

# **Broad Beach Restoration Project**

## **Coastal Development Permit Project Description FINAL**

**PREPARED FOR:**

**TRANCAS PROPERTY OWNER'S ASSOCIATION**

**PREPARED BY:**



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**JANUARY 2011**

**JOB NO. 6935**

## 1. INTRODUCTION

Broad Beach is located in the northwest portion of the County of Los Angeles and within the City of Malibu. The project area is comprised of the shoreline area fronting approximately 80 homes spanning approximately from Lechuza Point to Trancas Creek. Broad beach has been suffering shoreline erosion over the past 30 plus years, resulting in an almost complete loss of recreation and public access. Public access through dedicated public access ways from Broad Beach Rd. to the beach was rendered impossible during the most severe storms and tidal action over the past few years. The severe erosion problem now threatens private property and dune fields along this stretch of beach.

The Trancas Property Owner's Association (TPOA), representing almost all of the property owners along the Broad Beach shoreline, has elected to address the extensive erosion by privately funding a beach and sand dune restoration project which will not only protect their homes but also restore the beach to its historic grandeur not only for their benefit but for the benefit of the public at large. The Broad Beach restoration project seeks to design, permit, and implement a shoreline restoration program that provides erosion control, property protection, improved recreation and public access opportunities, aesthetics, and dune habitat.

The vicinity and location of the project site are shown below in figure 1.

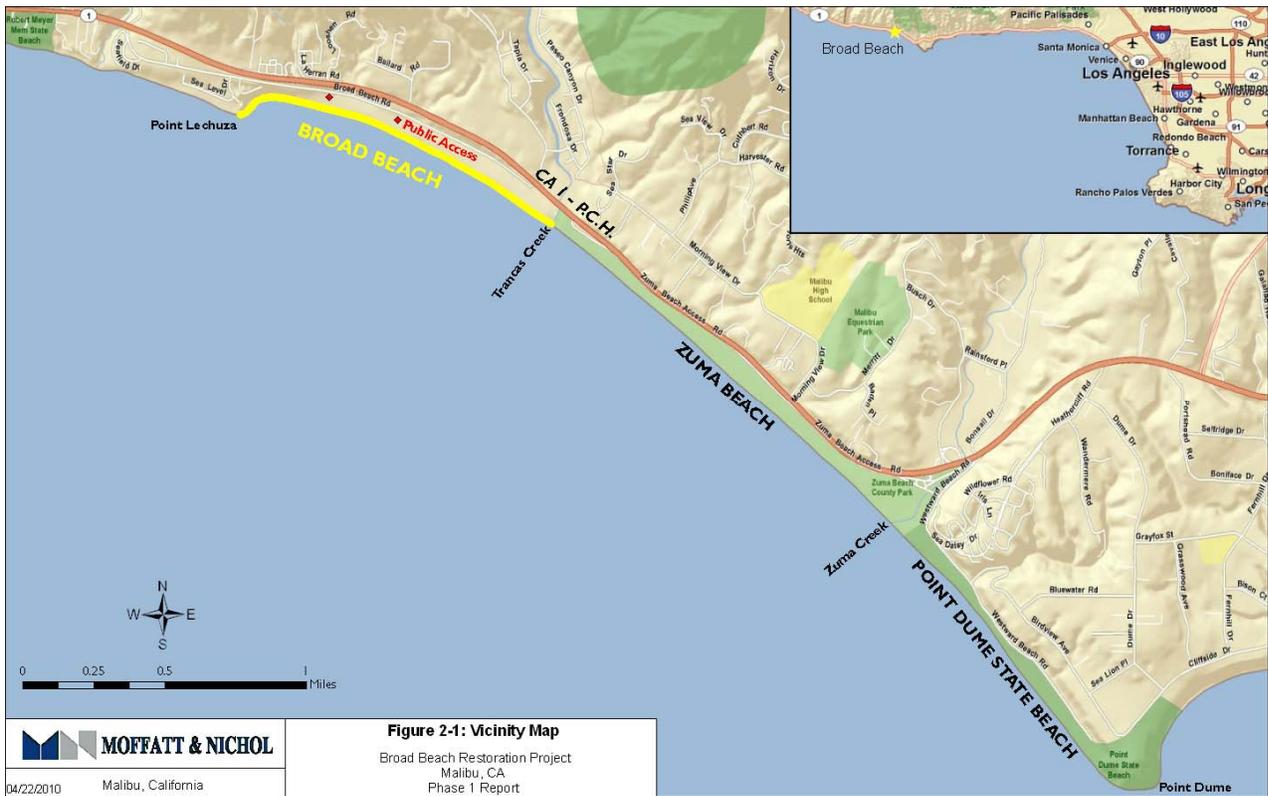


Figure 1 – Broad Beach Restoration Project Location

## 2. BACKGROUND

Development along Broad Beach began in the 1930s, consisting of small beach cottages. Given the limited infrastructure available, septic systems and leach fields were typically installed in or close to the sand dunes seaward of the residences. As construction continued and the site was further developed, most leach fields remained.

The Broad Beach shoreline is retreating because of a negative sand balance due either to a reduction in sand supply entering around Lechuza Point, or a change in the alongshore component of wave energy that increases the amount of sand leaving the beach near the vicinity of Trancas Creek. Between 1974 and 2009, approximately 600,000 cubic yards (cy) of sand was lost at Broad Beach, a majority of which has moved east to nourish Zuma Beach. On average, the shoreline moved inland 65 feet during that time period. The greatest beach recession occurred close to Lechuza Point and tapered off toward Trancas Creek. Since the sand budget turned negative in 1974, the Broad Beach loss rate has accelerated to approximately 35,000 cubic yards per year during the last 5 years. However, evidence suggests that this annual loss rate could be significantly higher owing to wave behavior and/or storm events and could reach up to 60,000 cubic yards per year. Currently, Broad Beach is a very narrow ribbon of sand visible primarily at low tide but inundated at high tide.



**Figure 2 - 1972 Aerial Photo (California Coastal Records Project, 2009)**



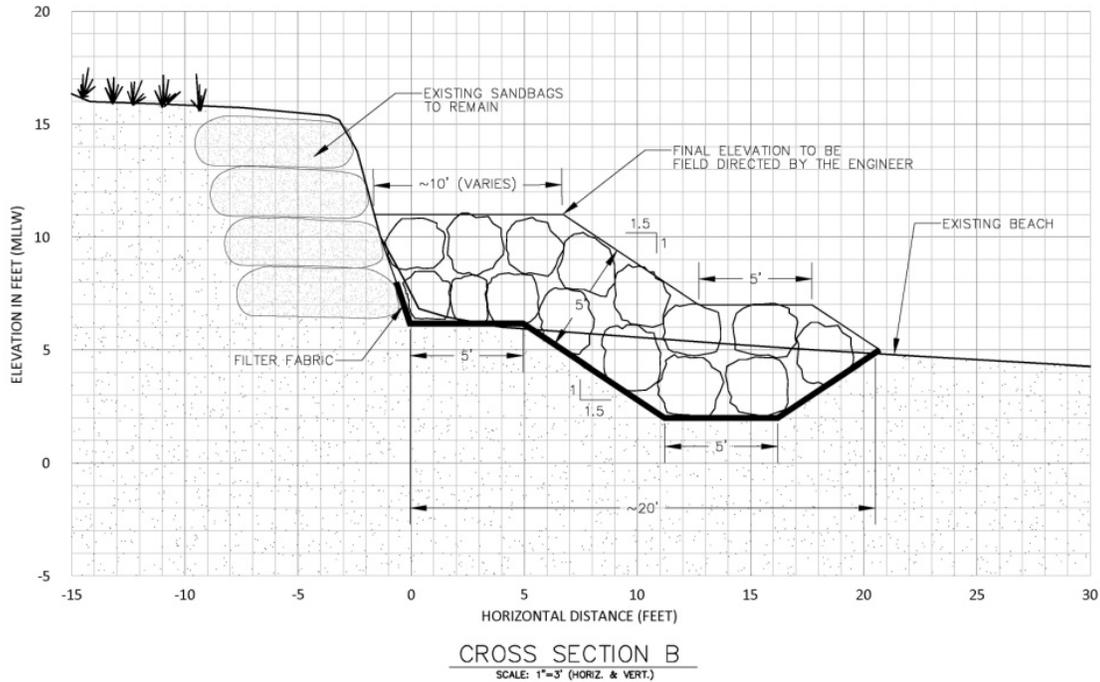
**Figure 3 - 2009 Aerial Photo (California Coastal Records Project, 2009)**

### **3. EMERGENCY REVETMENT**

High erosion rates during the 2009-2010 winter season and widespread failure of then existing temporary emergency sandbag revetments necessitated permitting and construction of a temporary emergency rock revetment by the TPOA. This revetment was considered the minimum action necessary and the least environmentally damaging alternative to implement the interim shore protection required to halt the critical erosion and protect residential structures and septic systems. Specific elements of the temporary rock revetment included:

- Filter fabric to eliminate loss of dune material through voids in the stone matrix;
- Reduced armor size (1/2 to 2 ton) stone to allow for faster construction;
- Shallow toe elevation for improved constructability.

Figure 4 below shows a typical design cross section for the emergency revetment.



**Figure 4 – Typical Revetment Design Cross Section**

In total, approximately 77,000 tons of rock were placed along Broad Beach in front of homes located between 30760 and 31346 Broad Beach Road. The rock, each piece weighing between  $\frac{1}{2}$  and 2 tons, was placed on top of a filter fabric layer and reaches an average elevation of +13 feet mean lower low water (MLLW). In accordance with permits issued by the California Coastal Commission (CCC) and City of Malibu, homes between 31302 and 31346 Broad Beach Road received a more robust rock revetment design and larger rock (up to 4 tons per rock). The project also involved redesigning the two current public access ways to include stairways over the revetment and onto the beach to provide continued and enhanced vertical public access to the shore. Construction of the revetment began on February 17th 2010 and ended on or about April 15th 2010. Complications associated with construction of the western access stairway has resulted in its construction ending in early December 2010.

It should be noted that the property owner at 30822 Broad Beach Rd opted not to participate in the revetment project and so a break in the continuity of the revetment occurs in front of this property. Drawings 3-a and 3-b in Appendix A, Preliminary Plan Set, depict graphically the final footprint of the revetment as measured on November 10<sup>th</sup> 2010. The western portion of the revetment is represented by the green outline in drawing 3-a while the eastern portion is shown in drawing 3-b.

## **Emergency Revetment Permits**

Permits required for the construction of the emergency revetment are as follows:

### **City of Malibu**

Coastal Development Permit No. 09-021

Engineering Permit No. 10-002

### **California Coastal Commission**

Coastal Development Permit No. 4-10-003-G

### **U.S. Army Corps of Engineers**

Sections 10 and 404 Permit File # 10-003 No. 2009-00979-PHT

### **Regional Water Quality Control Board (LA Region)**

Section 401C Water Quality Certification No. 2009-00979-PHT

### **Los Angeles County**

Dept. of Beaches and Harbors Permit No. RE-043-09

Dept. of Beaches and Harbors Permit No. RE-029-10

### **State Lands Commission**

Lease of State Lands

### **Caltrans**

Encroachment Permit No. 710-6TK-0146

## **4. LONG TERM PROJECT APPROACH**

Under Coastal Development Permit No. 09-021 issued by the City of Malibu for the emergency revetment, Condition 2 states that a follow-up permit for the rock revetment must be submitted. The longer term project now incorporates that emergency revetment into its design and so this permit application seeks approval to have the emergency revetment become a permanent and integral part of the longer term shore restoration effort.

The TPOA Broad Beach Restoration Strategy constitutes a holistic approach including enhanced beach access for the public, protection of private property for the homeowners and restoration of valuable dune habitat. This approach, which

must be built on property owner, community, stakeholder and regulatory agency consensus, aims to solve the beach erosion problem for today and into the future. Components of the approach are: 1) sand nourishment, 2) appropriate shoreline protection (rock revetment), and 3) dune restoration.

### **1. Sand Nourishment**

The primary element of the shoreline protection and enhanced public access would be through an ongoing beach nourishment project. Beach nourishment serves as a primary element of the Broad Beach Restoration strategy. The TPOA seeks to restore Broad Beach with significant "dry" sand between the dune system and the shoreline.

The TPOA and its consultant Moffatt & Nichol has focused a significant amount of its recent Broad Beach work on the sediment transport characteristics of the Broad Beach area and surrounding region, to understand the scope and scale of a beach nourishment project that could meet the long term goals of the project at a definable cost. These efforts have included detailed analyses of beach profiles and surveys, wave data and historic shoreline positions. An extensive collection of ortho-rectified aerial photographs have been acquired, digitized and analyzed to develop an extremely valuable data set of historic mean high tide line positions from 1946 until the present. These data combined with historic wave data and modeling of longshore sediment transport have allowed the TPOA to estimate the most probable range of sand loss rates for the Broad Beach area. This information is being directly applied to the design of an ongoing beach nourishment project.

Research findings show that the sand loss rate in the Broad Beach area can reach 60,000 cubic yards per year. In addition to the natural shore protection benefit afforded by a widened beach, the general public would also directly benefit through enhanced and unprecedented access and related recreational opportunities.

The City of Malibu and the public will garner significant benefits from the proposed beach nourishment project. Without implementation of the proposed restoration strategy, the shoreline is expected to continue to erode. Our investigation of historic shoreline erosion patterns indicates that beach losses may be progressing downdrift toward Zuma Beach and beyond.

### **2. Revetment**

As part of the long term strategy for protection of private property, the emergency revetment placed in 2010 will be buried in the landward edge of the widened,

nourished beach. This shore protection would remain buried unless severe beach erosion or other conditions preclude maintaining sufficient beach width for protection. The revetment would serve as a last line of defense against future severe erosion during extreme storm events.

### **3. Dune Restoration**

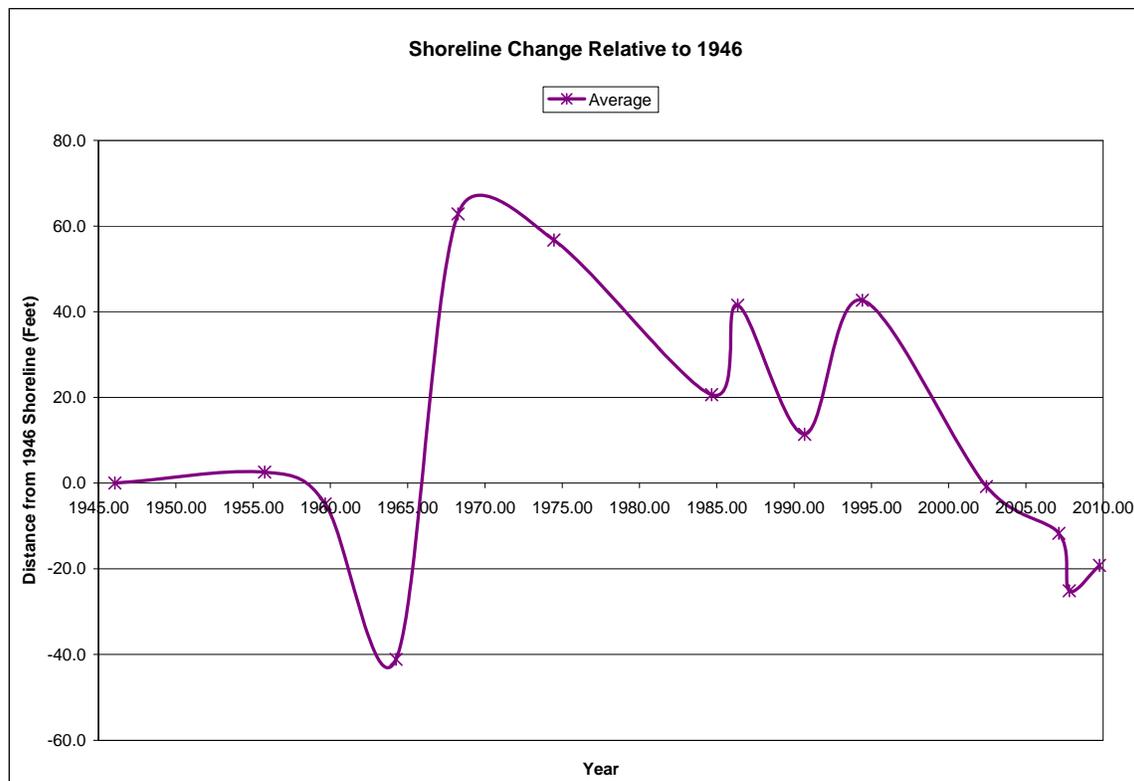
The restoration project also intends to protect and enhance the existing coastal dune system. Benefits include restoration of this important habitat with a reservoir of sand in the case of severe future erosion.

Figure 5 below shows in cross section how the restored beach and dune system would look. Drawing 8 in the accompanying plan set in Appendix A represents the vision of a post-restoration Broad Beach in plan view.

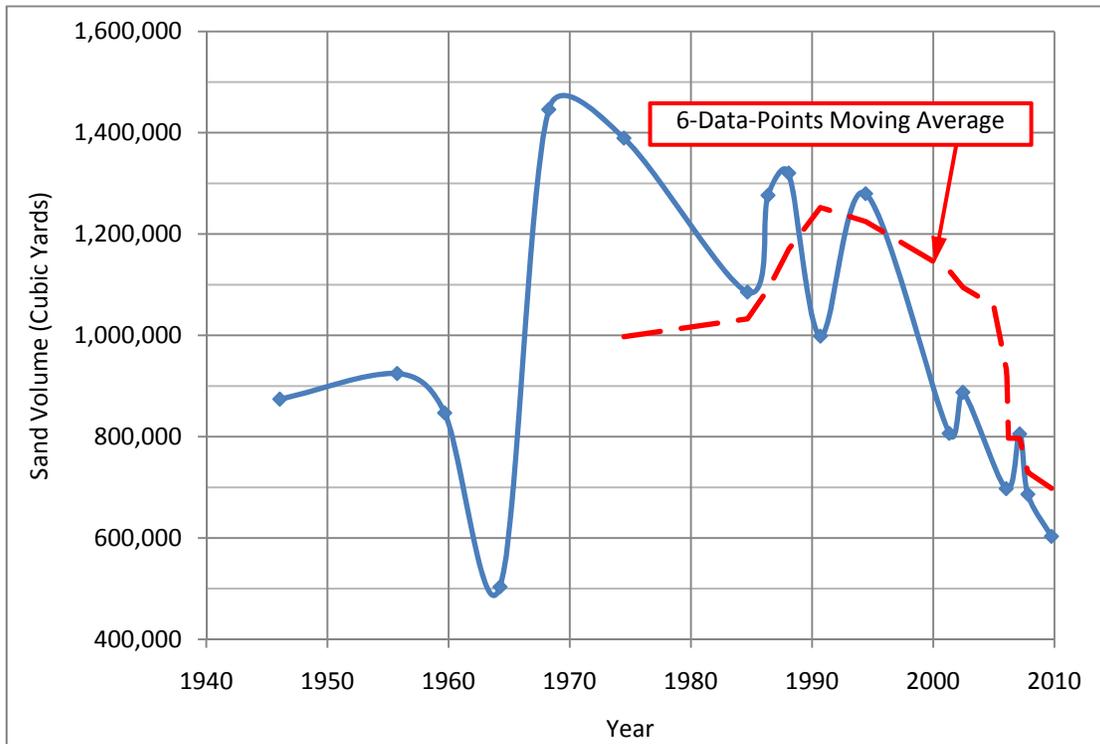
**Figure 5 – Cross Section of Final Beach and Dune Restoration**

## Shoreline Change and Sediment Transport Rates

In determining the amount of material required to adequately restore the diminishing shoreline to its general 1970's dimensions, detailed sediment transport rate analysis was conducted based on shoreline position analysis, profile change analysis and known transport rates in the region. A crucial step in estimating sediment transport rates is the application of a relationship between shoreline position and sand volume. In the Broad Beach Restoration Project Phase 1 Report prepared by Moffatt & Nichol in coordination with Everts Coastal (included herewith as Appendix C) the shoreline positions and change rates were converted to volumetric transport rates. Figure 6 below shows the average Broad Beach shoreline change relative to 1946 while Figure 7 shows the volumetric changes for the full 63 year data record.



**Figure 6 - Average Broad Beach Shoreline Change**



**Figure 7 - Volumetric Changes, 1946-2009**

### Project Design

Imported beach quality material will be placed over the existing revetment to create a restored dune. The dune elevation will be approximately +20 ft MLLW at its highest point and will have a crest width of 50 ft. In areas where the constructed dune abuts existing dune on the landward side, it will meet or exceed the elevation of the existing dune thus providing protection for any existing dune habitat. In areas where the constructed dune abuts lower lying non dune private properties, the dune will slope landward for 10 to 20 feet in a 3:1 slope (ratio of horizontal: vertical dimensions). On the seaward side of the dune, the slope will also be 3:1 and will extend for between 16 and 20 ft. The seaward dune slope will meet the design beach height of approximately from 12 to 14 ft MLLW. The new beach will measure 100 ft in width and will slope seaward for approximately 70 ft at a 5:1 slope.

It is estimated that the total project area footprint incorporating beachfill, dune material and dune buffer will cover 1,821,000 ft<sup>2</sup>.

Based on the aforementioned shoreline position and sediment transport analysis, it is estimated that a total of 600,000 cy is the anticipated amount of beach material required for this restoration project. This volume of material will meet the

design beach width of 100 feet as well as the restored dune height of +20 feet MLLW and width of 50 feet. The anticipated project footprint in plan view is provided in drawings 1-a and 1-b while a typical cross section view is provided as drawing 2 in the accompanying Preliminary Plan Set enclosed herewith as Appendix A.

### Permits Required for Long Term Project

The following permits are required for the construction of the long term shore and dune restoration project

**Table 1 – Permits Required for Long Term Project**

Level of Government	Permit Name	Issuing Agency
Local	Coastal Development Permit	City of Malibu
Regional	Section 401C Water Quality Certification	Regional Water Quality Control Board (LA Region)
State	Lease of State Lands	State Lands Commission
	Coastal Development Permit	California Coastal Commission
Federal	Sections 10 and 404 Permit	U.S. Army Corps of Engineers

The County of Los Angeles may also need to issue a Department of Beaches and Harbors permit and Caltrans an Encroachment Permit as were required for the emergency revetment project. It is the intention of TPOA and their agents to work closely with the agencies in order to ensure the permitting process unfolds in a timely and effective manner.

## 4. ALTERNATIVES

An initial planning study was conducted to determine the basic physical parameters for the site and to develop a clear basis of design that will help direct the project development and entitlement effort. Project alternatives were developed at a concept-level to estimate costs and benefits, and to provide a basis for the project entitlement and environmental review process.

Shoreline management options considered as part of the overall restoration strategy include:

- Managed retreat, wherein residential structures and other facilities that are damaged or endangered by continuing erosion are relocated or abandoned;
- Construct a structure, such as a seawall or revetment, to limit the continuing damage or threat of damage; or
- Initiate a program of periodic beach nourishment to provide the desired level of protection, perhaps in conjunction with dune habitat restoration and hard structures either onshore or offshore. Any nourishment activities at Broad Beach would also benefit Zuma Beach and shorelines further east, at no cost to the public.

The results of a preliminary screening analysis identified three alternatives as viable candidates for the long term restoration of Broad Beach:

*Alternative 1 - Beach Nourishment and Dune Restoration with Buried Temporary Revetment*

This alternative will form the primary focus of the analysis moving forward based on the fact that the emergency revetment has already been permitted (on an emergency basis) and placed.

*Alternative 2 – Beach Nourishment and Dune Restoration with Buried Long-Term Revetment*

The emergency revetment that was constructed this past winter was designed with the intent that it could be augmented in the future with one or two outer layers of properly sized armor stone. While it is acknowledged that the revetment is intended to remain buried within the maintained beach nourishment, there may be occasions in the future when a major

storm or series of storms hit at a time when there is sufficient surplus of sand on the beach to protect property.

*Alternative 3 – Alternative 1 or Alternative 2 Augmented with Sand Retention Reefs*

This alternative will continue to be analyzed in an effort to reduce future beach nourishment requirements, enhance the nearshore environment and provide improved surfing conditions. It will be considered as a stand-alone project that could be added on to any of the other beach nourishment alternatives. It is widely held that this option would require extensive studies and a very compelling argument to be permitted.

More detail is provided on project alternatives in the accompanying Phase 1 Report attached to this application as Appendix C.

## **5. SAND SOURCE INVESTIGATION**

Two main types of sand sources exist - one from the offshore ocean, and the other from the upland. Typically offshore ocean sand sources can provide high quality marine sand at a relatively low overall cost, with minimal environmental impact. Upland sediment sources can also provide sandy beach compatible material, which may be more immediately available than offshore sand, but which may also lead to increased impacts and costs from trucking. Upland sand is typically found behind dams, at quarries, at flood control sites in rivers and detention basins, and at certain alluvial deposits.

A sand source investigation has been initiated to identify viable sources of sand for beach nourishment, followed by the appropriate sampling and testing programs to verify acceptability and compatibility. The investigation identified the sources to be analyzed further to confirm their candidacy. The results of a preliminary investigation based on existing data and studies were compiled into a report completed in June 2010 and titled the Sand Source Investigation Report. This report is included herewith as Appendix D.

The initial sand source investigation has identified a number of offshore sites which may yield material compatible with Broad Beach material. Permitting to collect samples of this material is currently in process and is expected to be completed by early 2011. Drawings 6 and 7 in the accompanying plan set in Appendix A show existing and candidate offshore sand source sites.

## 6. CONSTRUCTION METHODS / DESIGN FEATURES TO AVOID IMPACTS

It is anticipated that the majority of the material required for beach and dune restoration will come from offshore sources and will be pumped directly onto the beach. This will greatly limit the amount of material to be trucked in. It is possible that the only material to be brought to the beach via truck will be inland material deemed suitable for capping dune habitat and it would roughly amount to less than 50,000 cubic yards.

This section is intended to provide a clear understanding of how sand would be dredged, delivered to the receiver site, and then manipulated to be suitable for public use. It also identifies the design features/specific methods to be incorporated into final design or the contractor's specifications to avoid significant impacts and minimize potential adverse impacts.

Construction would consist of:

1. Dredging the offshore borrow sites with either a hopper dredge or cutterhead suction dredge
2. Transporting the sand via hopper to Broad Beach which would connect with floating/submerged discharge lines outletting on the beach (use of booster pumps as necessary)
3. Discharging the sand at Broad Beach within training dikes
4. Redistributing the sand as needed with earthmoving equipment, such as scrapers, and grading the beach fills to required dimensions with bulldozers.

### Dredging Operations

Beach replenishment operations would include the use of dredge vessels, which would dredge sediment from the offshore borrow sites and transfer the sediment to the proposed receiver site. The contractor may use one of two types of dredge vessels, a hopper dredge or a cutterhead suction dredge; both are described below. Regardless of the dredge type, the U.S. Coast Guard would post a *Notice*

*to Mariners* with the coordinates of dredging activity so that ocean users can avoid the activity.

For both dredge vessels, discharge lines would have to be placed in the ocean. Some portions of these lines would be floating. The floating portion of the dredge discharge line would be marked and lighted for navigation safety and a *Notice to Mariners* would be issued through the U.S. Coast Guard. The discharge line would be trucked or floated in segments to the appropriate placement locations and assembled using cranes and other equipment. The line may be a combination of plastic high density polyethylene (HDPE) and steel materials, depending on need and availability, and would be approximately 30 inches in diameter.

### **Hopper Dredge**

The hopper dredge is a self-contained vessel that loads sediment from an offshore borrow site, then moves to a receiver site for sand placement. The hopper dredge contains two large arms that have the ability to drag along the ocean floor and collect sediment. The drag heads are about 10 feet square. The hopper dredge moves along the ocean surface with its arms extended, making passes back and forth until its hull is fully loaded with sediment. The vessel can hold approximately 2,000 to 5,000 cy of sediment per load.

The hopper dredge can be located just offshore of each site, as it can generally reach within approximately 0.5 mile of shore to offload. No booster pumps are needed as the hopper dredge connects to a floating or submerged pump line from shore. The vessel then pumps a slurry of sediment and sea water onto the receiver site. Submerged lines are encased by several large tractor tires to minimize abrasion of the ocean floor or reefs.

The hopper dredge can also connect to a floating platform called a mono buoy, which is used to interconnect the floating pump line with a steel sinker pipeline that would run the rest of the distance to the beach. The mono buoy is generally anchored to the seabed at an appropriate depth and location to serve the project needs, depending on locations of sensitive resources and engineering considerations. For this project, the mono buoy would be anchored in at least 25 feet of water. The permit would include conditions to avoid sensitive resources such as kelp, reefs, and structures such as outfalls. An anchor plan would be prepared for each mono buoy for submittal to the resource agencies prior to

construction that illustrates the relationship between anchors on the ocean floor and identifying any sensitive resources in the vicinity.

### **Cutterhead Suction Dredge**

A cutterhead suction dredge is similar to a hopper dredge in that it uses a long arm that extends down to the sea floor to dredge sediment. A rotating head about 8 feet in diameter sweeps an area approximately 300 feet wide. However, a cutterhead dredge breaks up sediment material along the seafloor, then uses a vacuum mechanism to suck sediment into an intake line and pump it directly to shore through a discharge line. The cutterhead dredge anchors above a borrow site while its arm swings back and forth to dredge up sediment. It then pumps a mixture of sediment and sea water through a floating discharge line directly onto the receiver site. The discharge line would either be assembled afloat, connected to the cutterhead suction dredge, and pulled to land by tugboats, or assembled on land and dragged offshore to the dredge by tugboat. Unlike the hopper dredge, the cutterhead dredge remains at the dredge site for the entire operation while pipelines carry the material.

Booster pumps would be required approximately every four miles if a cutterhead suction dredge is used. Discharge pipes would either be floating in the ocean or onshore along the beach. The exact locations of pumps are not known at this time.

For all pipeline delivery routes, the floating and submerged portions of the dredge discharge line would be routed to avoid sensitive resources to the maximum extent feasible. Assuming use of a cutterhead suction dredge, the discharge line would require management and maintenance activities during the construction period. After replenishment was complete, all pipelines would be removed.

The dredge discharge line would either be floating or placed on the beach. During the operation, floating pipeline segments would be subject to weather and wave conditions. If substantial wave action is anticipated, any floating pipe would be temporarily dismantled until suitable wave conditions returned. The pipeline could then be temporarily staged along the beach and reconstructed once wave conditions allow. Coordination with the U.S. Coast Guard, as described above, would be a critical component of floating pipeline placement.

Onshore pipeline segments would be placed along the toe of the revetment. The discharge line would be placed on top of the existing sand or cobbles and be buried at intervals to provide for pipe anchoring and for beach access to the public. Areas of active construction, i.e., where sand is being emitted from the pipe and redistributed by earthmoving equipment, would be cordoned off from the public with signs. Construction crews would also be on-site to monitor the construction site to prohibit public access. All other areas of the discharge line would be open to public use.

Maintenance of the discharge line would occur as necessary. The line may be affected by waves and tides and may periodically require added support, protection, or relocation. Earthmoving equipment and cranes may be used to maintain onshore portions of pipeline. More frequent line maintenance may be required for the onshore line at the Broad Beach as little room exists for line placement and protection at this site. The line may be more exposed to waves and may be affected during high tides or waves. If floating, the line would be subject to weather, and would need to be taken down two to three days prior to a predicted weather event. While this is time-intensive process, the intent of maintenance is to provide safety and security for these temporary features.

### **Training Dikes**

Training dikes would be constructed to reduce turbidity and aid in the retention of pumped sand at receiving beaches. The material coming from the dredge material discharge pipeline is a slurry mix of sand and water. Once the water flows back to the ocean, the heavier sand settles onto the beach. The training dike system consist of two dikes—one that is perpendicular to the beach connected to one that is parallel to the beach, forming an “L” with the long end parallel to shore. The dikes would be constructed using two bulldozers. Sand would be placed at a single discharge point behind (i.e., landward of) the dikes. The dikes would be used to direct the flow of the discharge and slow the velocity of the slurry effluent, thereby allowing more sediment to settle onto the beach instead of remaining in suspension and being transported back into the surfzone. Given how little sand currently exists at the Broad Beach site, an initial quantity of sand would be discharged on the highest portion of the beach at low tide for use in building the dikes.

### **Beach Building**

Beaches would be formed by deposition of sand from the dredge discharge line within the training dikes. Sand would be graded and spread along the beach to the dimensions of the beach fill plan using two bulldozers. One crane may be used to progressively move the discharge pipeline along the beach as the fill is placed and the beach fill is lengthened. Sand placement around storm drain outlets would be designed to allow proper drainage.

### **Dune Building**

The project length dune would most probably be formed by deposition of sand from the dredge discharge line within a raised and diked containment system. Sand would be graded and spread along the dune to the dimensions of the dune fill plan using smaller bulldozers. One crane may be used to progressively move the discharge pipeline along the dune as the fill is placed and the dune is lengthened. Sand placement around storm drain outlets would be designed to allow proper drainage.

### **Drainage.**

It is understood that a number of public drains owned by the City of Malibu and a to-be-determined number of private (stormwater) drains are currently daylighting onto Broad Beach. The location of these drains will be mapped and final project design will incorporate a solution to ensure that any remaining drainage pipes can continue to function post construction.

### **Projected Project Maintenance**

Given that the sand loss rate in the Broad Beach area is exceptionally high, on the order of up to 60,000 cubic yards per year, it is anticipated that this shore beach and dune restoration project will require maintenance into the future. Such maintenance would take the form of placing more high quality beach compatible material on the project site approximately every decade or possibly more frequently.

### **Construction Phasing / Schedule**

The potential start date for construction is fall of 2012 and is anticipated to take a total of 3 months. A permit duration of 5 years is requested.

### **Other Projects in the Area**

At this time it is thought that no other beach sited projects are scheduled to occur in the Broad Beach area.

### **IMPACT AVOIDANCE / MINIMIZATION**

During construction, impacts to waters of the U.S. will be minimized by use of appropriate BMPs such as limiting the overfilling of the dredge to reduce turbidity from spillage, restricting dredging and disposal near sensitive habitats and conducting water quality monitoring to assess turbidity levels. Ensuring the material on the beach is placed behind a sand berm will allow settlement of sediment before excess water is drained off and hence curtail turbidity.

**APPENDIX A****PRELIMINARY PLAN SET**

- Drawing 1-a: Project Plan View – Beach Nourishment and Dune Restoration with buried Long-Term Revetment - Western Portion**
- Drawing 1-b: Project Plan View – Beach Nourishment and Dune Restoration with buried Long-Term Revetment - Eastern Portion**
- Drawing 2: Cross Section View – Beach Nourishment and Dune Restoration with buried Long-Term Revetment**
- Drawing 3-a: Project Plan View – As-Built Revetment in Green - Western Portion DRAFT**
- Drawing 3-b: Project Plan View – As-Built Revetment in Green - Eastern Portion DRAFT**
- Drawing 4: Cross Section – As-Built Revetment Profiles**
- Drawing 5-a El Nino MHTL’s and Septic Systems As Surveyed Pre Construction– Western Portion**
- Drawing 5-b El Nino MHTL’s and Septic Systems As Surveyed Pre-Construction– Central Portion**
- Drawing 5-c: El Nino MHTL’s and Septic Systems As Surveyed Pre-Construction– Eastern Portion**
- Drawing 6: Sand Source Locations**
- Drawing 7: Candidate Offshore Sand Sources**
- Drawing 8: A Vision of a Post Restoration Broad Beach**

**APPENDIX B**

**BIOLOGICAL ASSESSMENT / CEQA DOCUMENT**

**TO BE PROVIDED**

**APPENDIX C**

**BROAD BEACH RESTORATION PROJECT**

**PHASE 1 REPORT – APRIL, 2010**

**PREPARED BY  
MOFFATT & NICHOL  
IN COORDINATION WITH  
EVERTS COASTAL**

**APPENDIX D**

**SAND SOURCE INVESTIGATION REPORT**

**JUNE, 2010**

**APPENDIX E**

**SEDIMENT GRAIN SIZE EVALUATION  
OF POTENTIAL RECEIVER SITES**

**TO BE PROVIDED**

**APPENDIX F**

**PROJECT MONITORING PLAN**

**TO BE PROVIDED**

**APPENDIX G**

**ADDRESSES OF ADJOINING PROPERTIES AND RADIUS MAP  
(CERTIFIED)**

**TO BE PROVIDED**

**APPENDIX H**

**PROPERTY OWNERSHIP DATA**