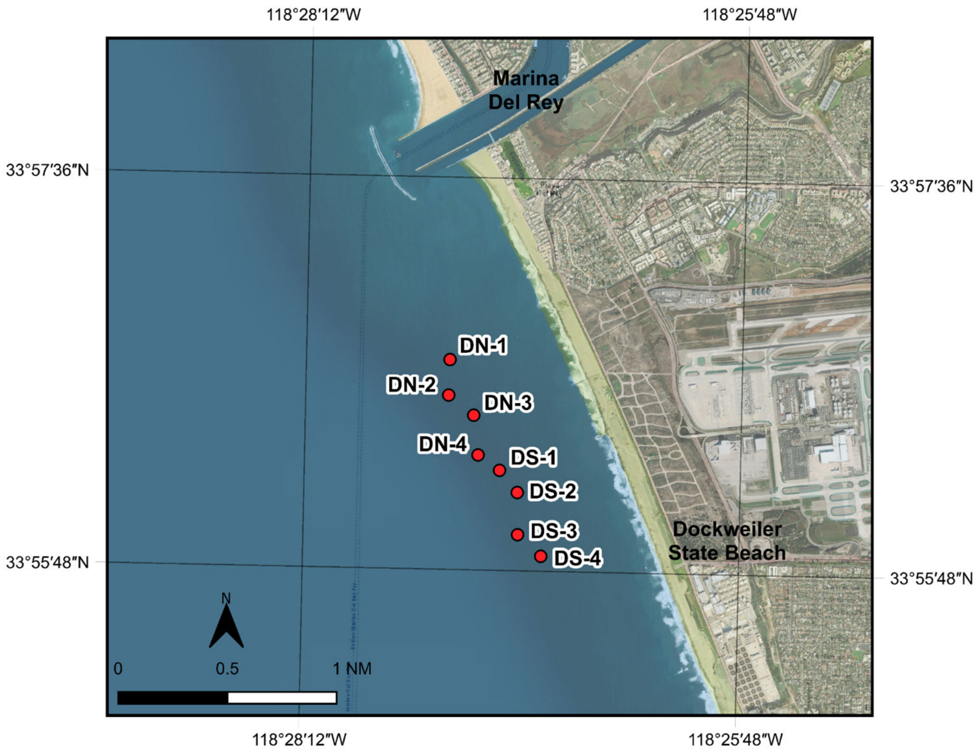

Figure 6-5. Vibracore Sites, Dockweiler State Beach

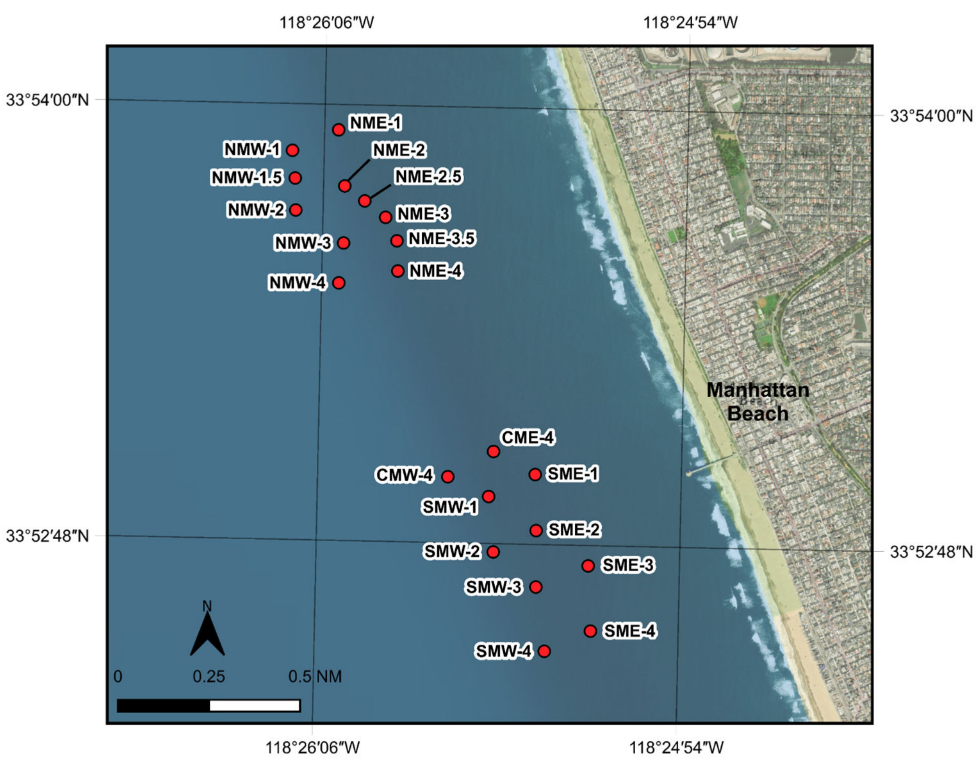

Figure 6-6. Vibracore Sites, Manhattan Beach

6.2.8 Summary

In 2011 and 2012, seven areas were considered as potential sources of sediment for beach nourishment: Broad Beach-Zuma Beach, Corral Canyon, Malibu Point, Santa Monica, Venice Beach, Dockweiler State Beach, and Manhattan Beach. Of these, only the site off Dockweiler State Beach contained sediment that is compatible with the native sand at Zuma/Point Dume Beach and Redondo Beach and suitable for beach nourishment. It is estimated that over 3,000,000 cy of sand with a median grain size of about 0.5 mm may exist at the site, making it an appropriate source for the proposed resilience projects.

6.3 Inland Sediment Sources

This section outlines potential inland sediment sources, including reservoirs and debris basins managed by the County, dams, local watercourses (rivers, creeks, streams, and lagoons), and transportation and development projects. The locations of the potential sources are shown in Figure 6-7. As noted above, inland sources are less preferred than those of marine origin for beach nourishment; however, inland sources may be desirable for small projects (*e.g.,* dune construction) and for beach maintenance.

6.3.1 County-Owned Reservoirs and Debris Basins

Reservoirs and debris or retention basins trap material that may otherwise travel downstream and cause flooding. Infilling is sporadic and dependent on several factors, including the rate and timing of precipitation. Material that is impounded within these features is removed during maintenance events and typically is placed in a landfill, used as landfill cover, or repurposed as construction fill. If beach quality sediment within the reservoir can be identified and segregated, it can be used as beach nourishment. Potentially viable beach sand sources from reservoirs and debris basins managed by the Los Angeles County Flood Control District (LACFCD) are listed in Table 6-1 along with the approximate minimum trucking distance between the sand source and each of the three resilience sites.

6.3.2 Dams

LA County's largest inland source of beach quality sediment proximate to the coast is the Rindge Dam reservoir in Malibu (Noble Consultants and Larry Paul & Associates, 2017). The dam was constructed in the 1920's along Malibu Creek for water supply and flood control purposes. The dam effectively trapped sediments that would have travelled to the coast naturally, resulting in rapid filling of the reservoir with soil and debris. By the 1950s, the reservoir was almost filled with sediment and no longer functional for water storage or flood protection.

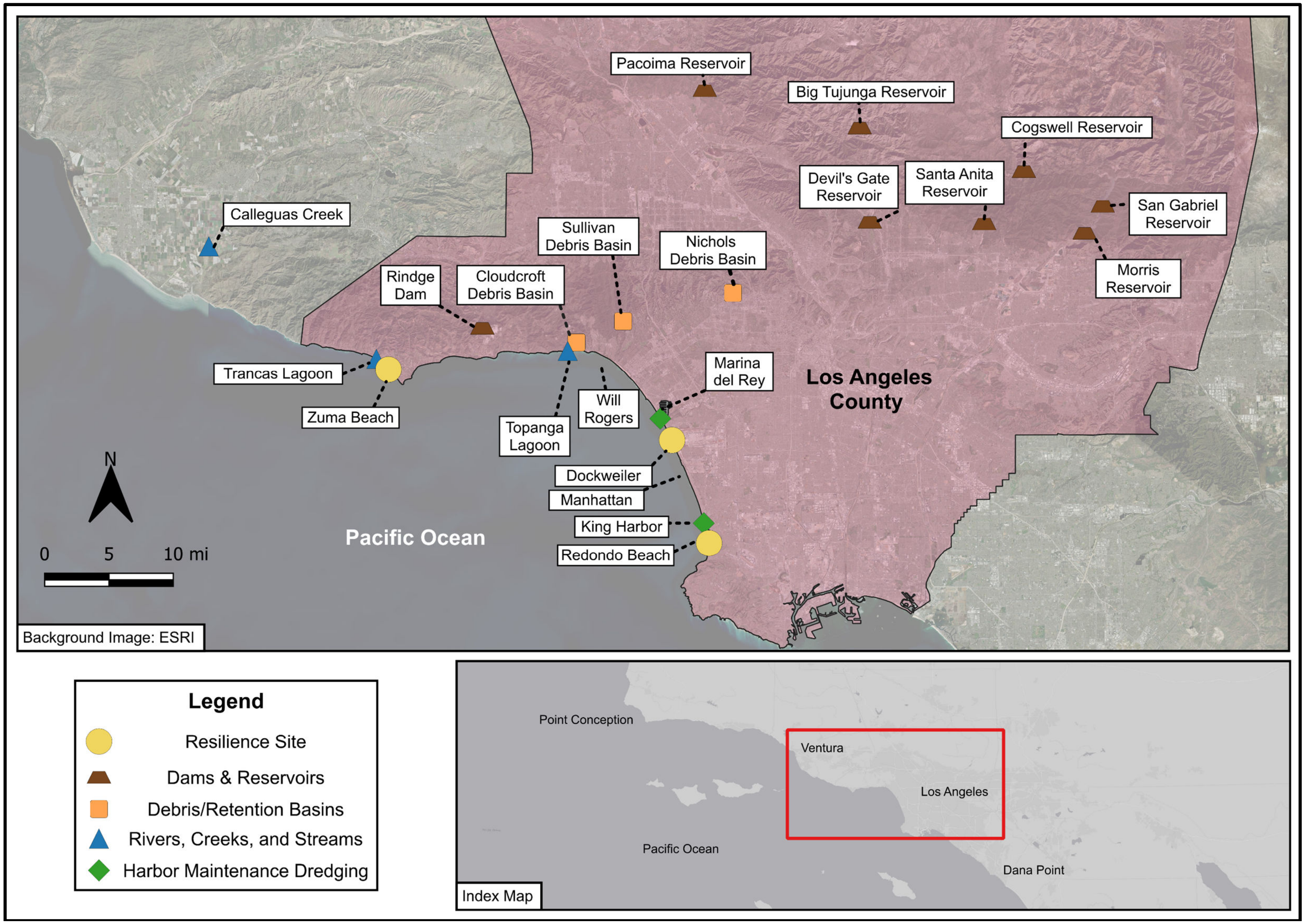

Figure 6-7. Location Map of Potential Inland Sand Sources

Table 6-1. Distance Between Reservoirs / Debris Basins and Resilience Sites

Receiver Site	Minimum Distance (miles)									
	Reservoir							Debris Basin		
	Pacoima	Big Tujunga	Devil's Gate	Cogswell	San Gabriel	Morris	Santa Anita	Cloudcroft	Sullivan	Nichols
Zuma Beach	48	61	54	80	67	65	59	17	24	33
Dockweiler SB	32	45	34	60	48	45	42	13	12	13
Redondo Beach	42	54	39	65	52	49	47	24	23	24

Note: Debris Basins are relatively small and may not generate adequate volumes of sediment for beach nourishment (Zimmer, 2025).

The Malibu Creek Ecosystem Restoration Project is investigating removal of the dam and restoration of natural sediment delivery to the shoreline. As part of the project, approximately 276,000 cy of beach quality sediment has been identified as suitable for beach nourishment. While this material is presently designated for either onshore or nearshore placement just east of Malibu Pier, there is a potential need for the project to identify alternative receiver sites, and discussions between the County and the project team are ongoing.

6.3.3 Local Watercourses

Rivers, creeks, streams, and lagoons along the coast offer a potential source of fill material when flood control or maintenance activities generate beach quality sediments. Three sites near the resilience projects are Calleguas Creek, Trancas Creek and Lagoon, and Topanga Lagoon.

6.3.4 Transportation and Development Projects

Major transportation projects such as roadways and bridges may generate surplus sediment from excavation activities and development projects frequently generate beach-quality sediments that can be used for beach nourishment. However, it should be noted that the quantity of available sediment is likely to be small and more suited to opportunistic beach nourishment projects or maintenance events.

7 Economic Considerations

The following subsections outline the probable costs to design, construct, and monitor the proposed projects and project alternatives and presents the estimated economic benefits to be generated based on the nonmarket value of recreation.

7.1 Cost Estimation

Moffatt & Nichol (2025) estimated the probable cost to design, construct, and monitor the proposed projects and project alternatives. The estimates are based on the unit and mobilization/demobilization costs provided by the contractor as part of similar projects, including:

- **USACE San Clemente Beach Nourishment Project:** Large-scale beach nourishment project conducted in late 2023 and mid-2024. Project utilized an offshore borrow site and hopper dredge similar to that which could be used for the Zuma/Point Dume and Redondo Beach resilience projects;
- **USACE Encinitas-Solana Beach Shoreline Protection Project:** Large-scale beach nourishment project similar to the San Clemente project described above. Project completed in late 2023; and
- **USACE Surfside/Sunset Beach Nourishment Project**: Beach nourishment project in north Orange County utilizing a cutterhead section dredge similar to that which could be used for the Redondo Beach project in the event the temporary nearshore placement area (Section 6.1.2) is used.

7.1.1 Zuma Beach & Point Dume

Table 7-1 summarizes the probable cost to construct the Proposed Project, Alternative 1 and Alternative 2 at Zuma Beach and Point Dume. Detailed costs follow. It is important to note the following:

1. The cost covers the period up to but not including the first renourishment cycle (assumed to be five years, Section 5.1.1). **Renourishment costs are not included**.
2. The sand source is assumed to be offshore of Dockweiler State Beach (Section 6.2.6). Inland sand sources were not evaluated due to the length of time and impacts to the environment and public resulting from trucks delivering sand quantities of 500,000 to 750,000 cy. For example, if each truck delivers 14 cy of sand, nearly 36,000 truck trips will be required.

Table 7-1. Probable Cost of Construction, Zuma Beach and Point Dume

Alternative	Beach Nourishment	Dune Habitat	Monitoring and Maintenance	Contingency	Planning and Support	Total
Proposed Project *500,000-cy Nourishment; 8.6-acre Dune Habitat*	$33,394,500	$261,500	$885,000	$8,635,250	$5,699,265	**$48,875,515**
Alternative 1 *500,000-cy Nourishment; 12.8-acre Dune Habitat*	$33,394,500	$355,500	$885,000	$8,658,750	$5,714,775	**$49,008,525**
Alternative 2 *750,000-cy Nourishment; 8.6-acre Dune Habitat*	$46,644,500	$261,500	$885,000	$11,947,750	$7,885,515	**$67,624,265**

Notes:
1. Cost **does not** include renourishment.
2. Sand source is assumed to be offshore of Dockweiler State Beach.

DRAFT OPINION OF
PROBABLE CONSTRUCTION COSTS
LA County DBH Coastal Resilience Project
Zuma Beach Proposed Project
[500,000 CY Nourishment From Offshore and 9 Acres of Dune]

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL
	Beach Nourishment Components				
1	Mobilization & Demobilization of Earthmoving Equipment	1	LS.	$25,000.00	$25,000
2	Mobilization & Demobilization of Dredging Equipment	1	L.S.	$6,850,000.00	$6,850,000
3	Temporary Protective Construction Fence	6,500	LF	$3.00	$19,500
4	Offshore Dredging off Dockweiler Beach & Transport Onto the Beach	500,000	CY	$47.00	$23,500,000
5	Grading New Sand on the Beach and Longitudinal Dikes for Turbidity	500,000	CY	$6.00	$3,000,000
	Subtotal Beach Nourishment				**$33,394,500**
	Expand Living Shoreline Areas				
6	Install Sand Dune Fencing (3,000 lf per acre)	27,000	LF	$6.00	$162,000
7	Remove Non-Natives	9	AC	$2,500.00	$22,500
8	Apply Dune Plant Seeds (1,000 per acre)	9,000	EA	$0.25	$2,250
9	Install New Perimeter Fencing - Cable and Post (1,000 lf per acre)	9,000	LF	$2.50	$22,500
10	Install Kiosk (one on each end of the dune fields)	2	EA	$25,000.00	$50,000
11	Install Signage (one per dune acre)	9	EA	$250.00	$2,250
	Subtotal Expand Living Shoreline				**$261,500**
	Monitoring and Maintenance				
13	Pre, During, and Post Construction Monitoring	1	LS	$200,000.00	$200,000
14	Shoreline Monitoring	1	LS	$180,000.00	$180,000
15	Borrow Site Survey Support	1	LS	$180,000.00	$180,000
17	Borrow Post-Construction Monitoring	1	LS	$80,000.00	$80,000
18	Pre and Post Receiver Site Detailed Topo	1	LS	$95,000.00	$95,000
19	Permit Compliance Reporting/Monitoring	1	LS	$150,000.00	$150,000
	Subtotal Monitoring				**$885,000**
	Subtotal Items				**$34,541,000**
	Contingency of 25%				$8,635,250
	Planning, Environmental Review, Permitting, Design (7%)	1	EA		$2,590,575
	Construction Support Services (2%)	1	EA		$863,525
	Construction Management (3.5%)	1	EA		$1,208,935
	Inspection, Survey, and Administration (3%)	1	EA		$1,036,230
	Grand Total				**$48,875,515**

ASSUMPTIONS:

1 Contractor stages at entire north end parking lot and south end parking from restrooms to Point Dume.
2 No construction fencing needed at living shoreline location.
3 Mobilization & Demobilization cost is taken directly from 2024 contractor bids for the USACE Encinitas and Solana Beach Project. These may increase over time by escalation/inflation but that is not factored in yet.
4 Sand is dredged from the Dockweiler Offshore Borrow Site and the sand quality is excellent.
5 Cost **does not** include renourishment.

DRAFT OPINION OF
PROBABLE CONSTRUCTION COSTS
LA County DBH Coastal Resilience Project
Zuma Beach Alternative 1
[500,000 CY Nourishment From Offshore and 13 Acres of Dune]

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL
	Beach Nourishment Components				
1	Mobilization & Demobilization of Earthmoving Equipment	1	LS.	$25,000.00	$25,000
2	Mobilization & Demobilization of Dredging Equipment	1	L.S.	$6,850,000.00	$6,850,000
3	Temporary Protective Construction Fence	6,500	LF	$3.00	$19,500
4	Offshore Dredging off Dockweiler Beach & Transport Onto the Beach	500,000	CY	$47.00	$23,500,000
5	Grading New Sand on the Beach and Longitudinal Dikes for Turbidity	500,000	CY	$6.00	$3,000,000
	Subtotal Beach Nourishment				**$33,394,500**
	Expand Living Shoreline Areas				
6	Install Sand Dune Fencing (3,000 lf per acre)	39,000	LF	$6.00	$234,000
7	Remove Non-Natives	13	AC	$2,500.00	$32,500
8	Apply Dune Plant Seeds (1,000 per acre)	13,000	EA	$0.25	$3,250
9	Install New Perimeter Fencing - Cable and Post (1,000 lf per acre)	13,000	LF	$2.50	$32,500
10	Install Kiosk (one on each end of the dune fields)	2	EA	$25,000.00	$50,000
11	Install Signage (one per dune acre)	13	EA	$250.00	$3,250
	Subtotal Expand Living Shoreline				**$355,500**
	Monitoring and Maintenance				
13	Pre, During, and Post Construction Monitoring	1	LS	$200,000.00	$200,000
14	Shoreline Monitoring	1	LS	$180,000.00	$180,000
15	Borrow Site Survey Support	1	LS	$180,000.00	$180,000
17	Borrow Post-Construction Monitoring	1	LS	$80,000.00	$80,000
18	Pre and Post Receiver Site Detailed Topo	1	LS	$95,000.00	$95,000
19	Permit Compliance Reporting/Monitoring	1	LS	$150,000.00	$150,000
	Subtotal Monitoring				**$885,000**
	Subtotal Items				**$34,635,000**
	Contingency of 25%				$8,658,750
	Planning, Environmental Review, Permitting, Design (7%)	1	EA		$2,597,625
	Construction Support Services (2%)	1	EA		$865,875
	Construction Management (3.5%)	1	EA		$1,212,225
	Inspection, Survey, and Administration (3%)	1	EA		$1,039,050
	Grand Total				**$49,008,525**

ASSUMPTIONS:

1. Contractor stages at entire north end parking lot and south end parking from restrooms to Point Dume.
2. No construction fencing needed at living shoreline location.
3. Mobilization & Demobilization cost is taken directly from 2024 contractor bids for the USACE Encinitas and Solana Beach Project. These may increase over time by escalation/inflation but that is not factored in yet.
4. Sand is dredged from the Dockweiler Offshore Borrow Site and the sand quality is excellent.
5. Cost **does not** include renourishment.

DRAFT OPINION OF
PROBABLE CONSTRUCTION COSTS
LA County DBH Coastal Resilience Project
Zuma Beach Alternative 2
[750,000 CY Nourishment From Offshore and 9 Acres of Dune]

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL
	Beach Nourishment Components				
1	Mobilization & Demobilization of Earthmoving Equipment	1	LS.	$25,000.00	$25,000
2	Mobilization & Demobilization of Dredging Equipment	1	L.S.	$6,850,000.00	$6,850,000
3	Temporary Protective Construction Fence	6,500	LF	$3.00	$19,500
4	Offshore Dredging off Dockweiler Beach & Transport Onto the Beach	750,000	CY	$47.00	$35,250,000
5	Grading New Sand on the Beach and Longitudinal Dikes for Turbidity	750,000	CY	$6.00	$4,500,000
	Subtotal Beach Nourishment				**$46,644,500**
	Expand Living Shoreline Areas				
6	Install Sand Dune Fencing (3,000 lf per acre)	27,000	LF	$6.00	$162,000
7	Remove Non-Natives	9	AC	$2,500.00	$22,500
8	Apply Dune Plant Seeds (1,000 per acre)	9,000	EA	$0.25	$2,250
9	Install New Perimeter Fencing - Cable and Post (1,000 lf per acre)	9,000	LF	$2.50	$22,500
10	Install Kiosk (one on each end of the dune fields)	2	EA	$25,000.00	$50,000
11	Install Signage (one per dune acre)	9	EA	$250.00	$2,250
	Subtotal Expand Living Shoreline				**$261,500**
	Monitoring and Maintenance				
13	Pre, During, and Post Construction Monitoring	1	LS	$200,000.00	$200,000
14	Shoreline Monitoring	1	LS	$180,000.00	$180,000
15	Borrow Site Survey Support	1	LS	$180,000.00	$180,000
17	Borrow Post-Construction Monitoring	1	LS	$80,000.00	$80,000
18	Pre and Post Receiver Site Detailed Topo	1	LS	$95,000.00	$95,000
19	Permit Compliance Reporting/Monitoring	1	LS	$150,000.00	$150,000
	Subtotal Monitoring				**$885,000**
	Subtotal Items				**$47,791,000**
	Contingency of 25%				$11,947,750
	Planning, Environmental Review, Permitting, Design (7%)	1	EA		$3,584,325
	Construction Support Services (2%)	1	EA		$1,194,775
	Construction Management (3.5%)	1	EA		$1,672,685
	Inspection, Survey, and Administration (3%)	1	EA		$1,433,730
	Grand Total				**$67,624,265**

ASSUMPTIONS:

1 Contractor stages at entire north end parking lot and south end parking from restrooms to Point Dume.
2 No construction fencing needed at living shoreline location.
3 Mobilization & Demobilization cost is taken directly from 2024 contractor bids for the USACE Encinitas and Solana Beach Project. These may increase over time by escalation/inflation but that is not factored in yet.
4 Sand is dredged from the Dockweiler Offshore Borrow Site and the sand quality is excellent.
5 Cost **does not** include renourishment.

7.1.2 Dockweiler State Beach

Table 7-2 summarizes the probable cost to construct the Proposed Project, Alternative 1 and Alternative 2 at Dockweiler State Beach. Detailed costs follow.

Table 7-2. Probable Cost of Construction, Dockweiler State Beach

Alternative	Dune Habitat	Sand Barrier	Monitoring and Maintenance	Contingency	Planning and Support	Total
Proposed Project *850-ft Sand Barrier;* *2.6-acre Dune Habitat;* *3 Beach Access Points*	$107,625	$1,327,500	$40,000	$368,781	$460,977	**$2,304,883**
Alternative 1 *850-ft Sand Barrier;* *2.8-acre Dune Habitat;* *2 Beach Access Points*	$111,775	$1,327,500	$40,000	$369,819	$462,273	**$2,311,367**
Alternative 2 *700-ft Sand Barrier;* *2.7-acre Dune Habitat;* *4 Beach Access Points*	$109,700	$1,095,000	$40,000	$311,175	$388,969	**$1,944,844**

DRAFT OPINION OF
PROBABLE CONSTRUCTION COSTS
LA County DBH Coastal Resilience Project
Dockweiler State Beach Proposed Project
[Dune Habitat (1.3 acres enhanced + 1.3 acres restored), Sand Barrier Wall]

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL
	Expand Living Shoreline Area Components				
1	Install Sand Dune Fencing (3,000 linear feet per acre, over 2.6 ac)	7,800	LF	$6.00	$46,800
2	Remove Non-Natives (Weeding over 1.3 Acres of Enhancement Area)	1.3	AC	$2,500.00	$3,250
3	Apply Dune Plant Seeds (1,000 per acre) over 1.3 acres Restoration Area	1,300	EA	$0.25	$325
4	Install New Perimeter Fencing - Cable and Post (1,000 linear feet per acre)	2,600	LF	$2.50	$6,500
5	Install Kiosk (one on each end of the dune fields)	2	EA	$25,000.00	$50,000
6	Install Signage (one per dune acre rounded up to the nearest whole number)	3	EA	$250.00	$750
	Subtotal Expand Living Shoreline				**$107,625**
	Sand Barrier Wall Components				
7	Mobilization	1	LS	$10,000.00	$10,000
8	Footing	850	LF	$500.00	$425,000
9	Wall Installation	850	LF	$1,000.00	$850,000
10	Sculpting	850	LF	$50.00	$42,500
	Subtotal Sand Barrier Wall				**$1,327,500**
	Monitoring and Maintenance				
11	Pre-Construction - Snowy Plovers	1	LS	$10,000.00	$10,000
12	Construction - Snowy Plovers	1	LS	$10,000.00	$10,000
13	Post-Construction - Dune Plants, Weeding	1	LS	$20,000.00	$20,000
	Subtotal Monitoring				**$40,000**
	Subtotal Items				**$1,475,125**
	Contingency of 25%				$368,781
	Planning, Environmental Review, Permitting, Design (15%)	1	EA		$276,586
	Construction Support Services (2.5%)	1	EA		$46,098
	Construction Management (5%)	1	EA		$92,195
	Inspection, Survey, and Administration (2.5%)	1	EA		$46,098
	Grand Total				**$2,304,883**

ASSUMPTIONS:

1 Contractor stages at parking lot.
2 No construction fencing needed at living shoreline location.

DRAFT OPINION OF
PROBABLE CONSTRUCTION COSTS
LA County DBH Coastal Resilience Project
Dockweiler State Beach Alternative 1
[Dune Habitat (1.3 acres enhanced + 1.5 acres restored), Sand Barrier Wall]

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL
	Expand Living Shoreline Area Components				
1	Install Sand Dune Fencing (3,000 linear feet per acre, over 2.8 ac)	8,400	LF	$6.00	$50,400
2	Remove Non-Natives (Weeding over 1.3 Acres of Enhancement Area)	1.3	AC	$2,500.00	$3,250
3	Apply Dune Plant Seeds (1,000 per acre) over 1.5 acres Restoration Area	1,500	EA	$0.25	$375
4	Install New Perimeter Fencing - Cable and Post (1,000 linear feet per acre)	2,800	LF	$2.50	$7,000
5	Install Kiosk (one on each end of the dune fields)	2	EA	$25,000.00	$50,000
6	Install Signage (one per dune acre rounded up to the nearest whole number)	3	EA	$250.00	$750
	Subtotal Expand Living Shoreline				**$111,775**
	Sand Barrier Wall Components				
7	Mobilization	1	LS	$10,000.00	$10,000
8	Footing	850	LF	$500.00	$425,000
9	Wall Installation	850	LF	$1,000.00	$850,000
10	Sculpting	850	LF	$50.00	$42,500
	Subtotal Sand Barrier Wall				**$1,327,500**
	Monitoring and Maintenance				
11	Pre-Construction - Snowy Plovers	1	LS	$10,000.00	$10,000
12	Construction - Snowy Plovers	1	LS	$10,000.00	$10,000
13	Post-Construction - Dune Plants, Weeding	1	LS	$20,000.00	$20,000
	Subtotal Monitoring				**$40,000**
	Subtotal Items				**$1,479,275**
	Contingency of 25%				$369,819
	Planning, Environmental Review, Permitting, Design (15%)	1	EA		$277,364
	Construction Support Services (2.5%)	1	EA		$46,227
	Construction Management (5%)	1	EA		$92,455
	Inspection, Survey, and Administration (2.5%)	1	EA		$46,227
	Grand Total				**$2,311,367**

ASSUMPTIONS:

1 Contractor stages at parking lot.
2 No construction fencing needed at living shoreline location.

DRAFT OPINION OF
PROBABLE CONSTRUCTION COSTS
LA County DBH Coastal Resilience Project
Dockweiler State Beach Alternative 2
[Dune Habitat (1.3 acres enhanced + 1.4 acres restored), Sand Barrier Wall]

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL
	Expand Living Shoreline Area Components				
1	Install Sand Dune Fencing (3,000 linear feet per acre, over 2.7 ac)	8,100	LF	$6.00	$48,600
2	Remove Non-Natives (Weeding over 1.3 Acres of Enhancement Area)	1.3	AC	$2,500.00	$3,250
3	Apply Dune Plant Seeds (1,000 per acre) over 1.4 acres Restoration Area	1,400	EA	$0.25	$350
4	Install New Perimeter Fencing - Cable and Post (1,000 linear feet per acre)	2,700	LF	$2.50	$6,750
5	Install Kiosk (one on each end of the dune fields)	2	EA	$25,000.00	$50,000
6	Install Signage (one per dune acre rounded up to the nearest whole number)	3	EA	$250.00	$750
	Subtotal Expand Living Shoreline				**$109,700**
	Sand Barrier Wall Components				
7	Mobilization	1	LS	$10,000.00	$10,000
8	Footing	700	LF	$500.00	$350,000
9	Wall Installation	700	LF	$1,000.00	$700,000
10	Sculpting	700	LF	$50.00	$35,000
	Subtotal Sand Barrier Wall				**$1,095,000**
	Monitoring and Maintenance				
11	Pre-Construction - Snowy Plovers	1	LS	$10,000.00	$10,000
12	Construction - Snowy Plovers	1	LS	$10,000.00	$10,000
13	Post-Construction - Dune Plants, Weeding	1	LS	$20,000.00	$20,000
	Subtotal Monitoring				**$40,000**
	Subtotal Items				**$1,244,700**
	Contingency of 25%				$311,175
	Planning, Environmental Review, Permitting, Design (15%)	1	EA		$233,381
	Construction Support Services (2.5%)	1	EA		$38,897
	Construction Management (5%)	1	EA		$77,794
	Inspection, Survey, and Administration (2.5%)	1	EA		$38,897
	Grand Total				**$1,944,844**
	ASSUMPTIONS:				
1	Contractor stages at parking lot.				
2	No construction fencing needed at living shoreline location.				

7.1.3 Redondo Beach

Table 7-3 summarizes the probable cost to construct the Proposed Project, Alternative 1 and Alternative 2 at Redondo Beach. Detailed costs follow. It is important to note the following:

1. The cost covers the period up to but not including the first renourishment cycle (assumed to be five years, Section 5.1.1). **Renourishment costs are not included**.

2. The sand source is assumed to be offshore of Dockweiler State Beach (Section 6.2.6). The Redondo Beach temporary nearshore placement area may be feasible for Alternative 2. Inland sand sources were not evaluated.

Table 7-3. Probable Cost of Construction, Redondo Beach

Alternative	Beach Nourishment	Groin	Dune Habitat	Monitoring and Maintenance	Contingency	Planning and Support	Total
Proposed Project *300,000-cy Nourishment; Groin at Pier; 4.5-acre Dune Habitat*	$17,982,500	$3,884,575	$35,625	$715,000	$5,654,425	$4,523,540	**$32,795,665**
Alternative 1 *300,000-cy Nourishment; 4.5-acre Dune Habitat*	$17,982,500	-	$35,625	$715,000	$4,683,281	$3,746,625	**$27,163,031**
Alternative 2 *150,000-cy Nourishment; Groin at Pier; 4.5-acre Dune Habitat*	$12,432,500	$3,884,575	$35,625	$715,000	$4,266,925	$3,413,540	**$24,748,165**

Notes:
1. Cost **does not** include renourishment.
2. Sand source is assumed to be offshore of Dockweiler State Beach.
3. Use of Redondo Beach temporary nearshore placement area reduces cost of Alternative 2 to $16,193,165.

DRAFT OPINION OF
PROBABLE CONSTRUCTION COSTS
LA County DBH Coastal Resilience Project
Redondo Beach Proposed Project
[300,000 CY Nourishment From Offshore, Pier Groin, and 0.5 Acres of Dune]

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL
	Beach Nourishment Components				
1	Mobilization & Demobilization of Earthmoving Equipment	1	LS	$25,000.00	$25,000
2	Mobilization & Demobilization of Dredging Equipment	1	LS	$6,850,000.00	$6,850,000
3	Temporary Protective Construction Fence	2,500	LF	$3.00	$7,500
4	Offshore Dredging off Dockweiler Beach & Transport Onto the Beach	300,000	CY	$31.00	$9,300,000
5	Grading New Sand on the Beach and Longitudinal Dikes for Turbidity	300,000	CY	$6.00	$1,800,000
	Subtotal Beach Nourishment				**$17,982,500**
	Pier Groin Components				
6	Mob/Demob/Prep Work	1	LS	$1,000,000.00	$1,000,000
7	Groin Installation (520 feet long) in 2004 dollars	520	LF	$2,667.00	$1,386,840
8	Escalation from 2004 to 2030	1	LS	78%	$1,081,735
9	Econcrete Covering	10,400	SF	$ 40.00	$416,000
	Subtotal Pier Groin				**$3,884,575**
	Create Living Shoreline Area				
10	Install Sand Dune Fencing (3,000 linear feet per acre, over 0.5 ac)	1,500	LF	$6.00	$9,000
11	Apply Dune Plant Seeds (1,000 per acre) over 0.5 acres Restoration Area	500	EA	$0.25	$125
12	Install New Perimeter Fencing - Cable and Post (1,000 linear feet per acre)	500	LF	$2.50	$1,250
13	Install Kiosk (one assumed)	1	EA	$25,000.00	$25,000
14	Install Signage (one per dune acre rounded up to the nearest whole number)	1	EA	$250.00	$250
	Subtotal Expand Living Shoreline				**$35,625**
	Monitoring and Maintenance				
15	Pre, During, and Post Construction Monitoring	1	LS	$100,000.00	$100,000
16	Shoreline Monitoring	1	LS	$100,000.00	$100,000
17	Borrow Site Survey Support	1	LS	$180,000.00	$180,000
18	Borrow Post-Construction Monitoring	1	LS	$80,000.00	$80,000
19	Pre and Post Receiver Site Detailed Topo	1	LS	$95,000.00	$95,000
20	Permit Compliance Reporting/Monitoring	1	LS	$150,000.00	$150,000
21	Post-Construction - Dune Plants, Weeding	1	LS	$10,000.00	$10,000
	Subtotal Monitoring				**$715,000**
	Subtotal Items				**$22,617,700**
	Contingency of 25%				$5,654,425
	Planning, Environmental Review, Permitting, Design (7.5%)	1	EA		$2,120,409
	Construction Support Services (2%)	1	EA		$565,443
	Construction Management (3.5%)	1	EA		$989,524
	Inspection, Survey, and Administration (3%)	1	EA		$848,164
	Grand Total				**$32,795,665**

ASSUMPTIONS:

1 Contractor stages at parking lot.
2 Mobilization & Demobilization cost is taken directly from 2024 contractor bids for the USACE Encinitas and Solana Beach Project. These may increase over time by escalation/inflation but that is not factored in yet.
3 Sand is dredged from the Dockweiler Offshore Borrow Site and the sand quality is excellent.

DRAFT OPINION OF
PROBABLE CONSTRUCTION COSTS
LA County DBH Coastal Resilience Project
Redondo Beach Alternative 1
[300,000 CY Nourishment From Offshore and 0.5 Acres of Dune]

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL
	Beach Nourishment Components				
1	Mobilization & Demobilization of Earthmoving Equipment	1	LS	$25,000.00	$25,000
2	Mobilization & Demobilization of Dredging Equipment	1	LS	$6,850,000.00	$6,850,000
3	Temporary Protective Construction Fence	2,500	LF	$3.00	$7,500
4	Offshore Dredging off Dockweiler Beach & Transport Onto the Beach	300,000	CY	$31.00	$9,300,000
5	Grading New Sand on the Beach and Longitudinal Dikes for Turbidity	300,000	CY	$6.00	$1,800,000
	Subtotal Beach Nourishment				**$17,982,500**
	Create Living Shoreline Area				
6	Install Sand Dune Fencing (3,000 linear feet per acre, over 0.5 ac)	1,500	LF	$6.00	$9,000
7	Apply Dune Plant Seeds (1,000 per acre) over 0.5 acres Restoration Area	500	EA	$0.25	$125
8	Install New Perimeter Fencing - Cable and Post (1,000 linear feet per acre)	500	LF	$2.50	$1,250
9	Install Kiosk (one assumed)	1	EA	$25,000.00	$25,000
10	Install Signage (one per dune acre rounded up to the nearest whole number)	1	EA	$250.00	$250
	Subtotal Expand Living Shoreline				**$35,625**
	Monitoring and Maintenance				
11	Pre, During, and Post Construction Monitoring	1	LS	$100,000.00	$100,000
12	Shoreline Monitoring	1	LS	$100,000.00	$100,000
13	Borrow Site Survey Support	1	LS	$180,000.00	$180,000
14	Borrow Post-Construction Monitoring	1	LS	$80,000.00	$80,000
15	Pre and Post Receiver Site Detailed Topo	1	LS	$95,000.00	$95,000
16	Permit Compliance Reporting/Monitoring	1	LS	$150,000.00	$150,000
17	Post-Construction - Dune Plants, Weeding	1	LS	$10,000.00	$10,000
	Subtotal Monitoring				**$715,000**
	Subtotal Items				**$18,733,125**
	Contingency of 25%				$4,683,281
	Planning, Environmental Review, Permitting, Design (7.5%)	1	EA		$1,756,230
	Construction Support Services (2%)	1	EA		$468,328
	Construction Management (3.5%)	1	EA		$819,574
	Inspection, Survey, and Administration (3%)	1	EA		$702,492
	Grand Total				**$27,163,031**

ASSUMPTIONS:

1 Contractor stages at parking lot.
2 Mobilization & Demobilization cost is taken directly from 2024 contractor bids for the USACE Encinitas and Solana Beach Project. These may increase over time by escalation/inflation but that is not factored in yet.
3 Sand is dredged from the Dockweiler Offshore Borrow Site and the sand quality is excellent.

DRAFT OPINION OF
PROBABLE CONSTRUCTION COSTS
LA County DBH Coastal Resilience Project
Redondo Beach Alternative 2
[150,000 CY Nourishment From Offshore, Pier Groin, and 0.5 Acres of Dune]

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL
	Beach Nourishment Components				
1	Mobilization & Demobilization of Earthmoving Equipment	1	LS	$25,000.00	$25,000
2	Mobilization & Demobilization of Dredging Equipment	1	LS	$6,850,000.00	$6,850,000
3	Temporary Protective Construction Fence	2,500	LF	$3.00	$7,500
4	Offshore Dredging off Dockweiler Beach & Transport Onto the Beach	150,000	CY	$31.00	$4,650,000
5	Grading New Sand on the Beach and Longitudinal Dikes for Turbidity	150,000	CY	$6.00	$900,000
	Subtotal Beach Nourishment				**$12,432,500**
	Pier Groin Components				
6	Mob/Demob/Prep Work	1	LS	$1,000,000.00	$1,000,000
7	Groin Installation (520 feet long) in 2004 dollars	520	LF	$2,667.00	$1,386,840
8	Escalation from 2004 to 2030	1	LS	78%	$1,081,735
9	Econcrete Covering	10,400	SF	$ 40.00	$416,000
	Subtotal Pier Groin				**$3,884,575**
	Create Living Shoreline Area				
10	Install Sand Dune Fencing (3,000 linear feet per acre, over 0.5 ac)	1,500	LF	$6.00	$9,000
11	Apply Dune Plant Seeds (1,000 per acre) over 0.5 acres Restoration Area	500	EA	$0.25	$125
12	Install New Perimeter Fencing - Cable and Post (1,000 linear feet per acre)	500	LF	$2.50	$1,250
13	Install Kiosk (one assumed)	1	EA	$25,000.00	$25,000
14	Install Signage (one per dune acre rounded up to the nearest whole number)	1	EA	$250.00	$250
	Subtotal Expand Living Shoreline				**$35,625**
	Monitoring and Maintenance				
15	Pre, During, and Post Construction Monitoring	1	LS	$100,000.00	$100,000
16	Shoreline Monitoring	1	LS	$100,000.00	$100,000
17	Borrow Site Survey Support	1	LS	$180,000.00	$180,000
18	Borrow Post-Construction Monitoring	1	LS	$80,000.00	$80,000
19	Pre and Post Receiver Site Detailed Topo	1	LS	$95,000.00	$95,000
20	Permit Compliance Reporting/Monitoring	1	LS	$150,000.00	$150,000
21	Post-Construction - Dune Plants, Weeding	1	LS	$10,000.00	$10,000
	Subtotal Monitoring				**$715,000**
	Subtotal Items				**$17,067,700**
	Contingency of 25%				$4,266,925
	Planning, Environmental Review, Permitting, Design (7.5%)	1	EA		$1,600,097
	Construction Support Services (2%)	1	EA		$426,693
	Construction Management (3.5%)	1	EA		$746,712
	Inspection, Survey, and Administration (3%)	1	EA		$640,039
	Grand Total				**$24,748,165**

ASSUMPTIONS:

1 Contractor stages at parking lot.
2 Mobilization & Demobilization cost is taken directly from 2024 contractor bids for the USACE Encinitas and Solana Beach Project. These may increase over time by escalation/inflation but that is not factored in yet.
3 Sand is dredged from the Dockweiler Offshore Borrow Site and the sand quality is excellent.

7.2 Economic Benefit

Ceto Consulting (2025) utilized the anticipated performance of each project (Section 5) to evaluate their effects on coastal recreation and local economies, using nonmarket value (NMV) to quantify recreational benefits and spending estimates from recent survey data to estimate fiscal impacts from visitors.

7.2.1 Methodology

Carrying Capacity and the Role of Beach Nourishment

This analysis follows established methodologies in recreational economics, which allocate 100 square feet of "towel space" per visitor as an indicator of beach carrying capacity (King *et al.*, 2018; Pendleton *et al.*, 2006). Originally developed by the U.S. Forest Service and later extended by the U.S. Army Corps of Engineers, these methods help determine how much recreational space should be preserved or expanded through nourishment efforts.

Unlike models that assume visitors stop coming when space is reduced, this analysis recognizes that diminished towel space results in reduced social utility. This occurs through:

- Lower individual enjoyment due to overcrowding.
- Reduced experience quality for other visitors.
- Increased risks related to public health and safety (*e.g.,* difficulty in emergency response, sanitation challenges).

This methodology has been applied to other California beach nourishment projects, including Hermosa Beach and the Regional Beach Sand Project (RBSP III) in San Diego and Orange County.

Measuring Attendance with Cell Phone Data

Recent advances in cellphone-, or mobility-derived location data, widely used in commercial real estate and transportation studies, have provided a more accurate approach to tracking beach visitation (Patsch *et al.*, 2024; Mazzotta *et al.*, 2021; Tsai *et al.*, 2023; Merril *et al.*, 2020). Commercially available datasets, such as those from Placer.ai, use geospatial tracking to determine:

- The number of unique visitors to a beach.
- The times and durations of their visits.
- The home locations of visitors (based on nighttime phone activity).

This data is derived from completely anonymized cellphone location pings from 2018 to 2024, which are aggregated and processed through a modeling framework to estimate visitation numbers. No personally identifiable information (PII) is recorded, ensuring privacy compliance. More details on data collection methods can be found in Placer.ai's documentation and methodology reports.

This data allows for a more precise calculation of actual beach attendance and also enables researchers to analyze:

- Travel cost modeling, which estimates the economic effort required for visitors to reach the beach.
- Equity in beach access, identifying whether visitors are from underserved communities, a key concern for the State of California in coastal management and public policy.

By integrating cell phone data with economic modeling, this study provides a more reliable assessment of beach use, enabling LACDBH to make data-driven decisions on how nourishment projects will affect recreational value and local communities.

Historically, official beach attendance counts in Southern California have been significantly overestimated. A study by King and MacGregor (2012) found that reported attendance figures, particularly those from lifeguard estimates, were often inflated by a factor of four or more. Their study, which focused on Santa Barbara and Orange Counties, concluded:

> *Our results draw us to the conclusion that reported beach attendance at many sites in Southern California rarely corresponds to actual beach attendance. Our results further indicate that the general tendency is for agencies to overestimate, and that this overestimation depends on a number of factors.*

King and MacGregor's analysis compared midday survey-based counts conducted by research assistants with official lifeguard estimates, which varied in methodology and accuracy. Anecdotal evidence from lifeguards indicated that safety concerns took precedence over precise counting, making official numbers unreliable for economic assessments. One potential limitation of their study was its exclusion of certain activities, such as surfing, walking, and early morning or evening beach use.

Fiscal Impacts

Visitor spending includes what beachgoers spend on shopping, dining, and most significantly, overnight accommodations. To estimate these fiscal impacts, the model utilizes spending data from a recent study of beach spending (by the Ceto team and other researchers), including Santa

Barbara's two main beaches, which serve as a reasonable proxy for spending patterns at Los Angeles beaches. Based on this survey data, the economic model utilized herein assumes:

- Overnight visitors spend an average of **$82 per day**
- Day-trippers (who return home the same day) spend **$63 per day**

The model estimates lost tax revenue in two categories:

- Local (City and County) sales tax revenues (from lost sales subject to sales tax)
- Transient Occupancy Taxes (TOTs) that go to the local jurisdiction (City or County if unincorporated) from hotels, motels and short-term rentals, but not camping at State Parks.

The tax rates applied in the model are:

- Transient Occupancy Tax (TOT) Rate: 12% (uniform across the study area)
- Sales Tax Rate: 9.5% (except in Malibu, where it is 10%). Note: The State of California collects 6% of the sales tax revenue; the focus here is on the local share.

To estimate the percentage of overnight visitors, the model uses travel distance data from the cellphone derived attendance records. The following assumptions were applied:

- Visitors traveling less than 100 miles are assumed to be day-trippers
- Visitors traveling more than 250 miles are assumed to be overnight visitors
- Visitors traveling between 100-250 miles are assumed to be 50% overnight visitors, 50% day-trippers

Using these assumptions, the model estimates the percentage of overnight visitors at each study site:

- Zuma Beach and Point Dume: 12% overnight visitors
- Dockweiler Beach: 9% overnight visitors
- Redondo Beach: 7% overnight visitors

7.2.2 Results

Zuma Beach and Point Dume

Cellphone-phone derived visitation data for Zuma Beach, including contiguous Broad Beach and Point Dume Beach, indicates approximately 1.4 million people visit each year (note: Broad Beach and Point Dume Beach were included in the visitor counts based on the observation that visitors move freely between the three sites). In their current configuration, Zuma Beach and Point Dume beaches have excess carrying capacity (*i.e.,* more than enough usable dry beach to support current attendance) and retain sufficient width to sustain current peak attendance up to but not including the first renourishment cycle. As a result, the proposed project and alternatives do not impact the recreational value of the Zuma/Point Dume area, even with significant dune creation along the back beach.

However, it is important to note that this economic analysis only considers recreational value and does not consider value generated from other sources, such as storm damage reduction, environmental benefits, and mitigation. Given the various amenities and critical facilities located near the back beach, some of which were critically damaged in recent years (*i.e.*, Westward Beach Road, Section 2.1.5), it is expected that the value of storm damage reduction will be significant, if evaluated. In addition, it is expected that Zuma Beach and Point Dume will see increased recreational demand in the coming years as a result of several factors, including:

- **Population Growth:** Assuming annual population growth of 3% and consistent demand for recreation, attendance will increase by 180% from 2030 to 2050.
- **Substitution:** As nearby beaches erode and become increasingly crowded, more visitors will choose to visit Zuma Beach and Point Dume. Assuming a conservative substitution rate of 3% per year, Zuma could see an increase in demand of 320% from 2030-2050.

Given the lack of recreational benefit, a benefit-cost ratio was not computed for the proposed project and project alternatives at Zuma Beach. Benefits related to the other factors noted above will be evaluated in the next project phase to further refine the potential economic benefit of the project.

Dockweiler State Beach

The resilience project at Dockweiler State Beach is not primarily focused on increasing recreational area, thus no recreational benefits are included. Conversion of existing sandy beach to dune habitat will have a small negative impact on Dockweiler Beach's recreational value. However, given the length and width of the sandy beach in this area, the annual lost recreational value represents only about 1% of the total NMV, which is estimated at over $119 million annually (based on 1.9 million visitors at $62 per visitor per day). This indicates that Dockweiler Beach has sufficient area to accommodate the project while maintaining usable beach area for visitors.

In addition, the present study only evaluated economic benefits related to recreation. Other benefits, such as storm-damage reduction and environmental benefits will be evaluated as part of the next phase of the project. Once benefits are quantified, a benefit-cost ratio will be computed.

Redondo Beach

The economic model indicates that in the absence of beach nourishment (the "No Project" condition), the project area will not have adequate beach area to meet demand, resulting in cumulative revenue losses ranging from $2.6 million to $23.4 million annually for the 20-year period from 2030 to 2050. The Proposed Project fully mitigates these losses, while Alternative 1 mitigates all but 0.1% ($230,000). Alternative 2, with the smaller nourishment volume, avoids 92.6% of the NMV losses expected to occur under the No-Project condition.

Table 7-4 illustrates the benefit to cost ratio computed using the construction costs presented above and the avoided NMV losses for each project and alternative. The BC ratios are quite high, ranging from 6.18 to 7.59.

Table 7-4. Benefit to Cost Ratio, Redondo Beach

Project	Construction Cost	Recreational Value	Benefit to Cost Ratio
Proposed	$32.8M	$202.7M	6.18
Alternative 1	$27.2M	$202.5M	7.45
Alternative 2	$24.7M	$187.8M	7.59

7.2.3 Limitations and Considerations

The estimates in this analysis are based on present-day socioeconomic conditions and assume relatively stable population trends in Los Angeles County. However, several factors could influence beach attendance and fiscal impacts over time:

- **Climate Change and Beach Demand**: If summers become hotter, demand for beaches could increase, altering attendance patterns and increasing the importance of preserving beach capacity.
- **Shifts in Tax Rates**: The analysis applies current sales tax and transient occupancy tax (TOT) rates, but these could change over the project lifespan, affecting fiscal outcomes.
- **Spending and Accommodation Trends**: Visitor spending behavior and lodging preferences may evolve; particularly as short-term rentals (STRs) and hotel rates fluctuate.
- **Beach Profile Changes and Attendance Assumptions**: The model assumes consistent visitation patterns as the beach profile changes, without accounting for potential adaptive behavior by visitors.

These limitations highlight the dynamic nature of coastal recreation and fiscal impacts, reinforcing the need for continued monitoring and adaptive management to inform future policy decisions.

8 Alternatives Analysis and Project Selection

In an effort to objectively select the preferred alternative at each site, ranking matrices were developed based on the project objectives and the anticipated performance of each alternative. The ranking categories, described in Section 5, include: recreation, public access, dune habitat, and cost. Scores of 0 to 1 were assigned to each category, then weighted and summed to arrive at a final score, with 1 being the most favorable and 0 being the least favorable. All four categories are weighted equally; however, the weightings can be adjusted following County and stakeholder feedback regarding the relative importance of each.

8.1 Zuma Beach and Point Dume

The ranking matrix developed for Zuma Beach and Point Dume is shown in Table 8-1. As shown in the table, the recreation score was computed based on the average increase in beach width over the first renourishment cycle, relative to the pre-construction condition. The public access score was taken to be the portion of the shoreline not impacted by the addition of dunes to the back beach, while the dune habitat score was computed based on the total area of new or expanded dune. Finally, the cost score was computed as the relative cost among the three options, with the lowest cost receiving a score of 1 and the highest cost receiving a score proportional to the increase in cost relative to the lowest cost.

As shown in the table, Alternative 1, which includes a 500,000-cy beach nourishment and 12.8 acres of dune habitat is the preferred alternative, based primarily on the relatively low cost and the additional dune habitat created along the back beach. The Proposed Project was runner-up, while Alternative 2 was least preferred.

8.2 Dockweiler State Beach

The ranking matrix developed for Dockweiler State Beach is shown in Table 8-2. As shown in the table and described in Section 5.2.1, the recreation score was computed based on the relative length of the low sand barrier that prevents sand from being blown onto the bike and pedestrian path. The longest (850 ft) received a score of 1, while the shortest (700 ft) received a score of 0.82, as it is 18% shorter. The public access score was computed based on the number of beach access points, while the dune habitat score was computed based on the total area of new or expanded dune. Finally, the cost score was computed as the relative cost among the three options, with the lowest cost receiving a score of 1 and the highest cost receiving a score proportional to the increase in cost relative to the lowest cost.

As shown in the table, Alternative 2 is the preferred alternative, primarily based on it having the highest number of access points and relatively large dune area. The proposed project was runner-up, while Alternative 1 was least preferred.

8.3 Redondo Beach

The ranking matrix developed for Redondo Beach is shown in Table 8-3. As shown in the table and described in Section 5.3.2, the recreation score was computed based on the average increase in beach width over the first 20 years of the project (as there is no renourishment needed), relative to the pre-construction condition. Public access is primarily limited by the presence of the groin in the Proposed Project and Alternative 2, and as a result, these were given a score of 0.75. The dune habitat score was computed based on the total area of new or expanded dune. As was the case for Zuma / Point Dume and Dockweiler, the cost score was computed as the relative cost among the three options, with the lowest cost receiving a score of 1 and the highest cost receiving a score proportional to the increase in cost relative to the lowest cost.

As shown in the table, Alternative 1 is the preferred alternative due to the relatively low cost and absence of public access impacts. The proposed project was runner-up, while Alternative 2 was least preferred.

8.4 Summary

The preferred alternative for each site is:

Zuma Beach and Point Dume: *Alternative 1*: 500,000-cy beach nourishment, 12.8 acres of dune habitat, cost $49.0M

Dockweiler State Beach: *Alternative 2*: 700-ft long sand barrier, 4 beach access points, 2.7 acres of dune habitat, cost $1.94M

Redondo Beach: *Alternative 1*: 300,000-cy beach nourishment, 4.5 acres of dune habitat, cost $27.2M

Table 8-1. Ranking Matrix, Zuma Beach and Point Dume

	Category				Weighted Score
	Recreation[3]	**Public Access[4]**	**Dune Habitat[5]**	**Cost[6]**	
Weight	25%	25%	25%	25%	-
Scoring	0 = No Added Beach Width	0 = Significant Impacts	0 = No New or Expanded Habitat	0 = Highest Relative Cost	1 = Highest Score
	1 = Maximum Added Beach Width	1 = No Impacts	1 = Maximum New or Expanded Habitat	1 = Lowest Relative Cost	0 = Lowest Score
Proposed Project *500,000-cy Nourishment; 8.6-acre Dune Habitat*	**0.76** Average Additional Beach Width = 12.5 ft	**0.68** 4,600 ft of 14,500-ft long shoreline impacted by dunes	**0.67** 8.6 acres of new/expanded dune habitat	**1.00** Cost = $48.9M	**0.78** Runner Up
Alternative 1 *500,000-cy Nourishment; 12.8-acre Dune Habitat*	**0.76** Average Additional Beach Width = 12.5 ft	**0.53** 6,830 ft of 14,500-ft long shoreline impacted by dunes	**1.00** 12.8 acres of new/expanded dune habitat	**1.00** Cost = $49.0M	**0.82** **Selected Project**
Alternative 2 *750,000-cy Nourishment; 8.6-acre Dune Habitat*	**1.00** Average Additional Beach Width = 16.4 ft	**0.68** 4,600 ft of 14,500-ft long shoreline impacted by dunes	**0.67** 8.6 acres of new/expanded dune habitat	**0.62** Cost = $67.6M	**0.74** Last Place

Legend: Low Score (0 – 0.5), Average Score (0.6 – 0.7), High Score (0.8 – 1.0)

[3] Recreation Score computed as Average Additional Beach Width normalized by maximum Average Additional Beach Width for all alternatives. Average values computed relative to pre-construction condition over first renourishment cycle (Section).
[4] Public Access Score computed as % of shoreline not impacted by dune creation or expansion.
[5] Dune Habitat Score computed as area of new or expanded dune habitat normalized by maximum area of new or expanded dune habitat.
[6] Cost Score computed as the difference between the project cost and the lowest cost, normalized by the lowest cost. Cost includes initial nourishment only. No renourishment.

Table 8-2. Ranking Matrix, Dockweiler State Beach

	Category				Weighted Score
	Recreation[7]	Public Access[8]	Dune Habitat[9]	Cost[10]	
Weight	25%	25%	25%	25%	-
Scoring	0 = No Protection for Bike/Pedestrian Path	0 = No Beach Access Points	0 = No Enhanced or Restored Habitat	0 = Highest Relative Cost	1 = Highest Score
	1 = Max Protection for Bike/Pedestrian Path	1 = Maximum No. of Beach Access Points	1 = Maximum Enhanced or Restored Habitat	1 = Lowest Relative Cost	0 = Lowest Score
Proposed Project *850-ft Sand Barrier; 2.6-acre Dune Habitat with 3 Beach Access Points*	**1.00** 850-ft long Sand Barrier to Prevent Sand Accumulation on Bike and Pedestrian Path	**0.75** 3 Beach Access Points	**0.93** 2.6 acres of Enhanced or Restored Dune Habitat	**0.81** Cost = $2.30M (2030 to 2050)	**0.87** Runner Up
Alternative 1 *850-ft Sand Barrier; 2.8-acre Dune Habitat with 2 Beach Access Points*	**1.00** 850-ft long Sand Barrier to Prevent Sand Accumulation on Bike and Pedestrian Path	**0.50** 2 Beach Access Points	**1.00** 2.8 acres of Enhanced or Restored Dune Habitat	**0.81** Cost = $2.31M (2030 to 2050)	**0.83** Last Place
Alternative 2 *700-ft Sand Barrier; 2.7-acre Dune Habitat with 4 Beach Access Points*	**0.82** 700-ft long Sand Barrier to Prevent Sand Accumulation on Bike and Pedestrian Path	**1.00** 4 Beach Access Points	**0.96** 2.7 acres of Enhanced or Restored Dune Habitat	**1.00** Cost = $1.94M (2030 to 2050)	**0.95 Selected Project**

Legend: Low Score (0 – 0.5), Average Score (0.6 – 0.7), High Score (0.8 – 1.0)

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7 Recreation Score computed as % of bike and pedestrian path protected by low sand barrier along 850-ft long project reach.
8 Public Access Score computed as number of beach access points relative to maximum number of beach access points (4).
9 Dune Habitat Score computed as area of enhanced or restored dune habitat normalized by maximum area of enhanced or restored dune habitat.
10 Cost Score computed as the difference between the project cost and the lowest cost, normalized by the lowest cost. Cost includes initial nourishment only. No renourishment.

Table 8-3. Ranking Matrix, Redondo Beach

	Category				Weighted Score
	Recreation[11]	**Public Access**[12]	**Dune Habitat**[13]	**Cost**[14]	
Weight	25%	25%	25%	25%	-
Scoring	0 = No Protection for Bike/Pedestrian Path	0 = Maximum Impact	0 = No Enhanced or Restored Habitat	0 = Highest Relative Cost	1 = Highest Score
	1 = Max Protection for Bike/Pedestrian Path	1 = No Impact	1 = Maximum Enhanced or Restored Habitat	1 = Lowest Relative Cost	0 = Lowest Score
Proposed Project *300,000-cy Beach Nourishment; Groin at Pier; 4.5-acre Dune Habitat*	**1.00** Average Additional Beach Width = 75 ft	**0.75** Lateral access impeded by groin at pier	**1.00** 4.5-acre dune habitat	**0.67** Cost = $32.8M (2030 to 2050)	**0.86** Runner Up
Alternative 1 *300,000-cy Beach Nourishment; 4.5-acre Dune Habitat*	**0.87** Average Additional Beach Width = 65 ft	**1.00** No Impacts	**1.00** 4.5-acre dune habitat	**0.90** Cost = $27.2M (2030 to 2050)	**0.94** **Selected Project**
Alternative 2 *150,000-cy Beach Nourishment; Groin at Pier; 4.5-acre Dune Habitat*	**0.40** Average Additional Beach Width = 30 ft	**0.75** Lateral access impeded by groin at pier	**1.00** 4.5-acre dune habitat	**1.00** Cost = $24.7M (2030 to 2050)	**0.79** Last Place

Legend: Low Score (0 – 0.5), Average Score (0.6 – 0.7), High Score (0.8 – 1.0)

[11] Recreation Score computed as Average Additional Beach Width normalized by maximum Average Additional Beach Width for all alternatives.
[12] Public Access Score computed as 0.75 for alternatives with groin at pier and 1.00 for alternatives without groin at pier.
[13] Dune Habitat Score computed as area of enhanced or restored dune habitat normalized by maximum area of enhanced or restored dune habitat.
[14] Cost Score computed as the difference between the project cost and the lowest cost, normalized by the lowest cost. Cost includes initial nourishment only. No renourishment.

9 Stakeholder Feedback

Stakeholder feedback has been received as part of three public meetings: September 23, 2024, January 29, 2025, and April 16, 2025. The sections that follow summarize the feedback received and responses given. *Note this draft report will be updated to include the April 16 comments following the meeting.*

9.1 General Comments

Comment	Response
There are established protocols for monitoring wildlife during coastal construction projects, including California Grunion, and the report could state that those will be followed if construction occurs during a season when the resource could be impacted.	Recommended avoidance and mitigation measures, including those for California Grunion, have been added (see Section 3.3).
Is there a CEQA document identifying the Proposed Project and evaluating the project alternatives? If so, when should the agencies expect to review it?	The CEQA document has not been prepared. It will be prepared as part of Phase 3 of the project.
I would suggest that your schedule includes a few years of adaptive management and long-term maintenance.	Each project will include a 5-year post-construction monitoring period to evaluate project performance and adapt to new discoveries.
Are the “proposed” alternatives simply what was proposed originally when the project was submitted, or are they the current preference?	The "proposed" is the project proposed as part of the prior study. It is not necessarily preferred.

9.2 Zuma Beach and Point Dume

Comment	Response
What is the timing of beach nourishment?	Ideally, beach nourishment will occur outside of the high beach use season (Memorial Day to Labor Day) and prior to grunion runs (March 14 through August 31).

Comment	Response
How do the proposed dune habitat areas interplay with the existing dune areas?	The existing habitat will be expanded and enhanced. Planned activities include removing non-native species, seeding with native species, and creating designated corridors to the beach. Sand collection fencing will be installed to encourage dune growth and limit deposition in unwanted areas.
What is the length of Zuma / Point Dume?	Approximately 14,500 feet (Trancas Creek to Point Dume).
Is there revetment or cobble contemplated in this project?	We are not currently considering revetment or cobble. Cobbles do not naturally occur at the project site in large quantities.
Do these projects use opportunistic sources of sediment or sediment that needs to be purchased and transported?	The most likely sources will be harbor maintenance dredging or an offshore borrow site. The sand will need to be transported from the source to the beach via vessel and pumped onshore.
Will you be reviewing opportunities to partner with local municipalities to add misc. trash capture and nuisance urban runoff flow capture and infiltration?	No, stormwater quality improvement features are outside of the project scope.
If an offshore borrow source is an option, have any borrow sampling been conducted or plans to do so?	See Section 6.2. We will be preparing and implementing our own sampling and analysis plan for this project as part of the next phase of work.
I fully support the concept of offshore, underwater reef/rock structure for fish habitat and sand stabilization in front of Point Dume Beach.	At this time, offshore reef structures are not being considered, due in part to the area's designation as a State Marine Reserve. Our plan is to monitor the shoreline and potentially revisit such alternatives with the State if conditions warrant.
What does the runoff look like at Zuma? Will a dune retain significant volumes of runoff from road/upland?	The project will be designed to allow for sufficient runoff at those locations where it currently exists. We do not expect the dunes to impound runoff.

Comment	Response
Sea Grant funded a study a few years ago that looked at how sand was transported at Point Dume. A lot of it is apparently lost in the canyon. How will the sand be prevented from moving offshore into the canyon rather than along the nearshore for deposition?	See Section 2.1.2. While investigators agree that Point Dume acts as a partial barrier to longshore sediment transport, they have not yet reached consensus regarding the percentage of material transported into the canyon versus that which is transported around Point Dume into the Santa Monica Littoral Cell.
<u>Westward Beach Road Revetment</u> Has a replacement of the revetment with a co-benefiting nature-based alternative been explored within the scope of this project? On the same point, could some of the rock revetment be replaced by dune creation if we were able to create dunes in that area? I am concerned that the presence of the revetment will cause scouring. Would you consider relocating the restroom and otherwise narrowing the road or reducing parking to pull the beach further back and better able to sustain near term nourishment. Otherwise I don't see ever getting to a wet sand beach where the revetment is. The rocks scour the beach and impede growth.	The project focuses on adding more sand to Zuma Beach. Current understanding is that a significant amount of sand is being captured by Mugu Canyon and no longer replenishing the Zuma littoral cell. A potential nature based alternative to protect access to Point Dume beach via Westward Beach Road may be looked into after the beach is widened. Since the revetment falls outside of the demonstration living shoreline project, we can set up a separate meeting to discuss the specifics including interplay with the narrow beach, access road, adjacent cliff, restroom, parking lot, etc.
Since the Palisades fire burned materials from downcoast have made their way to Zuma beaches, can you describe how that happens since this project assumes a dominant down-coast transport?	The burned materials are driven primarily by wind on the surface of the water. Sediment transport is driven primarily by waves.
Where will the new Zuma sand come from?	See Section 6. Most likely sources are harbor maintenance dredging and an offshore borrow site.
What is the difference between dune creation and enhancement?	Dune creation refers to creation of a dune in an area that they currently do not exist. Dune enhancement refers to improvement and management of existing dunes.

Comment	Response
In terrestrial settings, maintaining living biotic parts of the soil is critical to success in restoration / gardening / agriculture. NRCS says 5% living material is preferential for soil. I recognize that dunes accrue from wind blown sediment, so this may be a different scenario. For clarification do beach dunes also need to have a living microbiome to thrive? If so, is that an element of these projects?	No microbiomes are needed.
Why doesn't the shoreline modelling data extend beyond 2016--nine years ago?	The shoreline simulations cover the period from 2023 to 2050. The calibration period is from 2009 to 2016 based on the availability of high-resolution shoreline data derived from Light Detection and Ranging (LiDAR) datasets. Validation was conducted between 2016 and 2023 using a combination of LiDAR and beach profile data.
Can you use some of the sediment behind Rindge Dam at this site?	Yes, LACDBH is discussing the option with CA State Parks.
Doesn't the dune creation project need to be continuous laterally across the beach? The dunes that you show on the plan are some distance apart. Won't that result in the destruction of the dunes in high wave/tide times?	See Section 2.3.3. Current state guidance indicates that dunes should be at least 100 ft long (along the beach). Each of the proposed dunes meets this criterion.

9.3 Dockweiler State Beach

Comment	Response
What is expected in terms of dune expansion seaward, and how the dune will be affected with the rising sea level?	The dunes are expected to expand offshore. As sea levels rise and the shoreline erodes, the dunes will function as reservoir of sand to nourish the beach during high tide or severe storm events.

Comment	Response
There is a hang glider area in the project area.	The project is designed to avoid obstructions to hang gliding access and activities.
Consider extending the existing Snowy Prover protection area from the north to the project area. This area has lower foot traffic and can be a good opportunity.	Noted.
Will the homeless encampment issue be addressed by this project?	Though it is an important issue, the homeless encampment issue will be addressed outside of this project.
What is the height of the proposed low sand barrier?	See Section 4.2.2. The wall is a little more than 2 ft tall with a base that is about 1 ft wide.
Will the fencing be permanent or removed after initial dune growth?	The fencing can be removed once the dunes are established. Rope and post barriers are intended to remain to reduce trampling.
Is the primary goal to keep sand off concrete or to build dunes?	Both.
Is a plant palette already selected for the dune?	Not yet. We will develop a plant palette in the next phase of this project.
The drains at the base of the wall could be a source of severe erosion on this inclined dune system. Is there a way to engineer a diffusion device, such that the water will run downhill less violently?	Noted. We'll take it into consideration.
What is the benefit of shortening the wall to 700 ft for the third alternative (Alternative 2)?	Less obstruction to the hang-gliding launch area.
Use of signage at dune project in Santa Monica has been very successful.	Noted.
Does "free access" refer to physical freedom of movement or financially free?	Financially free.

9.4 Redondo Beach

Comment	Response
What is the anticipated volume for beach nourishment at Redondo?	See Section 8.3. The preferred project includes approximately 300,000 cy of sand.
Assuming the ECOncrete groin is somewhat reflective, has there been any analysis on infragravity or edge wave trapping that could cause large velocity gradients and potentially localized erosion?	No. At this point, the groin is not included in the preferred alternative. If it is included at a later date, further study will be necessary.
This area has been nourished before. The sand came from Marina del Rey through Army Corps' dredging project. Recently, City of Redondo placed dredged sand from King Harbor to nearshore of the project area. The sand is available for this project.	Noted.
Most Sand is lost to Redondo Canyon, which is located about a half a mile outside of the beach. A rock structure may help retain sand longer and create a fish habitat.	We considered this in the initial part of the study; however, such techniques are unproven and can have unintended consequences. Given the relative stability of the beach in this area, we do not feel that such a structure is necessary but may consider it once we are able to monitor the fate of the sand.
Is there a study that measures sand movement?	Sand tracer studies can be conducted but are typically used for scientific purposes.
The Pier is pretty aged. The construction of a groin using the pier would not be structurally sound.	Noted. The groin is not included in the preferred alternative. In the event that a groin were included, detailed structural engineering design would be conducted along with inspection of the pier.
Why would you do Alternative 1 or Alternative 2 with no or a smaller sand retention feature. What is the benefit, except for cost? Would there need to be more frequent renourishment?	The alternatives are meant to provide a range of options from which to evaluate the relative merits of each approach. Based on the analysis, once the beach is nourished, renourishment would not be needed at Redondo Beach and a groin is not included in the preferred alternative.

Comment	Response
Sand retention (groin) alternative is not preferable due to its downcoast effect.	Downcoast effects are minimal due to the location of King Harbor. Nevertheless, a groin is not included in the preferred alternative.
Where is the sand coming from for Redondo?	See Section 6. Most likely sources are harbor maintenance dredging and an offshore borrow site.
I'm not very familiar with what is inland of this public beach...are the dunes just proposed for habitat value or would they provide protection for some development?	The dunes provide habitat value and protection for the restroom and bike path.
What is ECOncrete? How many other examples of green-grey projects like the groin proposal do we have on our shorelines?	ECOncrete has an admixture that promotes growth of marine habitat. It is being used to construct green-grey revetments in San Diego Harbor. Sea Grant is studying the effectiveness but the results are not complete.

10 Summary and Next Steps

As part of the first phase of the LACDBH Resilience Project Implementation, a feasibility study was conducted to evaluate projects proposed as part of the 2023 Coastal Resilience Study (Moffatt & Nichol, 2023) at three sites: Zuma Beach & Point Dume Beach, Dockweiler State Beach, and Redondo Beach.

10.1 Project Selection

The concepts outlined in the 2023 Coastal Resilience Study were used to develop a proposed project and two project alternatives at each site. The anticipated performance of each project was evaluated to estimate the relative benefits to recreation, public access, and dune habitat. These benefits, along with the cost of design, construction, and monitoring, were used to select a preferred project for each site. The preferred projects are summarized below:

Zuma Beach and Point Dume Beach

Beach nourishment of 500,000 cubic yards (cy) at Zuma Beach. Creation of dune habitat (4.1 acres) along Zuma Beach and enhancement of the existing dune habitat at Zuma Creek and Point Dume Beach (4.5 acres). Renourishment events are expected to be necessary about every five years. The project will be monitored to determine when renourishment is needed. Costs for renourishment have not been included.

Dockweiler State Beach

Construction of a 700-ft long low sand barrier between the existing dune system and the bike and pedestrian path. Active management of dune habitat (2.8 acres) through installation of four designated beach access paths, sand fencing to encourage deposition within the dune field, installation of boundary fencing along the border, removal of non-native species, and seeding with native species.

Redondo Beach

Beach nourishment of 300,000 cubic yards (cy) between Topaz Groin and Redondo Beach Pier. Creation of dune habitat (0.5 acres) fronting County facilities near Topaz Groin. Renourishment is not expected to be necessary for at least 20 years.

10.2 Sand Source

The projects at Zuma/Point Dume Beach and Redondo Beach will require a substantial quantity of beach nourishment (300,000 to 500,00 cy). Potential sand sources were evaluated, including those from harbor maintenance dredging, offshore borrow sites, and inland sources. Offshore borrow sites are the most favorable, particularly the site offshore of Dockweiler State Beach investigated as part of the Broad Beach Restoration Project in 2011 (Coastal Frontiers, 2011b). Based on the 2011 investigation, it is estimated that over 3,000,000 cy of sand with a median grain size of about 0.5 mm may exist at the site. This is coarser than the average median grain size at each of the receiver beaches (0.23 mm at Zuma, 0.46 mm at Redondo), which is preferred to extend the project life.

10.3 Economic Considerations

The probable cost of construction was estimated based on recent experience with similar projects in southern California. The costs include those for design, planning, permitting, monitoring, and construction. A 25% contingency on the construction and monitoring costs is included.

Zuma Beach and Point Dume Beach:	$49,008,525 (does not include renourishment)
Dockweiler State Beach:	$2,311,367
Redondo Beach:	$27,163,031

Recreational benefits were estimated using nonmarket value based on spending estimates from recent survey data. The Zuma/Point Dume and Dockweiler projects had no impact or a small negative impact on recreational benefits, respectively. However, value generated from other sources, such as storm damage reduction, environmental benefits, and mitigation were not considered and should be evaluated as part of the next project phase. The Redondo Beach project had a significant positive impact on recreation, with a benefit-to-cost ratio of 7.45 for the selected alternative.

10.4 Next Steps

The next two phases of the project are Preliminary Engineering and Design (Phase 2) and Environmental Review and Permitting (Phase 3). To expedite the permitting process, we recommend conducting these two phases in tandem.

Areas of particular emphasis will be the evaluation of economic benefits other than recreation for the Zuma/Point Dume Project and Dockweiler Project, development of detailed design drawings (90%), and preparation of a Sampling and Analysis Plan (SAP) to support dredging at the Dockweiler Borrow Site. We also recommend engaging a firm with expertise in graphic design and public communication to develop informational materials that will support public engagement and ownership of each project.

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