Orange County Coastal Regional Sediment Management Plan

Prepared for
U.S. Army Corps of Engineers
County of Orange
California Coastal Sediment Management Workgroup

Prepared by
Everest International Consultants, Inc.
In Association with
Science Applications International Corporation
Dr. Philip King

EVEREST

June, 2013

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EXECUTIVE SUMMARY

Purpose

The Orange County Coastal Regional Sediment Management Plan (Plan) was created to provide sufficient information for decision makers to develop policies and/or execute management sub-plans to restore and preserve the future vitality of Orange County beaches and coastal areas. Specifically, the Plan includes a comprehensive approach for the conservation, restoration, and preservation of the valuable sediment resources throughout the coastal watersheds and along the coast of Orange County. Plan goals include: reducing shoreline erosion and coastal storm damages; providing for environmental restoration and protection; increasing natural sediment supply to the coast; restoring and preserving beaches; maintaining or improving coastal access; improving water quality along coastal beaches, and; optimizing the beneficial use of material dredged or excavated from ports, harbors, wetlands, and other opportunistic sediment sources.

Regional Sediment Management

Humans have substantially altered natural sediment transport processes within California's coastal watersheds and sedimentsheds, reducing storm protection, habitat, and recreation potential. These process changes are shown within one schematic sedimentshed in Figure ES.1. Dams, built to control floods and store water, trap sediment in reservoirs and prevent sediment from moving downstream. Sand and gravel are mined from streams for use in construction. Legacy timbering, grading, and earth moving strip off vegetation and expose the sedimentsheds to excessive erosion. Construction of channels, roads, and buildings has been known to both reduce and increase erosion. Hardening of the watershed reduces the amount of erodible area, but increases stormflow runoff by limiting infiltration. These higher flows can lead to streambank downcutting, eroding banks, and filling of silt basins. Overall, these mechanisms lead to decreases in the amount of coarse sediment delivered to the beaches via streams. Some coastal structures such as harbors, jetties, groins, and breakwaters alter movement of sediment along the shoreline while other coastal structures such as riprap and seawalls can reduce the amount of sediment supplied directly to the shoreline through the reduction of bluff and cliff erosion.

Human modifications to the coastal sedimentsheds of California have resulted in a host of sediment-related problems. For example, beaches are undergoing accelerated erosion, reducing recreational opportunities and contributing to habitat loss, while increasing the probability of coastal storm damage. In addition, coastal wetlands and lagoons are experiencing accelerated sedimentation. Sand dredged from harbor channels is, in many instances, placed at locations that do not optimize the coastal beneficial use of the material.

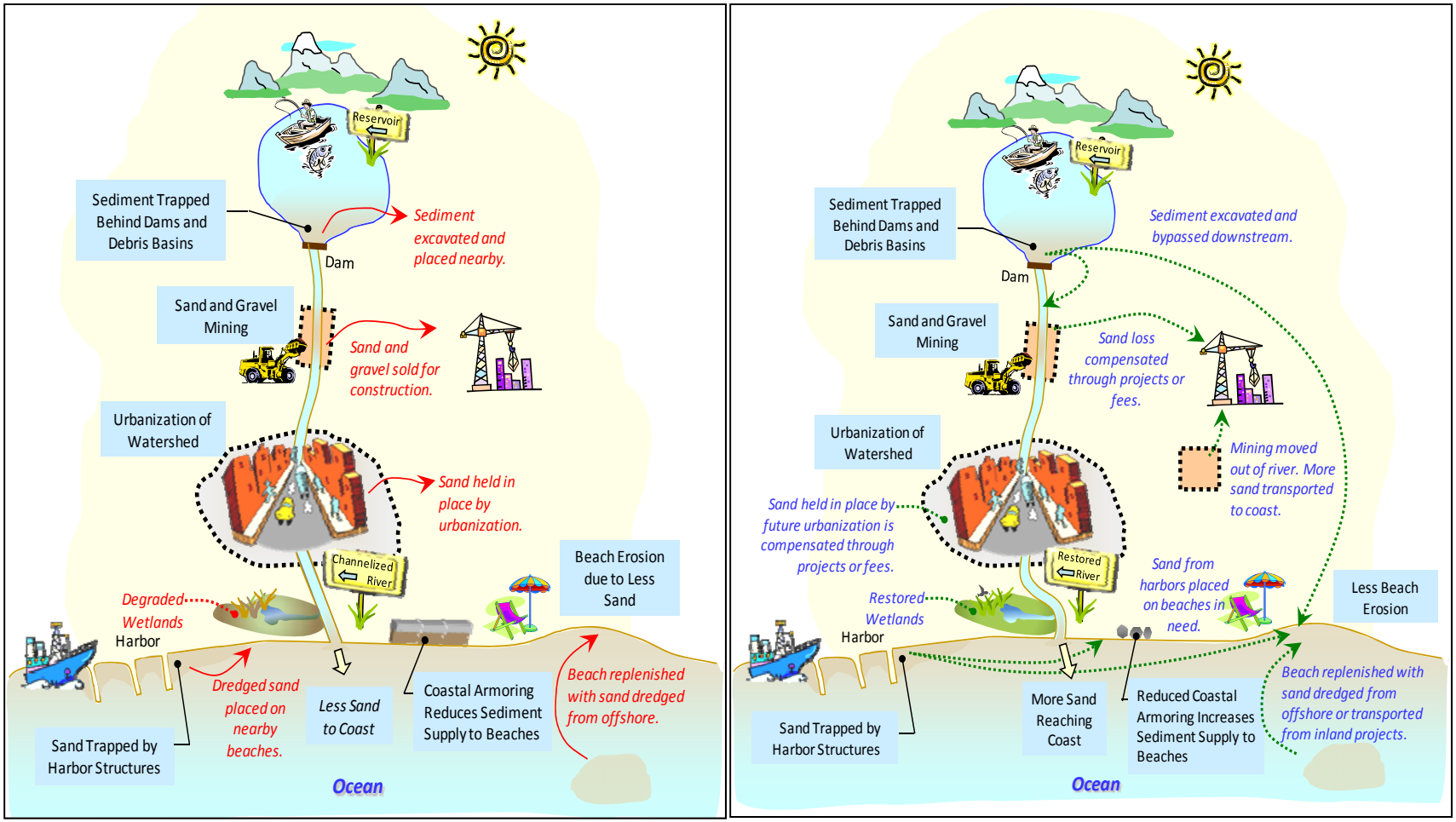


Figure ES.1 Schematics of Existing Sediment Management (left) and Coastal RSM (right)

Many of these issues are exacerbated by climatic and sea level changes associated with global warming.

Many of the problems caused by human modifications to the sedimentsheds can be solved and/or addressed through implementation of Regional Sediment Management (RSM) as represented in Figure ES.1 (Everest, 2007). These strategies include:

- Sediment can be bypassed around upstream dams and blockages and be transported either immediately downstream of the dam or directly to the coast;
- Sand and gravel mining activities can be moved away from river beds to prevent sand loss in river beds. For sand loss due to sand and gravel mining in the river, the loss can be compensated through restoration projects or mitigation fees;
- Sand loss associated with future urbanization can also be compensated through projects or fees;
- Sand dredged from harbor channels can be placed at locations that optimize the beneficial use of the material;
- Beach erosion can be reduced by restoring natural sedimentshed processes, bypassing sand around harbors, replenishing beaches with sand dredged from offshore or transported to the beach from inland projects, and reducing coastal armoring.

The Process

The California Coastal Sediment Management Workgroup (CSMW), which is co-chaired by the US Army Corps of Engineers (USACE) and the California Natural Resources Agency worked in partnership with the County of Orange to develop this Plan. This Plan is one component of a larger statewide effort called the California Coastal Sediment Master Plan (USACE, 2005a; California CSMW, 2006; California CSMW, 2009; California CSMW, 2012). Key to development of the Plan was stakeholder input from local and regional agencies, non government organizations, elected officials, the scientific community, and various groups within the CSMW and the County of Orange.

Data collection and Plan development were guided through multiple stakeholder meetings. In these meetings, known environmental, economic, physical, and regulatory data were described and new, previously unknown data, were provided to the project team by the stakeholders. Ideas for specific actions and activities that could be incorporated into the Plan were also suggested by stakeholders. Collected information was submitted to the database and pertinent summaries were prepared within Chapters 1 through 3 of the current report. This information was used to inform the stakeholder suggested activities in creation of the Plan.

The Plan

The resulting Plan, which is specific to Orange County beaches and shorelines, includes an array of potential projects with implementation priorities that are useful to stakeholders. This Plan is technically, economically, and environmentally feasible, includes recommendations for financial viability, includes suggestions for possible governance approaches, and includes recommendations on steps for Plan implementation.

The Plan activities, listed in Table ES.1, were prioritized based on a combination of stakeholder interests, perceived needs, recreational benefits, shore protection benefits, funding availability, costs, habitat impacts, regulatory requirements, and permitability. Plan activities were separated into type as follows: plan performance activities designed to improve performance of the Plan; construction projects that can be built and support coastal RSM; and governance and regulation activities to provide the governance structure and improve government regulation to facilitate Plan implementation. Almost all of the Plan activities can begin immediately, some are ongoing, some would have completion dates, some would be continuous, and some would be recurring without end. Plan activities are listed in Table ES.1 and discussed in detail in Chapter 4 of this report.

Table ES.1 Plan Activities

ACTIVITY	PRIORITY	TYPE
Initiate Outreach & Education	High	Plan Performance
Develop a Governance Structure	High	Governance and Regulations
Establish County Staff Position to Implement the Plan	High	Governance and Regulations
San Clemente Shoreline Project	High	Construction
Dana Point Harbor Dredging and Nearby Nourishment	High	Construction
Surfside-Sunset Beach Nourishment Project	High	Construction
Newport Harbor & Bay Dredging & Beach Nourishment	High	Construction
Bolsa Chica Maintenance Dredging and Huntington Cliffs Nourishment	High	Construction
Santa Ana River and Huntington Beach Wetlands Dredging	High	Construction
East Beach, Seal Beach Maintenance	High	Construction
Prado Dam Bypassing to Santa Ana River	High	Construction
Improved Monitoring and Performance Evaluation	High	Plan Performance
Data Gaps and Database	High	Plan Performance
Develop a Pilot SCOUP within Orange County	High	Governance and Regulations
Establish a Dedicated Fund and Process for Implementing Coastal RSM	Medium	Governance and Regulations

Table ES.1 continued

ACTIVITY	PRIORITY	TYPE
High Fines Sediment Nourishment Pilot Study	Medium	Plan Performance
Establish Funding Stream to Accommodate Incremental RSM Costs	Medium	Construction
Sea Level Rise Beach Sustainability Study	Low	Plan Performance
Orange County Dredge Ownership	Low	Construction
Sand Retention Feasibility Study	Low	Plan Performance
Huntington Harbour Dredging with Beach or Nearshore Placement	Low	Construction
Update the Plan	Low	Plan Performance
Update Sediment Budget for Laguna Beach Littoral Cell	Low	Plan Performance
Investigate Methods to Assess and Mitigate for Upstream Sand Mining	Low	Governance and Regulations
Study Large Grain Size Impacts at East Beach, Seal Beach	Low	Plan Performance
Update Sediment Transport Studies for Southern Orange County	Low	Plan Performance

Conclusions

While some beaches in Orange County are wide and healthy, there are many that have chronic erosion problems and even some of the wide beaches are dependent on ongoing nourishment activities. The Plan outlined in the current report addresses coastal maintenance needs through a multi-pronged approach ranging across geographic regions and utilizing many possible methods.

Some of the Plan activities can be carried out through existing institutions and do not require development of a joint powers authority (JPA). Other Plan activities, such as development of a SCOUP for Newport Harbor may be carried out by local agencies. Beyond these small or ongoing projects, an organized effort would likely be required to fully implement the Plan.

The first steps to fully implement the Plan are public outreach and education. This would be directed towards professionals and decision makers informing them what the Plan is and how it should be carried out. From there, collaborative discussions between local agencies would be required before a JPA could be modified or formed. This JPA would have the task of implementing and updating the Plan over the next 50 years. Many of the Plan activities can be carried out separately through various agencies and agendas, however dedicated staff or an agency would have a greater ability to implement the Plan through the many obstacles. The Plan describes and recommends an assortment of activities that should be carried out to fully embrace and implement coastal RSM in Orange County.

1. INTRODUCTION

The beaches of Orange County are among the region's most prized assets, setting the tone of the region and driving much of the economic activity. Besides the beaches, the Orange County coastline features marinas, nearshore and offshore habitats, and other resources that are crucial to the characteristics of the region. Some Orange County beaches are experiencing chronic erosion resulting from anthropogenic disruptions to natural processes. These disruptions take place inland through use of dams and sediment catchment basins as well as along the coast through the introduction of sediment blocking structures and harbors. These disruptions result in narrow beaches, changes to natural habitats, lost recreational opportunities, and coastal flooding of property and infrastructure.

For a greater understanding of these problems that impact not only Orange County, but all of the United States coastlines, a paradigm shift has begun through the concept of Regional Sediment Management (RSM). RSM seeks to restore coastal areas by eliminating or reducing disruptions to natural processes since such disruptions produce sediment imbalances and exacerbate coastal erosion. Through the coordinated effort of federal, state, and regional governmental agencies, a method of applying coastal RSM has begun. The federal and state programs that were initially developed were the *National Regional Sediment Management Demonstration Program* and the *California Coastal Sediment Master Plan*. These efforts laid out a step-wise approach in which physical and/or political regions within California would develop individual coastal RSM Plans which would all be coordinated after completion. The current report is the coastal RSM Plan for the Orange County region. The extent and location of the Orange County region (Plan area) is shown in Figure 1.1.

Figure 1.1 Project Location and Vicinity

1.1 Purpose

The purpose of this report is to develop the Orange County Coastal Regional Sediment Management Plan (Plan), which will provide sufficient information for decision makers to develop policies and/or execute management sub-plans for the future vitality of Orange County beaches and shoreline areas. This Plan benefits from a holistic integration of various elements (as shown in Figure 1.2), including economics, funding, species and habitat considerations, sediment receiver sites, regulations and permitting, construction, and sediment sources, each of which has numerous relations to one another and the Plan. The Plan is not a recipe for individual project implementation, but rather, an initial framework that various government entities can use as a guide for planning and developing more project or program specific activities. The Plan also provides a management framework as the basis for future state and federal grant applications to augment Orange County resources for implementation of beach restoration and maintenance projects as well as other RSM activities.

Figure 1.2 Plan Elements and Linkages

1.2 Objectives

The objectives of this project are presented below:

- Obtain and compile existing data and information that may be relevant to the project, including plans, reports, California Environmental Quality Act (CEQA) and National Environmental Protection Act (NEPA) documents, spatial data and other information.
- Engage stakeholders to obtain input, data, information, and plan formulation ideas; keep the stakeholders informed on the project progress; and seek input from them on the draft Plan. Stakeholders include local and regional agencies, non government organizations, elected officials, the scientific community, and various groups within the U.S. Army Corps of Engineers (USACE), California Coastal Sediment Management Workgroup (CSMW) and the County of Orange.
- Identify key opportunities and constraints of RSM projects in Orange County such as:
    - Areas of critical erosion and sediment deficit;
    - Potential nearshore disposal sites;
    - Potential sediment sources;
    - Sand retention structure opportunities;
    - Economic feasibility;
    - Potential funding streams;
    - Potential beneficial use of sediment opportunities;
    - Critical and sensitive habitat areas; and
    - Permitting requirements.
- Develop a Plan that is:
    - Specific to Orange County beaches and shoreline;
    - Includes an array of potential projects with implementation priorities;
    - Useful to stakeholders
        - Technically, economically, politically and environmentally feasible;
        - Includes recommendations for financial viability;
        - Includes recommendation to implement the Plan; and
        - Includes suggestions for possible governance approaches.

1.3 Relationship to Other Plans

The Plan is one component of a larger group of national and state RSM programs and plans and is supported by other master plans and management plans as described below.

1.3.1 National RSM Demonstration Program

The National RSM Demonstration Program is headed by USACE. USACE has a unique role in the implementation of RSM. The mission areas of USACE generally include navigation, environmental restoration, coastal storm damage reduction, and flood reduction. In particular, the mission area of ensuring the navigability of our Nation's waterways involves removing, transporting, and placing sediment, and in some cases providing material that is utilized to support the other mission areas. In planning, designing, and executing RSM, USACE works towards consensus with state and local partners.

In 1994, the Coastal Engineer Research Board was tasked with developing future directions that USACE should take. Task forces and working groups were formed, and by 1998 the concept of RSM was fully developed. The Mobile District of USACE was the first district to step forward with a RSM demonstration plan that received Congressional support in 1999. Separately, the grassroots movement for RSM grew with USACE districts pursuing RSM initiatives with state and local partnerships. In late 2000, the National RSM Demonstration Program expanded to include five additional sites in the United States, with Orange County being within the South Pacific Division demonstration site.

USACE's National RSM Demonstration Program was started largely through the Coastal Engineer Research Board initiative together with strong United States Congressional support from several coastal and Great Lakes states.

The goals of the National RSM Demonstration Program are as follows:

- To improve sediment management practice within USACE.
- To highlight and document unique elements of RSM and provide guidance for future implementation of specific RSM actions as appropriate.
- To foster state and local partnerships for RSM, resulting in a unified vision, cost sharing, and co-leadership of RSM actions.
- To engage cross-mission objectives of USACE. (e.g., achieve storm protection, navigation, and environmental restoration all in one project.)
- To define environmental and economic benefits for RSM.
- To improve decision support technology for RSM.

The intent of the National RSM Demonstration Program within USACE is to improve the management of coastal sediment resources, with consideration of the sedimentshed (from the riverheads, through the estuaries, and into the coasts). The program has been designed to accomplish this goal by minimizing the interruption of natural sediment transport processes or by enhancing these processes to maximize environmental and economic benefits. Implementation of RSM, both from the grassroots level prior to implementation of the national

program, and during the National RSM Demonstration Program has resulted in partnerships among USACE, state, local, and other federal offices, some of which are cost-sharing RSM projects. The intended result of state and USACE RSM initiatives is improved methods for managing sediment within our nation's waterways, with advances in conceptual, analytical, and numerical models, field measurement techniques, and implementation within Geographic Information System (GIS) frameworks to support regional studies.

1.3.2 California Coastal Sediment Management Workgroup

The CSMW is a collaborative effort by federal, state, and local agencies and non-governmental organizations working to address California's coastal sediment management needs on a regional and system-wide basis. CSMW was formed to help resolve the fact that site-specific solutions to coastal erosion/sedimentation problems historically did not examine regional contributions to the problem, hence the need for RSM. One of CSMW's main goals is to pursue innovative ways to solve coastal erosion problems along the California coast, often through beneficial use of sediment (i.e., sand) to fortify eroding beaches. State membership includes the California Natural Resources Agency, California Department of Boating and Waterways (CDBW), California Department of Parks and Recreation, California Coastal Commission (CCC), California Geological Survey, San Francisco Bay Conservation and Development Commission(BCDC), California State Coastal Conservancy (SCC), California Department of Fish and Game (CDFG), California State Water Resources Control Board (SWRCB) and the California State Lands Commission (CSLC). Federal membership includes USACE, U.S. Geological Survey (USGS), and the U.S. Environmental Protection Agency (USEPA). Non-governmental organization membership includes the California Coastal Coalition and the California Marine Affairs and Navigation Conference. The California Natural Resources Agency and USACE jointly chair the taskforce.

1.3.3 California Coastal Sediment Master Plan

State and federal agencies are now looking for an efficient blend of scientific techniques and public policies to facilitate regional inter-agency cooperative initiatives to protect, enhance and restore California's important coastal resources through a system-wide sediment management approach. In order to support these needs and facilitate implementation of RSM throughout the entire California coast, CDBW and USACE, with oversight by CSMW, have embarked on a multi-year effort to compile a California Coastal Sediment Master Plan (CSMP) (California CSMW 2006, California CSMW 2009, California CSMW 2012).

Goals of the California CSMP are to prioritize sediment management needs, streamline the permitting process, make information widely available, connect managers of areas of sediment deficit and those with excess sediment, and facilitate implementation of sediment projects. The California CSMP takes a watershed-based approach at a regional scale to formulate courses of action or strategies to solve coastal resources problems. The planning effort includes

collaboration among multiple parties, emphasis on leveraging partners' resources, sharing of information, and development of a common database.

Coastal RSM Plans

The Plan outlined in the current document is one of many coastal RSM plans that have been or are being developed as part of the California CSMP. These coastal RSM plans are being developed by formulating and seeding regional consensus-driven sediment management policy and guidance to restore and maintain coastal beaches and other critical areas of sediment deficit; reduce the proliferation of protective shoreline structures; sustain recreation and tourism; enhance public safety and access; and restore coastal sandy habitats.

Coastal RSM plans have been developed for Southern Monterey Bay, Santa Barbara/Ventura Counties, and San Diego County (PWA 2008, BEACON, 2009, Moffatt & Nichol, 2009a). These areas are marked by red boxes in Figure 1.3. Other coastal RSM plans are in progress as shown in the green stars in Figure 1.3. Some lessons learned from completed coastal RSM plans and their attempted implementation include:

- Have stakeholders identify sediment issues of concern at early stages and provide thoughts on possible solutions;
- Focus on the majority of issues that stakeholders agree on rather than the less common issues of contention;
- It is important to emphasize soft solutions;
- Implement opportunistic beach fill programs to contribute as much as possible to the region each year, and maximize what is allowable under each program;
- Continue maintenance dredging operations, such as at lagoons, and consider proportional placement to maximize benefits over space and time;
- Continue ongoing large projects periodically to offset remaining sediment losses, and help meet the balance of what is needed regionally;
- Consider sediment management devices when appropriate, such as artificial submerged reefs, which could reduce the volume needed for replenishment;
- Involve all local jurisdictions at the beginning of the process;
- Having an easily readable coastal RSM plan is important to getting buy-in from public and local managers and politicians;
- Effective coastal RSM plan implementation requires memorandums of understanding (MOUs) or other agreements covering the entire littoral cell, regional permits, funding, and project assistance;
- Incorporate the coastal RSM plan into Local Coastal Plans and General Plans;

- Identify appropriate members for a stakeholder advisory group and encourage them to participate from the beginning of Plan formulation;
- Funding of incremental construction, transportation, or placement costs is critical for successful RSM application;
- Indentify viable sources of beach quality sediment for use in RSM; and
- Effective Plan implementation will require a dedicated staff person to pursue funding, regional permits, and agency coordination.

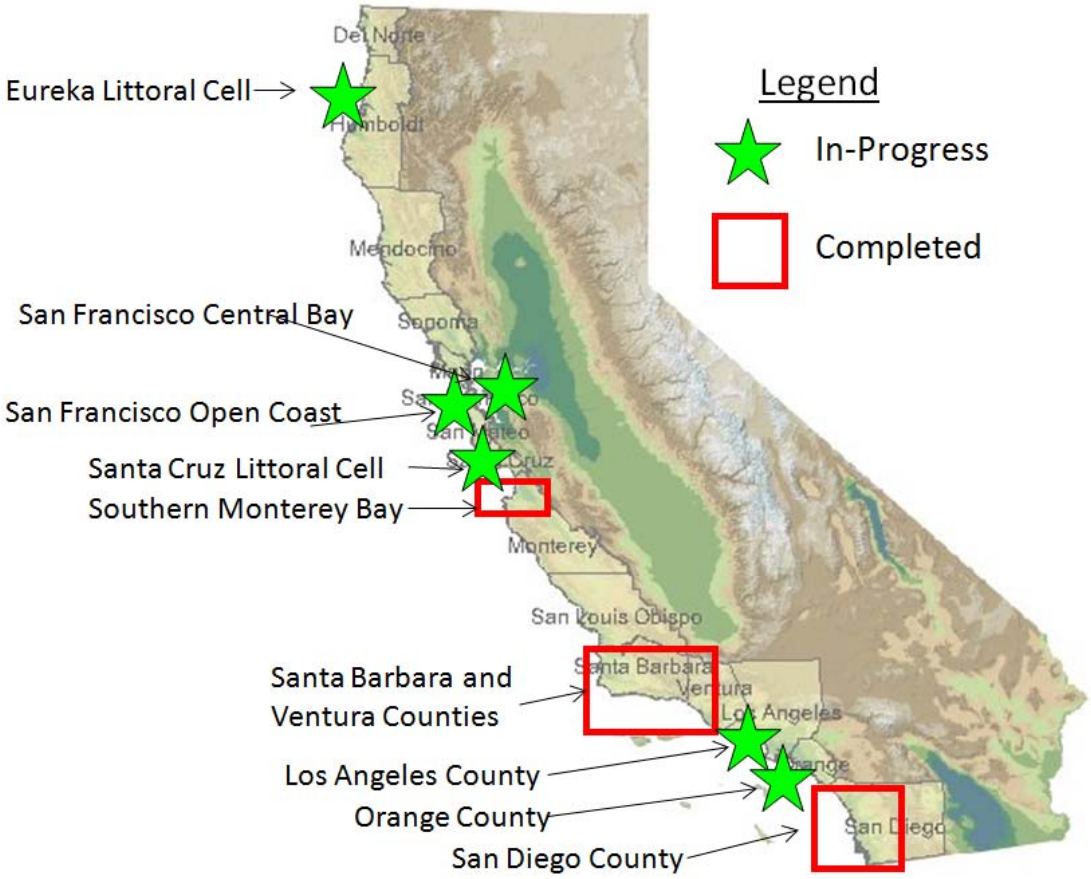


Figure 1.3 Previous and Ongoing Coastal RSM Plans

1.3.4 Other Relevant Plans

Other regional management plans and master plans that have been reviewed in the development of the Plan include: the *San Juan Creek Watershed Management Plan* (County of Orange, 2002), *the San Gabriel River Corridor Master Plan* (Moore Iacofano Goltsman, Inc., 2006), City of Newport Beach *Harbor Area Management Plan* (Weston Solutions, 2010); *Carbon*

Canyon Regional Park Master Plan (U.S. Army Engineer, 1974a & 1974b); *Prado Basin Master Plan and Environmental Impact Statement – Draft* (P & D Technologies, Inc., 2005); *Recreation Master Plan for Cucamonga Creek and Tributaries* (U.S. Army Engineer, no date); *Central Orange County Integrated Regional and Coastal Water Management Plan* (City of Newport Beach, 2009); and *the Aliso Creek Watershed Management Study Orange County, California* (USACE, 2002a). The *Final Sand Compatibility and Opportunistic Use Program Plan* (Moffatt & Nichol, 2006) plays an important role in development of the Plan as well.

1.4 Developing the Plan

The process to develop the Plan began with collection of reports and data. This information was then coalesced into a presentable form for presentation to the stakeholders, who provided input to fill knowledge gaps and provide preliminary suggestions for Plan activities. Stakeholder meeting minutes are available in Appendix A. The project team then incorporated this stakeholder information into the knowledge base which was submitted to the CSMW. The GIS data from this knowledge base is being made available in a spatial data website at http://coastalsediment.resources.ca.gov/. The project team compiled a preliminary list of Plan activities and presented this to the stakeholders, who commented on the list and suggested additional Plan activities. The presentation materials are published on the Orange County page within the CSMW website at http://www.dbw.ca.gov/csmw/crsmp_oc.aspx.

The Plan described in this report follows a pyramid of knowledge as illustrated in Figure 1.4. The foundation of this pyramid is discussed in Chapter 2 of this report, entitled Understanding the Orange County Coast. It describes basic terms and concepts needed to discuss coastal RSM in Orange County. The second layer, which is discussed in Chapter 3, contains Plan elements that represent projects, programs, and regulation recommendations. The top layer in this pyramid contains the recommended Plan activities as described in Chapter 4 of this report.

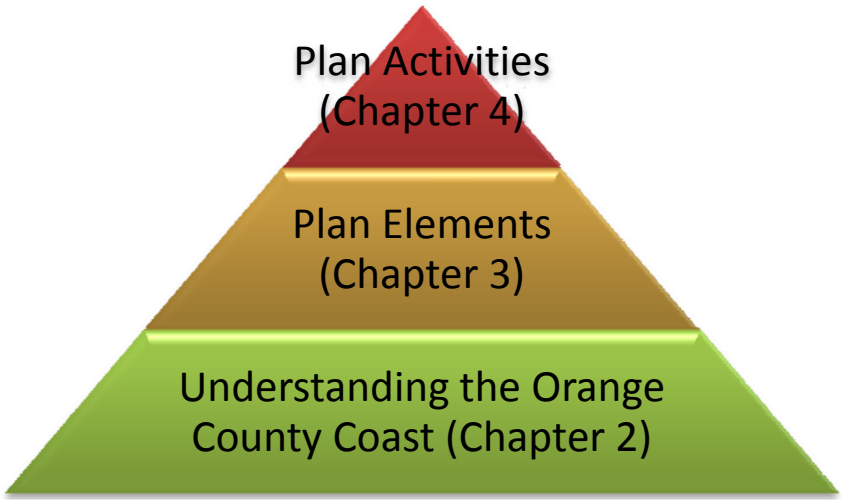


Figure 1.4 Plan Development Pyramid

1.5 Project Team

The project team was lead by USACE as the federal sponsor and the County of Orange as the local sponsor. The County of Orange participated in the Plan development to represent local issues and needs, and the CSMW participated in an advisory role to help maintain consistency with similar projects elsewhere in coastal California. While this document was prepared with significant input from USACE, the County of Orange, and other CSMW members, it may not necessarily represent their official positions.

Everest International Consultants, Inc. (Everest) was the prime consultant for the project responsible for all meetings, analyses, and reporting. Science Applications International Corporation (SAIC) provided assistance on biological and habitat issues while Dr. Philip King performed economics analyses for the project. Recommendations are presented in this report solely for consideration by government agencies, organizations, and committees involved in the management and protection of coastal resources in the Plan area.

2. UNDERSTANDING THE ORANGE COUNTY COAST

This section of the report provides a background and basic level of understanding of the physical and socioeconomic processes underlying beach evolution and maintenance in the Plan area.

2.1 Coastal Sediment Management Practices Overview

The Orange County coastline consists of a variety of landforms such as sand and cobble beaches, rocky intertidal areas, rocky cliffs, and loosely consolidated bluffs. These landforms provide habitat for numerous wildlife species including birds, mammals, reptiles, amphibians, fishes, and invertebrates. The California coastline also provides residential, industrial, commercial, and military land uses for humans as well as recreational and educational opportunities.

Much of the sediment that makes up the sand and cobble beaches of the coast is material carried to the coast by rivers and streams. Under natural conditions, weathering processes erode sediment from the watershed via numerous processes such as precipitation, wind, stream flow, and landslides. Streams transport gravel, sand, silts, and clays from the upper watershed areas down to the lower basins, where the sediment is subsequently transported to the coast during storm events. The volume and size of the sediment transported by streams depend upon the stream forces. Larger storms cause greater volumes of sediment with higher proportions of sand and gravel to be transported to the coast. Upon reaching the coast, waves, currents, and winds transport the sediment up and down the coast as well as onshore and offshore, contributing to the dynamic nature of coastal beaches.

Coastal sediment provides many beneficial uses for humans and wildlife. Sand and gravel provide habitat for various wildlife species that use streams and beaches, while sand also provides recreational beach space and shoreline protection for humans and infrastructure. Additionally, silts and clays carried from river substrates supplies needed nutrients for nearshore habitats. In-stream sand and gravel extraction are used by the construction industry for infrastructure development. Easy access to these important construction materials has been a factor in California's economic growth.

2.1.1 Problem – Human Modifications Have Altered Processes and Impacted Uses

Humans have substantially altered natural sediment transport processes within California's coastal watersheds, reducing storm protection, habitat, and recreation potential. Dams, built to control floods and store water, trap sediment in reservoirs and prevent sediment from moving downstream. Sand and gravel are mined from streams for use in construction. Legacy timbering roads, grading, and earth moving strip off vegetation and expose watersheds to

excessive erosion. Construction of channels, roads, and buildings has been known to both reduce and increase erosion. Hardening of the watershed reduces the amount of erodible area, but increases stormflow runoff by limiting infiltration. These higher flows can lead to streambank downcutting, eroding banks, and filling of silt basins. Overall, these mechanisms lead to decreases in the amount of coarse sediment available for delivery to the beaches via streams. Some coastal structures such as harbors, jetties, groins, and breakwaters alter movement of sediment along the shoreline while other coastal structures such as riprap and seawalls can reduce the amount of sediment supplied directly to the shoreline through the reduction of bluff and cliff erosion. These process changes are shown within one schematic sedimentshed in Figure 2.1.

Human modifications to the coastal watersheds and shorelines of California have resulted in the following sediment-related problems, some of which are exacerbated by climatic and sea level changes associated with global warming:

- Beaches are undergoing accelerated erosion, reducing recreational opportunities, contributing to habitat loss, and increasing the probability of coastal storm damage;
- Coastal wetlands and lagoons are experiencing accelerated sedimentation and/or erosion;
- Sediment is being removed, trapped, redirected, modified, and polluted as it moves through coastal watersheds to the shoreline and along the coast;
- Sand dredged from harbor channels are, in many instances, placed at locations that do not optimize the coastal beneficial use of the material; and
- Sediment supply to the coast has been, and continues to be, reduced as a result of interruptions caused by dams and debris basins, sand and gravel mining, artificially stabilized shoreline, and hardened coastal watersheds.

2.1.2 Solution – Coastal RSM Plans

Many watershed and shoreline problems caused by human modifications to the coast can be solved and/or addressed through implementation of RSM. A schematic representation of RSM as developed by the CSMW (Everest, 2007) is shown for one typical sedimentshed in Figure 2.2. These strategies are:

- Sediment can be bypassed around upstream dams and blockages and be transported either to immediately downstream of the dam or directly to the coast;
- Sand and gravel mining activities can be moved away from river beds to prevent sand loss in river beds. For sand loss due to sand and gravel mining in the river, the loss can be compensated through projects or mitigation fees;
- Sand held in place through urbanization can be compensated through projects or fees;

- Sand dredged from harbor channels can be placed at locations that optimize the beneficial use of the material;
- Beach erosion can be reduced by restoring natural watershed processes, bypassing sand around harbors, replenishment with sand dredged from offshore or transported from inland projects, and reducing coastal armoring.

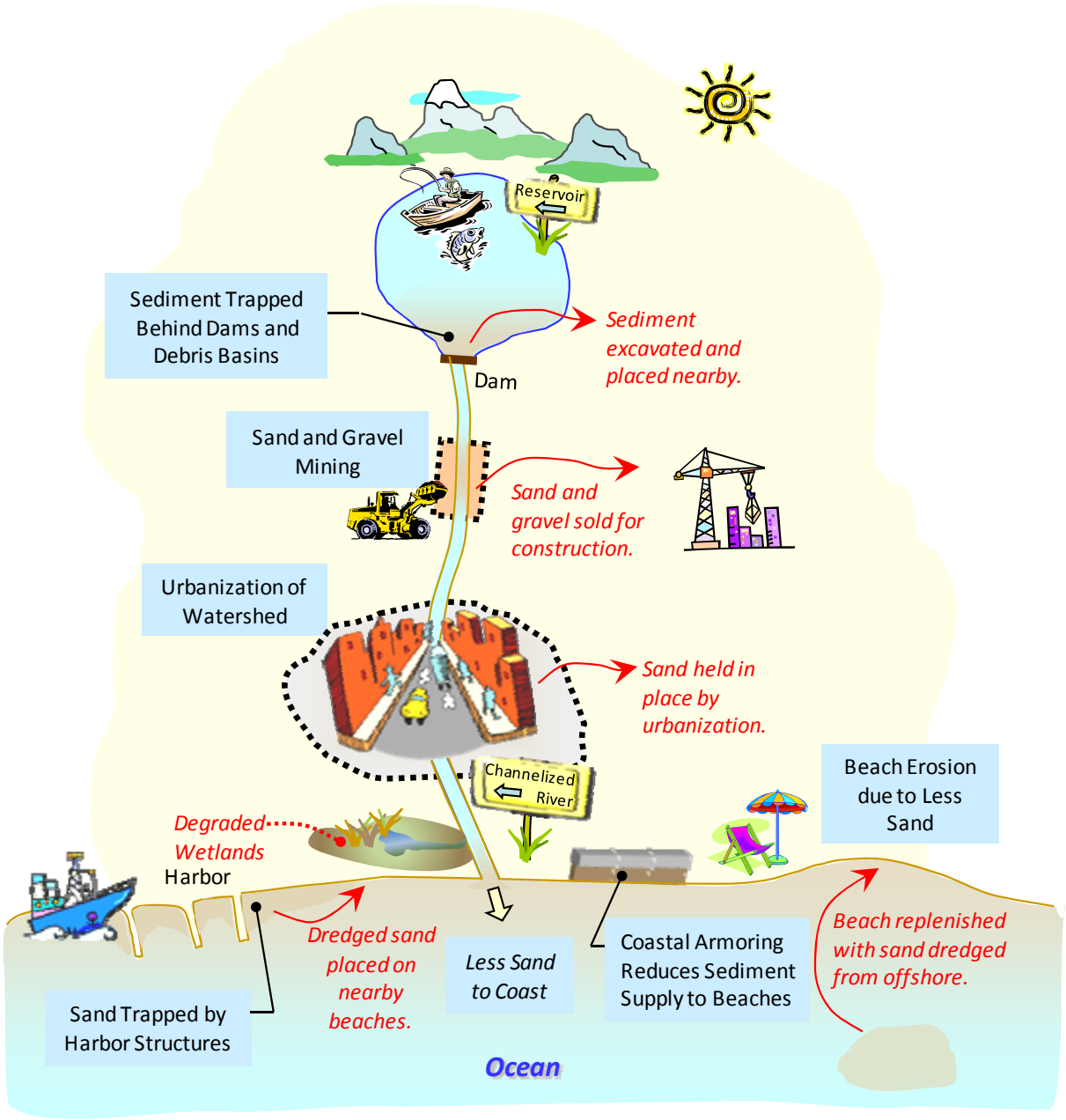


Figure 2.1 Existing Sediment Management Schematic

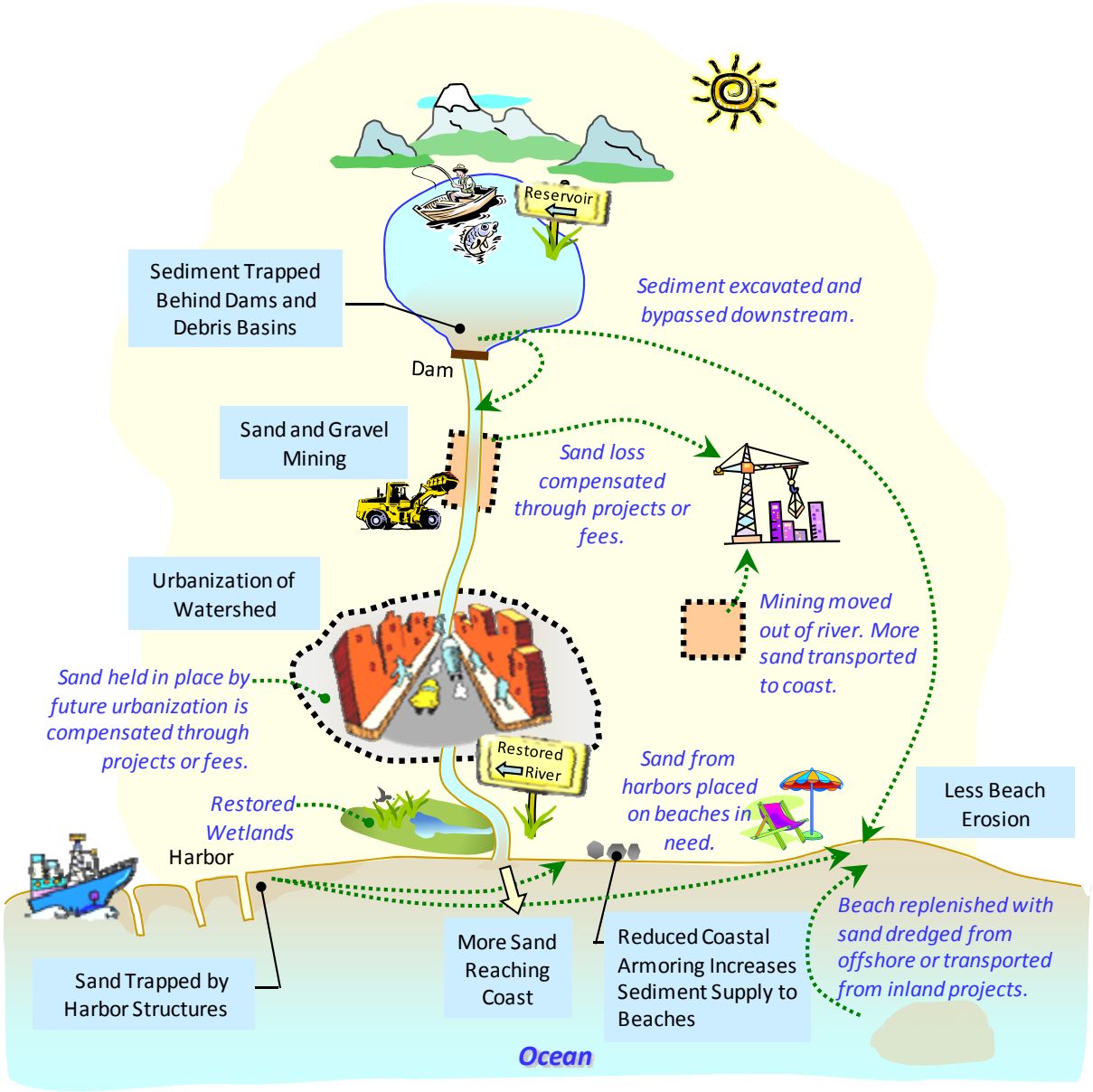


Figure 2.2 RSM Schematic

2.2 Physical Processes

This section of the report briefly describes basic physical processes useful for understanding sediment transport in the upland and coastal areas.

2.2.1 Watershed and Sedimentshed

A key aspect of the Plan is that it is regional in nature, which means it should encompass both what occurs on the beaches and in the uplands, where much coastal sediment has historically

originated. As the upland areas erode through natural and anthropogenic processes, a broad array of sediment is carried downstream through rivers, streams, creeks and flood control channels. Historically, the sediment load from these upland sources provided the majority of beach sediments (Griggs and Savoy, 1985; Richmond et. al., 2007). These upland sources have diminished as urban development hardens landscapes, and dams, reservoirs and debris basins trap sediment that was historically bound for the coast.

A watershed is an area of land that drains all the streams and rainfall to a common outlet such as the outflow of a reservoir, mouth of a bay, or any point along a stream channel (USGS, 2011). The term watershed is sometimes used interchangeably with drainage basin or catchment. A watershed includes both the streams and rivers that convey the water as well as the land surfaces from which water drains into those channels, and is separated from adjacent watersheds by a drainage divide. The watershed concept is so pervasive that government agencies have been developed to solve water related issues that are best addressed on a watershed basis. Watersheds within Orange County are shown in Figure 2.3 (County of Orange, 2008).

While sediments travel in watersheds, they are not typically the focus of watershed concerns and once sediments reach the coast they leave the watershed and enter what are known as littoral cells (see Chapter 2.3). Alternately, the term sedimentshed (Martin, 2005) focuses on sediment issues as the term watershed focuses on water issues. A sedimentshed is the area over which the lifecycle of sediment transport occurs, encompassing upland watersheds and coastal deposition areas in or outside the littoral zone. The sedimentshed concept would seem a logical approach for planning and regulating RSM issues. In the remainder of this report, watershed describes upland regions that drain into the littoral regions and sedimentshed is used where both regions are combined.

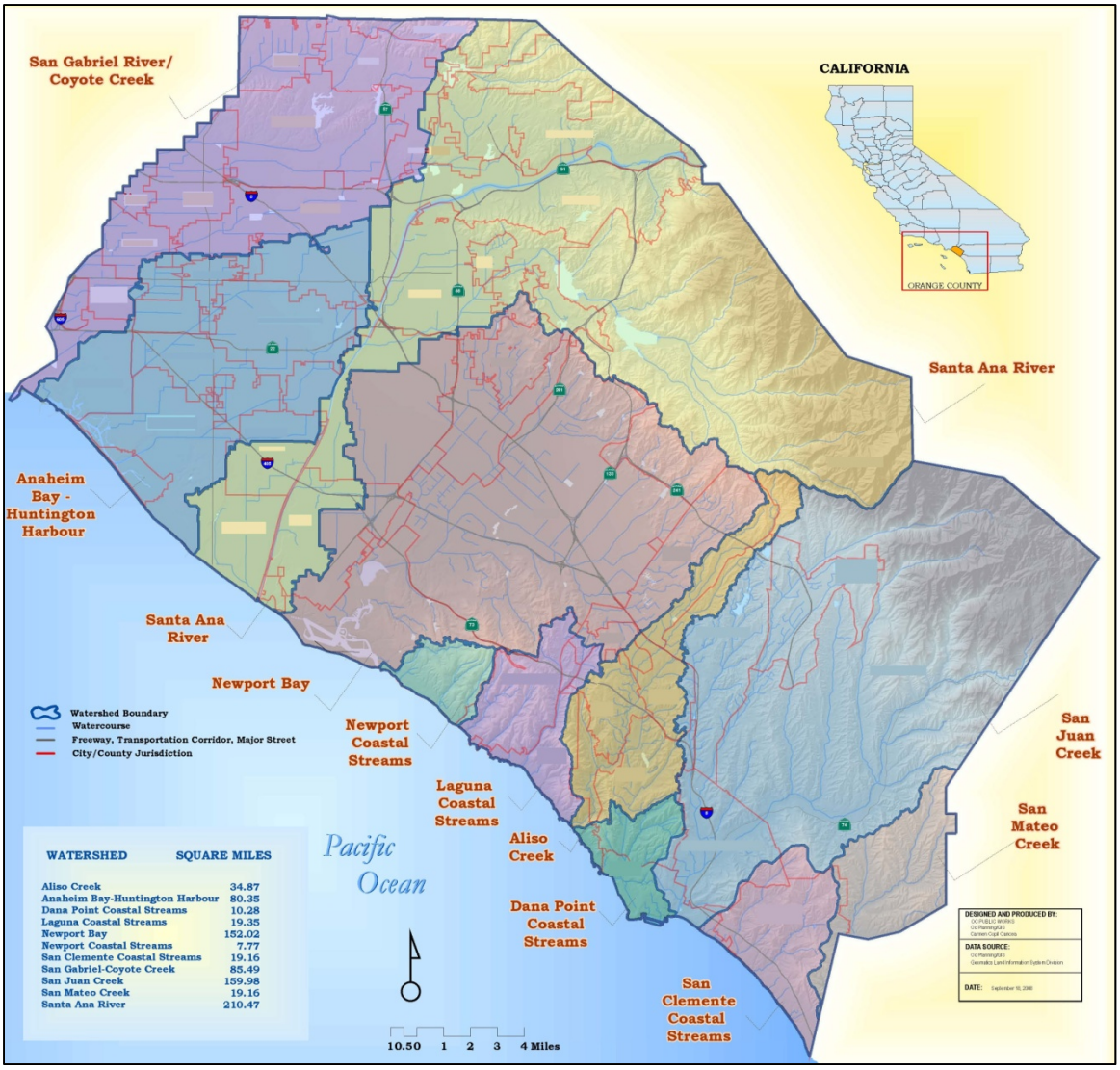


Figure 2.3 Orange County Watersheds (County of Orange, 2008)

2.2.2 Ocean Water Levels

Ocean water levels, in part, determine the shape and width of the beaches along the Orange County coast. The primary factors that affect ocean water levels in Orange County are: 1) astronomical tides, 2) sea level rise, 3) storms components, and 4) global climatic oscillations.

Tides

Astronomical tides in Orange County are of the mixed semidiurnal type, with two highs and two lows of unequal heights occurring each lunar day. Because tides occur at a large spatial scale,

the tidal characteristics are similar at coastal locations throughout Orange County. Tidal characteristics computed for the tidal epoch from 1983 to 2001 for the Newport Bay entrance are presented in Table 2.1 (NOAA, 2003) in relation to the Mean Lower Low Water (MLLW) vertical datum. Each of these represents either extreme recorded events or defined vertical means as calculated by NOAA over the tidal epoch and are given relative to a fixed vertical survey datum. The North American Vertical Datum of 1988 is the most recent vertical survey datum available for this area. Mean Lower Low Water (MLLW) is the common low tide datum used for describing tides.

Table 2.1 Tidal Characteristics at Newport Bay Entrance

DATUM OR LEVEL	ELEVATION (FEET, MLLW)
Maximum Measured Water Level (Jan 28, 1983)	7.67
Mean Higher High Water (MHHW)	5.41
Mean High Water (MHW)	4.67
Mean Tide Level (MTL)	2.80
Mean Sea Level (MSL)	2.77
Mean Low Water (MLW)	0.92
North American Vertical Datum of 1988	0.18
Mean Lower Low Water (MLLW)	0.00
Lowest Measured Water Level (Jan. 20, 1988)	-2.35

Source: NOAA (National Oceanic and Atmospheric Administration),2003

Sea Level Rise

USACE and many California State agencies have issued guidance for incorporating sea level rise into federal or state projects. USACE guidance states that potential sea level change must be considered in every USACE coastal activity as far inland as the extent of estimated tidal influence and recommends a multiple scenario approach to address uncertainty and help develop better risk-informed alternatives (USACE, 2011a). These scenarios cover a broad range of sea level changes termed low, intermediate, and high as shown in Figure 2.4. In this figure, the low scenario is an extension of historical global rates (1.7 millimeters per year), since the local Newport Beach tide gage did not record long enough for confident extrapolation. This

global rate is between other, nearby local rates observed at La Jolla and Los Angeles (2.1 and 0.8 millimeters per year, respectively). The intermediate and high scenarios are based on equations provided by USACE. The State of California has provided ranges of interim sea level rise guidance (CO-CAT, 2010) to be used until a final report from the National Academy of Sciences is available. Sea level rise projections in this interim guidance are shown in Figure 2.4 labeled "CA Interim Guidance." Which projection to use should be based on agency and context-specific considerations of risk tolerance and adaptive capacity. Additional regulation and policy on sea level rise was provided by the Office of the Governor (2008), SCC (2009) and the California Ocean Protection Council (2011).

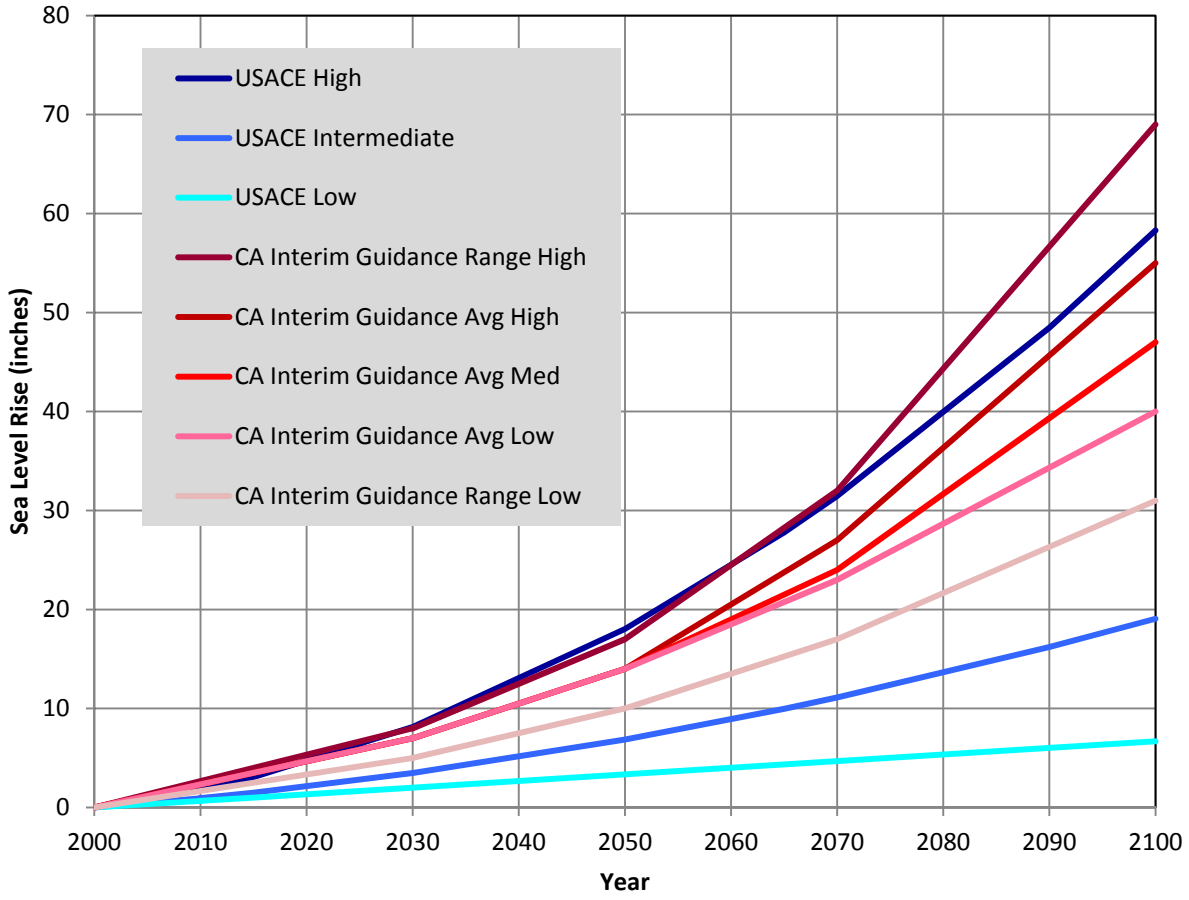


Figure 2.4 Sea Level Rise Projections

The National Academy of Science report (National Research Council, 2012) on sea level rise provides updated southern California sea level projections for year 2100 at 37 inches higher than those found in year 2000, with the projected range being from 17 to 66 inches. The CA Interim Guidance is expected to be replaced with new guidance for California based on these results.

Storms

Storm-induced changes in nearshore water levels arise from storm surge (from lowered barometric pressures, wind shear, and wave set up) and fresh water runoff. For example, the lowest locally recorded barometric pressure occurred during a storm on January 18, 1988. The combined storm induced changes resulted in water levels that were 0.7 feet above predicted astronomical levels at the Los Angeles Outer Harbor tide gage (USACE, 2002b). The fresh water component includes rainfall runoff and dam release and is particularly important for inland beaches such as those within Newport Bay and Huntington Harbour.

Climatic Oscillations

El Niño Southern Oscillations and Pacific Decadal Oscillations are global scale cyclic climatic variations that impact the local sea levels in the Project area. El Niño Southern Oscillation has a frequency of every four to seven years and results in temporary increases in sea level on the west coast of North and South Americas. For example, during the major El Niño Southern Oscillation event of the 1997-1998 season, monthly mean sea levels in southern California were increased by up to one foot (Flick, 1998 as reported in USACE, 2002b). On a longer time scale, the Pacific Decadal Oscillation was recently shown to be a likely cause of suppressed sea levels on the west coast of North America and may lead to a rapid increase in local sea levels in the near future (Bromirski et. al., 2010).

2.2.3 Waves

Waves are the driving force in generating longshore currents, sediment transport in the littoral zone, and shoreline changes. Ocean waves impacting the Orange County coast are produced by the following four sources (USACE, 2002b; Moffatt & Nichol, 2009a).

Northern hemisphere swell is derived from extratropical cyclones that occur in the northern Pacific Ocean. This comprises the most severe waves reaching the Orange County coast, and these waves usually have the greatest impact of all the wave sources. These swells generally approach from a swell window of from 275 degrees to 285 degrees (USACE, 1996a). The literature is less than clear as to whether long-term historical northern hemisphere swell activity has been increasing or remains steady and how it will trend in the future (Graham et. al., 2002; Inman et. al., 2006; Graham, 2005; Seymour, 2011; Bromirski et. al., 2002; IPCC, 2007).

Tropical storm swell is derived from hurricanes off the west coast of Mexico during the summer and early fall. Most of these hurricanes take a westerly track sending swell out to the Pacific Ocean. On occasion, a northwest track sends swell up to southern California, with the swell window ranging from 155 degrees to 200 degrees (USACE, 2002b).

Southern hemisphere swell is derived from extratropical cyclones from the South Pacific Ocean with the majority occurring from spring through early fall. These swells approach from about 170 degrees to 215 degrees, decaying significantly as they traverse across the Pacific Ocean.

Local sea is the term applied to steep, short period waves which for this project are generated by local winds and northwest winds in the outer coastal waters. The local winds can be further separated into pre-frontal winds from the southeast, gradient winds during the passage of a winter low pressure system from the west, and westerly sea breezes.

With the predominance of wave energy reaching the Orange County coast from the northern hemisphere, wave driven currents typically run from northwest to southeast throughout the winter and spring and cause the majority of longshore sediment transport. As this coast is also significantly exposed to southern swell, seasonal reversals in longshore sediment transport occur, typically in the summer. These seasonal longshore transport components tend to be much greater than the net difference between the two. Thus the combined gross longshore transport (south transport + north transport) is much greater than the net longshore transport (south transport – north transport). Variable climatic cycles result in a range of conditions from dominant southeastward sediment transport over certain periods, followed by periods of more balanced sediment transport directions. The shoreline morphology has equilibrated over time to follow predominant conditions and over the long-term is oriented to southeastward sediment transport, with sediment inputs to the littoral cells typically from the northwest and outputs from the littoral cells typically in the southeast.

2.3 Sediment Transport and Beaches

The Plan covers the entire 39 mile coastline of Orange County extending from the San Gabriel River in the north to the San Mateo Creek in the south. This stretch of coastline can be divided by many possible features, of which the physical process of sand transport seems most appropriate for a RSM plan. These physical processes are most easily described by a sand accounting system called the sediment budget and a geographical grouping method based on the littoral cell.

The sediment budget approach was developed to understand the impact of coastal processes on shoreline change. The sediment budget conceptually accounts for inflows (sources), outflows (sinks), and storage of sediment within a littoral cell. A littoral cell is a coastal compartment or physiographic unit that contains sediment sources, transport paths, and sediment sinks (USACE, 2002b). A littoral cell is typically a portion of the coastline that does not significantly transport to or receive littoral sediment from another cell in either the upcoast or downcoast direction (USACE, 1991). Most cells, however, are not absolutely separated and do have some leakage between them. Orange County has four major littoral cells as shown in Figure 2.5. These littoral cells are the Seal Beach Littoral Cell, the Huntington Beach Littoral Cell, the Laguna Beach Cells (USACE, 2002b), and the northern portion of the Oceanside Littoral Cell (USACE, 1991).

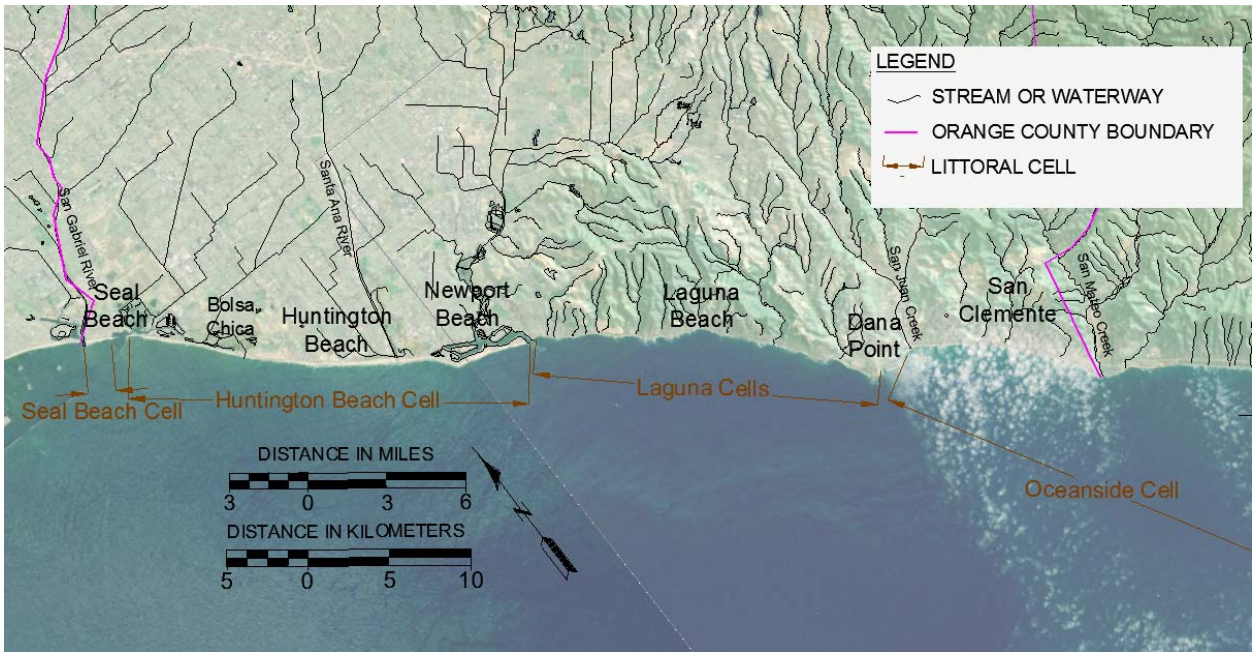


Figure 2.5 Orange County Littoral Cells

Within the littoral cell a complete cycle of sedimentation exists that can include erosion of upland terrain, fluvial transport to the shoreline, littoral transport along the shoreline with storage within the cell, and transport out of the cell. Sediment sources to a cell include rivers, bluffs, dunes, and artificial nourishment. Once sediment is entrained in the littoral transport system it can be lost from that system through various sinks, including aeolian losses to dunes, cross-shore transport to offshore, or by channeling of the sediment onto the continental shelf via a submarine canyon. Sand moves through a littoral cell along the beach and/or nearshore zone from source to sink and is temporarily stored at beaches within the cell. The sediment budget is either in balance with stable beaches, in a surplus with accreting beaches, or in deficit with eroding beaches.

The longshore sediment transport rate is an indicator of the rate of sand volume moving through a littoral cell over time. Sediment budgets and longshore sediment transport are tied to each other primarily via wave action in the surf and swash zones near the shoreline.

Each of the four littoral cells within the Plan region is briefly described below.

2.3.1 Seal Beach Littoral Cell

The Seal Beach Littoral Cell extends from the San Gabriel River to the west jetty of Anaheim Bay, both ends being near-complete barriers to alongshore sediment transport. This section of coast generally faces the southwest direction and runs for approximately one mile, divided in the middle by the Seal Beach Pier and groin. The City of Seal Beach is the only city within this cell.

The groin near the pier divides this cell into West Beach and East Beach. West Beach tends to be wide and mildly sloping while East Beach is narrow and steep, both backed by residential housing. Human intervention has strongly influenced coastal processes in the Seal Beach Littoral Cell. A net northwesterly sediment transport within the cell can be attributed in part to the sheltering effects of the Long Beach Breakwater and to wave reflection off the West Jetty of Anaheim Bay. Chronic erosion problems at East Beach, resulting from the net northwesterly transport, continue despite the construction of a transport blocking groin, intermittent beach nourishment, and semi-annual backpassing from West Beach to East Beach (Moffatt & Nichol, 2008; City of Seal Beach, 2012).

Key quantitative sediment components of this littoral cell as determined by USACE (2002b) include the following:

- Backpassing from West Beach to East Beach occurred from 1967 to 1976 totaling 208,600 cubic yards (yd^3).
- From 1963 to 1994, the average sediment contribution from the San Gabriel River was approximately 20,000 yd^3/year, with the majority of this material coming from the 1982-1983 storm season. This is predominantly fine grained sand.
- Beach nourishment from 1963 to 1988 yielded 370,000 yd^3 to East Beach with material coming from Anaheim Bay, West Beach, and the San Gabriel River. Another source indicated that 950,000 yd^3 has been artificially placed from 1959 through 1998 (Moffatt & Nichol, 2009c) with material coming from as far away as Palmdale.
- Sediment loss to Anaheim Bay has been calculated at 3,000 yd^3/year, and offshore loss from East Beach at 1,000 yd^3/year. Other losses are assumed to be negligible.
- From 1963 to 1994, the average migration of sediment from East Beach to West Beach was calculated at 16,000 yd^3/year.
- Including all sinks and sources, the net sand loss from 1963 to 1994 at East Beach was estimated at 8,000 yd^3/year while West Beach gained a net of 33,000 yd^3/year.
- Beach profile surveys were analyzed on data from 1963 through 1994 for one transect location at West Beach and one transect location at East Beach. In general, the beach has widened by about 400 feet during this period at West Beach and significantly narrowed at East Beach (USACE, 1998).

2.3.2 Huntington Beach Littoral Cell

The Huntington Beach Littoral Cell extends 15 miles from the east jetty of Anaheim Bay to the west jetty of Newport Bay. This cell includes from northwest to southeast the neighborhood of Surfside (within the City of Seal Beach), neighborhood of Sunset Beach (within the City of Huntington Beach), Bolsa Chica State Beach, City of Huntington Beach, Huntington State Beach, and the City of Newport Beach. This section of coast is generally oriented in the

northwest-southeast direction and is exposed to a complex array of sea and swell that drives sediment transport generally to the southeast. The beaches along this stretch of coast range from intermittently narrow at Surfside, wide at Bolsa Chica State Beach, narrow at the Huntington Cliffs, wide at the Huntington Beach Pier to West Newport Beach, narrow near the Newport Pier, and wide at the Balboa Peninsula in Newport Beach.

As in the case of the Seal Beach Littoral Cell, human intervention has strongly influenced coastal processes in this littoral cell. Of particular importance are periodic beach replenishments at Surfside-Sunset Beach and West Newport Beach and modifications at Bolsa Chica Ecological Reserve, Huntington Beach Wetlands, and the Santa Ana River. Also, coastal subsidence resulting from petroleum extraction was observed focused around the Huntington Cliffs (City of Huntington Beach, 1996). Natural processes affecting the cell include sediment input from the Santa Ana River and bluff erosion at Huntington Cliffs; the transport of sediment in both the alongshore and cross-shore directions under the influence of waves and currents; and the loss of sediment to Anaheim Bay, Newport Bay, and Newport Submarine Canyon.

Gadd et. al. (2006) found that the Surfside-Sunset Beach nourishment project provided substantial increases in beach width over time, not just at Surfside-Sunset Beach, but also farther southeast through littoral transport to Bolsa Chica State Beach, Huntington City Beach, Huntington State Beach and to West Newport Beach. They estimated that the project increased beach widths cumulatively at a rate of 5.2 feet/year at Surfside-Sunset Beach, 4.1 feet/year at Bolsa Chica State Beach, 1.6 feet/year at Huntington Cliffs, 4 feet/year at Huntington City Beach and 4.1 feet/year at West Newport Beach. These rates are substantial and indicate that the impacts of the project extend well beyond Surfside-Sunset Beach and have provided substantial increases in beach width over time.

Key quantitative sediment components of this littoral cell include the following:

- Beach nourishment at the Surfside-Sunset Beach has totaled over 20 million yd^3 from 1945 through 2009. The source of this material was Anaheim Bay and offshore (Mesa, 2011).
- Newport Beach has received over 9 million yd^3 of nourishment from 1935 through 2009, of which over 1 million yd^3 was in the form of backpassing from within the Newport Beach area. The source of this material was the Santa Ana River, Balboa Peninsula, Newport Harbor, and Newport Beach (Mesa, 2011).
- The following quantities were calculated from a sediment budget covering the time period from 1963 to 1995 (USACE, 2002b):
    - The Santa Ana River sand yield was estimated at 33,000 yd^3/year.
    - Sediment losses were estimated at 10,000 yd^3/year to Anaheim Bay; 3,000 yd^3/year to Newport Bay; and 1,000 yd^3/year to the Newport Submarine Canyon.

  - Sediment loss due to land subsidence has been estimated at 72,000 yd^3/year. From 1934 to 1975 elevation decreases of as much as 6 feet were observed at the Huntington Beach oil fields.
  - Offshore loss of sediment from the littoral cell was estimated at 78,000 yd^3/year.
  - Other losses were negligible.

- Net longshore sediment transport is highly varied along the cell, depending on time period and location within the cell, with rates ranging from 34,000 to 492,000 yd^3/year, all to the southeast (USACE, 2002b).
- For the entire littoral cell, the 1963 to 1997 period was marked by an average increase in beach width of 4.1 feet/year and a corresponding volume increase of 4.7 yd^3/foot-year (Gadd et. al., 2006).

The lagoon at the Bolsa Chica Ecological Reserve with a direct tidal connection to the beach and ocean was constructed in 2006. This lagoon requires periodic maintenance dredging to maintain adequate tidal prism and habitat distribution. The lagoon has been dredged twice (i.e., 2009 & 2011) since opening with material being placed on the beach between the inlet jetties and the Huntington Cliffs. This temporary sediment sink has little effect to the long-term sediment budget of the littoral cell since material entering the lagoon is eventually replaced on the beach within the littoral system.

2.3.3 Laguna Beach Littoral Cell

The Laguna Beach Littoral Cell extends 13 miles from the Newport Bay Entrance in the northwest to Dana Point Harbor in the southeast. This cell includes from northwest to southeast the neighborhood of Corona del Mar (within the City of Newport Beach), Crystal Cove State Park, the City of Laguna Beach, and the City of Dana Point. This cell is sometimes referred to as the Laguna Beach Mini Littoral Cells due to the presence of 23 littoral sub-cells that exist within the boundaries. This region is characterized by a high-relief coast which is irregular in plan, consisting of small sandy pocket beaches backed by seacliffs and separated from one another by headlands with reef extensions that function like underwater groins, retarding the alongshore movement of sand.

A sediment budget was performed for the period from 1927 to 1984 revealing the following key quantitative sediment components (USACE, 2002b):

- Sand discharge from streams represents the largest natural source of littoral material in these cells, with 1,900 yd^3/year coming from the Laguna Canyon watershed, 12,000 yd^3/year from Aliso Creek, 1,200 yd^3/year from Salt Creek, and modest quantities coming from numerous smaller streams and creeks. These quantities are being reduced, however, as the watersheds become developed.

- The estimated sand volume of seacliff contributions for the entire littoral cell was 7,920 yd^3/year.
- Beach nourishment has been limited to an estimated 1,000 yd^3/year at Corona del Mar State Beach at the north end of the littoral cell.
- Sand losses from the cell to the offshore (seaward of the littoral cell) were estimated at 1,640 yd^3/year and losses to the underlying seafloor (within the littoral cell) were estimated at 2,010 yd^3/year.
- Net longshore transport between sub-cells was estimated at between 1,000 yd^3/year and 15,000 yd^3/year depending on location and sand availability as detailed in Table 2.2.
- Other sources and sinks were deemed negligible.
- Beach widths in these littoral cells have been remarkably stable from 1934 through 1995. Buried within this long-term stability, seasonal variability was also evident with the south ends of pocket beaches widening in the winter and the north ends widening in the summer.

The sediment budget is expected to have changed significantly in the last 28 years since completion of the last sediment budget analysis. Development has occurred throughout the sedimentsheds, with the conspicuous addition of Laguna Niguel which was built after 1980. These developments make ground surfaces less pervious, changing the sediment load, and ultimately the coastal sediment budget.

Table 2.2 Net Longshore Sediment Transport Rates Within Laguna Beach Littoral Cell (1927-1984)

SUB-CELL NAME	NET LONGSHORE TRANSPORT (YD^3/YR)
Big Corona Beach	790
Little Corona Beach	1,259
East Corona Beach	1,385
Crystal Cove	113
Irvine Cove	30
Emerald Bay	659
Crescent Bay	318
Shaws Cove	378
Divers Cove Coast	188
Rockpile	188
Main Beach	556
Bluebird Canyon	515
Woods Cove Coast	311
Rockledge Coast	411
Victoria Coast	3,143
Treasure Island	3,069
Aliso Beach	14,417
Thousand Steps Coast	14,117
NW Three Arch Bay	14,417
Three Arch Bay	14,279
SE Three Arch Bay	14,591
Salt Creek Beach	15,368
Dana Strand Beach	15,209

Sub-cells from USACE, 2002b

2.3.4 Northern Oceanside Littoral Cell

The Oceanside Littoral Cell extends 51 miles from Dana Point Harbor in the northwest to Point La Jolla in the south. The portion of the littoral cell within the Plan area only extends 9 miles down to the mouth of San Mateo Creek. This section of the cell includes from north to south the

City of Dana Point, neighborhood of Capistrano Beach (within the City of Dana Point), and the City of San Clemente. This region is characterized by varying low and high-relief coastal sections which are somewhat regular in plan, consisting of long smoothly curving sandy beaches backed by roads, railroads, and seacliffs. Primary sediment sources to this portion of the cell are the San Juan, San Clemente and San Mateo Creeks as well as recent beach nourishments.

Key quantitative sediment components of this portion of the littoral cell as determined by USACE (1991) include the following:

- Under post-dam (after 1938) conditions, sand and gravel contributions in the sediment budget were from 38,000 to 39,000 yd^3/year from San Juan Creek. The San Clemente Shoreline Feasibility Study (USACE, 2011b) quotes sediment contributions from San Juan Creek as being from 8,000 to 52,071 yd^3/year and uses an average rate of 27,000 yd^3/year;.
- Under post-dam (after 1938) conditions, sand and gravel contributions in the sediment budget were zero from San Clemente Creek (also known as Prima Deshecha Canada and Segunda Deschecha Canada); and 20,000 yd^3/year from the combined San Mateo and San Onofre Creeks
- No sediment contributions were attributed to coastal bluffs in this reach, but 22,000 yd^3/year were attributed to coastal terrace erosion from 1933 to 1987.
- From 1945 to 1987 about 1,000 yd^3/year came into the littoral cell from the northern boundary at Dana Point.
- From 1945 to 1977 less than 50,000 yd^3/year of sediment left this portion of the littoral cell across the southern boundary at San Mateo Point. From 1978 to 1987 from 0 to 10,000 yd^3/year passed this boundary in southerly net transport.
- No material was lost offshore in this portion of the cell between 1934 and 1972, none was lost into submarine canyons, and Aeolian loss is negligible.

2.3.5 Sea Level Rise Impacts on Beaches

The effect of sea level rise will likely cause increased inundation of the entire coastal zone. Within this zone, coastal RSM impacts from sea level rise would likely be limited to beaches and wetlands.

Sea level rise impacts to wetlands will likely result in increased inundation, and changes to habitat distributions. In some cases this can be mitigated through addition of fill material which can fall under the umbrella of coastal RSM.

Sea level rise impacts to beaches would likely result in narrowing of those beaches. As sea level rises relative to land (assuming other sediment budget components remain relatively

constant and wave activity does not change dramatically), current theory holds that the sea floor profile in the surf zone will maintain the same shape as historically existed, moving upward with the rising sea level (Bruun, 1962; USACE, 2011c). The sand needed to maintain this shape is expected to come from existing beaches, thus the entire profile is expected to migrate landward. If the back beach remains fixed, beaches are expected to become narrower to maintain an equilibrium profile and beach narrowing is expected to accelerate if no action is taken to offset these losses. One possible mechanism to counter sea level rise induced shoreline erosion is through beach nourishment. The Bruun Rule (Bruun, 1962) has been used to calculate beach nourishment volumes to offset various sea level rise scenarios for all of southern California (Flick and Ewing, 2009). This type of analysis may be useful for estimating nourishment volumes to offset sea level rise in Orange County.

Coastal RSM is one mechanism to counter the effects of sea level rise and maintain functional wetlands and beaches. Since future sea level rise is expected to accelerate with passing time (see Figure 2.4), it is an important factor that needs to be considered for project designs. As the Plan moves forward, coastal projects that are either proposed or modified should include detailed analyses of sea level rise impacts during environmental review, permitting, and engineering design.

2.4 Socioeconomic Aspects

This section of the report provides an overview of population trends, beach attendance, beach access, beach amenities, and other recreational opportunities provided within Orange County beaches. These factors are essential in understanding the recreational value of these beaches and if and how much beach maintenance is worthwhile.

2.4.1 Regional Population Trends

According to the California Department of Finance (2012), Orange County currently has just over 3 million people, representing about 8 percent of the total population of California. Although the precise relationship between population and the demand for beaches is unknown, it is reasonable to assume that the demand will grow somewhat in line with local population growth. Table 2.3 presents population estimates from the California Department of Finance (2012) for regions important to the Project.

Orange County's population is projected to grow at 0.66 percent per year over the coming decade, but it is projected to slow to 0.16 percent after 2040, largely due to anticipated limits placed on the growth of residential housing. This rate of growth is significantly slower than the projected state average. However, the inland counties of San Bernardino and Riverside, which also provide a significant number of beach visitors, are projected to grow at much higher rates over the next 40 years. If the number of visitors to beaches in Orange County grows at the same rate as population growth for Orange County, then the number of visitors to Orange County Beaches would grow by a total of 18% over 2010 values. Cumulative growth for

Riverside and San Bernardino Counties are expected to be 89 percent and 55 percent, respectively, while the State of California is expected to grow by 37 percent. However given parking and other constraints such as substitutes for beach visitation, limited parking and traffic limitations it is unlikely that beach attendance will grow at the higher rates. Nevertheless, coastal managers should be aware that population growth in Orange County and elsewhere in California will place increasing strains on these scarce resources.

Table 2.3 Population Estimates 2010 through 2050

LOCATION	ORANGE COUNTY		RIVERSIDE COUNTY		SAN BERNARDINO COUNTY		CALIFORNIA	
YEAR	POP.	ANNUAL GROWTH	POP.	ANNUAL GROWTH	POP.	ANNUAL GROWTH	POP.	ANNUAL GROWTH
2010	3,016,606		2,191,449		2,038,445		37,312,510	
2020	3,220,788	0.66%	2,626,222	1.83%	2,283,798	1.14%	40,817,839	0.90%
2030	3,385,762	0.50%	3,145,948	1.82%	2,588,990	1.26%	44,574,756	0.88%
2040	3,509,352	0.36%	3,678,119	1.58%	2,885,687	1.09%	47,983,659	0.74%
2050	3,565,648	0.16%	4,137,882	1.18%	3,159,003	0.91%	51,013,984	0.61%
Change Since 2010	POP.	%	POP.	%	POP.	%	POP.	%
	549,042	18%	1,946,433	89%	1,120,558	55%	13,701,474	37%

Pop. = population

2.4.2 Description of Beach Recreational Characteristics

Orange County provides a wide variety of beaches and beach activities ranging from large, highly attended beaches like Huntington City and State Beaches to the smaller cove beaches in south Laguna Beach. Recreational activities also vary from sunbathing and light swimming to surfing. Boardwalk activity is also important at some beaches, particularly Newport Beach and Balboa Beach. Volleyball and other beach activities are provided at some beaches and scuba diving is popular in some caves. The discussion below focuses on the recreational opportunities at each major beach and a number of minor beaches, in Orange County starting from the northwest and moving southeast. All of these beaches are listed in Table 2.4. Each beach has a tracking number which is shown visually in Figures 2.6 and 2.7.

Table 2.4 Orange County Beach Names and Tracking Numbers

#	BEACH NAME
1	West Beach, Seal Beach
2	East Beach, Seal Beach
3	Surfside
4	Sunset Beach
5	Coral Cay
6	Davenport Beach
7	Bolsa Chica State Beach
8	Huntington Cliffs /Dog Beach
9	Huntington City Beach/Huntington Pier
10	Huntington State Beach
11	Santa Ana River County Beach
12	West Newport Beach/Newport Groin Fields
13	Newport Beach Pier/Newport Main Beach
14	Balboa Beach
15	Channel Place Park
16	Balboa Coves
17	Lake Street
18	Newport Island Park
19	Lido Park
20	Lido Peninsula
21	Marina Park
22	15th Street
23	Via Lido Nord
24	Via Lido Soud
25	10th Street
26	Crestview
27	Bayshore
28	Bay Island West
29	Edgewater/Montero
30	Bay Island East
31	Pacific Coast Highway Bridge
32	Linda Isle
33	North Star Beach
34	Newport Dunes
35	Beacon Bay
36	North Bay Front
37	South Bay Front
38	E Bay Avenue
39	Promontory Bay
40	Bayside Cove
41	East Bay Front
42	Harbor Patrol
43	M Street
44	Carnation Cove
45	China Cove
46	Pirate's Cove
47	Corona del Mar State Beach
48	Little Corona Del Mar
49	Crystal Cove State Park/Moro
50	Irvine Cove
51	Emerald Bay
52	Crescent Bay
53	Shaw's Cove
54	Fisherman's Cove
55	Diver's Cove/Picnic Beach/ Rockpile/Heisler Park
56	Laguna Beach/Laguna Main Beach
57	Brooks Street Beach
58	Bluebird Coast/Pearl Street Beach
59	Wood's Cove/Ruby Street Park
60	Victoria Beach/Lagunita Beach
61	Treasure Island Beach
62	Aliso County Beach Park
63	Camel Point Beach
64	Table Rock Beach
65	1000 Steps Beach
66	Three Arch Bay/Mussel Cove
67	Monarch Beach
68	Salt Creek Beach
69	Dana Strands
70	Dana Point/Three Caves Beach
71	Baby Beach/Dana Cove/Mother's Beach
72	Doheny State Beach
73	Capistrano County Beach
74	Poche Beach
75	San Clemente City Beach
76	San Clemente State Beach
77	Cottons

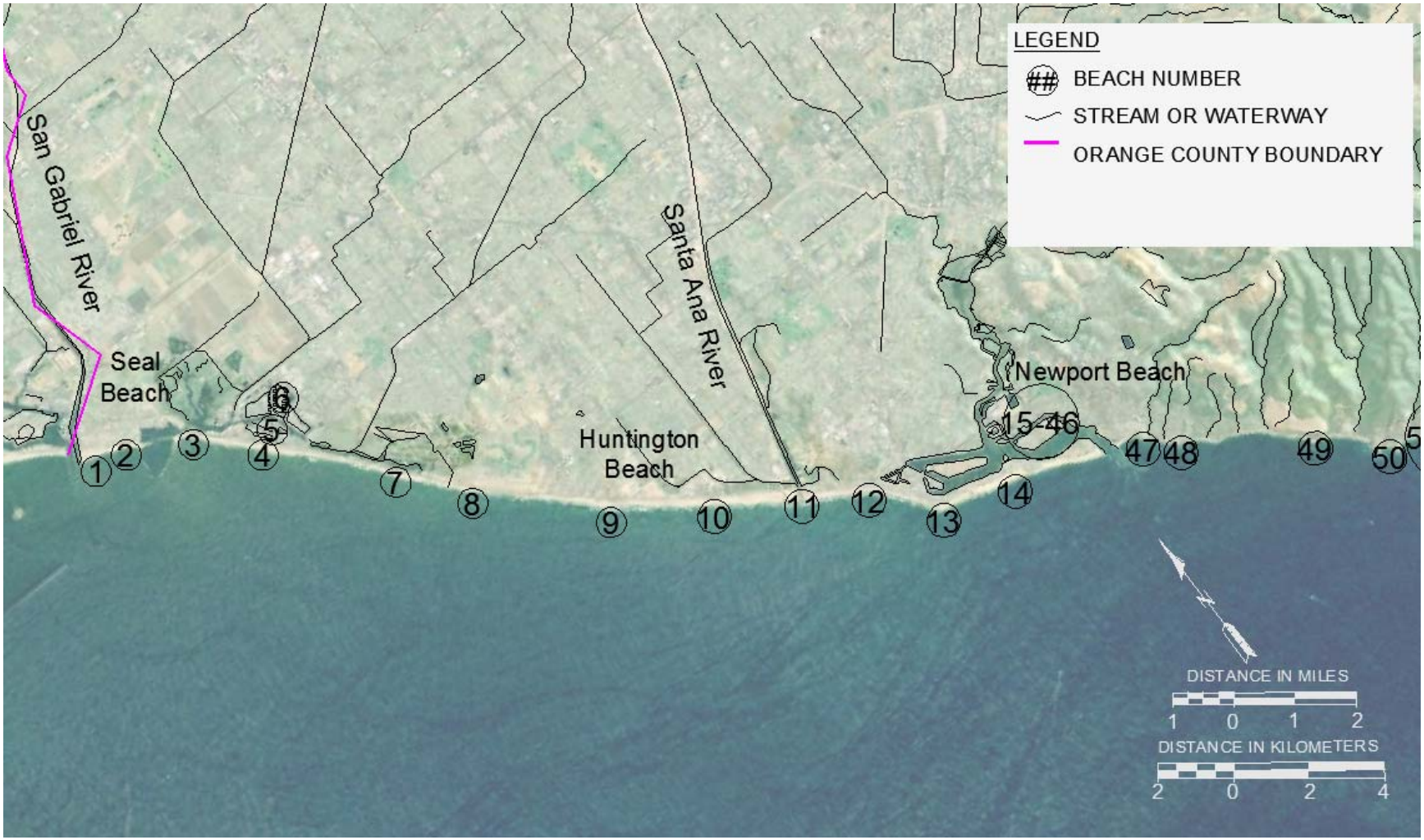


Figure 2.6 Northwest Orange County Beaches

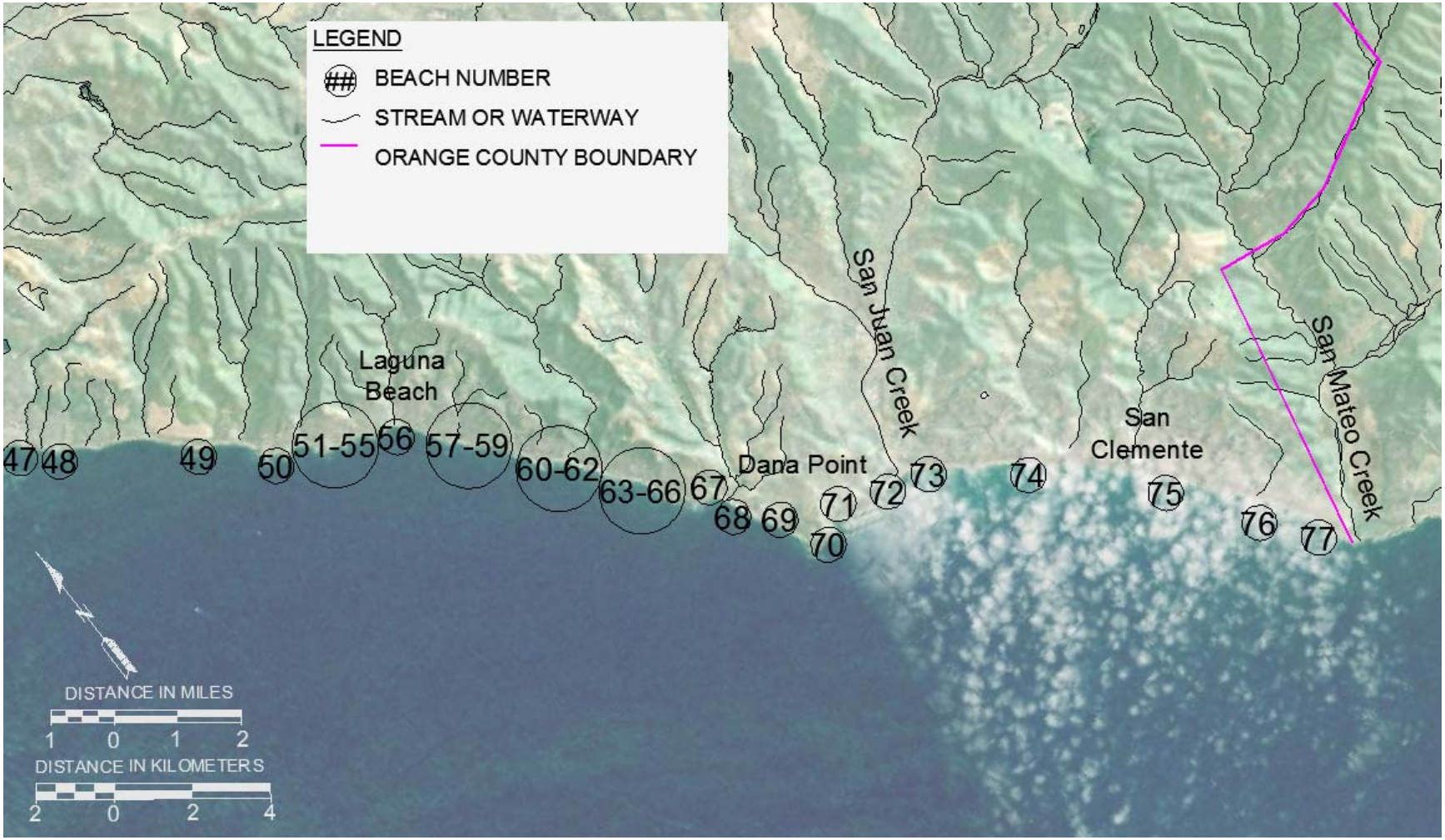


Figure 2.7 Southeast Orange County Beaches

 # 1, West Beach, Seal Beach: Located at the foot of 1st Street, the northern section of Seal Beach offers a wide beach with volleyball nets, restrooms and showers, and a small café and parking lot. Crowds here are a mix of locals, Los Angeles and Orange County residents, and overnight tourists from the beachfront vacation rentals. This beach is less crowded than the one to the south. Most patrons of Seal Beach tend to gravitate towards Main Street and its attractions. Surfing, body surfing, and boogie boarding are popular.

 # 2, East Beach, Seal Beach: Seal Beach Pier is located at the southwest end of Main Street in Seal Beach. Locals, Los Angeles and Orange County residents, and overnight visitors from the numerous hotels, summer rentals, and vacation homes nearby can be found patronizing the shops, bars, and restaurants that line the streets near the pier and beach. At the beach, fishing, surfing, and volleyball are popular. The beach also offers lifeguard service, restrooms and showers, nearby food service, and a boardwalk. The boardwalk is used equally by locals and tourists walking between the Main Street and their residences. There are also two large parking lots on either side of the pier and plentiful free street parking. In the winter, crowds concentrate around the shops.

 # 3, Surfside: Surfside is a private community within the City of Seal Beach, located between Anaheim Bay and Sunset Beach. This beach is primarily used by local families and a few surfers willing to make the walk from Sunset Beach to a wave that breaks near the base of the east jetty of Anaheim Bay. There are no facilities here and beach users from outside Surfside generally must park in Sunset Beach.

 # 4, Sunset Beach: Sunset Beach is a small community, within the City of Huntington Beach, with a wide sandy beach that offers free parking, restrooms and showers, lifeguards, and volleyball courts. Beach activities such as surfing, windsurfing and kite surfing dominate water sports, and many visitors can be found simply enjoying the sand and sun. There are numerous hotels in the area and many beach users are overnight tourists or visitors from Orange and Los Angeles Counties. There are a few restaurants in the immediate area.

 # 5-6, Huntington Harbour Beaches: Huntington Harbour contains a small number of pocket beaches, some accompanied by parks and play areas. These beaches are used primarily by local residents and visitors to the marina. Recreational amenities such as lifeguards are very limited. Access is also difficult for non-residents.

 # 7, Bolsa Chica State Beach: Bolsa Chica State Beach is located north of Seapoint Avenue and west of Pacific Coast Highway at the northern end of Huntington Beach. Amenities include plentiful parking, camping, restrooms and showers, lifeguards, a snack bar, and a beachside bike path. Each car is charged a California State Park day use fee of $15.00. Just across Pacific Coast Highway is the Bolsa Chica Ecological Reserve that has hiking paths and conducts organized tours of the wetland and its inhabitants. Most of Bolsa Chica's visitors are local residents with a few overnight campers and their families.

 # 8, Huntington Cliffs /Dog Beach: The northern section of Huntington City Beach, bordered by Seapoint Avenue to the north and Goldenwest Street to the south is Huntington Cliffs, also known as Dog Beach. This is one of the few locations in Orange County where dogs are allowed on the beach without a leash. The beach is very popular year-round with local and county residents and their pets. It is also popular with surfers attracted to the waves, which tend to be larger here than other nearby locals. The only amenities are metered parking, seasonal lifeguard service and pit toilets.

 # 9, Huntington City Beach: Huntington City Beach is a primary tourist destination and Orange County's most popular beach in terms of attendance. It has over 3,000 official parking spots, and the events, restaurants, and nearby shopping make for a crowded and colorful atmosphere. The beach offers a full range of amenities: year-round lifeguard service, a pier, a boardwalk, volleyball courts, and restrooms and showers. There are numerous hotels and condos in the area including a Hyatt, Hilton, and Best Western directly across Pacific Coast Highway, as well as restaurants and retail shops. The beach is also a renowned surfing destination and hosts numerous professional contests. The beach is used by many tourists but is also very popular with locals. During the winter, the flow of tourists is reduced but the area remains popular with city and county residents.

 # 10, Huntington State Beach: Huntington State Beach is the southernmost of the Huntington beaches, bordered by Pacific Coast Highway to the east, the Santa Ana River to the south, and Beach Blvd. to the north. There is a long and wide sandy beach that offers plentiful parking, volleyball, fire pits, lifeguards, restrooms and showers, seasonal snack stands, and a boardwalk. The crowd here tends to consist of Orange County families who come to enjoy the plentiful amenities and bike along the boardwalk. Although there is no overnight camping, the parking lot will often be filled with RVs. Surfing is less important here than at the Huntington City Beach to the north, with the exception of a break at the mouth of the Santa Ana River at the southern end.

 # 11-12, West Newport Beach/Santa Ana River County Park/Newport Groin Field: West Newport Beach is located to the west of Pacific Coast Highway, immediately south of Huntington Beach. High-end homes and condos abut the wide sandy beach. The beach offers volleyball courts, showers, and seasonally operated lifeguard towers. In the winter, when lifeguards are off duty, the surf and sand are observed by cameras atop each tower and a jeep patrol. This is also the case for the beaches to the south. The beach is a popular surfing destination. At the middle and southern end of the beach, eight rock jetties spaced about 300 feet apart inhibit sediment migration, creating reliable sandbars, making the waves break hollow, and attracting surfers. Also at the southern end of the beach begins a boardwalk extending the length of the peninsula that is heavily utilized by bikers and walkers year-round. One block inland, a narrow mixed-use grassy park runs the length of the beach. The park provides metered parking, restrooms, playgrounds, picnic tables, and at the southern end, racquetball, basketball, and tennis courts. Across Pacific Coast Highway near the center of the beach are a cluster of restaurants and hotels. This beach swells with tourists and locals of all

kinds in the summer and attracts a reduced but still consistent crowd in the winter, mostly local surfers, joggers, and families utilizing the park.

 # 13, Newport Beach Pier/Newport Main Beach: Further south and into the Newport Beach urban landscape off Balboa Blvd is the Newport Pier. There are two large metered parking lots, a tourist information booth, and a bathroom and shower facility at the base of the pier that support a swath of tourists utilizing the numerous restaurants, bars, and shops in the pier plaza. Crowds here, like most of accessible Orange County, swell in the summer and decrease but remain consistent in the winter, especially during favorable weather. Most are tourists strolling along the pier or in the pier plaza. The beach itself is narrower than the beaches to the north or south due to the parking lots, fish market, and lifeguard station constructed on the sand. Local residents account for only a small fraction of the crowd but may be found boogie boarding, body surfing, or patronizing a bar or restaurant. Surfing is still popular but less so than the beaches to the northwest. Amenities also include a boardwalk and seasonal lifeguards. About one half mile east of the pier is an additional bathroom facility and mixed use ball courts.

 # 14, Balboa Beach: Extending to the tip of the peninsula, south of Newport Pier, is Balboa Beach and Balboa Pier. The pier plaza and beach here are similar to that of Newport Pier: there are numerous shops, a bathroom and shower facility, a boardwalk, a playground and grassy area, and metered parking lots at the base of the pier. There is also a café at the end of the pier. Surfing is less popular here due to a steeply sloping beach and reduced wave quality, which has also made the pier more popular for fishing than Newport Pier. The beach to the south of the pier has similar characteristics to North Newport Beach, but with a smaller crowd. There are no parking lots or restrooms; street parking becomes scarcer as the peninsula thins, and the boardwalk ends about halfway down the beach. At the south end of the beach are a jetty and a small park offering views across the channel and into the bay. The jetty focuses waves to create the notorious Wedge surf break, attracting body surfers and boogie boarders during large swells.

 # 15-46, Newport Harbor Beaches: There are 32 small beaches located within Newport Harbor and Newport Bay. These are on the east side of the Balboa Peninsula and among the islands within the harbor, in particular on Balboa Island. The beaches within the harbor are accessible mostly by residents of the homes adjoining the private docks, people who rent the houses seasonally, or members of a local yacht club. King and Symes (2002) studied visitation patterns on Balboa Island and concluded that most (57 percent) visitors were local residents.

Attendance at these beaches is limited and concentrated mostly on the beaches with better access and lifeguard services. Much of the sandy stretches are quasi-private and the frequent boat lines and docks also limit access and recreational value as does the water quality inside the harbor and the narrow beach width. This area contains a number of smaller beaches that have limited amenities and host perhaps 10,000 – 15,000 visitors per year, mostly in the summer.

One popular beach within Newport Harbor is China Cove, located on the east side of Newport Harbor Entrance Channel, northwest of Corona del Mar State Beach. There are two small sandy coves, separated by a row of houses that are both accessible via Cove Street or a footpath from Ocean Boulevard, where visitors must park. Other than a seasonal volleyball court in the east cove, there are no amenities here. The beach is located within the harbor and the waves are calm so it serves as a useful launching point for kayaks or small watercraft. The beach is mostly used by locals and in the winter the crowd drops to sporadic walkers and kayakers.

 # 47, Corona del Mar State Beach: Corona del Mar State Beach is situated immediately east of the Newport Bay channel and southwest of Ocean Boulevard. A paid parking lot of over 500 spots is provided at the beach as well as street parking above the beach on the bluff. There are restrooms, showers, volleyball nets, lifeguards and a restaurant on the beach. The parking rate at the beach is $8.00/day; this fee is waived with restaurant validation. Since Corona del Mar is managed by Newport Beach, it does not accept the California State Park Day Use passes. The beach is used mostly by general beachgoers, many of them families local to the city or county, with a minority of tourists exploring the rocky point or enjoying the views from atop the bluff. The water in the cove is deep and the waves are usually calm. However with a large south swell a wave forms along the jetty at the north end of the beach, attracting a steady stream of surfers.

#48, Little Corona del Mar: About 1000 feet southeast of Corona del Mar State Beach at the foot of Poppy Avenue sits Little Corona del Mar beach. This small sandy cove can be reached by a footpath at the southern end of Ocean Boulevard. There are seasonal lifeguards and bathrooms here but no other amenities. Limited street parking is available atop the bluff on Ocean Boulevard and the surrounding residential streets. The beach is mainly used by locals sunbathing, walking, or exploring the reefs and tide pools on either side of the cove.

 # 49, Crystal Cove State Park/Moro: Wedged between Corona del Mar and Laguna Beach lies Crystal Cove State Park. There is a north and south entrance to the park, both located to the west of Pacific Coast Highway and each with its own parking and bathroom and shower facilities. Atop the bluff, there is a bike path that parallels the highway connecting the two entrances. At the mid-point is a small cafe crowded with park users and highway passers-by. Overall, Crystal Cove has parking for up to 400 cars. Each car is charged a California State Park day use fee of $15.00. El Moro campground has just opened on the terraced hillside, overlooking the ocean with 27 recreational vehicle and 30 tent sites. Also, guests stay in any of the 21 historical cottages nestled amongst the bluff. Accommodations range from $10 to $191 per night. From atop the bluff, numerous trails lead down to the beach. The beach consists of three distinct coves with narrow sandy areas and rocky reefs abutting the water. The beach is very popular with overnight visitors and local and county residents year-round. The southernmost cove, known as El Morro, is a popular surfing spot during large summertime south swells, but in the winter is dormant. Off-season use consists mainly of walking the beach and trail and exploring the rocky point tide pools.

 # 50, Irvine Cove: Irvine Cove is a private gated community in North Laguna Beach, just south of Crystal Cove State Park. There is no direct public beach access and thus the beach is mainly used by community members and their guests. The southern cove is wider and contains a restroom and shower facility, seasonal lifeguards, volleyball nets, and a playground. The waves are calm and swimming, snorkeling, kayaking, and other calm-water uses prevail. There is a tunnel through the headland that connects the two through which pedestrians can pass during low tides.

 # 51, Emerald Bay: Emerald Bay is a private gated community in North Laguna Beach located at the intersection of Highway 1 and Emerald Point Drive. The community offers no public beach access and the beach consists of a wide sandy cove with lifeguards, picnic areas, fire pits, volleyball courts, and bathroom and shower facilities. There is also a tennis court just off of the beach. This beach is very popular year-round with the residents of Emerald Bay and their guests.

 # 52, Crescent Bay: Crescent Bay is a small sandy cove located off of Cliff Drive in North Laguna Beach that is popular with locals year-round. Amenities include restrooms, showers, and seasonal lifeguards. There is a sandy shore break that attracts bodyboarders and skimboarders. Past the shore break is a deep cove suitable for swimming or diving. Atop the northern headland is a grassy park with views of the Pacific and the coves to the north and south. There are two public access points at Circle Way and Barranca Street, and numerous private pathways and stairways that lead to the beach. Parking is limited to the residential area. Beach users are mostly locals and a few scattered tourists who wander down from the Crescent Bay Inn.

#53, Shaw's Cove: The next beach south of Crescent Bay is Shaw's Cove, accessible via a stairway off of Cliff Drive. The cove and beach here are smaller than at Crescent Bay and there are no amenities. The width of the beach depends heavily on the tide and fishing and snorkeling/diving are the main uses. Parking is limited to the surrounding residential area. This beach is used mostly by local residents.

 # 54, Fisherman's Cove: Fisherman's Cove is the smallest of the North Laguna cove beaches. It is accessible via a narrow stairway off of Cliff Drive, 300 feet northwest of Diver's Cove. There are no amenities here and during significant high tides the beach becomes submerged. Fisherman's Cove is primarily used for diving, snorkeling, and fishing by local residents.

 # 55, Diver's Cove/Picnic Beach/Rockpile/Heisler Park: South of Cliff Drive, overlooking the ocean is Heisler Park. The park sits atop the bluff and provides access to Diver's Cove, Picnic Beach, and Rockpile. These three beaches all have narrow sandy banks and rocky shorelines. A seasonal lifeguard monitors Diver's Cove and Picnic Beach in the summertime and additional amenities are provided atop the bluff in Heisler Park. On the east and west sides of Cliff Drive are around 200 metered parking spots. In the park there are also two bathroom and shower facilities, numerous picnic areas, and a shuffleboard and lawn bowling court. At the north

headland is a gazebo that attracts street performers, informal merchants, and offers impressive views of the coves to the north and Main Beach to the south. This section of the coast is consistently crowded with locals, county residents, and overnight visitors. In the summertime the proportion of tourists rises. There are numerous hotels and condos in the immediate area. During swells from the south and west Rockpile, the most southern of the three coves, is a popular surfing spot, but the other beaches are mostly used for diving/snorkeling, walking, or tide pool exploration.

 # 56, Laguna Beach/Laguna Main Beach: Main Beach in Laguna is located at the foot of Highway 133 at Pacific Coast Highway. This is where the bulk of Laguna's beach-going tourists can be found as well as many local teenagers. Across Pacific Coast Highway are about four square blocks packed with restaurants, bars, art galleries, a movie theatre, and retail stores. North and south along Pacific Coast Highway are also many hotels. There are designated parking areas and one large structure in midst of this that is meant to supply beach parking as well. At the beach there are restrooms, a year-round lifeguard headquarters, a playground, engraved chess boards, a wooden boardwalk, and two basketball courts rumored to sporadically attract NBA talent. In the summer the beach swells with all types. In the winter, attendance remains steady but most are found strolling along the boardwalk or browsing the wares of the informal vendors or street performers. This beach is a natural stop for any family patronizing the nearby restaurants or shops of downtown Laguna.

 # 57, Brooks Street Beach: Brooks Street Beach is located west of Pacific Coast Highway at the foot of Brooks Street in south Laguna. There are no amenities here other than a couple of benches and trash cans atop the bluff, and parking is limited. A stairway leads down to the narrow beach that is often submerged during high tide. In the summertime this beach is popular with local surfers. Brooks Street is Laguna's marquee surfing destination. In the winter, the waves are less spectacular and crowds are sparse.

 # 58, Bluebird Coast/Pearl Street Beach: The Bluebird coast is located at the foot of Bluebird canyon and Pearl Street Beach is located at the foot of Pearl Street west of Pacific Coast Highway. These beaches are narrow, backed by homes and bluffs with seasonal lifeguard service but no bathrooms and limited street parking. The beaches are used mostly by local and county residents sunbathing or bodyboarding or skimboarding in the shorebreak. The beaches also attract tourists from a large hotel one block north and those seeking to view Arch Rock- a keyhole in the southern headland that connects to the next beach. Also, above the beach at 154 Pearl Street rests the oldest remaining house in Laguna Beach. Historians claim that it was built in 1883 with wood that washed in from shipwrecks.

 # 59, Wood's Cove/Ruby Street Cove: At the west end of Ruby Street in south Laguna is Ruby Cove. There is a small park atop the bluff from which a rough trail leads to a small sandy cove with a rocky shoreline. There are no amenities here and street parking is extremely limited. Users consist of local walkers, and a few divers/snorkelers when conditions are good.

 # 60, Victoria Beach/Lagunita Beach: Victoria Street Beach is reached via a stairway at the juncture of Victoria and Sunset Streets in South Laguna. The beach is very popular for skimboarding and the original and largest skimboard company in the world is named after it. The beach also attracts tourists who come to see a tower built into the cliff in 1926. The tower has a Victorian appearance and was built to provide a spiral staircase to beach users descending the steep bluff. There are no amenities at this beach apart from a volleyball court.

 # 61, Treasure Island Beach: Directly below the Montage Resort and west of Pacific Coast Highway opposite Lang Park is Treasure Island Beach. The beach is easily accessed from Aliso County Beach Park, via a groomed switchback path from the southwest corner of the Montage Resort, or a rough trail opposite the parking lot. Atop the bluff there are a series of grassy park areas connected by a path that contain bathrooms and picnic tables. The amenities available at Aliso Beach are also a short walk away. This beach is used as a less crowded alternative to Aliso County Beach Park, and is easier to access for overnight tourists from the Montage Resort. Across Pacific Coast Highway there is a small parking lot and additional street parking.

 # 62, Aliso County Beach Park: Aliso County Beach Park is located immediately west of Pacific Coast Highway opposite Aliso Way, just north of Camel Point. On the beach there are about 130 metered parking spots and in the east side of the park, across Pacific Coast Highway, there are an additional 90. The eastern parking lot is connected to the beach via a tunnel. Amenities at the beach include a snack bar, a bathroom, a shower facility, a playground, volleyball nets, and lifeguards. This beach is very crowded in the summer and remains popular in the winter. Aliso County Beach provides the most amenities and parking of all Laguna beaches and attracts a consistent and diverse crowd of local and county families in addition to a few overnight tourists. Skimboarding and bodyboarding are popular.

 # 63, Camel Point Beach: Camel Point Beach is located just south of Aliso County Beach Park and is accessible via a trail at the end of Camel Point Drive. The beach is a wide and sandy cove with two rocky headlands at its ends. Amenities include a bathroom and seasonal lifeguard service. This beach is used mostly by local and county residents seeking a smaller crowd than Aliso County Beach Park.

 # 64, Table Rock Beach: Table Rock Beach is a small, secluded cove accessible via a wooden staircase located near the intersection of Table Rock Drive and Pacific Coast Highway. Seasonal lifeguard service is the only amenity here. The beach is popular in the summertime with local and county residents attracted to its beauty and seclusion, and skimboarders attracted to its shore break. In the winter attendance drops off significantly.

 # 65, 1000 Steps Beach: 1000 Steps Beach is accessed via a steep stairway west of Pacific Coast Highway opposite 9th Street in South Laguna Beach. At the base of the stairs is small bathroom facility. Additional amenities include seasonal lifeguard service. This beach is very popular with bodyboarders and skimboarders from Orange County who come to ride a unique

wave created when swells bounce off the southern headland and combine with the shore break. Parking is available on Pacific Coast Highway and up 9th Street but is extremely limited, especially during the summertime. In the winter, the general beachgoers largely disperse and the more committed skimboarders remain.

 # 66, Three Arch Bay/Mussel Cove: Three Arch Bay is a private beach community accessed at the intersection of Vista del Sol and Pacific Coast Highway, immediately north of Monarch Bay. The coast is characterized by a large southern cove and two northern coves. Unlike the other private beach communities, sheer cliffs descend to the beach and there are no amenities apart from a seasonal lifeguard. The beach is popular year-round with community residents for surfing, swimming, and snorkeling/diving. There is also a renowned cliff diving jump on the south face of the northern headland than can be reached by hiking along the shoreline from Salt Creek Beach.

 # 67, Monarch Beach: Monarch Beach is a high-end private beach community that limits direct access to homeowners, beach club members, and guests of the St. Regis Resort, which is connected through an underground tunnel and tram. However, the beach is an easy walk north from Salt Creek Beach. At the beach there is a restaurant that and seasonal lifeguard service is provided by the community. The beach is very popular with local families in addition to the few who chose to make the walk from Salt Creek in search of lesser crowds. Surfing is only popular during very large swells and the beach is generally used for swimming, kayaking, and snorkeling/diving.

 # 68-69, Salt Creek Beach/Dana Strands: Salt Creek includes the beaches of Salt Creek County Beach Park and Dana Strands. This is a popular year-round beach. It is located west of Pacific Coast Highway at the foot of Niguel Road and receives the majority of South Orange County residents pouring to the nearest beach from inland communities. It has over 1,000 parking spots and a variety of amenities are there to accommodate visitors. The beach includes a seasonal snack bar and lifeguards, bathrooms and showers, a large grassy area with picnic areas, volleyball courts and a basketball court. Salt Creek is also an important beach for surfing and bodyboarding. The majority of visitors are from Orange County communities but the beach also has a consistent flow of overnight tourists; the Ritz Carlton is located just above the beach and the St. Regis just across the street. The southern portion of the beach, known as Dana Strands, has a funicular elevator to shuttle patrons down the steep bluff to the beach.

 # 70, Dana Point/Three Caves Beach: West of Dana Point Harbor just outside the breakwater is Three Caves Beach, named for the small caves embedded in the cliff. Parking is available in a nearby lot of about 200 spots and the beach is accessible via a concrete stairway at the foot of the jetty. The beach is narrow and rocky and often submerged. Restrooms and a snack bar are available near the parking lot.

 # 71, Baby Beach/Dana Cove /Mother's Beach: At the northern end of Dana Point Harbor, southwest of Dana Point Harbor Drive, is a small sandy beach circumvented by a series of

grassy areas and a small parking lot. Buoys denote a small swimming zone. This beach is mainly used by tourists and county residents who come to picnic while children swim safely in the still water. Kayak rentals are also available and the beach serves as a safe and useful place to launch. Restroom and seasonal lifeguard service is provided, and the snack bar at Dana Cove Beach is a short walk away. In the winter, attendance drops significantly.

 # 72, Doheny State Beach: Doheny State Beach is located east of Dana Point Harbor, at the intersection of Pacific Coast Highway and Dana Point Harbor Drive. Amenities include lifeguards, a snack bar, bathrooms, showers, volleyball nets, barbeques, picnic areas, fire pits, and camping areas. The beach is popular year-round with overnight tourists, and local and county residents. There are a few reefs and a river mouth sandbar that produce soft but well shaped waves that are popular with longboard and novice surfers and also make the waves safe for children. There is also a large grassy area that is used in the summertime for concerts and events and otherwise is often crowded with visitors playing a range of games. In the park, there are 120 camping sites, and also many hotels in the area.

 # 73, Capistrano County Beach: Capistrano County Beach is located directly west of Coast Highway on Beach Road. The narrow beach is used mostly by county residents and overnight tourists from the nearby hotels. In the summer, amenities here are plentiful and the waves are calm, attracting families who can safely swim. A large parking lot provides 128 metered spaces. There is a volleyball court, basketball courts, bathrooms and showers, and lifeguards. In the winter, the beach stores close but the basketball and volleyball courts are still popular during nice weather.

 # 74, Poche Beach: Poche beach is located near the intersection of El Camino Real and Camino Capistrano. There is a private parking lot on Camino Capistrano with about 100 spots across El Camino Real. Although some visitors use this lot, it is private. The lot also caters to overflow parking from an adjoining plaza containing a Department of Motor Vehicles office and a few other shops. Beach access is through an underpass of El Camino Real. There is a volleyball net but no other public amenities. In the center of the beach is the private Shorecliffs Beach Club that offers a wealth of amenities to its members. Poche has lower visitation than most beaches in this area and has had water quality issues. It is primarily used in the summer by a few local families and by crowd-averse and novice surfers year-round.

 # 75, San Clemente City Beach: The northern section of San Clemente's coast is, for the most part, a thin stretch of sand just west of the railroad tracks that caters to surfers. The width of the beach depends on the tide. These beaches can be reached via pedestrian paths off of Mariposa and Buena Vista streets and parking is limited to the residential streets. The exception is at the north end, where a metered parking lot of about 250 spots located just across El Camino Real caters to the patrons of the Ole Hanson Beach Club, a Metrolink station, and a wide beach that has seasonal lifeguards and snack bar, and a playground and restrooms. This beach is popular with bodyboarders and local and county families in the summertime, but

in winter is popular for surfing. The north end is also where the San Clemente Pedestrian Beach Trail begins.

At the foot of Avenida del Mar at the center of San Clemente sits the San Clemente Pier; the San Clemente City Beach stretches to the north and south. The Pier is crowded year-round with all types of beach users. There are a few hotels and numerous condos located nearby so overnight tourists represent a significant source of tourism, especially in the summer. The Pier is also popular with local and county residents who surf, bodyboard, fish, or dine at the restaurants on the pier, the snack bar on the beach, or any of the establishments located across the street from the beach in the area known as the 'Pier Bowl'. Parking is provided in a metered lot of around 170 parking spots, plus additional metered street parking. Additional amenities at the beach include bathroom and shower facilities, shaded picnic areas, and a playground. Just north of the pier is the San Clemente City Lifeguard Headquarters. Farther north of the Pier is Linda Lane Beach Park, located at the base of Linda Lane. This beach has similar amenities to the Pier and is just short walk away. This beach, however, is slightly less crowded and caters more to local and county families.

Farther south from the San Clemente pier is the "T-Street" beach. T-Street Beach is a popular surfing destination located at the intersection of Esplanade and W. Paseo de Cristobal. Near the beach there are 30 metered parking spots and additional street parking further up the two streets and within the residential area. A pedestrian bridge leads over the railroad tracks to the beach where there are lifeguards, a seasonal snack bar, a restroom, and shower facilities. T-Street is very popular with locals and county residents year-round. In the summer, surfing is prohibited from 10am to 6pm, and swimmers, bodyboarders, and sunbathers dominate the wide sandy beach. During summer mornings and evenings, and in the winter, surfing is popular at the centrally located reef break.

 # 76, San Clemente State Beach/Calafia Beach: San Clemente State Beach can be reached off Avenida Calafia which intersects the I-5 freeway. The park provides around 150 campsites, year-round lifeguard service, and restroom and shower facilities. Trails from the bluff top park lead to the beach. In the summer months the beach and campground are filled with overnight visitors. In the winter, mostly local surfers remain.

Where Avenida Calafia terminates near the beach is the San Clemente State Beach - Calafia. The state provides a metered parking lot of 190 spots, a restroom and shower facility, and seasonal food and lifeguard service. The beach here is narrower than the beaches to the north or south, nevertheless due to the available amenities it is heavily populated by local, county, and tourist beachgoers when the weather is favorable. In the winter, surfers remain. The San Clemente Inn is just a few blocks from this beach and a few other hotels are located east of the freeway.

 # 77, Cottons/Cotton's Point: The beach backing Cottons surf break is in the City of San Clemente, between San Clemente State Beach and the Orange County Border. It is the

northernmost beach in the Trestles area, accessible via a paved path off of Christianitos Road that runs to Trestles (through San Onofre State Beach and the San Mateo Wetlands). Parking is available on the east side of the I-5 in a paid lot of just over 100 spots or on the adjacent street. There are no amenities here apart from a pit toilet at the base of the path. Cottons is a well regarded surfing destination and the beach is primarily used by surfers. In the winter the demographic is mostly local and southern California residents, however in the summer the beach is crowded with traveling surfers. Cottons is also the location of President Nixon's Western White House, La Casa Pacifica, which sits atop Cottons overlooking the ocean.

2.4.3 Attendance and Recreational Amenities

Data were collected on attendance and recreational amenities for the Plan as described in Appendix E. Table 2.5, below, provides official estimates of attendance for all beaches in Orange County where such data exists. Most of the major beaches and all state beaches provide such data. No data exist where spaces are blank. King and McGregor (2011) found that these official estimates are often too high, especially at smaller beaches and this study did not provide alternative estimates. The estimates of high and low season attendance are taken from Dwight (2007) and differ from official estimates. Note also that Coastal Resources Management (CRM, 2009) studied some specific intertidal sites at Corona Del Mar and parts of Laguna Beach, which provide a wealth of data on this aspect of beach and coastal visitation

Even though these estimates do not include all beaches in the Orange County, the overall attendance estimates are striking with just over 46 million day visits per year. Huntington City Beach tops the list with 9.9 million visitors per year. Newport - Balboa Beaches are close behind, with 7.8 million visitors per year. Laguna City estimates its beaches have 4.1 million visitors per year. A number of other beaches in Orange County have over one million visitors per year, those being Seal Beach, Bolsa Chica State Beach, Huntington State Beach, Aliso County Beach Park, Dana Strands - Doheny State Beach, and San Clemente City Beach.

Table 2.6 indicates which beaches have various recreational amenities including restrooms, lifeguards, showers, piers, campgrounds, etc. The final column rates the popularity of surfing at each beach with a rating based on purely subjective standards. A rating of 0 indicates no surfing is available or it is virtually nonexistent. A rating of 4 indicates that surfing is extremely popular. The most popular surfing beaches such as Huntington City Beach, West Newport Beach, and Cottons attained a rating of 4 on this scale.

Table 2.5 Attendance at Orange County Beaches

#	Beach	Annual	High Season	Low Season
1,2	Seal Beach (East - West)	2,278,774	1,221,977	1,056,797
3	Surfside			
4	Sunset Beach	2,257,856	1,210,760	1,047,096
5,6	Huntington Harbour Beaches			
7	Bolsa Chica State Beach	2,764,712	1,318,241	1,446,471
8	Huntington Cliffs			
9	Huntington City Beach	9,931,425	5,325,659	4,605,766
10	Huntington State Beach	2,542,332	1,412,753	1,129,579
11,12	West Newport Beach			
13	Newport Beach Pier	7,844,108	4,206,349	3,637,758
14	Balboa Beach			
15-46	Newport Harbor Beaches			
47	Corona Del Mar State	369,515	231,285	138,230
48	Little Corona Del Mar			
49	Crystal Cove State Park	666,820	266,966	399,854
50	Irvine Cove			
51	Emerald Bay			
52	Crescent Bay			
53	Shaw's Cove			
54	Fisherman's Cove			
55	Diver's Cove - Heisler Park			
56	Laguna Beach	4,131,516	2,215,497	1,916,019
57	Brooks Street Beach			
58	Bluebird Coast			
59	Woods Cove			
60	Victoria Beach			
61	Treasure Island Beach			
62	Aliso County Beach Park	3,298,056	1,768,560	1,529,496
63	Camel Point Beach			
64	Table Rock Beach			
65	1000 Steps Beach			
66	Three Arch Bay			
67	Monarch Beach			
68,69	Salt Creek Beach – Dana Strands	3,967,715	2,127,660	1,840,055
70	Dana Point	1,214,374	651,200	563,174
71	Baby Beach			
72	Doheny State Beach	1,827,231	775,969	1,051,263
73	Capistrano County Beach			
74	Poche Beach			
75	San Clemente City Beach	2,583,940	1,385,620	1,198,320
76	San Clemente State Beach	519,641	222,454	297,188
77	Cottons			

Table 2.6 Recreational Amenities of Orange County Beaches

#	Beach	Access	Rest-room	Showers	Lifeguard	Pier	Board-walk	Restaurant/ Snack Bar	Play-ground	Volley-ball	Camp-ground	Surfing
1	West Beach, Seal Beach	2	y	y	y	n	y	y	n	y	n	3
2	East Beach, Seal Beach	3	y	y	y	y	y	y	y	y	n	3
3	Surfside	3	n	n	y	n	n	n	n	n	n	2
4	Sunset Beach	3	y	y	y	n	n	y	y	y	n	3
5,6	Huntington Harbour Beaches	1	varies	n	varies	y	n	y	y	varies	n	0
7	Bolsa Chica State Beach	3	y	y	y	n	y	y	n	n	y	3
8	Huntington Cliffs	3	y	n	y	n	Y	n	n	n	n	4
9	Huntington City Beach	4	y	y	y	n	Bluff	y	y	y	n	4
10	Huntington State Beach	4	y	y	y	n	Y	y	n	y	n	3
11,12	West Newport Beach	2	y	y	y	n	Y	y	y	y	n	4
13	Newport Beach Pier	3	y	y	y	y	Y	y	y	y	n	3
14	Balboa Beach	2	y	y	y	y	Y	y	y	y	n	1
15-46	Newport Harbor Beaches	1	n	n	harbor patrol	n	N	y	n	n	n	0
47	Corona Del Mar State Beach	3	y	y	y	n	N	y	y	y	n	1
48	Little Corona Del Mar	2	y	n	y	n	N	n	n	n	n	0
49	Crystal Cove State Park	3	y	y	y	n	bluff	bluff	n	n	y	2
50	Irvine Cove	1	y	y	y	n	n	n	y	y	n	0
51	Emerald Bay	1	y	y	y	n	n	n	n	n	n	0
52	Crescent Bay	1	y	y	y	n	n	n	n	n	n	0
53	Shaw's Cove	1	n	n	n	n	n	n	n	n	n	0
54	Fisherman's Cove	1	n	n	n	n	n	n	n	n	n	0

Table 2.6 continued

#	Beach	Access	Rest-room	Showers	Lifeguard	Pier	Board-walk	Restaurant/ Snack Bar	Play-ground	Volley-ball	Camp-ground	Surfing
55	Diver's Cove - Heisler Park	1	varies		varies	n	varies	n	n	n	n	0
56	Laguna Beach	2	y	y	y	n	y	y	y	y	n	0
57	Brooks Street Beach	1	n	n	n	n	n	n	n	n	n	3
58	Bluebird Coast	1	n	n	n	n	n	n	n	n	n	0
59	Wood's Cove	1	n	n	n	n	n	n	n	n	n	0
60	Victoria Beach	1	n	n	y	n	n	n	n	y	n	0
61	Treasure Island Beach	2	y	y	y	n	bluff	n	n	n	n	0
62	Aliso County Beach Park	3	y	y	y	n	n	y	y	y	n	0
63	Camel Point Beach	1	y	n	y	n	n	n	n	y	n	0
64	Table Rock Beach	1	n	n	y	n	n	n	n	n	n	0
65	1000 Steps Beach	1	y	n	y	n	n	n	n	n	n	2
66	Three Arch Bay	1	n	n	y	n	n	n	n	n	n	1
67	Monarch Beach	1	y	y	y	n	n	y	n	y	n	0
68,69	Salt Creek Beach	3	y	y	y	n	n	y	y	y	n	4
70	Dana Point	3	n	n	n	n	n	n	n	n	n	0
71	Baby Beach	2	y	y	y	nearby	n	y	y	n	n	0
72	Doheny State Beach	3	y	y	y	n	n	y	y	y	y	4
73	Capistrano County Beach	3	y	y	y	n	n	y	y	y	n	0
74	Poche Beach	3	n	n	y	n	n	n	n	n	n	1
75	San Clemente City Beach	4	y	y	y	y	y	y	y	y	n	3
76	San Clemente State Beach	3	y	y	y	n	y	y	n	y	y	3
77	Cottons	2	y	n	jeep	n	n	n	n	n	n	4

2.4.4 Parking and Access of Beaches in Orange County

The California Coastal Act mandates that all of California's beaches should be accessible to the general public and not just those who own property on the beach. Parking capacity is an important factor at many beaches since it limits access and often determines the maximum capacity for beach use, especially on crowded weekends in the summer. Consequently it is useful to know what the parking capacity is for each beach. Most large beaches have official parking lots next to the beach that typically charge by the hour, day or season. Metered parking on the street near the beach is also prevalent in many beach towns such as Huntington City Beach and West Newport Beach.

Table 2.7 provides data for parking and access at Orange County's beaches. Data were collected for this study as detailed in Appendix E. The second column in Table 2.7 rates access on a scale of 1 to 4, with 1 being poor and 4 being very good. To earn a rating of 4 a beach must be close to the major roads, have adequate parking near the beach and have good mass transit opportunities. Only Huntington City and State Beaches and San Clemente City Beach were rated with a 4. San Clemente City beach has a train stop. Many otherwise very popular beaches had good access earning a 3. Beaches earning a 2 such as Cottons and China Cove required significantly more effort to get to. A number of beaches rated a 1 particularly the many coves in Laguna where parking is very restricted and beaches inside Newport Harbor, most of which are quite small and have restricted access.

Table 2.7 also provides the number of official parking spots, parking fees, metered street parking, and free parking available. The average percentage of street parking available to beach visitors was estimated as part of this report. Normally, beach visitors must compete with other drivers for parking.

Table 2.7 Parking and Access at Orange County Beaches

#	Beach	Access	Bus Access	Train Access	# Official Parking Spots	Parking Fee ($)	# Metered Street Parking	% of Metered for Beach	Parking Fee	Free Street Parking	% of Free for Beach
1	West Beach, Seal Beach	3	n	n	119	0	0	n/a	n/a	246	60
2	East Beach, Seal Beach	3	y	n	286	5/day	0	n/a	n/a	582	60
3	Surfside	2	y	n	0	n/a	0	n/a	n/a	0	n/a
4	Sunset Beach	3	y	n	623	0	0	n/a	n/a	610	70
5,6	Huntington Harbour Beaches	1	n	n	n/a						
7	Bolsa Chica State Beach	3	y	n	2136	15/day	0	n/a	n/a	0	n/a
8	Huntington Cliffs /Dog Beach	3	y	n	248	1.5	0	n/a	n/a	0	n/a
9	Huntington City Beach	4	y	n	3102	15/day	914	50	1.5	4830	30
10	Huntington State Beach	4	y	n	2676	15/day	0	n/a	n/a	0	n/a
11,12	West Newport Beach	2	y	n	104	1	150	90	1	1357	30
13	Newport Beach Pier	3	y	n	387	1	470	50	1	605	10
14	Balboa Beach	3	y	n	762	1	270	70	1	1700	30
15-46	Newport Harbor Beaches	1	y	n	892	varies	0	n/a	n/a	715	15
47	Corona Del Mar State Beach	3	n	n	545	8/day	0	n/a	n/a	610	70
48	Little Corona Del Mar	2	n	n	0	n/a	0	n/a	n/a	240	70
49	Crystal Cove State Park	3	blufftop	n	414	15/day	0	n/a	n/a	0	n/a
50	Irvine Cove	1	n	n	0	n/a	0	n/a	n/a	0	n/a
51	Emerald Bay	1	n	n	0	n/a	0	n/a	n/a	0	n/a
52	Crescent Bay	1	y	n	0	n/a	56	50	1.5	157	40
53	Shaw's Cove	1	y	n	0	n/a	26	40	1.5	87	15
54	Fisherman's Cove	1	y	n	0	n/a	n/a				
55	Diver's Cove - Heisler Park	1	y	n	0	n/a	n/a				

Table 2.7 continued

#	Beach	Access	Bus Access	Train Access	# Official Parking Spots	Parking Fee ($)	# Metered Street Parking	% of Metered for Beach	Parking Fee	Free Street Parking	% of Free for Beach
56	Laguna Beach	2	y	n	325	2	320	15	2	58	10
57	Brooks Street Beach	1	PCH	n	0	n/a	63	30	1.5	8	20
58	Bluebird Coast	1	PCH	n	0	n/a	55	50	1.5	45	20
59	Wood's Cove	1	PCH	n	0	n/a	20	20	1.5	51	20
60	Victoria Beach	1	PCH	n	0	n/a	0	n/a	n/a	47	20
61	Treasure Island Beach	2	PCH	n	20	1.5	122	60	1.5	0	n/a
62	Aliso County Beach Park	3	y	n	220	1	0	n/a	n/a	25	100
63	Camel Point Beach	1	PCH	n	0	n/a	0	n/a	n/a	80	90
64	Table Rock Beach	1	PCH	n	0	n/a	0	n/a	n/a	118	60
65	1000 Steps Beach	1	PCH	n	0	n/a	0	n/a	n/a	110	60
66	Three Arch Bay	1	n	n	0	n/a	0	n/a	n/a	0	n/a
67	Monarch Beach	1	n	n	0	n/a	0	n/a	n/a	0	n/a
68,69	Salt Creek Beach	3	PCH	n	1004	1	0	n/a	n/a	110	85
70	Dana Point	3	n	n	193	0	0	n/a	n/a	0	n/a
71	Baby Beach	2	n	n	130	0	0	n/a	n/a	0	n/a
72	Doheny State Beach	3	entrance	n	771	15/day	0	n/a	n/a	0	n/a
73	Capistrano County Beach	3	y	n	128	1	0	n/a	n/a	157	95
74	Poche Beach	3	y	n	129	0	29	n/a	n/a	0	0
75	San Clemente City Beach North	3	y	y	253	1	15	75	1	60	60
75	San Clemente City Beach Pier	4	y	y	487	1	110	100	1	756	80
75	San Clemente City Beach South	4	y	y	740	1					
76	San Clemente State Beach	3	top of park	n	170	15/day	0	n/a	n/a	0	n/a
77	Cottons	2	trailhead	n	105	15/day	0	n/a	n/a	93	97

3. PLAN ELEMENTS

This section discusses the elements that were used to develop Plan activities. Plan elements include the potential sediment receiver sites that can accept sediment, possible sediment sources, available methods to implement RSM solutions, biological constraints, regulatory and permitting constraints, governance issues, and possible funding sources. These elements can be viewed as the building blocks from which Plan activities were created.

3.1 Receiver Sites

A key component of RSM is disposal or placement of available sediment. Disposal refers to management alternatives that rely on discarding dredged material, usually without the intent for beneficial use. Placement of clean material on beaches and nearshore can provide benefits of widening the receiving beach areas. Typical coastal disposal and placement options include open ocean disposal, submerged aquatic disposal, nearshore confined disposal, unconfined nearshore placement, and beach nourishment. Placement options within the watershed include downstream from dams and reservoirs, along stream banks, and in landfills. Sediment disposal and placement options are discussed below.

3.1.1 Open Ocean Disposal

Open ocean disposal involves placing dredged material at designated open ocean disposal sites, if the material is proven suitable for such disposal. There are currently two designated open ocean disposal sites near Orange County: LA-2 Ocean Dredged Material Disposal Site (ODMDS), which is located in San Pedro Bay, approximately six miles south of the Los Angeles Harbor; and LA-3 ODMDS, which is off the Orange County coast, approximately four miles southwest of the entrance to Newport Harbor. The LA-2 site was designated as a permanent disposal site in 1991 and serves Los Angeles and Long Beach Harbors, the Los Angeles River Estuary, Marina del Rey, Anaheim Bay and Huntington Harbour. LA-3 was designated as a permanent disposal site by the U.S. Environmental Protection Agency (USEPA) in 2005 to service the disposal needs of the Orange County harbors (USEPA and USACE, 2004).

3.1.2 Landfills

Landfill disposal options include placement at inland confined disposal facilities and Class I, II, and III commercial landfills. Primary issues with using a commercial landfill include: 1) available landfill capacity, 2) high disposal fees, 3) high transport and trucking costs, and 4) dewatering requirements and costs. In addition to the above, other issues with development of a landfill include: 1) land availability and facility capital cost, 2) containment leaching, 3) effluent control, and 4) long-term end use.

3.1.3 Nearshore Confined Disposal

A nearshore confined disposal facility involves placing contaminated dredged materials inside a diked nearshore area or island constructed with containment and control measures such as lining, covering and effluent control. This disposal option has been employed by the Ports of Los Angeles and Long Beach for many years and has been the standard method for disposing of contaminated dredged sediments.

3.1.4 Confined Aquatic Disposal

Confined aquatic disposal is a procedure where contaminated sediments are placed into a submerged mound or depression and covered with clean sediments to form a cap that will prevent upward migration of contaminants into the water column or surficial sediment layer. This option was successfully constructed for a pilot study in 2001, where material was placed near one of the oil islands off the coast of Long Beach (USACE, 2002c).

3.1.5 Nearshore Nourishment

Placement of sediment in the nearshore environment, close to beaches, can restore beaches for recreational use and protect the shoreline from erosion. These nourishments should have grain sizes comparable to those of the native beach material, as well as being aesthetically compatible in color and texture with the native beach material. If deposited close enough to the beach, the placed sediment will gradually move onshore by waves and currents, thereby increasing the beach width. Where sediment is suitable, nearshore placement is a preferred method over the previously mentioned disposal options due to the indirect benefits to beaches.

3.1.6 Beach Nourishment

Beach nourishment involves placing available sediment along eroded shorelines to replenish and widen beaches. Nourished material should have grain sizes comparable or slightly larger than those of the native material as well as aesthetically compatible in color and texture with the existing beach material. Where sediment is beach suitable, beach nourishment is a preferred placement method due to the direct benefits accrued by the beaches.

3.1.7 Upland Stream and River Placement

Placement of sediment along a stream, creek, or river bank for purposes of downstream nourishment is a relatively uncommon attempt to replicate natural sediment transport processes around an existing dam or other sediment trap. Example projects that intend to utilize this method are the Santa Anita Reservoir Sediment Removal Project (Los Angeles County Department of Public Works, 2007) and the Prado Basin Sediment Management Demonstration Project (Orange County Water District, 2011 and Appendix D). Where sediment is suitable,

stream and river placement is a preferred mechanism due to the indirect benefits accrued by the beaches.

3.1.8 Coastal Receiver Sites

The preferred coastal receiver sites are explicitly listed because of their known need for nourishment. These sites are beach or nearshore locations that have received sand in the past, have been identified in previous work as in need, or are listed as Beach Erosion Concern Areas (BECAs) by the California CSMW (2010). These coastal receiver sites are listed in the order of geographic location from west to east in Table 3.1, and marked in Figure 3.1 using the beach tracking numbers previously developed in Table 2.4. The receiver sites were prioritized based on need, hence the most eroded beaches with the highest recreational use and the greatest potential for storm damage have a high need and the widest beaches with lowest recreational use and lowest potential for storm damage have a low need. These needs were determined in consultation with Orange County and USACE. Additional details on each receiver site can be found in the references listed in Table 3.1.

Table 3.1 Coastal Receiver Sites

BEACH #	NEED	NAME	LOCATION	LITERATURE REFERENCE
2	High	East Beach	Seal Beach	2
3,4	High	Surfside-Sunset Beach	Seal Beach, Huntington Beach	1
5	Medium	Coral Cay	Huntington Harbour	6, 8
6	Low	Davenport Beach	Huntington Harbour	8
8	High	Huntington Cliffs	Huntington Beach	1
10	Low	Huntington State Beach, Santa Ana River County Beach	Huntington Beach, Newport Beach	2
11,12	Medium	West Newport Beach	Newport Beach	2
13	High	Newport Beach Pier	Newport Beach	4
15	Medium	Channel Place Park	Newport Harbor	5
17	High	Lake Street	Newport Harbor	5
18	Medium	Newport Island Park	Newport Harbor	5
21	High	Marina Park	Newport Harbor	5
22	Medium	15th Street	Newport Harbor	5
23	Medium	Via Lido Nord	Newport Harbor	5
25	Medium	10th Street	Newport Harbor	5
29	High	Edgewater/Montero	Newport Harbor	5
36	Medium	North Bay Front	Newport Harbor	5
37	Medium	South Bay Front	Newport Harbor	5
41	Medium	East Bay Front	Newport Harbor	5
43	High	M Street	Newport Harbor	5
44	Medium	Carnation Cove	Newport Harbor	5
45	High	China Cove	Newport Harbor	5
46	High	Pirate's Cove	Newport Harbor	5
47	Low	Corona del Mar State Beach	Newport Beach	2
71	Low	Baby Beach	Dana Point Harbor	3, 4
72	Medium	Doheny State Beach	Dana Point	7
73	High	Capistrano County Beach	Dana Point	3
75	High	San Clemente City Beach	San Clemente	1, 9

References:
1 = CSMW, 2010;
2 = USACE, 2002b;
3 = CCC, 2007;
4 = Miller, 2011;
5 = Everest, 2009a;
6 = Cornerstone Technologies, Inc., 2005;
7 = USACE, 1991;
8 = Webb, 2011;
9 = CCC, 2011.

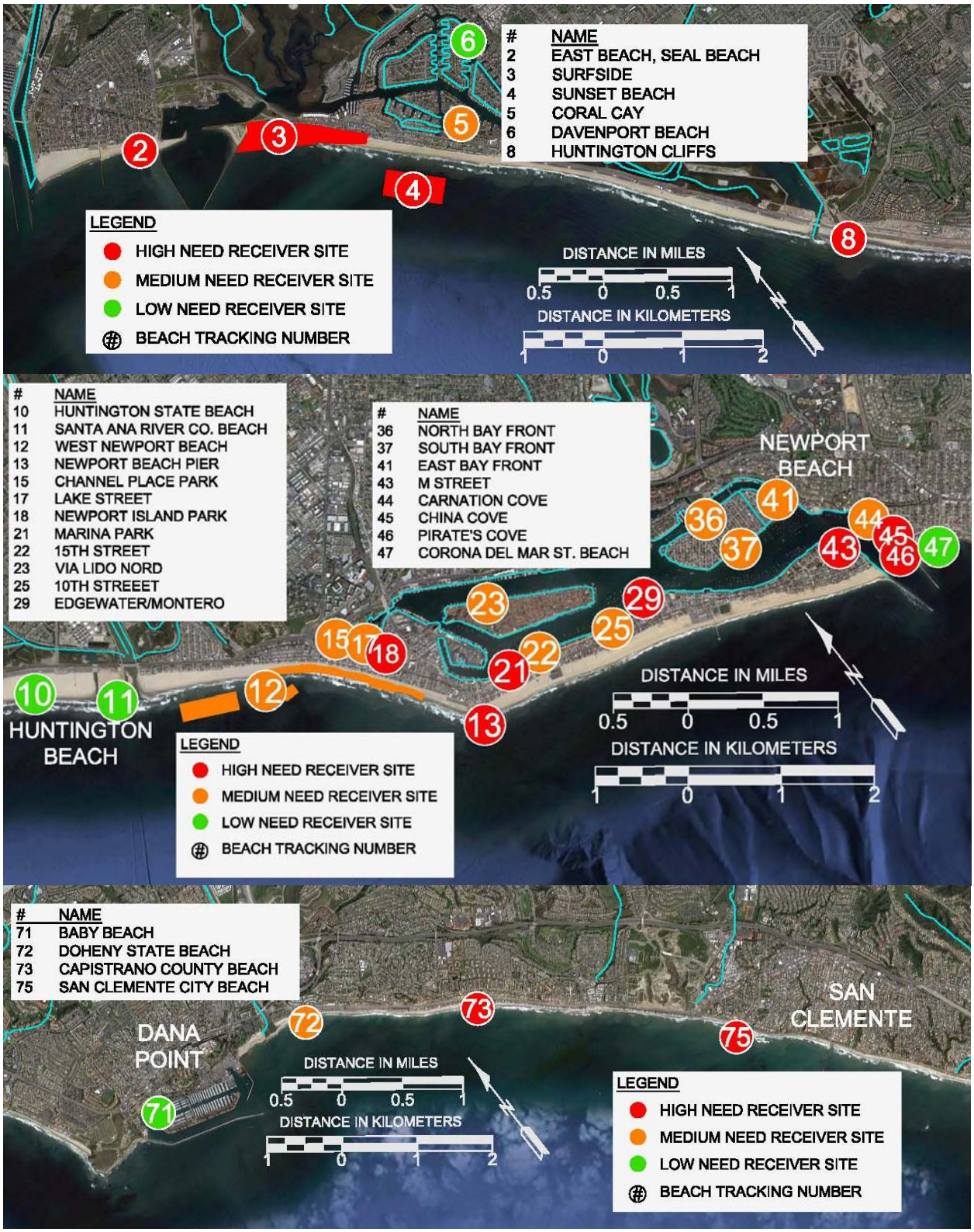


Figure 3.1 Coastal Receiver Sites

3.2 Sediment Sources

Information on possible sediment sources for nourishment projects within the Plan area is presented within this section of the report. Although some sediment quantity and grain size characteristics of these sources are known, information regarding material properties, timeframe of their availabilities and transport costs varies and continually changes depending on project-specific characteristics. The listings of potential sediment sources are in the early stages of development, and can be expanded as more information becomes available. Sources are separated into upland and coastal categories. Information on the type of source (such as reservoir, lake or debris basin) is also presented. Due to the large number of sources listed, physical properties of each source are not provided. Instead, general descriptions of those properties on a wider scale are summarized below.

3.2.1 Upland Sediment Sources

Upland sediment sources are diverse and most numerous within drainage courses such as water-related infrastructure. These include reservoirs, lakes, retention basins, debris basins, retarding basins, rivers, creeks, and stream beds. Construction projects can also be a good source of upland sediment. Two examples of typical upland sediment sources are shown in Figure 3.2, with sand deposition occurring in the upper reaches of San Diego Creek and upstream of Upper Newport Bay.

Figure 3.2 Sand in San Diego Creek at Main Street (left) and Jeffrey Road (right) (photos: Doug Shibberu)

The upland sediment sources listed in Table 3.2 is limited to those locations within 50 miles of the coast and drain to the Orange County coast. These upland sediment source locations are shown graphically in Figure 3.3. There are sediment volume and grain size data available for some of the upland sediment sources, but most of these are identified here as potential

sediment sources for the first time. Since lakes and reservoirs are known deposition areas within the watersheds, it was assumed that each of these is a potential upland sediment source in Table 3.2. Additional research would be required to determine how much sediment is available in each source, how much of those sediments is sand, and the rates at which this material replenishes itself. Literature references are provided for the upland sediment sources listed in Table 3.2. Total volume of available sand within each watershed is provided in the following sections as an aggregate of volumes within each dam, river, creek, basin, or reservoir.

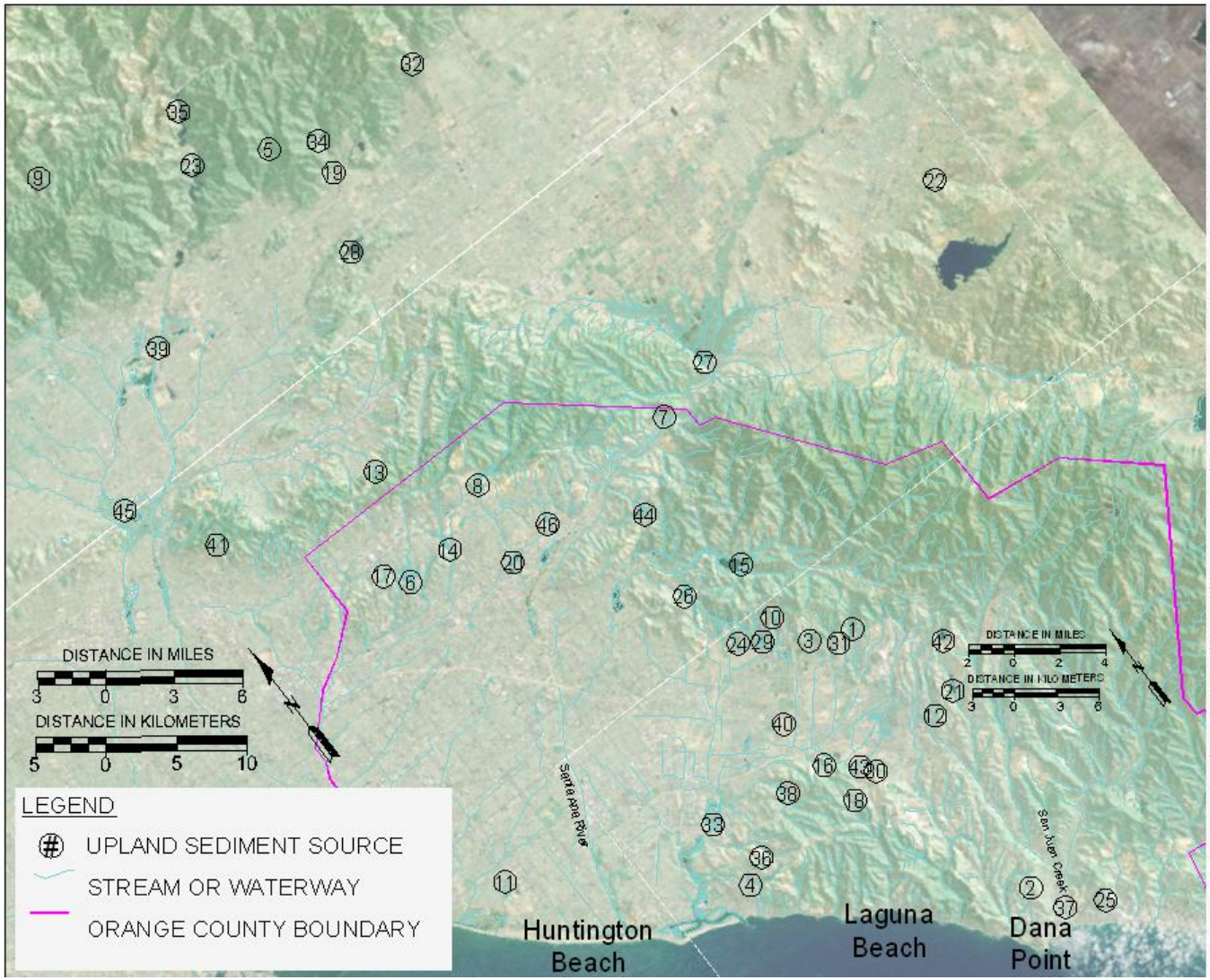
Table 3.2 Upland Sediment Sources

#	NAME	TYPE	COUNTY	LITERATURE REFERENCE
1	Agua Chinon	Retarding Basin	Orange	1
2	Aliso Sewer Tunnel	Construction	Orange	4
3	Bee Canyon	Retarding Basin	Orange	1
4	Big Canyon	Reservoir	Orange	5
5	Big Dalton	Reservoir	Los Angeles	2
6	Brea Flood Control Basin	Reservoir	Orange	2
7	Brush Basin	Debris Basin	San Bernardino	6
8	Carbon Canyon	Reservoir	Orange	2, 9
9	Cogswell	Reservoir	Los Angeles	2
10	E. Hicks Canyon	Retarding Basin	Orange	1
11	Edinger, Sunset, Wintersburg	Flood Control	Orange	7
12	El Toro	Reservoir	Orange	5
13	Fieldbrook	Debris Basin	Los Angeles	6
14	Fullerton	Reservoir	Los Angeles	2, 9
15	Irvine (Santiago R.)	Lake	Orange	5
16	Laguna	Reservoir	Orange	9
17	Laguna	Lake	Orange	5
18	Lagunas	Lake	Orange	5
19	Live Oak	Reservoir	Los Angeles	2
20	Miller Retarding Basin	Debris Basin	Orange	1
21	Mission Viejo	Lake	Orange	5
22	Mockingbird Canyon	Reservoir	Riverside	9
23	Morris	Reservoir	Los Angeles	5
24	Orchard Estates	Retarding Basin	Orange	1
25	Palisades	Reservoir	Orange	5

Table 3.2 continued

#	NAME	TYPE	COUNTY	LITERATURE REFERENCE
26	Peters Canyon	Reservoir	Orange	5
27	Prado	Flood Control Basin	Riverside	2, 8, 9
28	Puddingstone	Reservoir	Los Angeles	2, 9
29	Rattlesnake Canyon	Reservoir	Orange	5
30	Rossmoor Number 1 799	Reservoir	Orange	5
31	Round Canyon	Retarding Basin	Orange	1
32	San Antonio	Reservoir	Los Angeles, San Bernardino	2
33	San Diego Creek	Creek	Orange	4, 10
34	San Dimas	Reservoir	Los Angeles	2
35	San Gabriel	Reservoir	Los Angeles	2
36	San Joaquin	Reservoir	Orange	5
37	San Juan Creek	Creek	Orange	4
38	Sand Canyon	Dam	Orange	5
39	Santa Fe	Reservoir	Los Angeles	2, 9
40	Trabuco	Retarding Basin	Orange	1
41	Turnbull	Debris Basin	Los Angeles	3
42	Upper Oso Dam	Reservoir	Orange	5
43	Veeh	Reservoir	Orange	5
44	Walnut Cyn	Reservoir	Orange	5
45	Whittier Narrows	Reservoir	Los Angeles	2
46	Yorba Linda	Reservoir	Orange	5

References:
1 = Higgins et. al., 2004;
2 = Slagel et. al., 2006;
3 = Corps of Engineers, 1960;
4 = Stakeholder Minutes;
5 = Lakelocate.com, 2011;
6 = Noble Consultants, 2000;
7 = Tetra Tech, Inc., 2000;
8 = Golder Associates, Inc. 2009;
9 = USGS, WICP, RESSED;
10 = Shibberu, 2011.



#	NAME	TYPE
1	Agua Chinon	Retarding Basin
2	Aliso Sewer	Construction
3	Bee Canyon	Retarding Basin
4	Big Canyon	Reservoir
5	Big Dalton	Reservoir
6	Brea Flood Control	Reservoir
7	Brush Basin	Debris Basin
8	Carbon Canyon	Reservoir
9	Cogswell	Reservoir
10	E. Hicks Canyon	Retarding Basin
11	Edinger, Sunset	Flood Control
12	El Toro	Reservoir
13	Fieldbrook	Debris Basin
14	Fullerton	Reservoir
15	Irvine (Santiago R.)	Lake
16	Laguna	Reservoir
17	Laguna	Lake
18	Lagunas	Lake
19	Live Oak	Reservoir
20	Miller	Retarding Basin
21	Mission Viejo	Lake
22	Mockingbird Cyn	Reservoir
23	Morris	Reservoir
24	Orchard Estates	Retarding Basin
25	Palisades	Reservoir
26	Peters Canyon	Reservoir
27	Prado	Flood Control Basin
28	Puddingstone	Reservoir
29	Rattlesnake Cyn	Reservoir
30	Rossmoor 1 799	Reservoir
31	Round Canyon	Retarding Basin
32	San Antonio	Reservoir
33	San Diego	Creek
34	San Dimas	Reservoir
35	San Gabriel	Reservoir
36	San Joaquin	Reservoir
37	San Juan Creek	Creek
38	Sand Canyon	Dam
39	Santa Fe	Reservoir
40	Trabuco	Retarding Basin
41	Turnbull	Debris Basin
42	Upper Oso Dam	Reservoir
43	Veeh	Reservoir
44	Walnut Cyn	Reservoir
45	Whittier Narrows	Reservoir
46	Yorba Linda	Reservoir

Figure 3.3 Upland Sediment Sources

San Gabriel River Watershed

Second only to the Los Angeles River, the San Gabriel River is the most heavily controlled river in southern California. Within its drainage there are 38 smaller check dams, 16 debris basins, 8 flood control and storage reservoirs, two larger flood control basins, several artificial percolation basins, and near-complete channelization below the mountain catchments (Brownlie et. al., 1981). The potential sand delivery of the San Gabriel River under natural conditions, assuming no controls existed upstream, was estimated at 784,000 yd^3/year. From Section 2.3.1 of this report, the current sand delivery for this river was estimated at 20,000 yd^3/year. The 764,000 yd^3/year difference between these rates is provided as an estimate of the volume of sand that is trapped in the upland sediment sources along this river. These three sand volumes as well as those for other watersheds are summarized in Table 3.3.

Huntington Harbour Watershed

The watershed that drains into Huntington Harbour is large and heavily urbanized with much of the material originating from drainage outlets, such as the Wintersburg, Sunset (i.e., Heil), and Edinger (i.e., Bolsa Chica) Flood Control Channels. There are insufficient diversion systems, sediment traps, silt traps, or catch basins to remove all the sediment, trash and debris from these channels before it reaches Huntington Harbour. Results from a bathymetric survey of Huntington Harbour in the year 2000 indicate that approximately 34,000 yd^3 of sediment needs to be dredged (Tetra Tech, Inc., 2000). It has been estimated that the future sediment dredging rate is approximately 11,000 yd^3/year (Moffatt & Nichol, 2009b), with the sand portion being much less. In addition, it can be assumed that a large and unknown quantity of potential RSM beneficial sand is trapped in upland catchments that feed into Huntington Harbour.

Santa Ana River Watershed

The Santa Ana River is highly controlled and channelized and is the largest and most heavily used river in southern California (Brownlie et. al., 1981). Under natural conditions it was estimated that 430,000 to 650,000 yd^3/year of sand could be delivered to the coast from the Santa Ana River. USACE estimated a sand yield of 33,000 yd^3/year (USACE, 2002b) and Brownlie et. al. (1981) estimated that 140,000 yd^3/year are currently being delivered to the coast. From this, it is estimated that from 250,000 to 617,000 yd^3/year are trapped in upland areas. Roughly 226,000 yd^3/year of sand is estimated to be trapped behind the Prado Dam (CDBW et. al., 2002), with the remaining assumed to be distributed amongst other upland sediment sources. A separate study by Slagel and Griggs (2006) estimated that dams and flood control devices along the Santa Ana River reduce the rate of sand and gravel flow to the coast by 243,000 yd^3/year.

Newport Bay Watershed

There has been extensive upstream sediment catchment basins added to remove coarse sediment before it enters the Upper Newport Bay. Prior to the installation of these basins, USACE estimated approximately 1 to 1.5 million yd^3 of sediment would be transported to the Lower Newport Bay in a 15-year cycle (Weston Solutions, 2009), averaging 67,000 to 100,000 yd^3/year. Most of the sediment is now trapped upstream of the Upper Newport Bay.

Aliso Creek Watershed

The single largest contribution to the Laguna Beach Littoral Cell is Aliso Creek. The historical sand yield from Aliso Creek was estimated to be 12,000 yd^3/year (Everts Coastal, 1997) for a period prior to 1982. No estimates are available for the combined volumes of sand that are trapped in the watershed. A more recent estimate of the sand load from this creek yielded 18,300 yd^3/year based on conditions as recent as year 2006 (Tetra Tech, Inc., 2009). Various restoration alternatives are being considered for the creek which will likely change the sand load, depending on which alternative is adopted (Tetra Tech, Inc., 2010).

North Oceanside Littoral Cell Creeks

Contributions from the San Juan, San Clemente, San Mateo, and San Onofre Creek watersheds were provided by USACE (1991) and described in Section 2.3.4 of this report.

Table 3.3 Upland Sediment Volumes by River or Creek

WATERSHED	POTENTIAL SAND LOAD (YD^3/YEAR)	CURRENT SAND LOAD (YD^3/YEAR)	UPLAND TRAPPED SAND (YD^3/YEAR)	UPLAND TRAPPED SEDIMENT (YD^3/YEAR)
San Gabriel River	784,000	20,000	764,000	-
Huntington Harbour	-	<<11,000	-	-
Santa Ana River	430,000 – 650,000	33,000 - 180,000	243,000 – 617,000	-
Newport Bay	-	-	-	67,000 – 100,000
Aliso Creek	-	18,300	-	-
San Juan Creek	48,000 – 56,000	39,000 – 38,000	9,000 - 18,000	-
San Clemente Creek*	-	0	-	-
San Mateo and San Onofre Creeks	39,000	20,000	19,000	-

- = unknown, << = much less than
**currently known as Prima Deschecha Canada and Segunda Deschecha Canada*

Sand and Gravel Mining

By some estimates, the primary cause of sediment deficits in California beaches is not dams but sand and gravel mining (Magoon et. al., 2005; Richmond et. al., 2007), with southern California losses averaging an estimated 20 million yd^3/year (Kent et. al., 2005). There are dozens of legal sand mining operations within 50 miles of the Orange County coast and most of these operate by removing sand and aggregate from existing stream beds or immediately adjacent to them. A few examples of quarries that mine sand within this region are listed in Table 3.4. This list includes only a small fraction of the many sand mines in the Plan area. While this mining is controlled by the U.S. Bureau of Land Management, California Department of Conservation, and the CSLC and mineral extraction fees are paid, neither the sand nor mining fees are currently applied to offset sand loss at the coast.

Table 3.4 Samples of Sand and Gravel Mines Within the Plan Area

NAME	LOCATION	COUNTY
Rancho Mission Viejo Sand & Gravel Mine	Trabuco Creek, San Juan Capistrano	Orange
Carmeus Industrial Sands	Santa Ana R., Riverside	Riverside
Ewles Materials	San Juan Creek, San Juan Capistrano	Orange
Cemex	Corona	Riverside
Ortega Rock Quarry	San Juan Creek, San Juan Capistrano	Orange
Mission Viejo Sand Plant	San Juan Creek, San Juan Capistrano	Orange
Crestline Quarry	San Juan Capistrano	Orange
San Juan Creek	Dana Point	Orange
Blue Light Mine	Silverado	Orange
Orange Quarry	Placentia	Orange
Corona Quarries	Corona	Riverside
Hanson Aggregates	Corona	Riverside
All-American Asphalts	Corona	Riverside
Riverside Cement Company	Corona	Riverside

3.2.2 Coastal and Offshore Sediment Sources

Potential coastal and offshore sediment sources include traditional nearshore sources just offshore of the active littoral zone, harbor and marina maintenance dredging projects, wetland restoration and maintenance dredging projects, and river maintenance dredging projects. The coastal and offshore sediment sources from west to east are listed in Table 3.5 and shown in Figure 3.4. Details on existing sediment volumes, grain sizes, and replenishment rates can be found in the associated references and the CSMW GIS database.

Some offshore sediment sources have names designated by USACE (e.g., ORA-1) and their physical properties are well documented. Others, such as the deposition just outside of Dana Point Harbor have not been investigated in detail. The three harbors within the Plan area are Huntington Harbour, Newport Harbor, and Dana Point Harbor, all with varying sedimentation rates and grain size characteristics.

In addition to the harbors, there are numerous tidally influenced estuaries and lagoons, including the San Gabriel River Estuary, the Bolsa Chica Ecological Reserve, the Huntington Beach Wetlands (including Talbert Marsh), the Santa Ana River Estuary, the Newport Banning Ranch Wetlands (including Semeniuk Slough), and the Upper Newport Bay.

Beaches sometimes serve as coastal sediment sources where bypassing or backpassing occurs. Examples within Orange County are West Newport Beach and the Balboa Peninsula. Both are wide throughout the year, tend to accrete over the long-term, have beach compatible sand, and are located near other beaches that are in need of sand.

Almost all of these coastal sediment sources have been dredged in the past with the overwhelming majority of material being placed either offshore, nearshore, or on beaches. Most of these sources have dredging programs in place or planned for the near-term.

Table 3.5 Coastal and Offshore Sediment Sources

#	Name/Designation	Type	Location	Grain Size Data Avail.	Reference
1	ORA-1	Offshore	South of Long Beach Breakwater	Yes	1
2	San Gabriel River Estuary	Estuary	Seal Beach	Yes	2,3
3	West Seal Beach	Beach	Seal Beach	Yes	2, 4
4	Anaheim Bay	Lagoon/ Harbor	Newport Beach	Yes	1,5
5	ORA-2	Offshore	Surfside-Sunset, Seal & Huntington	Yes	1,6
6	Huntington Harbour	Harbor	Huntington Beach	Unknown	5,7,8
7	Bolsa Chica Ecological Reserve	Lagoon/ Estuary	Huntington Beach	Yes	5,9
8	Huntington Beach Wetlands, Talbert Marsh	Lagoon	Huntington Beach	Yes	2,10
9	Lower Santa Ana River	Estuary	Newport Beach	Yes	1,5,11
10	West Newport Beach	Beach	Newport Beach	Yes	2,4
11	Newport Banning Ranch	Lagoon	Newport Beach	Unknown	2
12	ORA-3	Offshore	Newport Beach	Yes	1,12
13	Newport Harbor	Harbor	Newport Beach	Yes	1,5
14	Upper Newport Bay Ecological Reserve	Lagoon/ Estuary	Newport Beach	Yes	1,5
15	Balboa Peninsula	Beach	Newport Beach	Yes	2,4
16	Dana Point Nearshore	Offshore	Dana Point	Unknown	13,4
17	Dana Point Harbor	Harbor	Dana Point	Yes	5,15,16
18	Lower San Juan Creek	Estuary	Dana Point	Unknown	2

References:
1 = USACE, 2010a, 2011d;
2 = Stakeholder Meetings;
3 = Los Angeles County Sanitation Districts, 2006;
4 = USACE, 2002b;
5 = Moffatt & Nichol, 2009b, 2010;
6 = USACE, 1989;
7 = Tetra Tech, 2000;
8 = Moore & Taber, 1986;
9 = Merkel & Associates, 2010;
10 = Moffatt & Nichol, 2004a, 2004b;
11 = Golder Associates, Inc. 2009;
12 = USACE, 1993;
13 = Everts Coastal, 1997;
14 = USACE, 1996a;
15 = CCC, 2007;
16 = Kinetic Laboratories and Moffatt & Nichol, 2007.

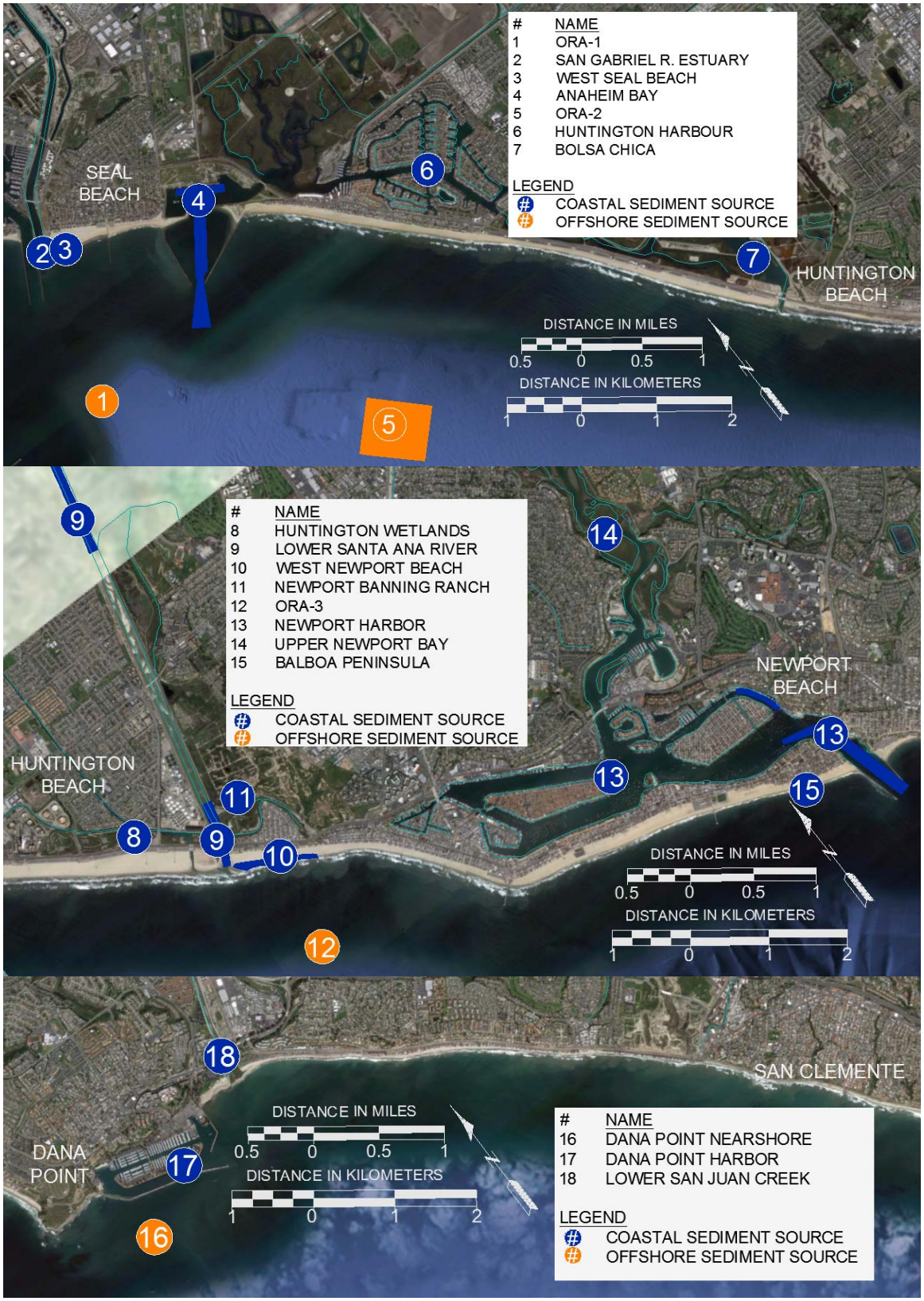


Figure 3.4 Coastal and Offshore Sediment Sources

3.3 Construction Solutions

Various capital improvement projects are considered within the Plan as means to physically address beaches that have a known need for either nourishment or retention. These capital improvements often take the form of maintenance activities, construction projects, or purchases of major equipment. Short descriptions of typical construction projects and methods are presented in the following along with discussion of key coastal RSM issues associated with each.

3.3.1 Bypassing and Backpassing

Bypassing within the context of this report includes actually bypassing of sediment around a dam or other obstruction as well as trucking (or transporting by other means) sediment to downstream or downcoast locations. Bypassing can take place around dams and sediment traps at upland sediment sources or around harbors and sediment traps within coastal littoral systems.

Dam bypassing entails dredging sediment from an upstream location and depositing that sediment either immediately downstream or farther downstream either within the river or on the banks of a river. An excellent example of a proposed fluvial bypassing demonstration is the ongoing Prado Basin Sediment Management Demonstration Project proposed by the Orange County Water District and USACE.

Trucking, rail, conveyor belt, or other transport of sand from an upstream location directly to the beach would loosely be considered a form of bypassing in that the material is bypassing the obstruction and being deposited where it naturally would have gone, had the obstruction not been present.

Coastal bypassing within Orange County occurs as a result of maintenance dredging in the Bolsa Chica Ecological Reserve, the Huntington Beach Wetlands, Santa Ana River Estuary, Newport Harbor entrance channel, and the Dana Point outer harbor. All of these efforts result in placement of dredged sand downcoast as beach nourishment.

Backpassing is similar to bypassing in that sediment is dredged from one coastal littoral source and placed in another. With backpassing however, the material is placed upcoast instead of downcoast. Nearby examples where backpassing occurs are at the Balboa Peninsula and from West Beach to East Beach in Seal Beach.

3.3.2 Beach Nourishment

As discussed in Section 3.1 of this report, beach nourishment, also known as beach replenishment or beach fill, is the placement of mostly sand sized sediment on the upper profile of the beach, sometimes extending into the tidal zone, for purposes of widening the profile. The

method typically utilizes hydraulic pumping of sand slurry, or truck dumping, or scraper dumping of sand on the beach, which would then be reworked by dozers. The process usually results in a temporarily wider and higher constructed beach berm, evolving to a longer-lasting but narrower equilibrium profile, and ultimately dissipating to the pre-construction state. Beach nourishment usually occurs on beaches that are chronically narrow and erosive, thus requiring repetitive nourishment to maintain the desired beach width. Beach nourishment is an instrument in the RSM tool box for beach erosion in that beneficial use of sand sometimes entails placement on the beach.

A California-wide opportunistic beach nourishment program, termed the Sand Compatibility and Opportunistic Use Program (SCOUP) Plan for San Diego Region was developed for the CSMW as a template to facilitate the development of local opportunistic sand programs in California (Moffatt & Nichol, 2006). Opportunistic use or re-use would allow or simplify the beneficial beach use of sand that would otherwise be disposed of in a landfill, construction fill, or offshore.

3.3.3 Nearshore Nourishment

As discussed in Section 3.1 of this report, nearshore nourishment, also known as nearshore fill or nearshore disposal, is the placement of mostly sand sized sediment on the lower shore profile below the low tide line and often out to within the depth of closure. The depth of closure is the depth at which sediment transport is not substantially affected by littoral processes. The primary purpose of nearshore nourishment is to widen the profile and the beach. The method typically utilizes hydraulic pumping of sand slurry, or barge or hopper dumping of sand in the nearshore. The process usually results in a temporary nearshore constructed sand mound, evolving to a longer-lasting equilibrium profile with some onshore sand migration widening the beach, and ultimately dissipating to the pre-construction state. Nearshore nourishment usually occurs on beaches that are chronically narrow and erosive, thus requiring repetitive nourishment to maintain the desired beach width. Nearshore nourishment is an instrument in the RSM tool box for beach erosion in that beneficial use of sand sometimes entails placement in the nearshore.

3.3.4 Stockpiling

The use of stockpiles for temporary storage of sediment can increase the flexibility of an opportunistic sediment source by both reducing costs and extending timelines. Stockpiles can be useful when a sediment supplier cannot fund transport to the coast, when sediment processing is required before beach nourishment, or when sediment volumes are too great for the permitted receiver site. Lack of sufficient funds to transport sediment to the coast can be caused by the project being too small to justify a large and efficient mobilization or the sediment source is too far from the coast, requiring great haul distances. Regional stockpile locations should be sited to support any Orange County SCOUP sites as they arise.

3.3.5 Sand Retention

Sand that is placed upon erosive beaches without some form of retention will be short lived. Therefore, beach nourishment at highly erosive beaches can become more economical when combined with appropriate ways to retain sand. Traditional coastal structures such as groins and breakwaters have been used effectively to stabilize beaches in the past, however their use in the future is unlikely to be favored. The challenge then is to find an effective sand retention methodology that is environmentally consistent with the policies of the Orange County stakeholders. In response to this challenge, the Plan should seek ways to demonstrate and implement new and innovative sand retention technologies that are more compatible with the Orange County coastal setting and provide multi-purpose benefits of beach preservation, biological enhancement, and increased recreation opportunities.

Reefs

Artificial reefs have been identified as potential sand retention devices that would be compatible with permitting agencies, improve recreational opportunities, and improve hard bottom habitat (Moffatt & Nichol Engineers et. al., 2001). By breaking waves offshore, reefs can dissipate and reduce the amount of wave energy reaching the beach, thus creating a wave shadow region where sediment can fall out of suspension. The wider beach in the lee of a reef is called a salient. These multipurpose reefs are still experimental and lack proven design methods. The existing artificial prototypes have so far attained questionable or unattained expectations, some with clear negative consequences (Ranasinghe and Turner, 2006). As these types of structures are experimental, provisions for adaptive management, modification, or removal should be incorporated into the design if performance results are not achieved.

Pratte's Reef in El Segundo is a recent example of a surf mitigation reef that did not achieve expectations and was therefore removed at great expense. The City of Solana Beach has been working with USACE in pursuit of an artificial reef with the primary goal of enhancing sand retention at Fletcher Cove (Everest, 2009b). Secondary goals may be improved surfing and biological enhancement. The multi-purpose artificial reef project at Oil Piers, in Ventura County, that is being pursued in collaboration with USACE and BEACON (ASR Ltd., 2004) presents a promising submerged reef methodology that, if successful, can lead to new opportunities for innovative beach restoration, preservation, and enhancement. Both of these projects are in early stages of development, but should be monitored as the Plan is updated in the future.

Dewatering

Beach face dewatering is defined as the lowering of groundwater within the beach to increase natural accretion processes. This dewatering is based on the principle that the less saturated a beach face is when a wave swashes up onto it, the more water can infiltrate into the beach and less water is available to carry sand particles back down with the backwash, resulting in a net

deposition of sand on the shoreface. Dewatering can either be active, with pumps and pipes, or passive, relying on gravity flow through buried pipes. The PEM (Pressure Equalization Module) is a commercial example of the passive approach. These dewatering technologies are relatively new and unproven in shoreline management within California.

Soft Solutions

There are many sand retention approaches that are considered soft solutions in that they are not constructed of rock or concrete. Beach planting is a common soft solution applied on the Gulf and Atlantic coasts. Use of geotextile, sand filled bags is considered a semi-soft solution in that the structures function similar to their hard counterparts, but are considered more temporary and removable.

3.4 Economic Impacts and Feasibility

This section presents estimates of the total direct economic impact of beach spending in Orange County. It also examines the Surfside-Sunset Beach nourishment project by USACE at a very general level. It should be noted that beaches provide a number of important economic functions besides recreation. In particular, beaches act as a buffer against storm damage to inland property. Estimating these benefits is time-consuming and beyond the scope of this study, but in some cases these benefits can be larger than the recreational benefits. With sea-level rise, the benefits of the storm damage reduction are likely to be significantly higher. For examples of the economics studies of sea level rise in California, see King et. al. (2011) and Pendleton et. al. (2010). Beaches also provide ecological benefits that are more difficult to quantify in dollars. Costanza (2006) provides quantitative estimates of the ecological value of New Jersey's shoreline habitat, though habitat value varies considerably with shoreline habitat.

3.4.1 Economic Impacts

This section provides a discussion of the economic impacts of Orange County's beach tourism, which is important for policy decisions by state, city and county officials as well as other stakeholders.

A next level of analysis would be a comparison of the economic benefits to the construction cost of a particular project and beyond that would be a feasibility analysis of individual projects. Only a cursory review of the economic impacts are considered here since benefit cost and feasibility analyses would require designed alternatives with quantities, transport methods, and timelines, which is beyond the scope of the current effort.

Attendance estimates are the starting point for estimating beach spending. Official data were used where available. However, many smaller beaches in Orange County do not have official estimates, in which case, attendance was based on data developed for the current study.

These consist of counts in high and low season as well as interviews with lifeguards or other people familiar with the sites. For Cottons, data from Nelsen et. al. (2007) was used.

Spending varies considerably by the visitor. However, King and Symes (2003) found that average spending patterns are reasonably consistent across beaches in southern California, differing mainly between those who are on day trips and those who stay overnight. Consequently, the critical variable is the percentage of visitors staying overnight.

King and Symes (2002) found that 30 percent of high season visitors in Huntington Beach stayed overnight. This percentage was applied throughout Orange County to estimate the overnight visitors from day use patterns.

City, county, and state tax receipts were also estimated based on the spending estimates from King and Symes (2002), which provide detailed data on the types of spending. Sales taxes were estimated based on the spending subject to sales tax and the local sales tax percentage was distributed by the government mandated formula. For most cities in Orange County relevant to this study, the sales tax is 7.75 percent with 6.25 per cent going to the State, 0.75 percent going to the city of origin for the sale and 0.75 percent going to the County. If the area is unincorporated 1.5 percent goes to the County.

Transient occupancy taxes (TOT) are important for city governments and represent significant sources of local revenues. The TOT is set by each city, or county for unincorporated areas, and is typically 10 percent of the overnight lodging expense, though these rates do vary. Parking is also a significant source of revenue for many cities such as Huntington Beach. Since many visitors park in street parking not designated specifically for beaches, city parking revenue data cannot be used to estimate beach parking revenue. Instead, King and Symes' (2002) data were used. Parking fines can also be a significant source of revenue, often as large as parking fees themselves, but these were not estimated as part of this project.

The increase in state income taxes or local property taxes generated by beach tourism was not estimated since there is no simple direct way to do so. However, these impacts are likely to be significant.

Table 3.6 presents estimates of the economic and tax revenue impacts of Orange County beaches based on direct spending. Spending estimates are directly related to visitation; as attendance increases, spending increases proportionately. If the indirect and induced impacts of this spending were considered, the total impact to Orange County would be approximately doubled and the impacts to cities would be substantially higher. Larger cities capture more of the indirect and induced impacts.

Overall, it is estimated that Orange County beaches generate $1.3 billion in direct spending, $70.4 million in California taxes, $8.5 million in Orange County taxes, and $7.9 million in taxes for all of the cities involved. Not surprisingly, Huntington City Beach generates the most economic impact, followed by Newport - Balboa Beaches.

Table 3.6 Economic and Tax Impacts of Orange County Beaches

#	Beach	Annual Attendance	% Overnight Visitors	Total Annual Spending	City Sales Tax	City TOT	Total City Taxes	County Tax	State Tax
1,2	Seal Beach (East -West)	2,278,774	10 - 20	$58,018,470	$331,763	$283,369	$615,132	$331,763	$2,764,694
3,4	Surfside-Sunset Beaches	2,257,856	10 - 20	$63,631,504	n/a	n/a	n/a	$363,938	$3,032,814
7	Bolsa Chica State Beach	2,764,712	10 - 30	$81,545,257	$417,382	$458,538	$875,920	$417,382	$3,478,179
9	Huntington City Beach	9,931,425	10 - 20	$305,929,749	$1,792,242	$1,663,348	$3,455,590	$1,792,242	$14,935,346
5,6	Huntington Harbour Beaches	45,000	10 - 30	$1,428,200	$7,207	$10,435	$17,642	$7,207	$60,059
10	Huntington State Beach	2,542,332	10 - 20	$71,804,196	$370,772	$327,609	$698,380	$370,772	$3,089,763
12-14	Newport -Balboa Beaches	7,844,108	10 - 30	$234,294,894	$1,196,222	$1,463,140	$2,659,362	$1,196,222	$9,968,513
15-46	Newport Harbor Beaches	13,000	10	$344,443	$1,803	$812	$2,614	$1,803	$15,023
47,48	Corona Del Mar State, Little Corona Beaches	369,515	10	$9,790,535	$51,243	$26,817	$78,060	$51,243	$427,029
49	Crystal Cove State Park	666,820	10 - 30	$19,347,190	n/a	n/a	n/a	$109,999	$916,660
56	Laguna Beach	4,131,516	10 - 30	$123,403,841	$630,054	$770,640	$1,400,694	$630,054	$5,250,446
62	Aliso County Beach Park	3,298,056	10 - 20	$92,946,689	$480,159	$410,118	$890,277	$480,159	$4,001,325
67	Monarch Beach	220,000	10 - 20	$6,143,567	$31,798	$23,189	$54,987	$31,798	$264,982
68	Salt Creek Beach	3,967,715	10 - 30	$118,511,291	$605,074	$740,087	$1,345,161	$605,074	$5,042,284
70,71	Dana Point - Baby Beach	1,214,374	10 - 20	$34,223,823	$176,799	$151,009	$327,808	$176,799	$1,473,325
72	Doheny State	1,827,231	5 - 10	$47,044,457	$247,786	$49,017	$296,803	$247,786	$2,064,883
73	Capistrano County Beach	516,788	10 - 30	$15,805,704	$80,325	$116,844	$197,169	$80,325	$669,376
75	San Clemente City Beach	2,583,940	10 - 30	$60,438,445	$401,625	$584,220	$985,846	$401,626	$3,346,881
76	San Clemente State Beach	519,641	20 - 35	$17,037,650	$85,459	$59,890	$145,349	$85,459	$712,157
77	Cottons	330,000	10 - 30	$10,092,885	$51,292	$74,612	$125,904	$51,292	$427,437
	Total	47.3 million	n/a	$1.4 billion	$6.9 million	$7.2 million	$14.1 million	$7.4 million	$61.9 million

n/a = not applicable

3.4.2 Economic Benefits of Surfside-Sunset Beach Nourishment Project

USACE has been conducting a sand nourishment project at Surfside-Sunset Beach since 1964 and is expected to continue this project in the future with no sunset date. This project was initiated to mitigate other federal work and has had broad ranging economic benefits to the region.

As reviewed in Section 2.3.2 of this report, Gadd et. al. (2006) found that the Surfside-Sunset Beach nourishment project provided substantial increases in beach width over time, not just at Surfside-Sunset Beach, but also throughout the entire littoral cell. This widespread beach accretion indicates that the project benefits extend well beyond Surfside-Sunset Beach. Although beaches provide a number of economic benefits, these can generally be divided into storm damage protection benefits and recreational benefits.

Surfside-Sunset Beach is highly developed with housing and infrastructure adjacent to the beach and businesses and the Pacific Coast Highway a few hundred feet inland from the beach. Moving southeast along the littoral cell, Bolsa Chica State Beach primarily serves as a recreational area and fronts an ecological reserve with little development. If beach widths were allowed to become narrow a substantial amount of parking could be threatened and eventually, Pacific Coast Highway could be threatened. Bluff erosion and subsequent impacts to parking, beach access, and Pacific Coast Highway are the primary concerns at Huntington Cliffs. Moving southeast to Huntington City Beach, some infrastructure lies just behind the beach. West Newport Beach is primarily residential, with many homes abutting the beach. At all of these locations, during a severe storm it is likely that many of these buildings and infrastructure could be threatened. Maintaining a wide beach reduces this probability significantly. Looking to the future, King et. al. (2011) found that nourishment could be a cost effective policy tool to reduce the erosion and storm damage impacts from future sea level rise at select California beaches.

The recreational value of Surfside-Sunset Beach by itself is relatively small. By maintaining the existing beach, the Surfside-Sunset Beach nourishment project maintains this recreational value. However, the down coast benefits from the Surfside-Sunset Beach nourishment project, particularly at Huntington City Beach and Huntington State Beach are substantial. King (2001) found that increasing beach width raises recreational value and visitation substantially. More recently, Pendleton et. el. (2011a) used data from Los Angeles and Orange County beach visitors to find that increased beach width does significantly increase both recreational value and overall visitation at beaches, including the beaches impacted by the Surfside-Sunset Beach nourishment project. The overall benefits of the project, including existing and future recreation and storm damage protection benefits along the entire littoral cell, are likely to be substantial.

The Anaheim Bay (Huntington Harbour) study which is currently idle by USACE (2003) proposes to add a second entrance between the Pacific Ocean and Huntington Harbour and could have implications for the Surfside-Sunset Beach nourishment project. This multi-purpose

project would potentially increase security within the Seal Beach Naval Weapons Station, improve navigation into Huntington Harbour, restore ecosystems within the Seal Beach National Wildlife Refuge, and improve storm damage protection at Surfside. Some alternatives could re-align the jetties at the harbor entrance thus reducing the erosion rate at Surfside and reducing the frequency or amount of material needed for the Surfside-Sunset Beach nourishment project. If this were to occur, the downcoast benefits of the Surfside-Sunset Beach nourishment project would likely be reduced (USACE, 2002b).

3.5 Biological Habitats and Resources

Activities associated with RSM have the potential to result in direct, indirect, or cumulative impacts to biological habitats and resources. The environmental review and permitting process includes assessment of the impacts and identification of appropriate impact avoidance or minimization measures to ensure significant impacts do not occur during project implementation. A number of environmental laws and regulations guide that process (Section 3.6). The following sections provide an overview of biological habitats and resources within the Plan area of particular relevance to coastal RSM planning and implementation.

3.5.1 Habitats and Resources

The coastline of Orange County includes a variety of habitats including sandy beaches, subtidal soft-bottom, rocky tidepools, offshore reefs, bays, estuaries, and harbors. In addition, vegetated habitats such as kelp beds and seagrasses (eelgrass meadows, surfgrass beds) have localized occurrence in rocky and embayment areas. Several of these habitats are considered sensitive habitats or support sensitive resources.

Federally designated habitat areas of particular concern (HAPCs) include the following: estuaries, canopy kelp beds or forests, seagrasses, and rocky reefs. Several state marine protected areas (MPAs), which provide additional regulatory protection of biological resources, occur within the Orange County study area. CDFG maps of the MPAs within Orange County are available in Appendix C. State water quality protection areas, which are designated as Areas of Special Biological Significance (ASBS), also are associated with two state marine conservation areas (SMCAs) within the MPA system, those at Robert E. Badham and Irvine Coast locations (within the Crystal Cove SMCA), and Heisler Park (within the Laguna Beach SMCA).

Other sensitive resource areas include locations where endangered or threatened species may occur, such as designated critical habitat, nesting sites, foraging areas, or over-wintering areas. In addition, major haul out or roosting areas of fully protected species or important nursery or spawning areas of state-managed fishery species also are considered sensitive biological resource locations in this document. Sensitive or high interest species in Orange County coastal areas where RSM involved dredging or sand placement may occur include the following:

- Federal and state endangered California least tern (*Sterna antillarum browni*);
- Federal threatened western snowy plover (*Chardrius alexandrinus nivosus)* and critical habitat*;*
- Federal endangered Southern California Steelhead (*Oncorhynchus mykiss*) evolutionary significant unit and critical habitat ("evolutionary significant unit" is a term developed by NOAA Fisheries (NMFS, 2012a) to describe distinct population segments of salmon under the endangered species act);
- Federal endangered green sea turtle (*Chelonia mydas*);
- Fully protected marine mammals such as California gray whale (*Eschrichtius robustus*) and protected dolphins, porpoises, seals and sea lions (Fully Protected is a designation used by the CDFG);
- Fully protected California brown pelican (*Pelecanus occidentalis californicus*);
- California grunion (*Leuresthes tenuis*) spawning beaches;
- Pismo clam (*Tivela stultorum*), if within persistent clam bed areas; and
- Olympia oyster (Ostrea lurida), if within persistent oyster bed areas.

Table 3.7 summarizes the regional distribution of coastal habitats in Orange County. The locations of many of these habitats in the vicinity of potential RSM areas are shown on Figures 3.5 through 3.9.

Figures 3.5 through 3.9 show locations of hard-bottom, canopy kelp, seagrasses, bays and estuaries (including harbors), man-made hard-bottom structures, selected managed species, and RSM locations. The figures are intended to show the types of habitats and resources generally considered with coastal RSM projects involving beach nourishment, and include locations of receiver sites and sediment sources identified in Sections 3.1 and 3.2 of this report. The identified USACE sites include dredge and receiver areas that have been historically used within the region. The figure legends list a portion of the types of data in the project geographic information system (GIS). Individual figures show the available mapped data for different reaches of the study area where RSM activities have or may occur.

The tan colored polygon called hard substrate includes bedrock and cobble; sand is the dominant habitat type offshore and generally may be assumed in areas where hard-bottom is not shown. Some nearshore bedrock areas and embayment soft-bottom areas include vegetated habitats.

Table 3.7 Regional Distribution of Coastal Habitats in Orange County

HABITATS	RELATIVE OCCURRENCE	OCCURRENCE IN ORANGE COUNTY
Sandy Beach	Majority of shoreline	Most shorelines
Soft-bottom Subtidal	Majority of subtidal	Nearshore, embayments
Nearshore Reefs/ Rocks	Localized areas	Huntington Cliffs, Newport Beach, Laguna Beach, Crystal Cove, Dana Point, San Clemente
Surfgrass Beds	Localized areas on hard-bottom	Corona Del Mar State Beach, Laguna Beach, Dana Point, San Clemente
Eelgrass Meadows	Localized in embayments	Anaheim Bay, Seal Beach National Wildlife Refuge, Huntington Harbour, Bolsa Chica Ecological Reserve, Huntington Beach Wetlands, Lower Newport Bay, Dana Point Harbor
Kelp Forests/Beds	Localized areas on hard-bottom	Newport Beach, Laguna Beach, Dana Point, San Clemente
Creeks/Rivers	Five	San Gabriel River, Santa Ana River, Aliso Creek, San Juan Creek, San Mateo Creek
Bays/Harbors	Four	Anaheim Bay, Huntington Harbour, Newport Bay, Dana Point Harbor
Other Wetlands	Six	Los Cerritos Wetlands, Seal Beach National Wildlife Refuge, Bolsa Chica Ecological Reserve, Huntington Beach Wetlands, Newport Banning Ranch, Upper Newport Ecological Reserve

Vegetation data are distinguished according to dominant vegetation type (i.e., kelp, understory algae, seagrass). Kelp canopy and understory algae map layers may overlap and vary by year depending on environmental conditions. The multiple years of kelp coverage from 1967 through 2008 are combined into a simple kelp feature (orange color). This kelp and the understory algae records provide a good indication of locations with hard-bottom vegetated HAPC, which may or may not have surface kelp canopies. Mapped seagrasses include surfgrass (1980 - 2009) on nearshore hard-bottom or eelgrass (2003) on soft-bottom embayment habitats. Available seagrass (2003) data are not exact, but rather show areas within which eelgrass (e.g., Alamitos Bay) or surfgrass may occur (e.g., nearshore area off San Clemente, nearshore area from Corona del Mar to Dana Point). Some areas where eelgrass may occur are not mapped because of unavailable GIS data (e.g., Anaheim Bay, Huntington Harbour, Bolsa Chica Ecological Reserve).

Managed species shown on the figures include California least tern, western snowy plover, and California grunion, which are particularly relevant to beach nourishment. Least tern and/or snowy plover nesting sites and potential over-wintering areas for snowy plover and federally-designated critical habitat for snowy plover are based on resource agency publications and monitoring records. Beach locations where grunion spawning records have been compiled are

delineated along the shoreline. The managed species data should be viewed as potential to occur; actual occurrence will vary depending on environmental conditions and year.

Additional map features on the figures include artificial structures such as shipwrecks, and artificial reefs. Several marine protected areas are shown on the figures. These MPAs are described in Table 3.12 and detailed maps are included in Appendix C of this report.

Mapped information on the figures was from several sources, including MarineMap (*http://marinemap.org/*), Chambers Group (2011), Everest (2011), Marshalek (2010), MBC Applied Environmental Sciences (2009a), San Diego Nearshore Program (*http://nearshore.ucsd.edu/*), Sea & Sage Audubon Society (2011), Tierra Data (2006), USACE (2011d), and the U.S. Fish and Wildlife Service (USFWS, 2007a, 2011).

Figure 3.5 Sensitive Biological Resources, Seal Beach to Bolsa Chica

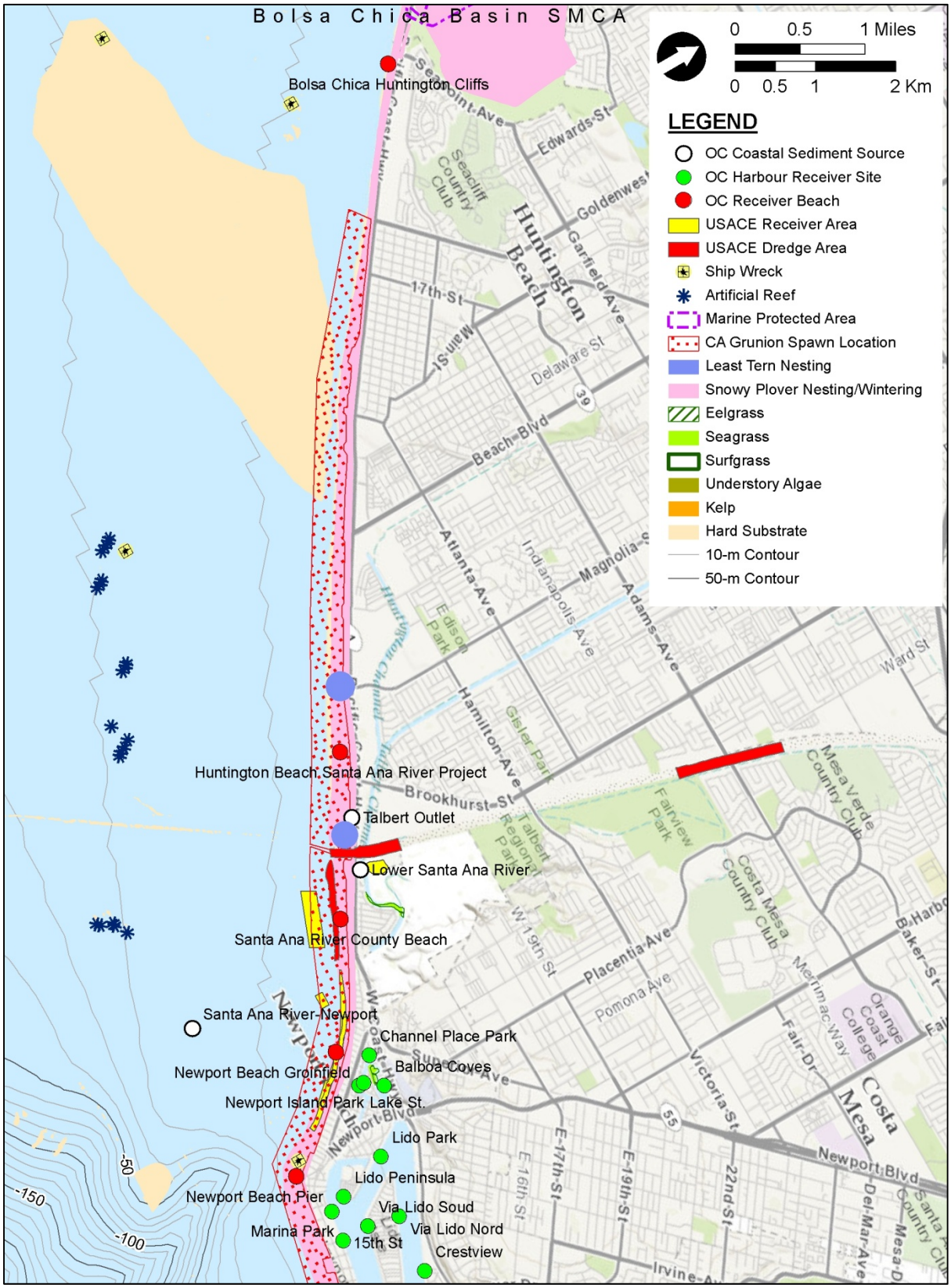


Figure 3.6 Sensitive Biological Resources, Huntington Cliffs to West Newport Beach

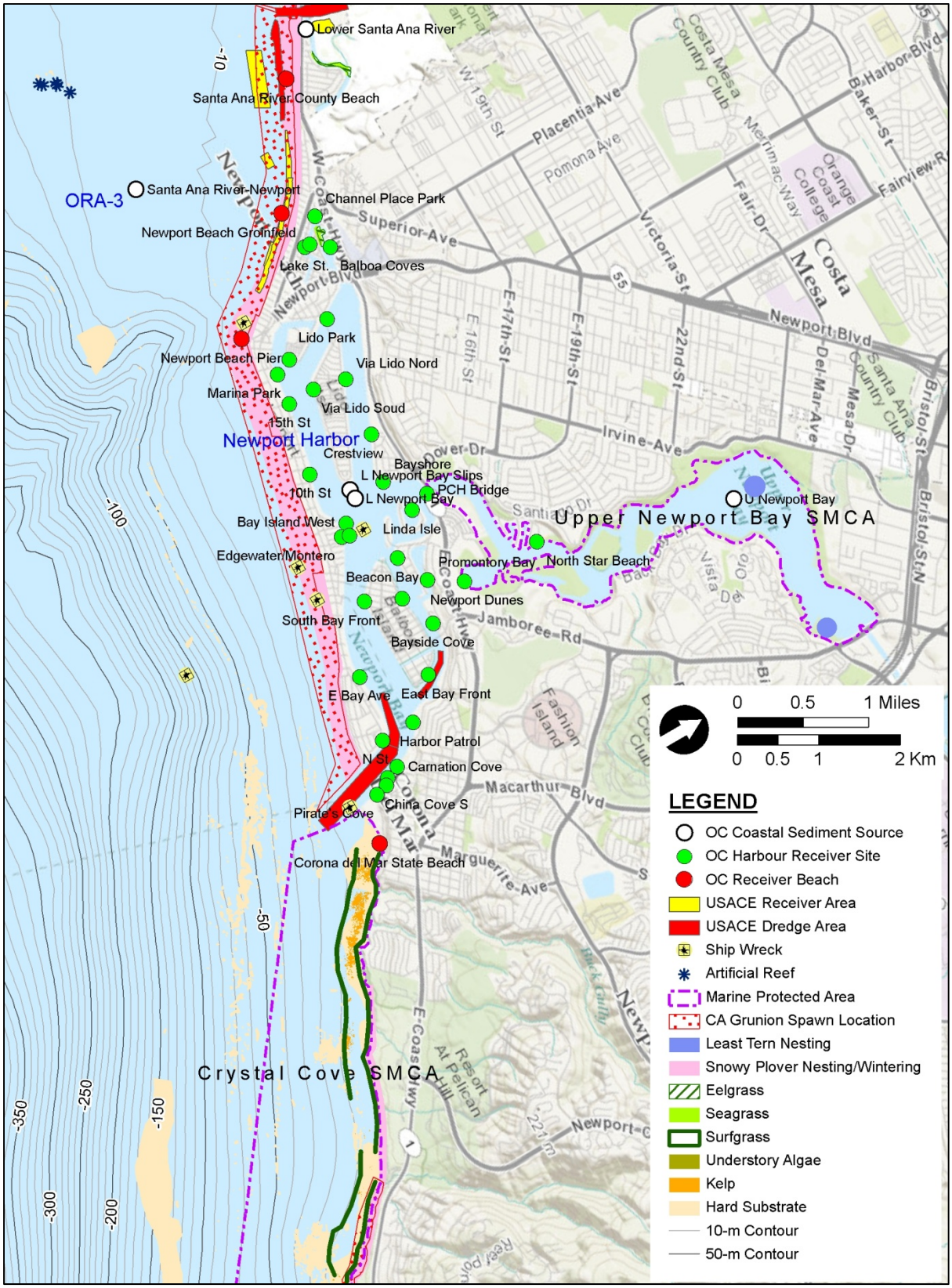


Figure 3.7 Sensitive Biological Resources, Newport Beach to Corona Del Mar

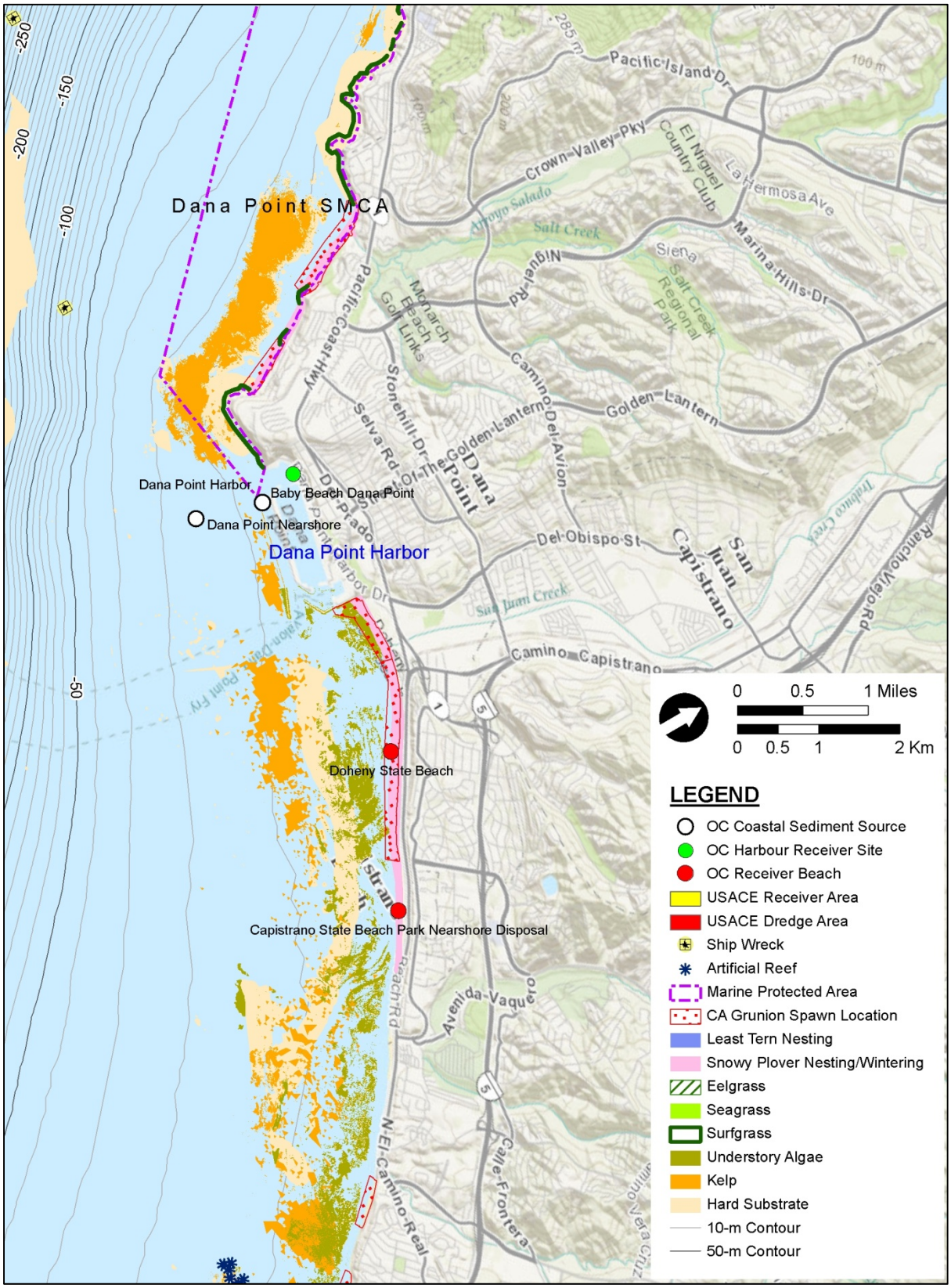


Figure 3.8 Sensitive Biological Resources, Salt Creek to Capistrano Beach

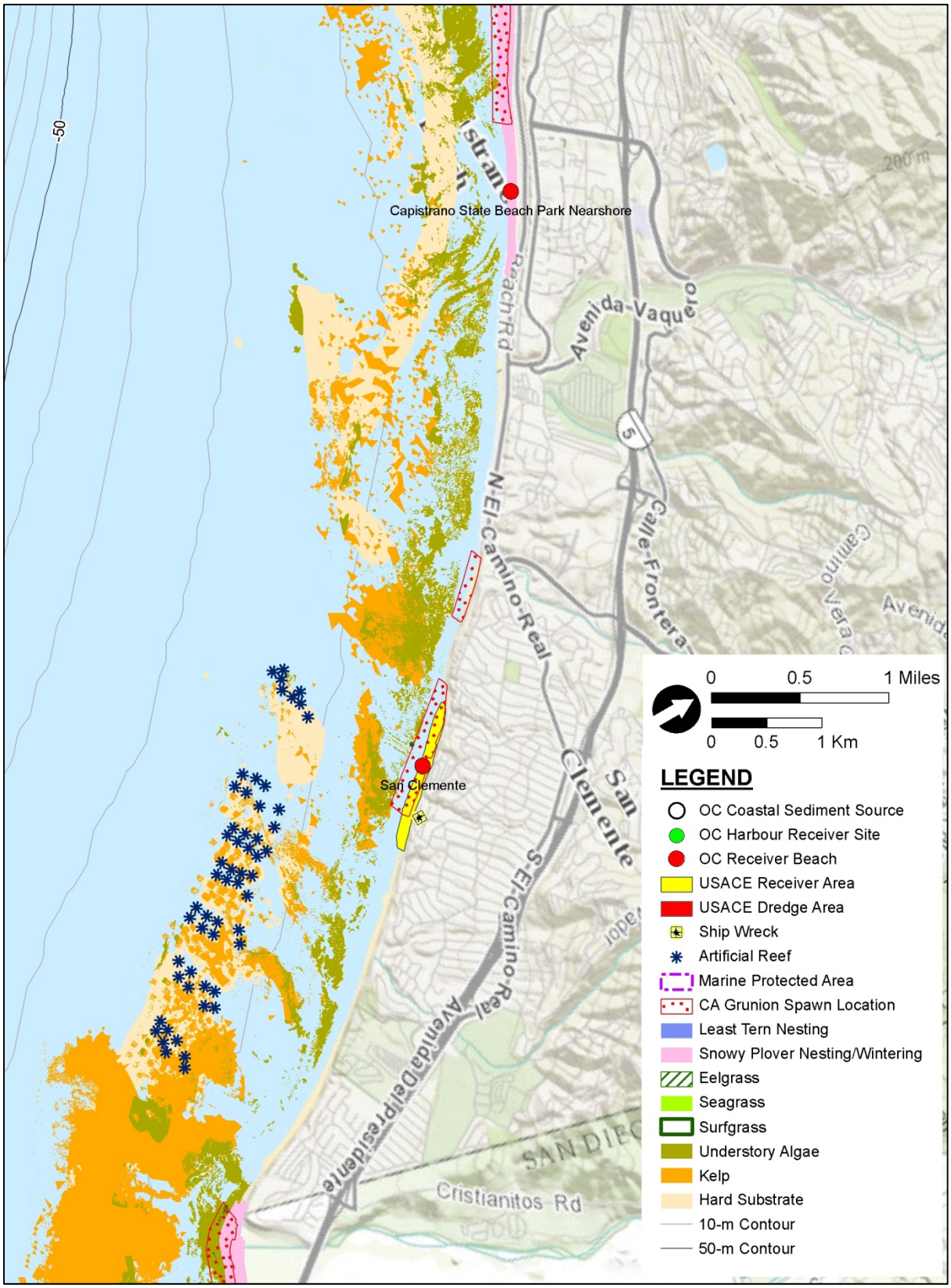


Figure 3.9 Sensitive Biological Resources, Capistrano Beach to San Clemente

Sandy Beach and Subtidal Soft-Bottom Habitats

Sandy beaches may be inhabited by a variety of invertebrates (e.g., clams, worms, sand crabs, other crustaceans), which provide forage for shorebirds along the shore and fishes in the surfzone. California grunion use suitable sandy beaches as spawning habitat. The threatened snowy plover forages and winters on certain beaches in the Orange County.

Whimbrel
Photo credit: Andrew Lissner

Subtidal soft-bottom habitat supports a substantial variety of invertebrates, both within and living on or above the sediment, which provide forage for bottom-associated fish. Generally, the diversity of invertebrate assemblages increases with distance offshore.

Reefs/Rocks

Rocky habitats are localized in occurrence in southern California. Habitat values and functions may vary considerably among hard-bottom areas depending on physical characteristics and degree of sand influence. Reef height and complexity are primary factors associated with habitat quality (Ambrose et. al., 1989; SAIC, 2011a). Low-lying reefs subject to sand scour support few biological resources. Reefs that extend above the height of seasonal sand movement generally support diverse communities of invertebrates, fish, and vegetation. Intertidal rocky areas also provide important resting areas for pinnipeds (e.g., sea lions and seals). Hard-bottom areas attract recreational sport diving, fishing, and educational interest.

Kelp Forests/Beds

Giant kelp (*Macrocystis pyrifera*) forests (or beds), with their extensive vertical structure, support diverse assemblages of invertebrates and fish and foraging habitat for birds and marine mammals. Kelp beds support species of commercial and recreational importance such as California spiny lobster (*Panulirus interruptus*) and sea urchins (*Stronglyocentrotus* spp.). The extent of kelp bed surface canopies varies between years as a result of storms, sand scour, sedimentation, and other oceanographic conditions (e.g., El Niño Southern Oscillation) (Foster and Schiel, 1985; Tegner and Dayton, 1987; Parnell, et al. 2010)..

Inshore kelp and understory algae
Photo credit: Danny Heilprin

Surfgrass Beds

Surfgrass

Photo credit: Karen Green

Surfgrass grows on rocky habitats from low intertidal to subtidal depths. Two species occur off the coast of California, *Phyllospadix. scouleri* with short flowering stems and *P. torreyi* with long flowering stems. Although surfgrass may range to depths of 50 feet, beds become patchy and gradually disappear below 23 feet (Williams, 1995). Surfgrass is a nursery habitat for the California spiny lobster. Surfgrass is adapted to seasonal sand movement in shallow water and is considered a sand tolerant species (Littler, et al. 1983). However, excessive or prolonged sedimentation may lead to habitat degradation and/or loss (Plechner, 1996; Craig et. al., 2008). Although surfgrass may recover relatively quickly from small scale disturbance by vegetative expansion, recovery can take years if there is substantial disruption and/or loss of the rhizome mat. Surfgrass geospatial data were not available for all areas; therefore, available reports also were consulted for records of occurrence.

Eelgrass Meadows

Eelgrass and black surfperch

Photo credit: Rick Ware CRM, 2009

Eelgrass is a marine vascular plant consisting of subsurface rhizomes and above ground leaves. Eelgrass forms submerged beds, also termed meadows, on soft-bottom sediment in protected waters. In southern California, eelgrass may grow year round, although beds exhibit some die back or bed thinning in winter with reduced leaf density and slowed growth (Ware, 1993). Eelgrass habitat is an important spawning and nursery area for finfish and shellfish species, including anchovies, topsmelt, California halibut, California spiny lobster, sand bass, and surfperch (Hoffman, 1986; Ware, 1993). Eelgrass distribution is affected by light availability and tolerance to light reduction varies depending on environmental conditions, time of year, and water depth. The extent of eelgrass meadows varies considerably between years as a result of storms and other factors. Similar to surfgrass, eelgrass is slow to recover from physical impacts that result in removal of rhizomes or seed bank. Eelgrass geospatial data were not available for all areas; therefore, available reports also were consulted for occurrence records.

California Grunion

Photo credit: Doug Martin

Grunion is a pelagic, schooling fish that generally occurs from just beyond the surf line to a depth of approximately 60 feet off sandy beaches. The grunion spawns on beaches primarily between March and August, although timing may be earlier or later depending on environmental conditions and location (Martin 2006). Grunion may spawn on any or all of the 4 to 5 nights following full and new moons (e.g., spring tides), beginning a little after high tide (Gregory 2001, Martin 2006). The CDFG makes available each year the predicted grunion runs from March through August. Habitat suitability for spawning may vary seasonally associated with natural sand erosion and accretion cycles.

California Least Tern

Photo credit: Kathy Keane

California least tern is a state and federal listed endangered species. Least terns are migratory and are only present in California during the breeding season of April through September (Atwood, et al. 1994). Least terns feed on small surface schooling fishes such as topsmelt, northern anchovy, jacksmelt and mosquitofish. They forage within one to two miles of breeding colonies (Collins et. al., 1979), although non-breeders may forage at greater distances (Massey and Atwood, 1980).

Western Snowy Plover

Photo credit: Callie Bowdish

Snowy plover is a federal threatened species and California Species of Special Concern. Critical Habitat has been designated at several beaches in Orange County. The USFWS also has identified locations where habitat may be suitable to support wintering concentrations (wintering areas), although information on actual use is limited. The breeding season for western snowy plovers extends from early March to late September. Snowy plovers feed on sand crabs, sand hoppers, and a variety of insects associated with washed-ashore kelp (wrack). Snowy plovers have cryptic coloration and shelter in depressions, which increases their vulnerability to impacts by vehicles and human disturbance (Lafferty, 2000).

Other Species

Other sensitive or high interest biological resources occur or have the potential to occur within the study area, but are not shown on the figures. These are briefly described below.

Endangered black abalone has the potential occur on intertidal and nearshore rocky reefs between Corona Del Mar State Beach and Dana Point; however, low evidence of recruitment or adult survivorship has been reported in this area by the National Marine Fisheries Service (NMFS, 2010a).

Fully protected California brown pelican may rest on a variety of structures (e.g., jetties, floats, docks) and rocks along the mainland. Major roost sites have been reported at the entrance jetties to Anaheim Bay, Bolsa Chica Ecological Reserve, and the jetties of Dana Point Harbor (Strong and Jaques, 2003). Minor roost sites have been reported at the entrance jetties to Newport Bay, Arch Rock, Crystal Cove (Pelican Point), Laguna Beach (Emerald Bay), Dana Point (San Juan rocks), and Doheny State Beach.

Pismo clam beds historically occurred between Seal Beach and Newport Beach (Knaggs et. al., 1977). Pismo clams were severely impacted in southern California by the 1982-1983 El Niño (CDFG, 2001). In 1989, 10,000 clams were transplanted to Huntington State Beach from Pismo Beach in central California; however, few clams were found in follow-up surveys. Recent reports of clam beds in the study area are limited to Huntington Beach (CDFG, 2009).

Native Olympia oysters historically occurred in several California estuaries, but have experienced widespread decline since the 1900s. Localized restoration efforts have been undertaken to help restore oyster beds, including creation of an oyster reef area at Castaways mudflat in upper Newport Bay to augment the small naturally occurring population in the bay (*http://www.restore-olys.org*). Oysters filter-feed and may contribute to improved water quality in areas where dense beds occur; in addition, the shell substrate of oyster beds provide habitat and refuge for other invertebrate and fish species.

Critical habitat for endangered Southern California Steelhead Evolutionary Significant Unit is designated for the San Juan Creek and the Trabuco Creek, which is an upstream tributary. The mouth of San Juan Creek is at Doheny State Beach. Lower San Juan Creek does not support runs of steelhead under current conditions due to significant barriers to upstream migration, although fish occasionally are observed (Becker et al., 2010). A steelhead recovery plan for San Juan and Trabuco Creeks was prepared in 2007 (CDM, 2007). USACE currently is conducting a feasibility study to reduce flood damage risk, channel erosion and instability, and improve habitat quality along San Juan creek, and the tributary Oso and Trabuco Creeks (USACE, 2010b).

The federal endangered tidewater goby (*Eucyclogobius newberryi*) has been extirpated from rivers and creeks in Orange County (USFWS, 2005)

No seal or sea lion (pinniped) rookeries occur in Orange County (CDFG, 2009); however, pinnipeds commonly occur in harbors hauled out on buoys, moorings, or docks. Common dolphins (*Delphinus delphis*) and bottlenose dolphins (*Tursiops truncatus*) occur in the surf zone and in offshore waters (Geraci and St. Aubin, 1990). Pacific white-sided dolphins (*Lagenorhynchus obliquidens*) and Risso's dolphins (*Grampus griseus*) also are known to

seasonally occur. California gray whales migrate through the Plan area primarily between December and May within approximately two miles of shore (Graham, 1989; Geraci and St. Aubin, 1990; Bonnell and Dailey, 1993).

Based on their distributional ranges (NMFS, 2012b), the following sea turtles have the potential to occur offshore: loggerhead (*Caretta caretta*); leatherback (*Dermochelys coriacea*); and olive ridley (*Lepidochelys olivacea*). The leatherback sea turtle is federally endangered, and the other species are federally threatened. Green sea turtles occasionally are observed within bays and estuaries.

Tables 3.8 and 3.9 and Figures 3.5 through 3.9 summarize sensitive biological resources in the vicinity of coastal sediment source and receiver sites identified for Orange County. Descriptions of habitat types and sensitive biological resources in the vicinity of the sediment source and receiver sites follow below.

Seal Beach to Bolsa Chica

Sediment sources occur at the San Gabriel River, Anaheim Bay; within Huntington Harbour, Bolsa Chica Ecological Reserve; and offshore Seal Beach and Surfside-Sunset Beach (Figure 3.5). Beach receiver sites include East Beach in Seal Beach, Surfside-Sunset Beach, and Huntington Cliffs. Harbor receiver sites include Coral Cay and Davenport Beach in Huntington Harbour. A nearshore receiver site has been used off Surfside-Sunset Beach.

Sandy beach and subtidal soft-bottom are the primary habitats at and within one mile of all sediment source and receiver locations from Seal Beach to Bolsa Chica. Pismo clams have the potential to occur off Huntington Beach.

Although eelgrass map coverage was not available, reports indicate that this habitat occurs within Anaheim Bay, Huntington Harbour, Bolsa Chica Ecological Reserve (Tetra Tech, 2008; CDFG, 2009; NMFS, 2010b), and Newport Bay (CRM, 2009). Proximity to eelgrass habitat may be an impact consideration for dredging projects conducted in those embayments.

Other impact considerations for beach receiver sites include potential spawning of grunion between March and August depending on habitat suitability. Additional considerations include proximity to least tern nesting sites during their breeding season (April-September), occurrence of snowy plover, or major roost sites of California brown pelicans.

The closest least tern nesting sites are at Nasa Island within the Seal Beach National Wildlife Refuge and Bolsa Chica Ecological Reserve. The Surfside-Sunset Beach and Huntington Cliffs receiver sites have the potential to have least terns nesting within one mile or less during the breeding season. Sites within two miles of nest sites occur at Anaheim Bay and Huntington Harbour sediment sources and the following receiver sites: Seal Beach, Surfside-Sunset Beach (nearshore), and Huntington Harbour.

Table 3.8 Sensitive Biological Resources in the Vicinity of Receiver Sites

REGULATORY COORDINATION		NMFS CDFG	NMFS CDFG	NMFS CDFG	CDFG NMFS	NMFS	CDFG	USFWS	USFWS	CDFG	NMFS
Location	Figure	Reef	Kelp Bed	Seagrass	Grunion	Steel-head	Pismo Clam Bed	Least Tern	Snowy Plover	Brown Pelican	Sea Turtle
East Beach, Seal Beach	3.5				X		H	>1 - >2			
Surfside-Sunset Beach[1]	3.5				X			<1 - > 1			
Surfside-Sunset, Nearshore[1]	3.5							>1-2			
Huntington Harbour	3.5			Eelgrass				>1-2			
Huntington Cliffs	3.5, 3.6				X			<1	O		
Huntington State Beach	3.6				X		H	<0.5	O		
Lower Santa Ana River	3.6						H	<0.5			
Santa Ana River County Beach	3.6				X		H	0.5-<1	O		
Newport Beach[1]	3.6				X		H	<1-2	O		
Newport Beach, Nearshore[1]	3.6						H	<0.5-1			
West Newport Beach	3.7				X		H	> 1-2	O		
Newport Beach Pier	3.7				X		H	>2	O		
Newport Harbor, east (multiple sites)	3.7			Eelgrass				>2			
Newport Harbor, west (multiple sites)	3.7							>2			
North Star Beach, Upper Newport Bay	3.7							>1-2			
Corona Del Mar State Beach	3.7	<0.5	<0.5	Surfgrass				>3			
Baby Beach, Dana Point Harbor	3.8		Near jetty	Eelgrass				>5			
Doheny State Beach	3.8	<0.5	<1	Surfgrass	X	X		>5	O	X	
Capistrano Beach	3.8	<0.5	>1	Surfgrass				>5	O		
San Clemente City Beach[1]	3.9	<0.5	<0.5	Surfgrass	X			>5			

Notes: 1 = USACE receiver sites. Numbers in table refer to distance in miles. Least tern (= nest sites), Brown Pelican (= major roost sites). H = historical, O = overwintering, X = present or potentially present. Oyster beds have localized occurrence in Newport Bay.

Table 3.9 Sensitive Biological Resources in the Vicinity of Coastal Sediment Sources

REGULATORY COORDINATION		NMFS CDFG	NMFS CDFG	NMFS CDFG	CDFG NMFS	NMFS	CDFG	USFWS	USFWS	CDFG	NMFS
Location	Figure	Reef	Kelp Bed	Seagrass	Grunion	Steel-head	Pismo Clam Bed	Least Tern	Snowy Plover	Brown Pelican	Sea Turtle
San Gabriel River Mouth	3.5							> 2			X
Southeast of Long Beach Breakwater (ORA-1)	3.5							> 3			
Anaheim Bay[1]	3.5			Eelgrass				<1 ->1		X	
Surfside-Sunset Offshore ORA-2)[1]	3.5							> 2			
Huntington Harbour	3.5			Eelgrass				<1-2			
Bolsa Chica	3.5, 3.6			Eelgrass				<0.5	<0.5 (nest site)	X	
Huntington Beach Wetlands	3.6							<0.5-1			
Talbert Marsh Outlet	3.6			Eelgrass (in Marsh)				<0.5	O		
Lower Santa Ana River[1]	3.6							<0.5->2			
Newport Banning Ranch	3.7							<0.5			
Newport Beach Offshore (ORA-3)	3.7							>2			
Newport Harbor	3.7		Near entrance	Eelgrass				> 2		X	
Upper Newport Bay	3.7							<0.5			
Dana Point Harbor	3.8			Eelgrass				>5		X	
Dana Point, Nearshore	3.8	<0.5->1	<0.5->1					>5			

Notes: 1 = USACE receiver sites. Numbers in table refer to distance in miles. Least tern (= nest sites), Brown Pelican (= major roost sites). H = historical, O = overwintering. X = present or potentially present

Western snowy plover critical habitat occurs at Bolsa Chica Ecological Reserve. The only breeding sites within Orange County are at the reserve. Maintenance dredging within the reserve has the potential to disturb snowy plovers if conducted during their breeding season, which ranges from March through September. Non-breeding surveys between 2003 and 2010 indicate snowy plovers have the potential to occur at Sunset Beach and Bolsa Chica State Beach (USFWS, 2007b, 2010).

Major roost sites for California brown pelican occur at Anaheim Bay jetties and the Bolsa Chica Ecological Reserve (Strong and Jaques, 2003). Dredging activities within 300 feet of major roost sites have the potential to disturb brown pelicans (SAIC, 2011a, b).

Green sea turtles have been reported to concentrate in the warm water discharge of the Haynes Generating Station, which is located within the San Gabriel River (Aquarium of the Pacific, 2008). Potential occurrence of sea turtles may be an impact consideration for sediment sources located near the mouth of the San Gabriel River.

Huntington Beach to West Newport Beach

Coastal sediment sources occur at the Huntington Beach Wetlands, Santa Ana River, Newport Banning Ranch, and offshore of Newport Beach (Figure 3.6). Beach sediment receiver sites include Huntington Beach, Santa Ana River County Beach, and West Newport Beach. Nearshore receiver sites have been used off Newport Beach.

Sandy beach and subtidal soft-bottom are the primary habitats at and within one mile of all sediment source and receiver locations. Grunion has the potential to spawn at beach receiver sites between March and August depending on habitat suitability. Snowy plover critical habitat is designated near the entrance of the Santa Ana River (USFWS, 2011). Snowy plover may occur at Huntington State Beach, but no successful nesting has been reported in this area in the last five years (Sea & Sage Audubon Society, 2011).

Least tern nesting sites occur near the Santa Ana River and at Huntington Beach (Sea & Sage Audubon Society, 2011). These nesting sites are within one mile of the Huntington State Beach and Santa Ana River County Beach receiver sites, Newport Beach nearshore receiver site, lower Santa Ana River receiver and sediment source locations, and Newport Banning Ranch. The Newport Beach offshore sediment source and West Newport Beach receiver site are within two miles of the nesting site near the Santa Ana River.

Newport Beach to Corona Del Mar

Sediment sources and many potential receiver sites occur within Newport Bay (Figure 3.7). Beach receiver sites have been used near Newport Beach Pier and at Corona Del Mar State Beach.

Sandy beach and subtidal soft-bottom are the primary habitats within one mile of the receiver site near Newport Beach Pier. Grunion has the potential to spawn at the beach between March and August depending on habitat suitability. The area is identified as potential overwintering habitat for snowy plover, which have been observed downcoast during 2004-2010 winter surveys at Balboa Beach (USFWS, 2007b and 2010). Designated critical habitat for snowy plover occurs at Balboa Beach (USFWS, 2011).

Sandy beach and subtidal soft-bottom occur at receiver and sediment source locations within Newport Harbor and Upper Newport Bay. However, a primary habitat consideration for dredging and discharge of sediments at many of the sites within the bay is proximity to eelgrass. Eelgrass occurs within and along the shorelines of the entrance channel, Balboa Marina Channel, east Balboa Peninsula, east side of Bay Isle, along the perimeter of Balboa Island, Harbor Island, Collins Isle, Linda Isle, Balboa North Channel, Bayshores, and along the Corona Del Mar shoreline bend in lower Newport Bay (CRM, 2009). Eelgrass was not mapped in 2006-2008 in the western part of the bay near Lido Isle, north within the Newport Dunes Aquatic Park, or in the vicinity of North Star Beach. At the time of this report, the Orange County Coastkeeper is conducting an an eelgrass restoration project at De Anza peninsula.

Another sensitive resource consideration of Newport Harbor and Upper Newport Bay sites is proximity to least tern colonies during the breeding season, April to September. Least terns have the potential to forage in the vicinity of sediment sources and receiver sites; however, nesting islands in Upper Newport Bay are located more than two miles from most receiver and sediment sources. An exception includes North Star Beach, which is located within two miles, but more than 1.5 miles from nesting sites. The Upper Newport Beach sediment source location is close (<0.2 mile) to the new Least Tern Island.

A restoration project for Olympia oysters was completed at Castaways mudflat, which is located northeast of the Lido Isle receiver site in Upper Newport Bay.

Snowy plover critical habitat is designated at Balboa Beach between A and F Streets (USFWS, 2011), which is more than 1.5 miles from the Newport Beach Pier receiver site. Minor roost sites for brown pelican occur at the entrance jetties to Newport Bay (Strong and Jaques, 2003).

The receiver site at Corona Del Mar State Beach is located within a 0.5-mile stretch of sandy beach that is framed by cliffs and the rock jetty on the east side of the entrance to Newport Harbor. Hard-bottom habitat occurs downcoast, and nearshore reefs with surfgrass and kelp beds are less than 0.2 mile from the site. The Crystal Cove SMCA starts less than 0.2 miles downcoast. Endangered black abalone has the potential to occur between Corona Del Mar State Beach and Dana Point; however, low evidence of adult survivorship has been reported in this area (NMFS, 2010a).

Dana Point to Capistrano Beach

Sediment source and receiver sites occur within Dana Point Harbor (Figure 3.8). An offshore sediment source location has been identified less than one mile from the entrance to the harbor. Beach receiver sites occur at Baby Beach, Doheny State Beach and Capistrano State Beach. Nearshore placement also has been identified as an option at Capistrano County Beach (USACE, 2007b).

Sandy beach and subtidal soft-bottom are the primary habitats at sediment source and receiver sites. Eelgrass occurs in proximity to Baby Beach within Dana Point Harbor; small-to-large patches of eelgrass were located 160 to 412 feet west of the existing bulkhead at the Youth Sailing Center during surveys conducted in 2008-2009 (CRM, 2008; MBC Applied Environmental Sciences, 2009b). The Dana Point Harbor jetties are a major roost site for brown pelicans (Strong and Jaques, 2003).

Sandy beach habitat occurs at the Doheny State Beach receiver site. Grunion may spawn at the beach between March and August depending on habitat suitability. The area is identified as potential overwintering habitat for snowy plover; however, no snowy plovers were observed at this beach during winter surveys conducted between 2004 and 2010 (USFWS, 2007b and 2010). The Doheny State Beach receiver site is within the Doheny Beach SMCA (also refer to Section 3.6). Nearshore reefs occur downcoast of Dana Point Harbor. Historically canopy kelp was more abundant than mapped with recent surveys. Diver surveys indicate that surfgrass has localized occurrence on nearshore reefs between Dana Point Harbor and Capistrano County Beach (USACE, 2007b). A minor roost site for brown pelican occurs at Doheny State Beach.

The Capistrano County Beach receiver site includes beach or nearshore discharge options (USACE, 2007b). The beach is relatively narrow and includes sandy to mixed sand-cobble habitat. The beach is not mapped as a grunion spawning area. The area is identified as potential overwintering habitat for snowy plover. The site was not included in the 2004-2010 winter surveys for snowy plover (USFWS, 2007b and 2010); however, snowy plover have been reported to forage at the beach (USACE, 2007b). The nearshore area is sandy offshore of the beach. The nearshore area between Dana Point and Capistrano County Beach includes mixed sand and hard-bottom habitat with understory algae and localized occurrence of surfgrass (USACE, 2007b). Historically, canopy kelp has occurred upcoast and downcoast of the site; the nearest kelp beds were more than one mile from the site in 2008 (Figure 3.8).

San Clemente

Sandy beach is the primary habitat at the San Clemente City Beach receiver site (Figure 3.9). The beach is mapped as grunion spawning habitat along most of the site, but not at the downcoast end where the beach substantially narrows. Grunion has the potential to spawn at the site between March and August depending on habitat suitability. Nearshore reefs occur

offshore the site. Inshore reefs have understory algae and localized occurrence of surfgrass (Chambers Group, 2011). Canopy kelp beds occur offshore. The artificial Wheeler North Reef complex is located more than one mile downcoast from the site. Hard-bottom habitat with kelp and surfgrass occur upcoast of the receiver site.

3.5.2 Impact Considerations

Direct, indirect, and cumulative impacts to biological habitats and resources may result from RSM activities. These impacts, along with project constraints, methods to minimize impacts, and impact verification are summarized below with a more detailed review in Appendix B.

Direct, Indirect, & Cumulative Impact

Direct impacts are “caused by the action and occur at the same time and place” (40 Code of Federal Regulations Sec. 1508). Examples of direct impacts include burial or removal of soft-bottom, benthic invertebrates during sand placement or dredging/excavation, respectively. Direct impacts also may occur to invertebrates and fish that become entrained with water that is removed or pumped during dredging operations.

Indirect impacts are “caused by the action and are later in time or farther removed in distance, and may include ..... related effects on water and other natural systems, including ecosystems” (40 Code of Federal Regulations Sec. 1508). Indirect consequences of direct impacts to benthic organisms are reduction in forage for wildlife, the duration of which relates to benthic recovery rates. Waters are indirectly impacted by sediment disturbance or placement, resulting in increased turbidity and changes to water chemistry. Sand placement has the potential to indirectly benefit grunion and birds at erosive sites where the addition of sand could increase available beach habitat for fish spawning, bird resting, and bird foraging associated with development of a more seasonally persistent invertebrate prey base (SAIC, 2006).

Cumulative effects are the "impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions ...” (40 Code of Federal Regulations 1508.7). The cumulative effect may occur in the Plan area over time due to repeated effects from an action in the same area, additive effects from multiple impact sources, or a combination of effects taking place slowly over time.

Time and Proximity Constraints

Table 3.10 summarizes environmental constraint periods for relevant managed and sensitive species associated with sand placement on beaches. Construction work windows are relatively unconstrained during fall and winter except in areas with wintering concentrations of snowy plover. Construction work windows in spring and summer are constrained by California grunion if suitable beach habitat to support spawning is present. Additional constraints also may apply if

sites are located near nesting sites of California least tern or snowy plover, are within snowy plover critical habitat, or other species of concern are in the vicinity.

Proximity of RSM activities to sensitive resources is an important consideration relative to the need to implement mitigation measures to avoid or minimize impacts. The Los Angeles District of USACE specified in the Regional General Permit No. 67 (RGP 67) that opportunistic sand placement would be restricted unless coordinated in advance with USACE and USFWS if within 1,500 feet of snowy plover nest sites or 3,000 feet of least tern nest sites (USACE, 2006). A minimum distance of 300 feet has been used to minimize impacts of dredging near major roost sites of brown pelican (SAIC, 2011b).

Table 3.10 Summary of Environmental Constraint Periods by Species and Season

SEASON	MONTH											
	J	F	M	A	M	J	J	A	S	O	N	D
Fall-Winter												
Spring												
Summer												
Species	Relevant Sensitive Species Constraint Periods *											
Grunion – spawning												
Least Tern – breeding/nesting												
Snowy Plover – breeding/nesting												
Snowy Plover - wintering												

*Note: Coloring denotes the months associated with the seasonal periods. *Highlighted sensitive species constraint periods may start at the beginning or middle of the first month and run to the middle or end of the last month indicated. Constraint periods may differ in their specification among historical documents; for example, the constraint period for least tern is generally identified as April 15 to September 15 by USACE, although it is listed as April 1 to August 30 in RGP 67 (USACE, 2006). The snowy plover breeding season constraint period may be identified as March 1 to September 15 or September 30 (RGP 67). Generally, the grunion constraint period extends from March 1 through August 31. Constraint periods and work windows for coastal projects conducted in Orange County should be verified during project permitting, as applicable.*

Impact Evaluation & Minimization

RSM planning provides opportunity to increase the regional effectiveness of beneficial use of sediment sources. Because RSM activities can involve repetitive beach nourishment and dredging in certain areas, the potential for cumulative impacts is an anticipated issue of concern. Avoidance of repetitive disturbance within the same Plan area within the same year is recommended to promote recovery of the invertebrate prey base and minimize cumulative impacts. Avoidance or distance buffers generally are recommended to protect sensitive habitats or resources. If significant impacts were to occur to sensitive habitats (e.g., HAPC reefs, kelp bed, eelgrass, surfgrass), compensatory mitigation may be required. For example,

loss of eelgrass requires mitigation in accordance with the Southern California Eelgrass Mitigation Policy, as discussed in Appendix B.

Establishing a geospatial database to track projects would facilitate assessment of potential cumulative impacts on the basis of both geographical and temporal scales of disturbance. This information in combination with monitoring would support evaluations of project performance and possibly future adaptive refinement of implementation to optimize long-term benefits and reduce recreational and environmental impacts associated with RSM in Orange County.

Impacts of RSM projects would depend on project-specific details, site-specific environmental conditions, and construction schedule. Project-specific impact assessments would be conducted as part of the environmental review and permitting process prior to project implementation. Monitoring requirements may vary for different projects depending on resources within the vicinity of the proposed RSM project. Impact verification monitoring may be a permit requirement depending on level of concern or uncertainty associated with potential impacts to sensitive habitats. Monitoring requirements would be determined during environmental review and permitting. Additionally, monitoring may provide opportunities to gather additional information relative to sand placement techniques or minimization measures that would support adaptive management decision-making to improve the environmental effectiveness of plan implementation over time.

3.6 Regulatory and Permitting

The regulatory compliance process for construction projects consists of two key concepts: (i) environmental review, and (ii) permitting. The environmental review process consists of compliance with the NEPA and/or CEQA, as applicable, as well as other environmental laws and regulations.

The most relevant federal and state regulations pertaining to coastal RSM projects are summarized in Table 3.11, along with the corresponding regulatory requirements and agency responsible for administering each regulation. Permits or variances also may be required from local agencies. A more detailed review of relevant laws and regulations is provided in Appendix C. The geographic locations conceptually subject to these regulations are shown schematically in Figure 3.10.

An overview of the environmental review process and corresponding documents is given in Section 3.6.1. Practical considerations for coastal RSM implementation are reviewed in Section 3.6.2. Other regulatory considerations pertinent to the Orange County coastal RSM are identified in Section 3.6.3. These processes, rules, and regulations are explained in greater detail by the *Beach Restoration Regulatory Guide* (Everest, 2006) and the *Final Sand Compatibility and Opportunistic Use Program Plan* (Moffatt & Nichol, 2006).

3.6.1 Overview of the Environmental Review Process

Projects undertaken by federal agencies must comply with the NEPA. Projects requiring state or local government approval, financing, or participation must comply with CEQA. Different environmental documents are required under CEQA and NEPA, although joint documents may be prepared when there is shared responsibility between federal and local (e.g., state and municipal) agencies.

CEQA documents may either be a negative declaration, mitigated negative declaration, or environmental impact report (EIR). A negative declaration is appropriate when the project has no significant impacts. A mitigated negative declaration is appropriate for projects with potentially significant impacts that can be mitigated to be less than significant. An EIR is required for projects with impacts that cannot be mitigated to be less than significant or projects that are controversial with substantial public scrutiny.

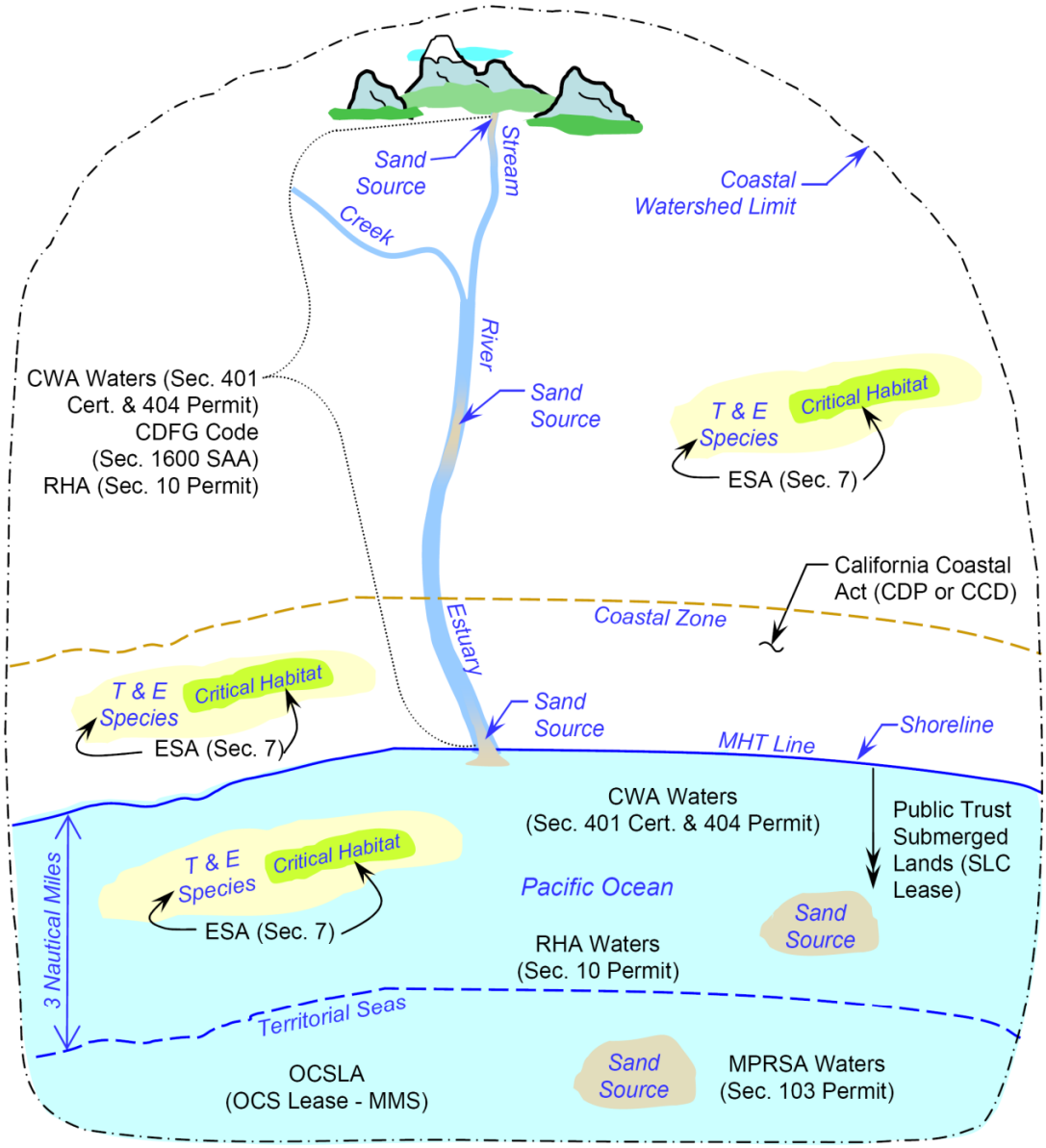
NEPA documents may include an environmental assessment (EA) followed by a finding of no significant impact (FONSI) or a more comprehensive environmental impact statement (EIS). An EA and FONSI are prepared for most regulatory actions. An EIS is required for projects that cannot be mitigated to be less than significant.

Environmental review is a public process that requires public notification, meetings, and specific time periods for public review and comment of the NEPA and/or CEQA document. NEPA or CEQA compliance can involve several steps with various decision points, depending on the complexity of the environmental issues as illustrated in Figures 3.11 and 3.12. Projects with a mitigated negative declaration or EA/FONSI generally take 3 to 6 months to complete environmental review, although Endangered Species Act consultations can lengthen the process. Completion of environmental review for an EIR or EIS can take 9 to 15 months. Timeframes may be influenced by the effectiveness of coordination with governmental and non-governmental organizations during the environmental review process.

Table 3.11 Relevant Regulations Affecting Beach Restoration Projects

POLICY/REGULATION	REQUIREMENT	PERMITTING/APPROVAL AGENCY
Federal		
National Environmental Policy Act	Compliance	Lead NEPA Agency
Coastal Zone Management Act	Coastal Consistency Determination	CCC
Rivers and Harbors Act	Section 10 Permit	USACE
Clean Air Act	Title V Operating Permit (see below under state)	USEPA, California Air Resources Board
Clean Water Act	Section 401 Water Quality Certification or Waste Discharge Requirements, Section 402 NPDES Permit, Section 303(d) listing & TMDLs	Santa Ana Regional Water Quality Control Board (below under state)
Clean Water Act	Section 404 Permit (404 Permit)	USACE
Endangered Species Act	Section 7 Consultation*	USFWS, NMFS
National Historic Preservation Act	Section 106 Approval*	State Historic Preservation Officer
Fish and Wildlife Coordination Act	Coordination Act Report* -EIS only	USACE
Magnuson-Stevens Fishery Conservation & Management Act	Assessment of Impacts to Essential Fish Habitat*	NMFS
Outer Continental Shelf Lands Act	Lease Agreement for Utilization of Outer Continental Shelf Sand	Minerals Management Service
State		
California Environmental Quality Act	Compliance	Lead CEQA Agency
California Coastal Act	Coastal Development Permit -	CCC
Porter-Cologne Water Quality Control Act	Compliance Permits under Clean Water Act Sections 401, 402	Santa Ana Regional Water Quality Control Board
California State Lands Public Resources Code	Lease Agreement for Utilization of Sovereign Lands	CSLC
California Public Resources Code Section 1600	Streambed Alteration Agreement	CDFG
California Endangered Species Act	Section 2081(b) Incidental Take Permit (state), Section 2081.1 Consistency Determination (state and federal)	CDFG
Water Quality Control Plan California Ocean Plan	Consistency Compliance	Santa Ana Regional Water Quality Control Board
California Clean Air Act	Title V Operating Permit	South Coast Air Quality Management District

** Review and compliance is usually triggered through the 404 permit process by USACE*



Legend

CWA = Clean Water Act
ESA = Endangered Species Act
RHA = Rivers and Harbors Act
CDFG = California Department of Fish and Game
MHT = Mean High Tide
SAA = Streambed Alteration Agreement
OCSLA = Outer Continental Shelf Lands Act
MMS = Minerals Management Service
MPRSA = Marine Protection, Research and Sanctuaries Act
SLC = State Lands Commission
CCD = Coastal Consistency Determination
CDP = Coastal Development Permit
T & E = Threatened and Endangered

Note: This figure is only intended as an aid to understanding regulatory compliance. Consultation with the agencies that have jurisdiction will determine actual regulatory requirements.

Figure 3.10 Schematic Representation of Regulatory Geographic Limits

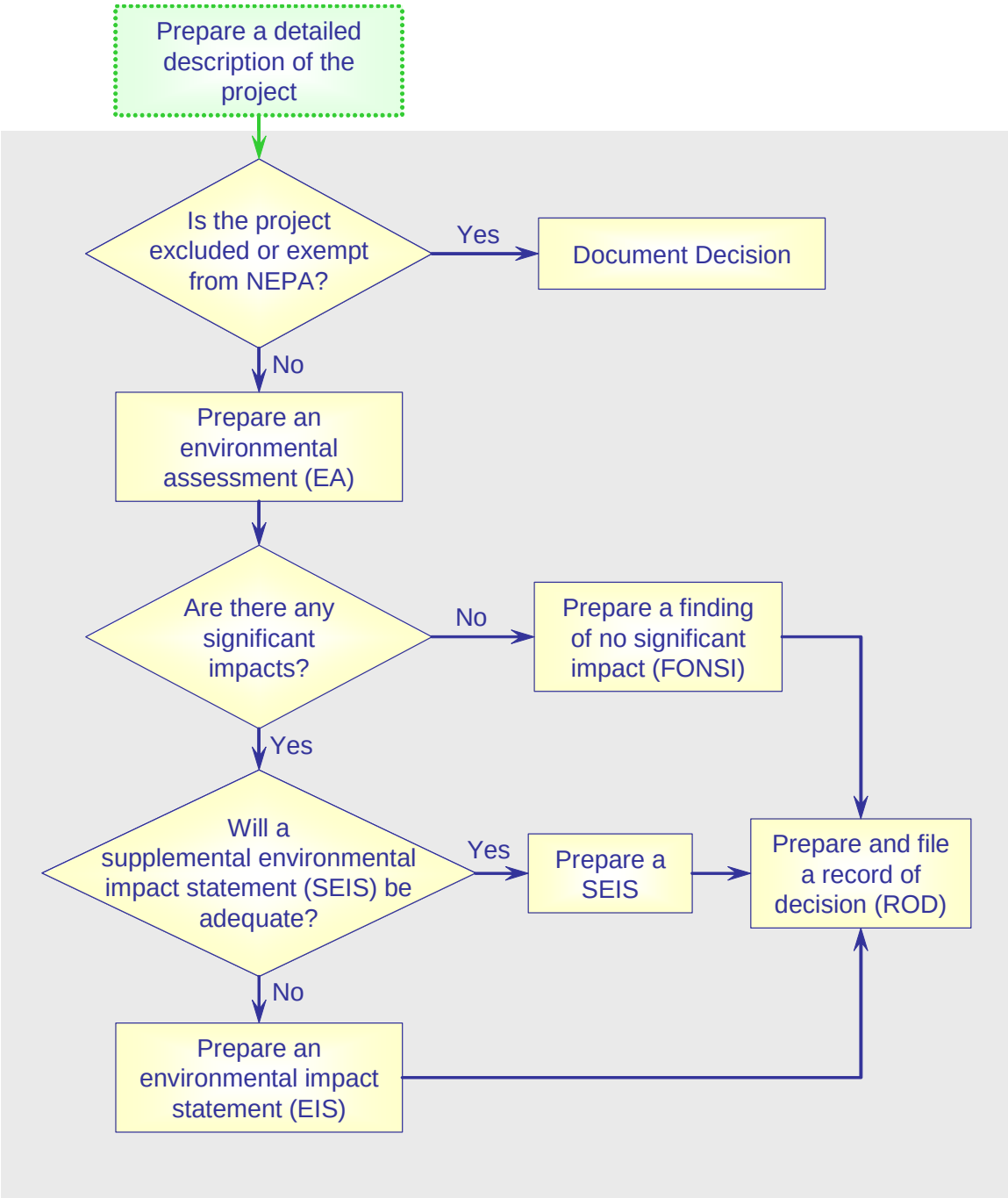
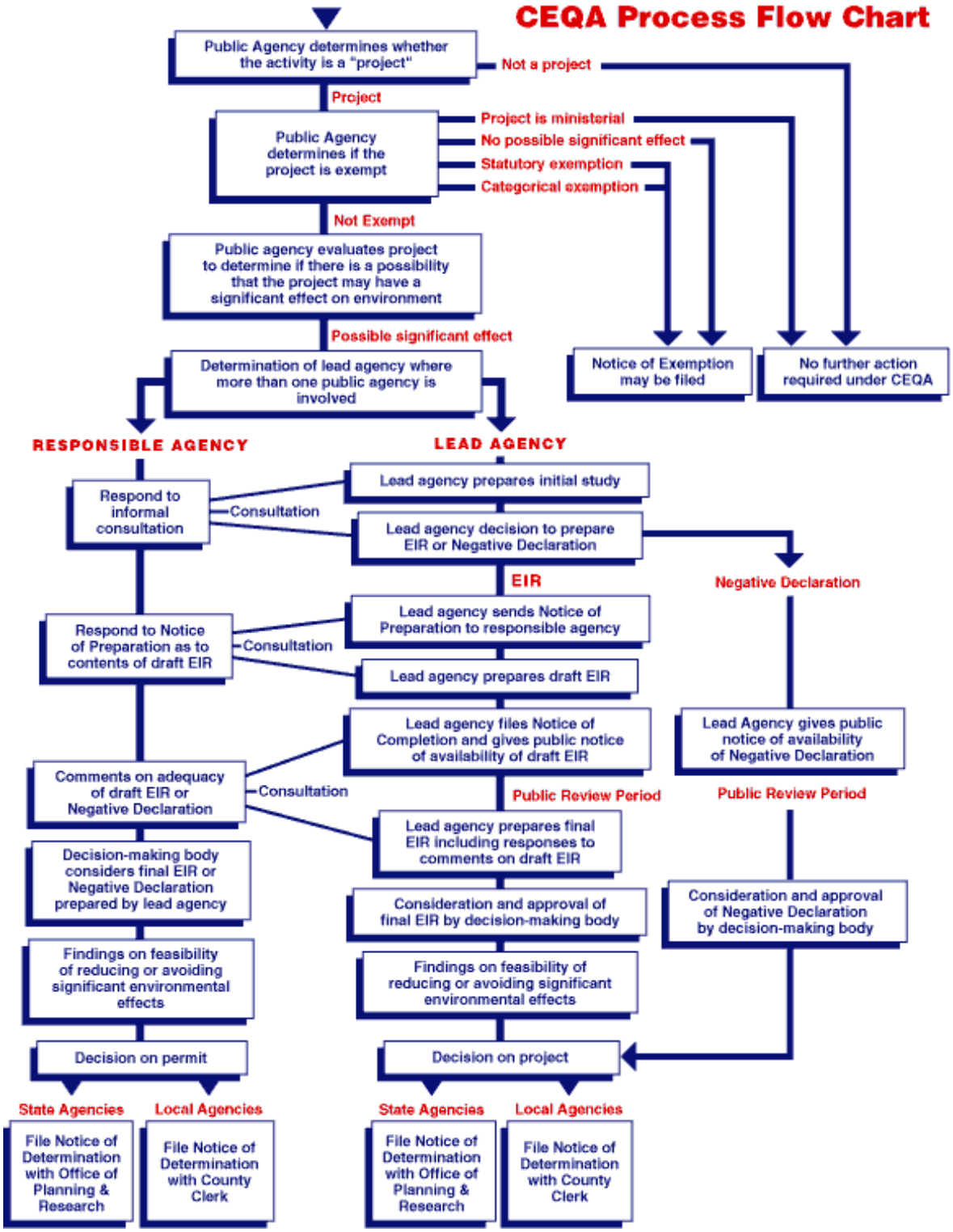


Figure 3.11 NEPA Compliance Flow Chart



Source: http://ceres.ca.gov/images/CEQA_process_chart.gif

Figure 3.12 CEQA Compliance Flow Chart

3.6.2 Practical Considerations for Beach Nourishment Permitting

State and federal agencies with permit authority for beach nourishment projects are concerned with public health and welfare, and the effects of potentially contaminated or toxic components, sedimentation, and turbidity on the environment that may occur from beach nourishment activities. Most Orange County coastal RSM permitting needs would likely be handled by an interagency team that was convened to coordinate permitting agency efforts as described below (SC-DMMT, 2010). Agency responsibilities and technical concerns pertaining to beach nourishment components of coastal RSM projects are also summarized below from other CSMW work (Moffatt & Nichol, 2006). A more detailed review of relevant laws and regulations is provided in Appendix C.

Southern California Dredged Material Management Team (SC-DMMT)

The permitting system for dredging and disposal can be lengthy and complex, involving several federal and state agencies that issue permits or other legal approvals. In southern California, a coordination process for managing dredging project permitting was developed in the form of the southern California Dredged Material Management Team (SC-DMMT). The goal of the SC-DMMT is to establish an interagency team for the coordinated review of dredging projects and dredging policy issues within the southern California area (SC-DMMT, 2010). Coordinated review of dredging projects and policy issues is expected to reduce redundancy and unnecessary delays in permit processing, promote consistency in dredging project reviews, facilitate development of consensus recommendations among regulatory staff, and increase overall efficiency. Additionally, the process of making suitability determinations for disposal of dredged material often requires agency interpretation of an extensive suite of testing that characterizes the physical, chemical, and biological nature of the sediment proposed for dredging. The contribution of regulatory agency staff to the suitability determination process reflects differing areas of technical expertise. In addition, increased coordination on dredging policy issues increases communication and allows consensus-building. Thus, the coordinated exchange of technical and policy information among agency staff at the SC-DMMT creates a common knowledge base to improve the likelihood of consistent and timely permit actions.

Membership of the SC-DMMT includes representatives from USACE, the CCC, the various Regional Water Quality Control Boards in southern California, and the USEPA. Member agencies are those with permitting authority over dredging related projects. Other regulatory agencies are invited to participate in SC-DMMT meetings; these agencies include CSLC, USFWS, CDFG, and NMFS.

Participation in SC-DMMT meetings is limited to member agencies and, when deemed appropriate by the assigned USACE project manager, applicants or applicant representatives. Other agency representatives may request a USACE project manager to invite project applicants or applicant representatives. While SC-DMMT meetings are not currently open to non-members, the members of the SC-DMMT are committed to ensuring that all stakeholders

have the opportunity to meaningfully participate in the dredging program decision making process. Stakeholders have several different kinds of opportunities to be involved in and informed of this process. First, the SC-DMMT reviews will not serve as a substitute for any public review and comment opportunities currently provided through the individual member agency decision making processes. Second, USACE prepares SC-DMMT meeting notes and posts them on USACE SC-DMMT website so that SC-DMMT activities are explained and available to all stakeholders.

The SC-DMMT is intended to focus on technical issues associated with dredging projects. The SC-DMMT may review dredging sampling and analysis plans, sampling results based on approved plans, and suitability determinations. The SC-DMMT may also evaluate its operating procedures and criteria for project review; discuss technical and policy issues associated with dredging project development, evaluation, suitability determinations, and approval; and discuss technical and policy issues associated with dredged material disposal and beneficial use.

Non-Governmental Organizations

There are several environmentally focused non-governmental organizations (NGOs) that are active in Orange County and are typically involved in reviewing coastal CEQA and NEPA documents. These should be contacted early in the project development phase to increase the likelihood that any environmental review addresses community concerns. A starter list of active NGOs in the area includes: the Orange County Coast Keeper, Newport Bay Conservancy, Orange County Marine Protected Area Council, Bolsa Chica Conservancy, Amigos de Bolsa Chica, Bolsa Chica Land Trust, and several chapters of the Surfrider Foundation, including the Huntington Beach/Seal Beach Chapter, the Newport Beach Chapter, and the South Orange County Chapter.

Chemical Contamination

Potential beach or nearshore nourishment material is required to be substantially free of chemical contamination, determined through background research and testing. Material may be considered substantially free of contaminants if it is composed of sand, gravel, or other inert material, and is found in areas of high current or wave energy. Isolation of the material from sources of contamination, based on previous testing and information about past and present land uses at the source location may also be considered in a decision about whether there is no “reason to believe” contaminants are present. Chemical and biological contamination of sediments is addressed in great detail in the Inland Testing Manual (ITM) (USEPA and USACE, 1998). The ITM does not address terrestrial soils in as much detail as dredged materials, however material compatibility criteria specified in the document are applicable to terrestrial materials. USACE and USEPA share authority over application of the ITM.

Sediment Grain Size

Analysis of the sediment grain size of potential beach nourishment material helps to determine impacts on the receiving environment. Reef habitat, bottom-dwelling organisms, and aquatic plants such as eelgrass, surfgrass, and kelp may become covered when fine-grained sediment settles from suspension. Also, contaminants tend to adhere to fine sediment grains. Acceptable grain size criteria and effects of turbidity caused when silt and clay are suspended in the water column are covered only in more general terms in the ITM. The acceptable percentage of fines (i.e., silt and clay) in beach nourishment is not specified.

USACE guidelines (1989) to determine the acceptable fines content for federal projects is based on matching the gradation of the native sediment within a certain percentage along the entire profile, from the beach out to the closure depth. The USACE method was devised internally for their dredging and beach replenishment projects and is not always applicable to other beach nourishment projects, but has served as the basis for a relevant analysis approach. This methodology is also specified in CSMWs Sand Compatibility and Opportunistic Use Program (SCOUP) (Moffatt and Nichol, 2006)

USACE and USEPA approach towards broadly applicable guidelines for acceptable fines content within potential beach nourishment is that the grain size distribution should generally match that within the natural grain size envelope of the receiving beach profile, and the restoration materials placed where most appropriate considering:

- The presence or lack of sensitive habitats that could be impacted;
- The possibility of contamination existing within the material;
- Probable sand dispersion;
- Volume of beach nourishment, timing of placement; and
- Human use of the beach.

To evaluate the appropriateness of the potential beach nourishment material's composition, agencies follow a process that considers whether the material for a project is excluded from certain testing requirements, or whether the project is required to perform more extensive analyses for a determination of suitability referred to as the 404(b)(1) evaluation. Both processes are summarized below. In terms of grain size compatibility, material with higher sand content is generally more likely to be approved by regulatory agencies for beach nourishment uses, whereas material with lower amounts of sand or substantial amounts of cobble may be used for beach nourishment if found to be similar to material at receiving sites

Agencies consider certain criteria that allow for exclusions from certain types and levels of chemical testing, thereby limiting the evaluation to Tier I testing. Resource agencies have historically utilized an "80/20 Rule of Thumb" as a prior screening tool with no formal policy basis. This rule allowed exclusion if the material was at least 80 percent sand and up to 20

percent fines. This informal rule has since been replaced by case-by-case comparisons of grain size distributions at source and receiving sites following the SCOUP approach (Moffatt & Nichol, 2006). Other exclusionary criteria include: the materials of concern are located distant from the sources of contaminants; the materials were deposited in pre-industrial times; the source and placement sites are adjacent and similar in chemistry; and if containment caps or other containment devices can be applied to isolate the contaminated material in place.

Projects and materials that do not meet exclusionary criteria typically have to undergo more extensive testing and analyses at Tier II or higher.

Coarser sands typically remain on the beach longer and therefore provide wider beaches than finer sand. Coarser sands are often considered better for use as beach nourishment because of the improved protection they provide for the cost incurred. Coarser sands will also form steeper equilibrium nearshore slopes at receiving beaches than finer sands. Surfers can consider steep beach slopes less desirable than flatter beach slopes since they tend to increase wave reflection and can cause waves to surge up on the swash zone instead of spilling or plunging in a surfable manner.

Fine-grained materials naturally occupy deeper portions of the beach profile, typically in water depths of between -20 and -40 feet MLLW. As such, fine-grained materials are also an important component of the littoral cell as they essentially anchor the lower profile. They also provide habitat for benthic organisms and foraging areas for fish and other species.

Recently, a pilot study of the fate and impact of a high fines concentration beach nourishment project occurred at the beach fronting the Tijuana Estuary (California Ocean Protection Council, 2008; Buhbe et. al., 2011). The purpose of the project was to monitor the environmental impacts of placing a beach nourishment with high fines content. Initial results concluded that biological resources do not appear to be affected by the project. This was likely due to the rapid recovery and high natural variability and resilience of the sandy intertidal community. An additional purpose of the study was to provide data and understanding for an ongoing review of current beach nourishment policy. This may eventually lead to changes in current regulation.

Turbidity

Turbidity is the cloudiness or haziness of a fluid caused by suspended solids. Turbidity is of concern to agencies because it can reduce the foraging ability of species that hunt for food using primarily visual senses, such as fish and birds. Turbidity can clog the apparatuses of filter feeding invertebrates and the gills of fish. Turbidity also decreases the penetration of light into the ocean water column thus reducing the ability of kelp and other sensitive flora to photosynthesize. Such impacts to sensitive plants could decrease the quality of habitat for other sensitive species such as lobster and fish. Turbidity can also be a nuisance and deterrent to recreational use of the beach by the public. Potential impacts to the public by the aesthetic detraction caused by turbidity are most significant during high-use periods of spring and

summer. These impacts are most likely when the turbid conditions are extensive in duration or area; short-lived and local turbidity conditions are not expected to cause the impacts just described.

Burial

Burial of marine resources from beach nourishment is a major concern to resource and permit agencies. Burial can cause mortality of organisms that cannot readily move (immotile) out of the footprint of impact. Such organisms include plants such as surfgrass, eelgrass, and kelp, and some invertebrates such as Pismo Clams. Also, partial burial of some plants can affect their health and condition and eventually lead to their mortality if it exists over a sufficient duration (e.g., six to twelve months). Burial can be a direct impact occurring within the footprint of initial placement during construction, or it can be an indirect impact occurring adjacent or near the initial placement site from dispersion of the sand by currents. Typically design and analyses of beach nourishment projects is done to consider burial as a potential impact by:

- Planning the placement to occur outside of sensitive resources that cannot tolerate burial; and
- Predicting potential sand dispersion and indirect burial of resources, and iterating project design to minimize the changes for significant impacts by reducing quantities, maximizing distance to resources, and minimizing the fines content (e.g., reducing the volume of material that will travel farthest the quickest by currents).

The goal of assessing potential indirect burial is to result in a post-project condition in the nearshore and offshore areas where depths of burial of resources are shallow enough to be below the level of significance, even with very conservative assumptions and calculations.

Color

Resource agencies have been less concerned about material color in the past because of more extensive use of dredged material for historic beach nourishment rather than upland material. Strong public reaction occurred when red-colored sand was placed over the white sand beach at Ponto Beach in Carlsbad, California in 1996. Dredged material and many upland source materials are typically darker colored than the receiving beach initially. When placed in the surf zone, the material is washed and reworked by waves resulting in sand very similar in appearance to the receiving beach. Permit agencies have informally indicated that the only criteria for color is to reasonably match the color of the receiving beach after reworking by waves for aesthetic reasons. Impacts to recreational beach use can occur during high-use periods of spring and summer.

Particle Shape

Use of natural sand rather than manufactured sand is considered more appropriate for beach nourishment. Natural sand consists of sub-rounded to rounded particles rather than sharp or angular particles. Natural sand is carried downstream in rivers where fluvial transport and chemical weathering causes wearing and rounding of particle edges. Upland source materials have also been rounded during their exposure to fluvial action in the previous cycle of erosion. Rounded particles are considered more comfortable to recreational users that frequently walk in bare feet and sit or lie on the sand in swimsuits and are therefore susceptible to irritation from sharper shaped particles. Use of manufactured sand and its angularities may inhibit colonization of interstitial flora and fauna that live on and between the sand grains.

Debris

Opportunistic sand must be generally free of trash, debris, and large fragments of organic material (e.g., tree limbs, shrubs, etc.) when placed on the beach. Debris content should be addressed considering the source location of material and past land uses on and around the site. Debris should definitely not constitute any portion of beach nourishment because of possible health and safety hazards posed by such materials and possible nuisance odors and visual impacts associated with their presence.

Compactability/Moldability of Proposed Beach Nourishment

Certain types of nourishment may form a hardpan when allowed to consolidate or if they are compressed. The potential for beach nourishment to become compacted if placed above the reach of the tides and exposed to the atmosphere is important in determining material suitability. Material that does not harden or form a crust that would prevent reworking by waves is desirable. If the potential material is compactable, it must be placed in the surf zone or nearshore portions of the beach profile (USACE, 2004). USACE and USEPA are working to identify appropriate tests for this material property. Until such time as appropriate tests are identified, higher-fine content material will be required to be placed in the nearshore or surf zone.

Receiver Site and Timing

The receiver site and timing of beach nourishment operations has been considered a significant factor by USACE in analyses according to Section 404(B)(1) Guidelines, and by the CCC in conditioning permits for recent projects. Material placement should occur away from sensitive resources (e.g., least tern and snowy plover foraging areas) and not occur during:

- Grunion runs;
- Nesting of relevant threatened or endangered species;

- Runs of steelhead trout; and
- Particularly high human use times, and not interrupt beach access.

Placement Rate

Placement rates have been restricted on previous beach nourishment projects to control turbidity levels on projects occurring near sensitive species or beach uses. Controlled or limited beach nourishment placement rates may also extend the sand placement period and thus the period of turbid conditions. The restriction has been applied to dredging projects and is typically expressed as a quantity of sand placed per year or month. Limiting the placement rate will also limit the number of truck or train trips per day required to transport land-based material. The number of trucks and trains must be controlled to minimize adverse impacts to air quality, traffic and circulation, public safety, and noise.

Project Monitoring

Physical and biological monitoring may be done prior to project construction to develop a baseline for comparison of potential effects, and during and after construction to quantify changes and enable analyses of project effects. Please refer to Section 7 for a detailed description of project monitoring requirements.

3.6.3 Other Regulatory Considerations or Guidance

General Permits

The Plan covers a range of project types that may qualify under a nationwide permit, regional general permits, or may require standard individual permits. All three types of permits are issued by the USACE regulatory program. Nationwide and regional general permits are discussed below.

Nationwide permits are one type of general permit that authorizes a category of activities throughout the nation. They are issued for five year periods, most recently in 2007 (USACE, 2007a). As of 2012, there were 50 nationwide permits covering a broad array of topics regulated under the USACE mission.

Regional general permits provide a process to streamline permitting, reviews and approvals, for projects generally considered to have minimal adverse environmental incremental or cumulative impacts on waters of the United States and, therefore, not requiring individualized permit review.

For replenishment projects within Newport Bay that are less than 1000 yd^3 (plus other conditions), the Newport Beach Harbor Resources Division maintains a Regional General Permit No. 54 (RGP 54). As issued by USACE (City of Newport Beach, no date; USACE, no

date), RGP 54 is valid for five years, with the most recent permit ending on October 4, 2011. The permit is currently in the process of being renewed. The RGP 54 simplifies the permitting process, condensing the individual homeowner documentation into a four page dredging application (with supporting documents) submitted to the Harbor Resources Division. General information such as locations, project description, quantities, depths, grain sizes, and environmental habitat information are required. For the Harbor Resources Division, the RGP 54 permitting application process typically requires five years to carry out, so once a new permit is granted, a new application process must begin immediately. In addition, once homeowners submit their dredging application it cannot be approved by the Harbor Resources Division, but must instead go before the CCC for review. This process would likely benefit from streamlining.

USACE (2005b) issued RGP 66 for the City of San Clemente to allow five years of beach nourishment at North Beach, Linda Lane, and T-Street. This permit ended in January 24, 2010, and is in the process of being renewed.

Sand Compatibility and Opportunistic Use Program (SCOUP)

SCOUP is a California-wide opportunistic beach nourishment program developed by the CSMW as a template to facilitate the development of local opportunistic sand programs (Moffatt & Nichol, 2006). SCOUP provides this template by identifying relevant and appropriate:

- Jurisdictional regulatory agencies, required permits and informational needs;
- Specific considerations needed to establish and rank potential receiver sites within the littoral cell or other regional area;
- Types of anthropogenic activities that could produce viable potential sources of sediment if located within an economic distance of the receiver site;
- Testing protocols, criteria and checklists required to assess potential physical, chemical and biological impacts associated with the use of opportunistic materials, as well as establish compatibility between potential sediment sources and the approved receiver site(s);
- Project design considerations including maximum volume, placement techniques, placement rates and location (typically based on biological or recreational concerns), and transportation methods/impacts (often associated with disturbance of nearby residents and economic considerations);
- Biological and physical monitoring concerns and testing needed before, during and after project construction, as well as reporting requirements;
- Description of user steps required to successfully implement a regional opportunistic program, including additional informational needs and project design considerations when using less-than-optimum source sands; and

- Specific examples of ways to increase public education and awareness.

Total Maximum Daily Load (TMDL) Considerations

Section 303(d) of the Clean Water Act requires the states to make a list of waters that are not attaining water quality standards and to develop total maximum daily loads or TMDLs for all waters and pollutants on the 303(d) list. A TMDL is the maximum load of a pollutant that can be discharged from point and nonpoint sources without exceeding water quality standards in the water body.

Sediment and/or siltation are sometimes identified as pollutants on the 303(d) list, as has occurred for San Diego Creek and upper Newport Bay. In March 1999 the Santa Ana Regional Water Quality Control Board approved a sediment TMDL for the Newport Bay watershed (*http://www.ocwatersheds.com/NewportBaySedimentTMDL.aspx*). The TMDL requires implementation and maintenance of sediment control measures to ensure that existing habitat acreages of Upper Newport Bay are not significantly changed and sediment discharges in the watershed are reduced by 50% over a multi-year period. The long term goal of the sediment TMDL is to reduce the frequency of dredging Upper Newport Bay to once every 20 to 30 years.

Other rivers and streams within the Plan boundaries that empty to the ocean do not include sediment as a listed impairment. However, sediment delivery to the coast is generally impacted by flood control projects, sand mining, urbanization, and construction permits that require erosion and sediment control to maintain sediment on-site and restrict conveyance to receiving waters.

Marine Life Protection Act (MLPA) Implications

A Marine Protected Area (MPA) is a discrete geographic marine or estuarine area that has been designated by law, administrative action, or voter initiative to protect or conserve marine life and habitat. The Marine Life Protection Act South Coast Study Region contains several MPAs within the Plan area as finalized on January 1, 2012 and shown in Table 3.12. These MPAs include SMCAs and state marine reserves (SMRs). Marine resource protection varies among MPAs. No take of marine resources is proposed for the Bolsa Chica Basin SMCA, Laguna Beach SMR, and Laguna Beach SMCA. Commercial and recreational fishing are allowed with restrictions within the other SMCAs. Coastal RSM activities (e.g., beach nourishment and maintenance dredging) or other sediment uses (e.g., beach grooming) are identified as allowable uses in several of the South Coast Study Region MPAs as listed in Table 3.12 (CDFG, 2012). Maps showing the MPAs for the Orange County CRSMP study area are provided in Appendix C.

Table 3.12 Orange County MPAs and Allowable Sediment Management

MPA	LOCATION	ALLOWABLE SEDIMENT MANAGEMENT
Bolsa Bay SMCA	Bolsa Bay Estuary, Huntington Beach	Maintenance dredging
Bolsa Chica Basin SMCA	Bolsa Chica Ecological Reserve, Huntington Beach	Maintenance dredging
Upper Newport Bay SMCA	Upper Newport Bay	Maintenance dredging
Crystal Cove SMCA	Crystal Cove State Park	Beach nourishment and other sediment management activities
Laguna Beach SMR	Laguna Beach	
Laguna Beach SMCA	Laguna Beach	Maintenance dredging
Dana Point SMCA	Dana Point	

Source: http://www.dfg.ca.gov/mlpa/title14section632.asp

Biological Impact Analysis (BIA) Resource Protection Guidelines

The California Resources Agency and USACE formed the California CSMW to facilitate regional approaches for protecting, enhancing, and restoring California's coastal beaches and sedimentsheds. The foundation of the CSMW's efforts is the development of the California CSMP as described earlier.

A key element of the California CSMP mission is to conserve, restore, and protect California's coastal resources. Accordingly, the CSMW commissioned preparation of the *Review of Sediment Management Impacts and Issues Relevant to Protection of California Coastal Biota, Volume 1: Biological Impacts Analysis* (BIA) (SAIC, 2011a). In addition, a companion Volume 2 was prepared that provides an abbreviated user's guide to the comprehensive review document, and includes resource protection guidelines (SAIC, 2011b). The guidelines address protection of California coastal habitats and sensitive resources throughout all phases from design through implementation of beach nourishment projects. The guidelines consider all the various activities associated with obtaining, delivery, and placement of sand at the beach.

The guidelines address resource protection considerations (e.g., mitigation measures) relevant to sand compatibility between source materials and receiver sites, water quality, invertebrate recovery after sediment removal or placement, sensitive species and habitats. Guidelines are provided for vegetated habitats (e.g., eelgrass, surfgrass, kelp beds), clam beds, fish (e.g., grunion), birds (e.g., California brown pelican, least tern, snowy plover), and marine mammals

(e.g., seals, sea lions, dolphins, whales). These are only guidelines and are not regulatory requirements. The CSMW is currently working with the Ocean Protection Council and Ocean Science Trust to conduct a scientific peer review of the draft BIA and Resource Protection Guidelines prior to finalization and acceptance of the reports.

3.7 RSM Governance

A governance structure provides a framework for the Plan to be used, including interpretations, updates and implementation of particular activities. The governance structure represents a coordinated implementation approach through an entity with appropriate jurisdictional authorities that provides for input from citizens as well as federal, state, regional, and local entities. Several existing regional governments and RSM entities were reviewed and are discussed in this section upon which governance recommendations are made in Chapter 4 of this report.

3.7.1 Joint Powers Authority (JPA)

A JPA is an institution permitted under the laws of many states whereby two or more public authorities can operate collectively. They are permitted under Section 6500 of the State of California Government Code. JPAs may be used where an activity naturally transcends the boundaries of existing public authorities (such as the sedimentsheds within Orange County). It is distinct from the member authorities; the JPA has a separate operating board of directors, and the board can be given any of the powers inherent in all of the participating agencies. In setting up a JPA, the constituent authorities must establish which of their powers the new authority will be allowed to exercise, and a term, membership and standing orders of the board need to be specified. Also, the JPA can employ staff and establish policies independently of the constituent authorities. JPAs are flexible and can be tailored to meet specific needs, and there are many differences among individual JPAs. To be effective at implementing RSM, the JPA would need to have authorities assigned specific to coastal matters. Example JPAs from southern California are reviewed below.

Southern California Association of Governments (SCAG)

SCAG is the nation's largest metropolitan planning organization, representing six counties, 191 cities, and more than 18 million residents, living in an area greater than 38,000 square miles. SCAG undertakes a variety of planning and policy initiatives to encourage a more sustainable Southern California now and in the future. Over the past four decades, SCAG has evolved as the largest of nearly 700 councils of government in the United States, functioning as the Metropolitan Planning Organization for Los Angeles, Orange, San Bernardino, Riverside, Ventura, and Imperial Counties.

As the designated Metropolitan Planning Organization, SCAG is mandated by federal and state law to research and draw up plans for transportation, growth management, hazardous waste management, and air quality. Additional mandates exist at the state level.

Orange County Council of Governments (OCCOG)

OCCOG is a JPA voluntarily established by its members pursuant to the Joint Exercise of Powers Act of the California Government Code. The OCCOG was formed for the following broad purposes:

- To facilitate area-wide planning and coordination in order to provide advice to public entities on a range of issues that affect multiple interests in Orange County;
- To create a unified subregional organization which will improve Orange County's abilities to be represented in the Southern California region, the State of California and the nation on issues and matters that affect collective Orange County interests;
- To accomplish the preparation of subregional plan components mandated by state and federal law;
- To conduct studies and projects designed to improve and coordinate the common governmental responsibilities and services on an area-wide and regional basis through the establishment of a council of governments; and
- To explore areas of intergovernmental cooperation and coordination of government programs and provide recommendations and solutions to problems of common general concern.

The OCCOG does not have the power to impose any tax, assessment, or land use requirement.

San Diego Association of Governments (SANDAG)

SANDAG comprises 18 city governments and one county government and is a forum for decisions on a wide range of issues. SANDAG is governed by a board of directors composed of mayors, council members and county supervisors, as well as non-voting advisory members from the Department of Defense, Caltrans, San Diego Port District, San Diego Water Authority, and others. In addition to the board, SANDAG also has a staff of professional planners, engineers, and research specialists. SANDAG builds consensus, makes strategic plans, obtains and allocates resources, plans, engineers, and builds public transportation, and provides information on a wide variety of topics. SANDAG also has the ability to issue bonds, as established in specific state legislation. SANDAG has a Shoreline Preservation Working Group with staff members guided by a Shoreline Preservation Strategy that was adopted by their board in 1993. This strategy places a large emphasis on beach nourishment. The Shoreline Preservation Working Group advises the Regional Planning Committee of SANDAG on issues

related to the Shoreline Preservation Strategy. SANDAG recently completed the *Coastal Regional Sediment Management Plan for the San Diego Region* (Moffatt & Nichol, 2009a).

Beach Erosion Authority for Clean Oceans and Nourishment (BEACON)

BEACON is a JPA with member agencies comprising the cities of Carpenteria, Goleta, Oxnard, Port Hueneme, Ventura, Santa Barbara, and the counties of Santa Barbara and Ventura. BEACON was established for the limited purposes of dealing with coastal erosion, beach nourishment, and beach problems in Ventura and Santa Barbara Counties. They have also recently expanded their purview to water quality issues and related beach and ocean pollution. BEACON is involved in an array of coastal studies and projects within its jurisdiction and works in close coordination with the parks, planning and public works departments of BEACON's member agencies. BEACON is staffed by a combination of specialist consultants and participation from member agency staff. Funding for BEACON comes through annual agency membership dues and grant funding from state and federal agencies. BEACON recently completed the *Coastal Regional Sediment Management Plan, Central Coast from Pt. Conception to Pt. Mugu* (BEACON, 2009).

Association of Monterey Bay Area Governments (AMBAG)

AMBAG was organized in 1968 for the purpose of regional collaboration and problem solving. AMBAG is a JPA governed by a twenty-four member board of directors comprised of elected officials from each city and county within the region. The AMBAG region includes Monterey, San Benito and Santa Cruz County. AMBAG serves as both a federally designated Metropolitan Planning Organization (MPO) and Council of Governments (COG). AMBAG performs metropolitan level transportation planning on behalf of the region. Among its many duties, AMBAG manages the region's transportation demand model and prepares regional housing, population and employment forecast that are utilized in a variety of regional plans.

AMBAG is a JPA governed by a Board of Directors composed of locally elected officials appointed by their respective city council or Board of Supervisors. Each member city has one representative on the Board, while each member county has two. The AMBAG board of directors sets policy and oversees a small professional staff. AMBAG's funding comes from various local sources, including the state and federal governments for mandated planning activities and grant projects. Funding comes from various local sources, including annual membership dues contributed by each member agency. AMBAG recently completed the *Coastal Regional Sediment Management Plan for Southern Monterey Bay* (Philip Williams & Associates, Ltd. 2008). AMBAG has recently decided to withdraw from oversight of RSM-related activities, reportedly due to concerns over whether their assigned authorities extend to coastal matters.

3.7.2 JPA Options

Adopting the SANDAG model, the governance structure would employ either OCCOG or SCAG as an existing JPA and include a multi-stakeholder coastal erosion committee that advises the executive director and board of directors. This structure would negate the need to establish a new JPA. If SCAG were the parent body, the organization could be extended to other geographic regions in the future (beyond Orange County), and the organization would already be set up to receive funding and implement projects. For either OCCOG or SCAG to be used, either board would need to expand their scope to take on this new role of coastal RSM.

Adopting the BEACON model would require formation of a new JPA that is focused on coastal RSM in Orange County and immediate upland areas, rather than using the SCAG or OCCOG as an existing JPA. The scope of the new JPA would be limited to coastal RSM issues and the geographic area would be limited to Orange County and those parts of Los Angeles and Riverside countiesthat are included within the Orange County sedimentsheds.

Either JPA option could enter into contracts for coastal processes studies, planning, environmental review, permitting and engineering as needed. Either JPA option also could enter into construction contracts for beach nourishment or beach retention structures, if deemed necessary or desirable by local agencies.

3.7.3 Partners

Three main partners typically work closely with a JPA for the implementation of coastal RSM. The CSMW provides the framework for coastal RSM plans throughout coastal California. The CDBW is the state department that funds many beach nourishment and erosion control projects, and is a member of CSMW. CDBW can cost share with any public agency that has a board comprised of elected officials and that has the authority to enter into an agreement. USACE is a federal agency that funds many beach nourishment, erosion control, and ecosystem restoration projects, and is also a member of CSMW. USACE can cost share with any non-federal public agency, and generally if CDBW can partner with the JPA then so can USACE. To partner with USACE, the JPA would need to sign an agreement and demonstrate an ability to pay.

3.8 Funding Streams

Current funding assistance for sediment-related projects typically originates from either the USACE (federal funds) or CDBW (state funds). The local contribution, or match, to these funds varies dependant on the funding source, but is needed to leverage the state or federal funds. Given the recent nationwide and state paradigm shift to RSM and ongoing competition for reduced funds available through the CSMW member agencies, it is possible that available resources may be preferentially allocated to those projects that are part of RSM Plans in the foreseeable future.

3.8.1 Federal Funding

In California, federal funding has historically been the most significant source of funding for beach nourishment, including substantial projects in the 1930s and 1940s using opportunistic sediment to nourish Huntington State Beach, West Newport Beach, Seal Beach and Doheny State Beach (CDBW, 2002). Today, federal projects are typically conducted by USACE and are limited to projects where there is a federal interest. The Surfside-Sunset Beach nourishment project is the most significant ongoing project in Orange County. USACE is also involved with a various studies and projects at Huntington Harbour, Santa Ana River, and San Clemente City Beach.

Since these projects are generally financed with from 35 to 50 percent state/local participation and 50 to 65 percent federal participation, federal projects can provide a substantial amount of leverage for coastal cities, counties, and the State of California. However, current budget debates in Washington D.C. have made it more difficult to obtain federal funding and it is reasonable to assume that federal funding may become more difficult to obtain in the future. However, USACE is involved in dredging operations at a number of sites in Orange County. Much of this opportunistic sediment is already used for nourishment but further examination of how this material can be used in the most beneficial manner is warranted. For example, a differential cost analysis could be performed to determine RSM-style improvements to the ongoing Surfside-Sunset Beach nourishment project whereby some material could be placed at other nearby receiver sites (e.g., East Seal Beach) in need of nourishment.

3.8.2 State Funding

California

California's shore protection program has been operated through the CDBW using funds from the state Harbors and Watercraft Revolving Fund. CDBW has taken the lead in funding nourishment projects, as well as helping to coordinate local, state, and federal efforts for coastal protection through the CSMW. Federal beach nourishment funds from the USACE come with local matching requirements which have frequently been supplied by the CDBW. In 2013, the CDBW will become a division within the California Department of Parks and Recreation and this will likely result in significant changes in the way business is done within the CDBW.

Proposition 84, the Clean Water, Parks and Coastal Protection Act of 2006, was approved on the November 2006 ballot. The bill was designed to provide $540 million for the protection of beaches, bays and California's coastal waters. Most of this money is likely to be used for environmentally related projects as well as projects focusing on water quality.

Approaches of Other States

Many other states have been active in financing beach nourishment. In particular, Florida has gathered financial and political support for beach nourishment. According to the Florida Shore

and Beach Preservation Association, over half of all recent beach spending in the state was financed from local funds. Florida uses a number of mechanisms to finance beach nourishment. State law requires that at least $30 million of revenues from Florida's real estate documentary stamp tax (equivalent to California's real estate transfer tax) must go for beach nourishment projects and in many years the state funds more than the required minimum (Flack, 2006).

Florida state law also requires that half of the non-federal funding for a nourishment project must come from local sources. In cases where state land is involved, the state share is higher (as much as 100 percent) and in some smaller projects the local share is higher. In Florida, the local share of these projects is, in fact, higher than the state share and considerably higher than the federal share.

In Florida, the primary means of financing the local share is the tourist development tax, which is essentially the same as California's TOT. In Florida, typically from one to three percent of the tax is dedicated to beach nourishment. The typical tourist development tax (levied by individual counties) is three percent. However, Florida also levies a six percent state sales tax on hotel occupancy and some counties also add on up to a one percent local discretionary tax, so the effective tax on tourists is generally nine to ten percent, not significantly different from the taxes on hotel and transient housing in California, which is not subject to sales tax.

In some parts of Florida, voters have also approved a special assessment on property (as part of the property tax). These assessments are generally higher for property closer to the beach and lower for property farther away. One advantage of these assessments is that bonds can be issued against them so that a nourishment project can proceed sooner than would be possible with other taxes, where one must typically wait until the money has been collected.

In New York State, the local governments cost-share, with the state paying 70 percent and the locals paying 30 percent of the non-federal cost of the project. In New Jersey, $25 million is dedicated annually from the legislature for shore protection projects across the entire state. These funds come from New Jersey's real estate transfer tax. Most of this money goes to the state share of federal projects with USACE. USACE generally funds 65 percent of these nourishment projects; the remaining 35 percent of the project is split between the state and the municipality. The state/local share in New Jersey is split 75 percent/25 percent, so it only costs the municipality nine cents out of every dollar to finance beach nourishment. New Jersey is also engaged in smaller state/local projects with no federal involvement, financed also at a 75 percent/25 percent state/local ratio. The municipalities typically raise bond revenues for their portion and counties sometimes fund a portion to help defer the local costs (Kaiser, 2006; King, 2006).

Delaware has passed a Beach Act which specifies at least $1 million per year go to beach nourishment and shoreline preservation. Delaware also finances shoreline protection and beach nourishment through bond measures, plus it added a one percent state accommodations tax, (essentially a TOT) dedicated to shoreline protection. According to Tony Pratt, who has been involved in beach nourishment issues in Delaware for many years, the Delaware General

Assembly will typically add funding if needed. In Delaware, the typical state and local cost share is 50/50. However the one percent TOT dedicated to nourishment (which in Delaware, unlike most states, is levied by the state) can be used as part of the local share (Pratt, 2006; King, 2006). This tax raises an estimated $1.7 million per year.

Texas appropriates a portion of the sales taxes generated by sporting goods to support parks and recreation. Since 1993, a portion of the sales tax revenue generated by sporting goods has been statutorily allocated to fund state park operations, capital, and local park grants. Prior to that, state and local parks were each allocated a one penny per pack tax on cigarettes, which probably set the precedent for providing equal allocations to state and local parks. The Sporting Goods Sales Tax allocation was introduced because the cigarette tax proved to be a declining revenue source that bore no relationship to the mission of providing state park services. Beach equipment is not specifically listed among the revenue generating categories (State of Texas, 2008).

3.8.3 Local Funding Sources

Transient Occupancy Taxes

As discussed in Section 3.4 of this report, TOTs provide a substantial source of revenue for local governments. Since beach tourism is often a primary draw for overnight visitors, there is a logic in dedicating some of the TOTs to shore protection. As shown in Table 3.13, TOTs at coastal cities in Orange County vary from 9 percent to 12 percent with most beach cities collecting 10 percent. Ten percent is typical for many cities in California. However, many larger coastal cities such as Los Angeles, Santa Barbara, and San Diego, charge 12 or 13 percent and San Francisco recently raised its TOT from 14 to 16 percent.

Consequently, it is not unreasonable to consider raising the TOT rates in line with other coastal cities. The cities of Encinitas and Solana Beach have already increased TOTs from 10 percent to 12 percent and used the proceeds to create a fund to finance beach restoration, including their share of the RBSPII.

TOTs can generate substantial funds for beach nourishment and are generally a politically feasible way to accomplish this goal. An example estimate of the revenue increases created by a one percent increase in TOTs is provide below for the City of San Clemente. County wide, beach visitors provide about $25 million in TOTs per year for Orange County and it is reasonable to assume that some of these revenues might be used for shoreline protection.

Although tax increases are unpopular, particularly in today's political climate, when put on the ballot, TOTs are generally easier to pass than other taxes. This is because the TOTs are mostly levied on people who come from out of town, and voters are less opposed when someone else pays. Also, since TOTs are levied on tourist dollars and beaches generate tourism, there is a direct link between the tax and beach restoration. It should be noted that an increase in TOT can also lower hotel revenues due to the higher hotel costs.

Table 3.13 TOT at Selected Orange County Beaches

#	CITY OR BEACH	TOT
1,2	Seal Beach Main	12%
3	Surfside	10%
4	Sunset Beach	10%
9,10	Huntington City and State Beaches	10%
12	West Newport Beach	9%
13,14	Newport Pier - Balboa Beach	9%
47	Corona Del Mar State	9%
48	Little Corona del Mar	9%
49	Crystal Cove State Park	10%
50-61	Laguna (all)	10%
62	Aliso County Beach Park	10%
67	Monarch Beach	10%
68,69	Salt Creek Beach	10%
70	Dana Point	10%
71	Baby Beach	10%
72	Doheny State	10%
73	Capistrano County Beach	10%
75	San Clemente City Beach	10%

Figure 3.13 presents data on all TOT ballot measures in California from 2003 through 2007 (League of California Cities, 2011). As shown, 32 measures passed and 22 measures failed, a roughly 60 percent success ratio. TOT measures can and do pass even with voters antipathy to taxes. The fact that the cities of Encinitas and Solana Beach passed successful initiatives also bodes well for their use in Orange County.

It is clear from an examination of other states that one of the primary sources of funding for beach restoration at the local level is the TOT or equivalent, though some local authorities also use property tax assessments and the real estate transfer tax. The cities of Encinitas and Solana Beach have already increased TOTs and used the proceeds to create a fund to finance beach restoration. In summary, TOTs are a viable option for raising shore protection funding within Orange County.

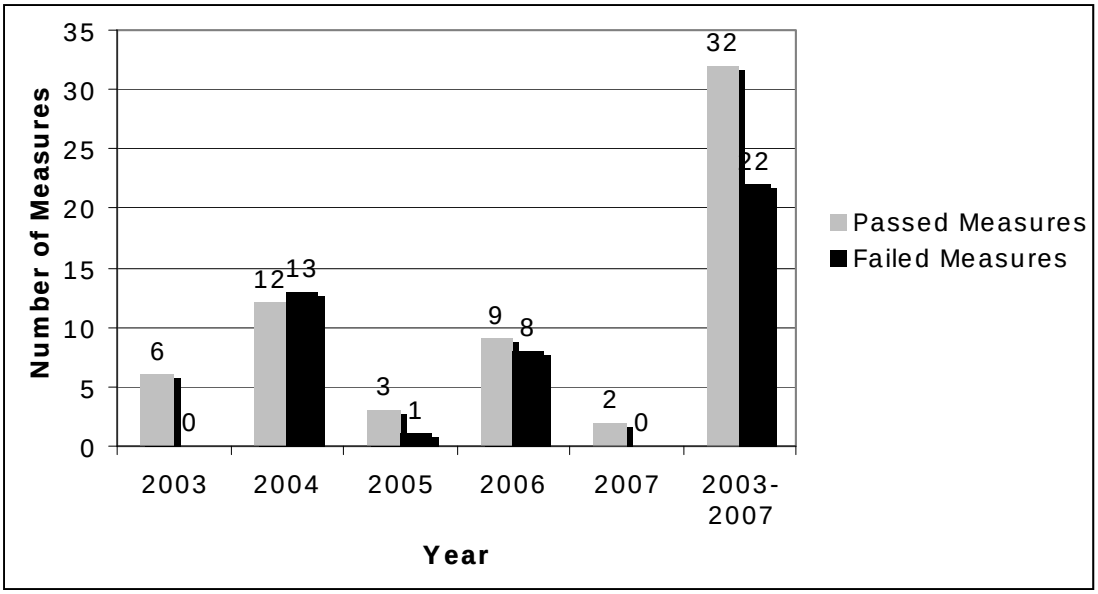


Figure 3.13 TOT Initiatives in California 2003 through 2007

Parking Fees

By law, California's beaches are open and free of charge to the public and coastal access has been an important part of California's coastal policy. As a result, parking fees are sometimes discouraged, particularly by the CCC. However in Orange County, parking fees are already a significant source of revenue for many cities such as Huntington Beach and Newport Beach.

Another significant hurdle is that most city parking fees go to a city's general fund revenues and are thus used for overall spending. At a time when tax revenues are shrinking it is likely to be difficult to move such funds to a dedicated fund for shoreline protection.

However, analysis of parking at Orange County beaches indicates that there are thousands of free parking spots used by beach visitors throughout the county. Moreover, since many (if not most) visitors gravitate toward free parking first before using paid parking, the availability of free parking also reduces the revenue from existing paid parking.

Table 3.14 lists free parking availability by beach in Orange County along with an estimate of the percentage available for beach parking by site. The final column includes a hypothetical calculation of revenue from beach visitors if these free parking spots were converted to pay parking and each meter generates $1000 per year. Under these assumptions, over $5 million per year could be generated for Orange County coastal maintenance.

There is also another rationale for using parking fees. Since day trippers spend much less than overnight visitors and much of this spending takes place out of town (e.g., on gas or food), they

generate very little tax revenues for local communities. To limit revenue collection to "free riders" who come from out of town as well as to increase the political viability of such a move, parking fees could be limited to non-residents by giving residents decals.

Consequently, cities could consider increasing parking fees at municipal beaches, including street parking. To minimize the impact on local citizens or even TOT paying condo-renters and hotel guests, these people can be exempted or given lower fees or free parking for a number of hours. This arrangement not only seems more equitable to all parties, but it would also make increasing parking fees more politically feasible.

Table 3.14 Free Beach Parking and Estimated Revenues from Metering

#	Beach	Free Street Parking	% Available for Beach Tourism	Annual Revenue Assuming $1000/meter
1	West Beach, Seal Beach	246	60	$147,600
2	East Beach, Seal Beach	582	60	$349,200
3	Surfside	0	n/a	
4	Sunset Beach	610	70	$427,000
5,6	Huntington Harbour Beaches			
7	Bolsa Chica State Beach	0	n/a	
8	Huntington Cliffs /Dog Beach	0	n/a	
9	Huntington City Beach	4830	30	$1,449,000
10	Huntington State Beach	0	n/a	
11,12	West Newport Beach	1357	30	$407,100
13	Newport Beach Pier	605	10	$60,500
14	Balboa Beach	1700	30	$510,000
15-46	Newport Harbor Beaches	715	15	$107,250
47	Corona Del Mar State Beach	610	70	$427,000
48	Little Corona Del Mar	240	70	$168,000
49	Crystal Cove State Park	0	n/a	
50	Irvine Cove	0	n/a	
51	Emerald Bay	0	n/a	
52	Crescent Bay	157	40	$62,800

Table 3.14 continued

#	Beach	Free Street Parking	% Available for Beach Tourism	Annual Revenue Assuming $1000/meter
53	Shaw's Cove	87	15	$13,050
54	Fisherman's Cove			
55	Diver's Cove - Heisler Park			$27,000
56	Laguna Beach	58	10	$5,800
57	Brooks Street Beach	8	20	$1,600
58	Bluebird Coast	45	20	$9,000
59	Wood's Cove/ Ruby Street	51	20	$10,200
60	Victoria Beach	47	20	$9,400
61	Treasure Island Beach	0	n/a	
62	Aliso County Beach Park	25	100	$25,000
63	Camel Point Beach	80	90	$72,000
64	Table Rock Beach	118	60	$70,800
65	1000 Steps Beach	110	60	$66,000
66	Three Arch Bay	0	n/a	
67	Monarch Beach	0	n/a	
68,69	Salt Creek Beach	110	85	$93,500
70	Dana Point	0	n/a	
71	Baby Beach	0	n/a	
72	Doheny State Beach	0	n/a	
73	Capistrano County Beach	157	95	$149,150
74	Poche Beach	0	n/a	$29,000
75	San Clemente City Beach	816	70	$640,800
76	San Clemente State Beach	0	n/a	
77	Cottons	93	97	$90,210
	Total			$5,381,360

Sales Taxes

Cities and counties have the authority to raise a portion of the sales tax and use the proceeds for quality of life issues. Even a small increase would raise funds for beach nourishment, though this solution may not be politically feasible.

One proposal, considered for San Diego County by SANDAG several years ago, was a 0.25 percent quality of life increase in the sales tax rate. State law allows such funds to be used for a variety of projects to improve the quality of life in a region. For example, sports stadiums may be financed by such a measure, such as attempted by the basketball team the Sacramento Kings. If such a measure passed and proceeds were pro-rated based on beach spending, as shown in Section 3.4.1, it would generate $2.6 million per year for Orange County.

Figure 3.14 presents data on all sales/use tax ballot measures in California from 2003-2007 (League of California Cities, 2011). As one can see, just over half of the 113 measures passed. Further, there does not seem to be a relationship between the size of the hike and the success rate, though half percent hikes were by far the most successful. This type of increase could possibly be more politically feasible if the revenues were shared for a number of purposes, perhaps coastal protection in general. A half-cent increase devoted to a variety of issues including coastal protection might be the most successful strategy, since it would allow for a coalition of interest groups to support the tax. It is also possible that a sales tax could be limited just for sporting goods and used to pay for beach nourishment and other recreational activities. The State of Texas appropriates a portion of the sales taxes generated by sporting goods to support parks and recreation. However, beach equipment is not listed among the revenue generating categories (State of Texas, 2008).

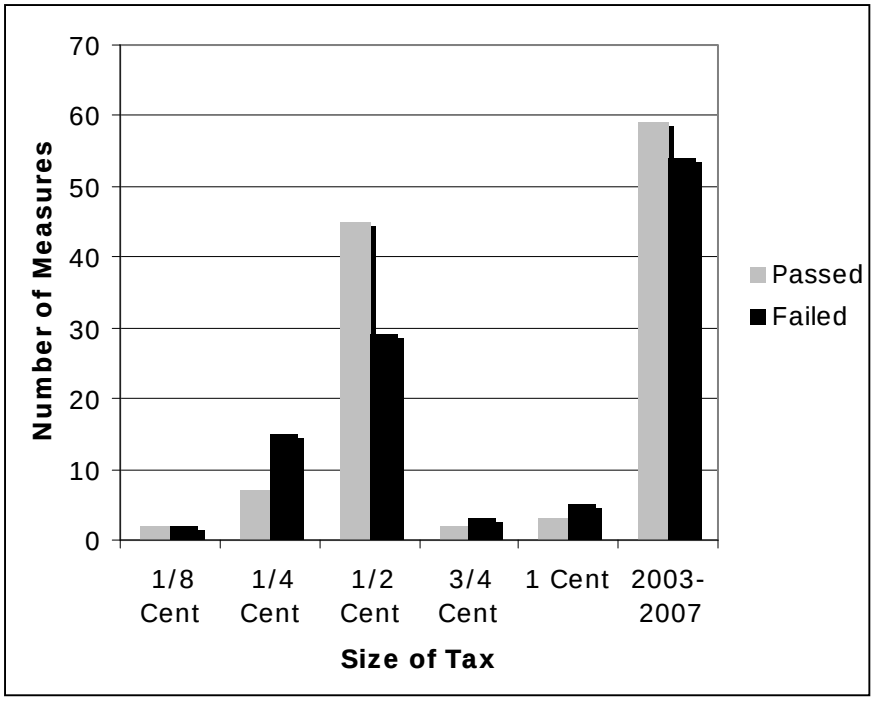


Figure 3.14 Sales and Use Tax Initiatives in California 2003 through 2007

Property Taxes

The State of California allows local governments to increase property taxes for certain reasons such as financing schools or other infrastructure investments. The two possible mechanisms reviewed here are Mello Roos increases and geological hazard abatement districts (GHADs).

Bond proceeds in Mello-Roos Districts are for the purpose of public land improvements. Public improvements within the context of community facilities districts are considered to be notably broader than improvements financed by traditional assessment districts. It takes a two-thirds majority vote of residents to establish a Mello-Roos District.

A GHAD is created to finance the prevention, mitigation, abatement or control of a geologic hazard. A geologic hazard is defined as an actual or threatened landslide, land subsidence, soil erosion, earthquake, fault movement, or any other natural or unnatural movement of land or earth. A GHAD may also be used to finance the mitigation or abatement of structural hazards that are partly or wholly caused by geologic hazards. Generally, GHADs have been used by cities and counties to help property owners who have or potentially could encounter geologic hazards to their property. A handful of relevant GHAD examples exist. In 1998 a GHAD was formed in the City of Capitola pursue the construction of a seawall to protect their cliff front properties. In 2002, the City of Solana Beach proposed establishing a GHAD to facilitate the construction of seawalls.

Figure 3.15 presents data on all City and Special Parcel Tax ballot measures in California from 2003-2007 (League of California Cities, 2011). As shown, more of the property tax measures fail than pass.

Sediment Impoundment Fees

Dams, debris basins and other results of human development have drastically reduced the flow of sand to the coast, leading in many cases to narrower beaches. As detailed in Table 3.3, Slagel and Griggs (2006) estimated that dams and flood control devices along Santa Ana River reduce the rate of sand and gravel flow to the coast by 243,000 yd^3/year.

If water districts or other agencies were charged a small sand mitigation fee (e.g., $1 /$yd^3$) a substantial amount of money could be raised (e.g., $243,000/year) for sand impounded in the Santa Ana River. However, this mitigation would likely be opposed by the assessed districts and/or agencies.

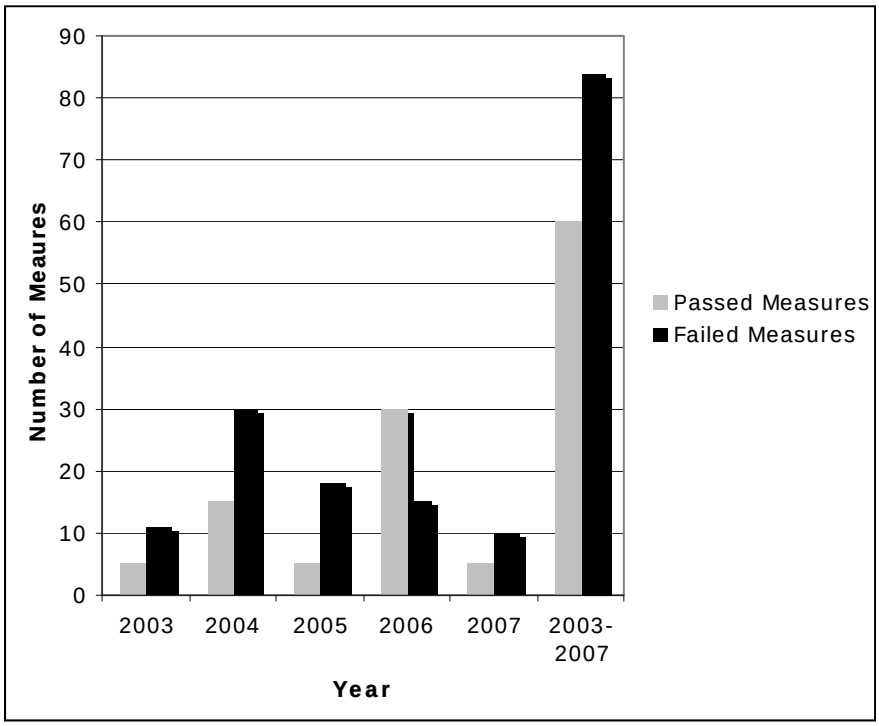


Figure 3.15 Property Tax Measures in California 2003 through 2007

Property Transfer Tax

Orange County currently levies a property transfer tax (similar to Florida's real estate transfer tax) of $1.10 per $1000 on all sales of private property in the county. Of the tax revenue, 50

percent goes to cities (e.g., San Clemente). This money is dedicated to general fund revenues. This rate is consistent with the vast majority of cities/counties in the state though a few cities in Alameda County such as Berkeley ($16.10), Oakland ($16.10) and Piedmont ($14.10) charge significantly higher rates. Although raising the property transfer tax and dedicating some or all of this is possible, it is likely to be less politically feasible than other solutions.

3.8.4 San Clemente Case Study

In this section of the report, to examine the funding proposals in more detail, they have been applied to the City of San Clemente as an example. San Clemente, with a population of just over 60,000, is typical of many smaller beach cities in Orange County. It has an active beach, with over two million visitors per year, though its economy has many other facets.

Transient Occupancy Taxes

Table 3.15 below examines the TOT collections for the City of San Clemente since 2007. King (2001a) found that 57 percent of the hotel TOTs were beach related. Including short term condo rentals this value increases to 62 percent of all TOT revenues. Given this, dedicating some TOT revenues to beaches may be reasonable. Currently San Clemente levies a 10 percent TOT like most other coastal cities in Orange County. A 1 percent increase in the TOT would have netted just over $150,000 in income per year. This is a substantial amount, but much less than the amount necessary to support a large nourishment project. If San Clemente "banks" this revenue it could raise $1 million in just over six years. Doubling the increase to a 2 percent increase would essentially double the revenue (assuming no significant impacts on demand) to $300,000 per year. As the data below indicates hotel revenue was higher in 2008, before the current recession hit, so it is also likely that San Clemente will see some recovery in hotel revenues (and hence TOT) in the coming years.

Table 3.15 TOT for San Clemente from 2007 through 2010

YEAR	2007	2008	2009	2010
TOT Base	$13,620,150	$14,658,520	$13,096,440	$13,719,370
10% (current)	$1,362,015	$1,465,852	$1,309,644	$1,371,937
11%	$1,498,217	$1,612,437	$1,440,608	$1,509,131
Effect of 1% increase	$149,822	$161,244	$144,061	$150,913

Source: City of San Clemente

Parking Revenues

Table 3.16 presents parking revenues for the City of San Clemente from 2008 through 2010. Overall, San Clemente raised between $1.5 and $1.6 million per year in parking revenues. King (2001a) estimated that 85 percent of the meter fees and 65 percent (roughly 75 percent overall) of the fines are directly related to beach tourism. Increasing parking fees, at least to non-residents, would also be a way to reduce the "free rider effect" of day-trippers who come to San Clemente's beaches but spend little money to support the infrastructure. The City raised its parking fees in 2010 by 50% (from $1 per hour to $1.50 per hour, so it is likely that these revenue projections will be significantly higher going forward.

Table 3.16 Parking Revenues for San Clemente from 2008 through 2010

REVENUE SOURCE	2008	2009	2010
Parking Violations	$516,355	$617,355	$452,666
Parking Meters	$694,903	$600,096	$624,377
Parking Permits	$118,157	$117,280	$123,160
Total	$1,329,415	$1,334,704	$1,200,203

Source: City of San Clemente

Table 3.17 shows the revenue that could be raised if the City of San Clemente charged for what is currently free street parking. This estimate assumes that these meters would net $1000 per year in revenue (parking fees and fines net of costs). In such a scenario, San Clemente could raise an additional $702,210 per year. It should be noted that some of the parking spots detailed in Table 3.22 are used by people attending Trestles, and those generally do not utilize San Clemente City services.

Table 3.17 Estimated Parking Revenues if Free Parking Converted to Paid

BEACH	FREE STREET PARKING	% AVAILABLE FOR BEACH TOURISM	ANNUAL REVENUE ASSUMING $1000 PER METER
San Clemente City Beach	816	75	$612,000
San Clemente State Beach	0	n/a	
Cottons	93	97	$90,210
Total			**$702,210**

Sales Taxes

Table 3.18 presents sales tax data for the City of San Clemente. Like most coastal cities in Orange County, the sales tax rate is 6.25 percent, which is low compared to many other cities in

the state. A 0.25 percent increase in sales tax dedicated to shoreline protection could raise a substantial amount in revenues, ranging from $1.5 to $1.9 million per year.

Table 3.18 Sales Taxes for San Clemente from 2007 through 2010

SALES TAX REVENUES	2007	2008	2009	2010
Sales Tax Base	$756,131,467	$750,508,400	$604,355,200	$662,085,467
0.75% to City (actual)	$5,670,986	$5,628,813	$4,532,664	$4,965,641
0.25% increase	$1,890,329	$1,876,271	$1,510,888	$1,655,214

Source: City of San Clemente

Special GHAD

As described earlier, a GHAD can be created to finance the prevention, mitigation, abatement or control of a geologic hazard such as actual or threatened landslide, land subsidence, soil erosion, earthquake, or fault. The City of San Clemente has a very large property tax base and raises just under $23 million per year. This represents over 70 percent of tax revenue collections for the city. It is reasonable to assume that a GHAD in the San Clemente area could raise substantial revenues. However, the boundaries of the GHAD would need to be spelled out precisely and the revenues could only be used to protect threatened property (i.e., storm damage protection) rather than recreation, though the two goals could be compatible.

3.8.5 Summary of Revenue Discussion

Overall, the above example indicates that there are many options to increase coastal protection funding for San Clemente. Of these options, TOTs are used in other states such as Florida to raise revenues for beach nourishment and the cities of Encinitas and Solana Beach have passed initiatives in recent years to facilitate beach nourishment. In California, 60 percent of TOT ballot measures passed in 2003 through 2007. However the case study of San Clemente indicates that the amount of revenues raised by TOTs may be modest.

Some cities may want to consider raising non-resident parking rates as a means of raising revenues for beaches. Parking fees are not popular, but if residents are exempt they may be effective in some places.

Even a modest increase in sales taxes would raise a substantial amount of money, though it is unlikely that all of this increase could be dedicated to beaches. Sales tax increases have about a 50 percent success rate in California, so a well-organized ballot initiative which included other issues besides beaches might succeed.

A GHAD may also be feasible but such a mechanism would require far more study and would likely have to be focused on a specific hazard to property owners. Property tax initiatives are generally less successful than other tax increases when placed on a ballot.

4. THE PLAN

The Plan activities listed in Table 4.1 were developed based on input from the Plan sponsors and stakeholders. Four types of activity categories are provided as follows:

1. Activities were ranked into high, medium, and low priority based on a combination of stakeholder interests, perceived needs, recreational benefits, shore protection benefits, funding availability, costs, habitat impacts, regulatory requirements, and permitability
2. Type of activity is based on:
    a. Plan Performance activities are designed to improve performance of the Plan. This includes monitoring and feedback activities which could inform other Plan activities for better decision making;
    b. Construction activities are projects that can be built and support coastal RSM; and
    c. Governance and Regulation activities are intended to provide the governance structure and improve government regulation to facilitate Plan implementation.
3. State of the activity separates between those that are existing and are expected to continue into the future and those that merely have the potential to begin (i.e. have not yet begun).
4. Duration separates activities into those that can be completed, those that would be ongoing without end, and those that would be recurring without end.

4.1 Initiate Outreach and Education

For the Plan to be implemented, it must be known. Outreach and education is a means to get the Plan into the hands of people, stakeholders, and agencies who can bring it into fruition. Once the Plan is finalized, the first steps of this activity are to develop a concise brochure and a webpage for the Plan. This should be followed with presentations of the Plan to technical, professional, and decision making bodies.

Table 4.1 Summary of Plan Activities

Activity	Priority	Type	State	Duration
Initiate Outreach & Education	High	Plan Performance	Potential	Project
Develop a Governance Structure	High	Governance and Regulations	Potential	Ongoing
Establish County Staff Position to Implement the Plan	High	Governance and Regulations	Potential	Ongoing
San Clemente Shoreline Project	High	Construction	Potential	Project
Dana Point Harbor Dredging and Nearby Nourishment	High	Construction	Existing	Recurring
Surfside-Sunset Beach Nourishment Project	High	Construction	Existing	Recurring
Newport Harbor & Bay Dredging & Beach Nourishment	High	Construction	Existing	Recurring
Bolsa Chica Maintenance Dredging and Huntington Cliffs Nourishment	High	Construction	Existing	Recurring
Santa Ana River and Huntington Beach Wetlands Dredging	High	Construction	Existing	Recurring
East Beach, Seal Beach Maintenance	High	Construction	Existing	Recurring
Prado Dam Bypassing to Santa Ana River	High	Construction	Potential	Recurring
Improved Monitoring and Performance Evaluation	High	Plan Performance	Potential	Ongoing
Data Gaps and Database	High	Plan Performance	Potential	Ongoing
Develop a Pilot SCOUP within Orange County	High	Governance and Regulations	Potential	Ongoing
Establish a Dedicated Funa and Process for Implementing Coastal RSM	Medium	Governance and Regulations	Potential	Project
High Fines Sediment Nourishment Pilot Study	Medium	Plan Performance	Potential	Project

Table 4.1 continued

ACTIVITY	PRIORITY	TYPE	STATE	DURATION
Establish Funding Stream to Accommodate Incremental RSM Costs	Medium	Construction	Potential	Ongoing
Sea Level Rise Beach Sustainability Study	Low	Plan Performance	Potential	Project
Orange County Dredge Ownership	Low	Construction	Potential	Ongoing
Sand Retention Feasibility Study	Low	Plan Performance	Potential	Project
Huntington Harbour Dredging with Beach or Nearshore Placement	Low	Construction	Potential	Recurring
Update the Plan	Low	Plan Performance	Potential	Recurring
Update Sediment Budget for Laguna Beach Littoral Cell	Low	Plan Performance	Potential	Project
Investigate Methods to Assess and Mitigate for Upstream Sand Mining	Low	Governance and Regulations	Potential	Ongoing
Study Large Grain Size Impacts at East Beach, Seal Beach	Low	Plan Performance	Potential	Project
Update Sediment Transport Studies for Southern Orange County	Low	Plan Performance	Potential	Project

4.2 Develop a Governance Structure

A governance structure provides a framework for the Plan to be used, including interpretations, updates and implementation of particular activities. The governance structure represents a coordinated implementation approach that provides a framework for input from citizens as well as federal, state, regional, and local entities. Any governance structure to be adopted would require extensive consideration and discussion among coastal public agencies. This Plan activity would be to begin collaborative discussions amongst the many local and regional agencies to consider starting a new JPA or joining an existing JPA. A recommended governance structure for the Plan is provided below.

Recommended Governance Structure

The Plan recommends a governance structure for implementation of RSM in Orange County by developing a new JPA following the model laid out by BEACON. Using SCAG as the governance structure is not recommended since the SCAG region covers all of southern California some of which is already covered by other JPAs such as SANDAG and BEACON. The OCCOG is not recommended since it does not include Los Angeles, Riverside, or San Diego Counties, which are included in the sedimentsheds within the Plan. Possible names for this new JPA are: Sustainable Beaches of Orange County (SBOC), Orange County Area Governments Beach Authority (OCAGBA), and Orange County Area Sedimentshed Authority (OCASA).

In this structure the JPA would act as the lead planning and coordinating agency which adopts, seeks funds, administers grants and studies, assists with implementation activities as deemed necessary by the local implementing agencies, facilitates collaboration on coastal issues, works to fill data gaps, and maintains and updates the Plan.

The JPA would receive funds, complete environmental documentation, acquire regional permits as appropriate, and plan coastal projects, as appropriate. Local land use decision-making and implementation would remain with the local agencies.

The JPA would be defined as the lead-planning agency for coastal RSM issues and other erosion control measures. Examples of other erosion control measures include seawalls, sand retention reefs, perched beaches, groins, revetments, breakwaters, and headland enhancement.

This Plan recommends that the JPA hire a dedicated staff member to assist the executive director to specifically manage coastal RSM issues and coordinate with other staff. The executive director would be advised and guided on RSM issues by a committee comprising of representatives from regional and local governments, academic institutions, industry, and non-profit organizations. The executive director would then report to a board of directors.

It is important to note that this structure may be updated as experience is gained with sand management in the Orange County sedimentsheds. The JPA may also find, like SANDAG and BEACON, that one or more technical staff members may be desired to help local agencies to implement particular projects which require special capabilities in coastal engineering, construction contract administration, and/or monitoring

Implementation

Implementation of this Plan means activation of the JPA's role to coordinate information and funding between the various levels of government and to solicit grant funding for various shoreline enhancement projects. In order for the Plan to be considered when coastal RSM activities are being planned or implemented, the JPA should promote referencing of the Plan in individual LCPs or Land Use Plans. The JPA could pursue implementation of the Plan by requesting that the local office of the CCC begin requiring all coastal RSM projects in Orange County be consistent with the Plan by beneficially re-using surplus sediment for nourishment.

The JPA should coordinate with all local agencies (city and county level) to pursue consistency with specific activities of the Plan in their zoning ordinances and municipal codes in their general plans. For example, any project component that requires a grading permit would be asked to show how that project could beneficially use surplus sediment (if it has the appropriate quality for nourishment purposes) within the coastal zone rather than for other purposes (such as construction materials or nourishment). Input from partner cities and counties would be received by the committee, which would then make recommendations to the JPA board of directors.

Long-Term Outreach and Dissemination

In order for the JPA to coordinate with the local and regional jurisdictions and special districts to implement the Plan, a long-term outreach program should be established. The JPA should develop existing resources including contact lists to provide a focused outreach campaign to encourage discussion amongst the relevant agencies and stakeholder groups. Public meetings should also be convened as appropriate in which the JPA should seek public input and consensus to guide the implementation of the recommended actions in the Plan. This Plan should also be supported through publication of brochures, fact sheets, and provision of information on the JPA and CSMW web pages.

4.3 Establish County Staff Position to Implement the Plan

Coastal RSM implementation demands professional and vigilant attention to work with the multitude of involved stakeholders, including local, state, and federal agencies. Coastal programs and issues are currently administered by the County of Orange via a structure that is sometimes divided between the OC Parks, OC Watersheds, and Public Works staff. The lack of

a single and clear administrative voice hinders the County's ability to effectively respond to short term and long range planning issues.

This activity would be to either empower existing staff or create a new position within the County of Orange to be dedicated to short term and long range coastal RSM issues that are relevant to implementation of the Plan. The position would be responsible for collaboration with local, state, and federal resource and regulatory agencies as well as stakeholders to address funding needs, activity implementation, Plan implementation, and long term coastal RSM strategy and planning.

4.4 San Clemente Shoreline Project

This activity would be to support progress of the San Clemente Shoreline Project. The City of San Clemente and USACE have entered into a cost sharing agreement and a feasibility study and EIS for the project is available (Chambers Group, Inc., 2011). The purpose of the project is to provide the most technically feasible and economically beneficial plan for reducing shoreline erosion and protecting coastal infrastructure from storm-induced wave attack along the San Clemente, California shoreline. A Chief of Engineers report was issued in April 2012 and has been finalized by the Secretary of the Army and transmitted to Congress.

Supporting this project could involve developing partnerships with other adjoining jurisdictions to leverage funding and would likely require continued funding of local portions of the project cost. Additionally, local jurisdictions can add this issue to their legislative platform, submit letters of support to grantees, assist lobbying state and federal sources, write letters to lobby DBAW, and continue to inform the public of their role in the project.

4.5 Dana Point Harbor Dredging and Nearby Nourishment

This activity would be to support and encourage the ongoing beneficial beach nourishment resulting from maintenance dredging at Dana Point Harbor. The County of Orange and Dana Point Harbor Department recently completed maintenance dredging of less than 114,000 yd^3 of material from Dana Point Harbor with beach nourishment of approximately 9,500 yd^3 at Baby Beach and 48,000 yd^3 at Capistrano County Beach (USACE, 2007b; CCC, 2007; USACE, 2008). The remaining dredged material was disposed at the LA-3 ODMDS. The historical average dredging rate within Dana Point Harbor is 48,000 yd^3 per project executed every nine years (Moffatt & Nichol, 2009b) and the previous project in 2000 also nourished Baby Beach and Capistrano County Beach. In addition to Baby Beach and Capistrano County Beach, nourishment at Doheny State Beach may be desirable to offset beach narrowing at this location. It is safe to assume that Dana Point Harbor will continue to require maintenance dredging in the future and beneficial use of this material is an integral component of coastal RSM. In addition to widening Capistrano County Beach, the nourishment at this location serves as a feeder beach to the BECA at San Clemente City Beach. Placing suitable dredged material on nearby

beaches such as the above nourishment projects is an excellent example of applied coastal RSM.

In addition to using the Dana Point Harbor as a sand source, it has been suggested by stakeholders that San Juan Creek has a substantial amount of sand that could be used for beach nourishment. This source should be investigated for potential use at nearby receiver sites.

4.6 Surfside-Sunset Beach Nourishment Project

This activity would be to support the ongoing Surfside-Sunset Beach nourishment project being carried out by USACE, State of California, Orange County, City of Newport Beach, and City of Huntington Beach. Stage 1 of this beach nourishment project began in 1964. From then until 2009, over 18 million yd^3 of sediment has nourished Surfside-Sunset Beach (Mesa, 2011). This project serves as a de-facto sediment source to the entire Huntington Beach Littoral Cell (ASBPA, 2007; Gadd et. al., 2006). Since material from this project naturally replenishes many beaches in the littoral cell through sediment transport, it is an excellent example of successful coastal RSM. Supporting efforts could include continuing local funding, seeking project partners, adding the project to local legislative platforms, and lobbying state and federal governments.

4.7 Newport Harbor & Bay Dredging & Beach Nourishment

This activity would be to support the ongoing efforts to dredge and nourish the beaches within Newport Harbor and Bay. These efforts are currently being carried out by the Newport Beach Harbor Resources Division and numerous individual property owners. Most of the beaches within Newport Harbor and Bay have varying degrees of chronic erosion problems. The solution to date has been to dredge nearshore silted waterways and place the beach suitable portions of material up on the beach. In addition to ongoing activities, the Harbor Resources Division has indicated a desire to maintain eroded beaches with supplemental beach quality sand from other regional sources. Supporting efforts could include contining local funding, seeking project partners, adding the project to local legislative platforms, and lobbying state and federal governments.

4.8 Bolsa Chica Maintenance Dredging and Huntington Cliffs Nourishment

This activity would be to support the ongoing maintenance dredging of the Bolsa Chica Ecological Reserve and nourishment of the nearby Huntington Cliffs. This maintenance is managed by the CSLC and is paid for through a dedicated project maintenance fund originally seeded by the Ports of Long Beach and Los Angeles. This maintenance dredging resulted placement of approximately 235,500 yd^3 of sand in the spring of 2009 and 396,300 yd^3 in the spring of 2011 (Woodfield, 2011). Material was placed south of Bolsa Chica, between the

entrance channel and the Huntington Cliffs (e.g., Seapoint Street). This beach nourishment widened the chronically narrow beaches at Huntington Cliffs. Supporting efforts could include seeking local funding, seeking project partners, adding the project to local legislative platforms, and lobbying state and federal governments.

4.9 Santa Ana River and Huntington Beach Wetlands Dredging

This activity would be to support the ongoing dredging and beach and nearshore nourishment in and around the Santa Ana River, Huntington Beach Wetlands, Talbert Channel, Huntington State Beach, and West Newport Beach. Frequent dredging of these wetlands and the Santa Ana River are required to maintain biological habitat, tidal flow, and river flow capacities. Maintenance dredging of the Lower Santa Ana River is dictated by flood protection thresholds described by the USACE (1996b). Most of the dredged material from these sources is beach quality sand. RSM clearly recommends beneficially placing this dredged sandy material within the littoral environment where it can contribute to maintaining these beaches. Further efficiencies may be gained by placing this dredged sand at a more chronically eroded beach such as at the Newport Pier. Supporting efforts could include continuing local funding, seeking project partners, adding the project to local legislative platforms, and lobbying state and federal governments.

4.10 East Beach, Seal Beach Maintenance

This activity would be to support the ongoing nourishment and maintenance activity at East Beach, Seal Beach. East Beach has an ongoing sand deficit, resulting in narrow beaches and frequent risk of storm flooding. Over the last few decades, this beach has been nourished from offshore dredging and inland sources. In addition, East Beach benefits from construction of an annual winter berm and other beach maintenance activities. The City of Seal Beach views these maintenance activities as necessary to protect properties from coastal flooding. Supporting efforts could include continuing local funding, seeking project partners, adding the project to local legislative platforms, and lobbying state and federal governments.

4.11 Prado Dam Bypassing to Santa Ana River

This activity would be to support and monitor progress of the Prado Basin Sediment Management Demonstration Project. Supporting efforts could include seeking local funding, seeking project partners, adding the project to local legislative platforms, and lobbying state and federal governments. This project is a critical demonstration of the possible difficulties and benefits of sediment bypassing around existing sediment transport barriers within the watershed or sedimentshed. A detailed description of the project is provided in Appendix D.

Upon the completion of Prado Dam in 1941, the sediment transport mechanics of the Santa Ana River watershed were dramatically altered. Once sediment-laden water enters the Prado Basin

the velocity of the water decreases, sediment settles out of the water and then relatively clean water is released through Prado Dam. Water that is discharged from Prado Dam can entrain existing sediment below the dam and transport the material to the coast. Because the Dam is cutting off the replacement source of sediment, the river below the Dam is “sand starved”. The presence of the Dam has severely altered the flow of sediments downstream, affecting natural habitats and decreasing replenishment of beach sands. The deposition of sediments is also restricting the storage capacity behind the dam. Since 1941, an average of 1.2 million yd^3/year of sedimentation has occurred within the Basin, for a combined loss of 80 million yd^3 of water storage capacity. Excessive sedimentation in and upstream of Prado Basin negatively impacts habitat, water conservation, and civil infrastructure.

The Orange County Water District is the proponent of the demonstration plan requesting a non-recreational outgrant development application with USACE as the federal agency for the project. The goal of the proposed project is to demonstrate the effectiveness of sediment removal from the Prado Basin and re-entrainment of sediment into the lower Santa Ana River, while protecting civil infrastructure, improving water conservation, and restoring ecosystems.

4.12 Improved Monitoring and Performance Evaluation

Generally, monitoring is permit-driven with differing requirements based on impact considerations associated with implementation of individual projects. While site-specific monitoring of coastal RSM projects will remain a necessary component of compliance with regulatory requirements, an effective regional monitoring framework would support evaluations of overall Plan performance and adaptive management of the Plan over time. Evaluation of Plan performance should be based on recreational, physical, and biological considerations, including cumulative impacts.

This activity would entail development of a regional monitoring framework specific for the County, which would identify the different types of information monitored with recurring coastal RSM projects and information needed to support all elements of the Plan. It is likely that establishment of long-term biological monitoring sites at physical monitoring locations would provide useful data to support the various performance evaluations. Also monitoring of surfing impacts from nourishment projects has recently been required and is recommended here. Performance evaluations would address issues of concern to stakeholders, including but not limited to the following considerations:

- Comparative use and cost-effectiveness of different sediment sources, receiver sites, nourishment volumes, and rates,
- Coastal erosion locations and effects of coastal RSM on beach widths or erosion rates,
- Changes in surfing or coastal recreational use patterns in areas of coastal RSM,

- Types of mitigation measures used during project implementation and reported effectiveness,
- Environmental benefits of Plan implementation,
- Success of habitat enhancement or restoration projects involving coastal RSM activities,
- Number of coastal RSM projects requiring compensatory mitigation to offset recreational or biological impacts,
- Use of the Plan to assist regional climate change adaptation planning and implementation,
- Development and use of tools (e.g., geospatial database) to track locations and frequency of projects to aid identification of areas where additional monitoring may be warranted to address cumulative impact concerns, and
- Adaptive management recommended changes in implementation of coastal RSM projects based on lessons-learned from Plan activities.

This activity generally would encourage compilation of relevant coastal RSM project information, coordination to obtain relevant recreation and economic statistics from local, state and federal government agencies, coordination with project applicants and resource agencies to identify lessons learned from project implementation, and focused long-term monitoring. These data collection would ideally be available for the data gaps and database plan activity.

4.13 Data Gaps and Database

The data collected for the current Plan has been submitted to the CSMW to bolster their database and spatial data website. The CSMW database has many possible useful applications:

- Establishing a geospatial database to track projects, sediment quantities, and frequency of implementation would facilitate assessment of potential cumulative impacts on the basis of both geographical (e.g., percentage of planning area affected) and temporal (frequency) scales of disturbance. This information in combination with monitoring would support evaluations of Plan performance and possibly future adaptive refinement of implementation to optimize long-term benefits and reduce environmental impacts associated with RSM in Orange County.
- Collecting geospatial data into one source could facilitate comprehensive cost/benefit analyses of various projects. For example if an upstream sediment source become available, an analysis of the varying costs and benefits associated with various transport and placement schemes may illuminate preferred alternatives.
- Having geospatial data quickly available to individual, already defined projects could save time, resources, and funding while researching and analyzing that project.

The CSMW database can be useful if well maintained and updated with new data as it becomes available. If not maintained, the data becomes stale and potential users will refer to new reports, publications, and data sources for individual projects instead of seeking information from the database. If the CSMW database is to be useful to Orange County RSM projects, the following activities are recommended:

- Continue to develop data and metadata standards for the various data types and inform data providers of those standards;
- Develop memorandums of understanding with Orange County, USACE and other data providers to encourage those providers to submit their data to the database;
- Maintain the CSMW GIS staff size at sufficient levels to maintain, monitor and update the database; and
- Constantly advertise the database amongst possible users.

The benefits of filling individual data gaps within Orange County are minimal without full implementation of the above activities. If the above activities can be executed, filling the following data gaps may prove useful for future individual projects: sand volumes within upland sediment sources, grain size distributions within the upland sediment sources, grain size distributions at receiver beaches, grain size distributions and volumes at coastal sediment sources.

4.14 Develop a Pilot SCOUP within Orange County

This activity would implement a regional opportunistic sediment use program within Orange County by utilizing the previously described SCOUP. The SCOUP was developed to streamline regulatory approval of small, less than 150,000 yd^3, beach nourishment projects using opportunistic sediment.

To carry out this process, a candidate government entity (e.g., city, JPA, etc…) would begin by evaluating potential receiver sites for need, community support, and construction accessibility. Once the receiver site or group of sites are chosen, identification and evaluation of potential sediment sources and stockpile locations is recommended, followed by a stepwise process as detailed in the SCOUP (Moffatt & Nichol, 2006). A handful of cities in San Diego County have already implemented SCOUP, those being Oceanside, Encinitas, Solana Beach, Coronado, and Imperial Beach.

A potential candidate group of receiver beaches are within Newport Harbor. The City of Newport Beach has experienced difficulties in their permitting process, so SCOUP may benefit this applicant. The beaches in Newport Harbor were previously evaluated and ranked for need and accessibility in Appendix C of the Newport *Harbor Area Management Plan* (Everest, 2009a). The highest ranking beaches were Marina Park, Edgewater/Montero, China Cove, and Pirate's Cove.

4.15 Establish a Dedicated Fund and Process for Implementing Coastal RSM

This activity would entail exploring and developing creative approaches related to historical reductions in sediment supply. As envisioned this would include assessing the contribution of coastal sediment supply reductions associated with navigation, flood control, and water storage projects as well as sand mining operations. Historically, these types of projects have been the primary causes of beach erosion along the California coastline, but California has been unable to secure funding to address these historical or legacy impacts. This activity would seek to establish a dedicated fund and process for implementing coastal RSM projects, including projects to offset beach erosion caused by historical navigation, flood control, and water storage projects. Alternatively, this might include the provision of funding to restore the ecosystem value and natural processes impacted by historical navigation, flood control, and water storage projects as well as sand mining operations.

Recent state funding for coastal projects has come from various agencies on a project by project basis. Until 2012, California had two beach programs, including the Beach Erosion Control Program and the Public Beach Restoration Program. The funding for these projects has originated from the Harbors and Watercraft Revolving Fund (HWRF), an account managed by DBW. There is concern that continued funding of California's beach restoration programs using ad-hoc funding from the HWRF may not last much longer.

A dedicated source of funding in State budget for coastal projects is justified by the substantial economic benefits derived by the State from coastal tourism and recreation. For example, visitors to California beaches spent over $61 billion in 2001, of which approximately 36% was spend by out-of-state visitors, and California's beaches generate over $15 billion annually in tax revenue. A dedicated fund could be established and maintained through various means discussed in Section 3.8 of this report. These dedicated funds could be used to enhance the State's Public Beach Restoration Program to target identified beach and other coastal restoration/nourishment projects.

A detailed proposal on the enhanced beach and coastal restoration/nourishment program should be conveyed to members of the California congressional delegation holding key committee positions in order to build support for federal assistance of the enhanced program. Engaging members of the delegation who are on the House and Senate Appropriations Committees in the State's beach nourishment program will enable California to better compete with other states for beach monies.

The governance body should work collaboratively to develop an approach to address present day and future reductions in sediment supply. This approach should include the entire coastal watershed that supplies sediment to the beaches and nearshore areas. The preferred approach is to encourage, develop, and/or fund activities (e.g., removal of hydromodifications such as dams and other barriers) that reestablish and/or mimic the natural transport of sediment through the watershed down to the beach and nearshore areas. Where this is not feasible, artificial

means (e.g., excavation/dredging with downstream placement) should be explored to move sediment through the watershed. These activities would help address sediment reductions associated with historical activities and, more importantly, help offset beach erosion and shoreline retreat associated with future rises in sea level.

4.16 High Fines Sediment Nourishment Pilot Study

This activity would consist of monitoring the results of the high fine sediment beach nourishment pilot projects conducted in Santa Cruz and Imperial Beach, California and implementing a similar pilot study within Orange County.

The pilot projects in Santa Cruz and Imperial Beach, California indicated that sands remained in the littoral zone while fines settled farther offshore, essentially mimicking the fate of storm discharges (SAIC, 2011). Energetic coastal processes facilitated the reworking of the sediments. Material significantly coarser, finer, or with a greater shell content than native beach sediments have the potential to adversely impact invertebrates, fish, or shorebirds. Therefore, project location, sediment volume, method of sediment placement, and timing are important considerations relative to the use of high fines sediments for beach nourishment. Generally, it is recommended that high fines sediments be discharged in the surf zone, scheduled during the fall and winter to mimic natural processes, and an adaptive process starting with small placement volumes and monitoring be used to determine appropriate limitations based on site specific conditions.

The Imperial Beach pilot project is also known as the Tijuana River National Estuary Reserve Study, funded in part by the CSMW. While results from this project (California Ocean Protection Council, 2008; Buhbe et. al., 2011) are being digested into recommendations, it may be beneficial to initiate a high fines beach or nearshore nourishment pilot study within Orange County. The pilot study would provide quantitative data on impacts of high fines sediments on nearshore habitats for use in evaluating whether future placement of high fines sediments on the beach or nearshore is desirable. Potential pilot study locations could be East Beach, Seal Beach, Surfside-Sunset Beach, or Capistrano County Beach. Newport Beach is also a viable location for this study as it has a beach nourishment need and multiple sources of high fines sediment (e.g., Semeniuk Slough and Newport Harbor).

These are all locations that have received nourishment in the past, are expected to require nourishment in the future, and could potentially benefit from opportunistic use of high fines sediment source material.

If it were found that sediment sources with fine content higher than 20% had negligible habitat impacts, it could be argued that future sediment sources with similar physical and chemical characteristics may likewise have similar habitat impacts and should therefore be permitted. Conversely, if the high fine content sediment had significant habitat impacts, then future use of similar sediment would continue to be very difficult to permit.

4.17 Establish Funding Stream to Accommodate Incremental RSM Costs

This activity would be to establish a permanent, county-wide, funding stream to accommodate the incremental costs associated with RSM construction. Typically dredging projects require the least cost disposal. If funds were available, the rather small incremental costs required to construct, transport, or dispose the dredged material the extra distance to achieve RSM would be accommodated. Thus RSM could be achieved within existing projects for only a small additional cost. Also, having a readily available funding source within Orange County would make the additional RSM required permitting and project planning more feasible.

4.18 Sea Level Rise Beach Sustainability Study

This activity would entail performing an engineering and economics study to determine the nourishment requirements necessary to offset projected sea level rise impacts throughout the Orange County coastline and to find potential managed retreat options within Orange County. Th is study would have two foci: 1) to determine whether, where, and how much beach and nearshore nourishment would be necessary to offset sea level rise impacts on the Orange County coast; and 2) to find locations within Orange County where managed retreat is a viable economic adaptation option against sea level rise. The study would include a calculation of the recreational and flood damage costs of unmitigated shoreline erosion resulting from sea level rise. In addition, it would include development of conceptual solutions and associated costs to mitigate the sea level rise scenarios recommended by government agencies. Results from this study would be used in long-term planning for the Orange County coast.

4.19 Orange County Dredge Ownership

Orange County recently completed a study of whether it would be financially beneficial for the county to purchase and operate a dredge (Moffatt & Nichol, 2009b). This study found that there is sufficient dredging demand to support the purchase and operation of a small dredge. Much of the dredging in Orange County is performed on low volume, shallow dredging projects with offshore disposal of fine grained sediments. This somewhat unusual project type requires a rare mix of small, shallow dredge equipment and ocean-classed disposal barges. The anticipated workload would range from 100,000 to 275,000 yd^3/year. The routine maintenance projects identified and included in the study were: Dana Point Harbor, Newport Dunes Lagoon & Marina, Newport Harbor federal channel, miscellaneous private projects within Newport Harbor, Bolsa Chica Tidal Inlet, and Huntington Harbour.

The study concluded that “the purchase of a small hydraulic dredge and ocean-ready disposal barges would be less expensive and better serve the dredging needs of the County as compared to the current system for contracting dredging on a project-by-project basis. However, there are complications that would have to be resolved, including aligning the various

funding sources currently used to fund dredging in the County as well as insurance and labor considerations."

4.20 Sand Retention Feasibility Study

This activity would consist of a study to determine whether a sand retention device would be economically beneficial over existing methods at key erosion hotspots within Orange County. Aspects of the study would include the following:

- Update on the Oil Piers and Fletcher Cove reef projects;
- Summary of recent state of the art advancements in sand retention devices;
- Development of a short list of erosion hot spots that may benefit from sand retention;
- Conceptual design of sand retention devices at those hotspots; and
- Compare costs between sand retention and existing beach maintenance methods at those hotspots.

4.21 Huntington Harbour Dredging with Beach or Nearshore Placement

This activity would be to investigate whether any material from the ongoing maintenance dredging of Huntington Harbour is of sufficient quality for beach or nearshore nourishment and to investigate funding or other mechanisms to encourage placement of this dredged material on Surfside Beach or in the nearshore.

The various channels and basins within Huntington Harbour, Sunset Harbor, Anaheim Bay, the Seal Beach Naval Weapons Station, and the Seal Beach National Wildlife Preserve require infrequent maintenance dredging, with the dredged spoils usually being dumped offshore at an ODMDS.

Material from the surrounding watershed is causing shoaling within Huntington Harbour navigation channels and marinas, creating channel navigation restrictions, and impairing the use of launch ramps and public and private boat slips. Dredging was previously conducted in Huntington Harbour from 1967 to 1976 during initial construction and in various areas in 1988, 1989, and 1999. Results from a bathymetric survey of Huntington Harbour in May 2000 suggested that approximately 34,000 yd^3 of sediment needed to be dredged. To this end, the City of Huntington Beach and Orange County have proposed to carry out maintenance dredging in the 2012/2013 fiscal year.

Much of this sediment originates from urbanized flood control channels and other drainage outlets such as the Wintersburg, Sunset (i.e., Heil), and Edinger (i.e., Bolsa Chica) Flood Control Channels (USACE, 2001). The watershed that drains into Huntington Harbour is large and heavily urbanized. In June 2003, the Federal government added Huntington Harbour to its

list of impaired water bodies after USEPA found unacceptable levels of polychlorinated biphenyls (PCBs) and dieldrin. Since much of the shoaling identified in 2000 was located near drainage outlets, there is concern that the sediment buildup might be so contaminated with toxic metals, pesticides, and PCB's that special dredging and other management measures may be required for sediment disposal. It is unknown if or how much of the sediment proposed to be dredged from Huntington Harbour can be placed on the beach or nearshore, so investigation into this matter is recommended.

4.22 Update the Plan

The Plan should be a living document that would benefit from periodic updates to add or modify data, information, understanding, and recommended activities. The Plan should be updated using a collaborative approach between the various stakeholders and led by either the new JPA (see Section 4.2) or Orange County and USACE. The update should include a review of the coastal RSM strategies outlined in the current Plan, modifications to activities based on lessons learned, and potential additional activities as appropriate. Much of the updated understanding should come as direct results from the studies recommended within the Plan activities. As with the current Plan, future modifications should be carried out in a transparent fashion with full cooperation and inclusion of the stakeholders and the public in general.

4.23 Update Sediment Budget for Laguna Beach Littoral Cell

The most recent sediment budget for the Laguna Beach Littoral Cell was for a time period ending in 1984 (USACE, 2002b). Given the large amount of development occurring in the area in the last 28 years, it is expected that sediment yields and the sediment budget for this area have changed significantly. This activity would be to update the sediment budget for the Laguna Beach Littoral Cell to better represent current conditions.

4.24 Investigate Methods to Assess and Mitigate for Upstream Sand Mining

This activity would be to perform a study to identify methods to assess and mitigate for removal of beach sand from upstream creeks, streams and river beds.

4.25 Study Large Grain Size Impacts at East Beach, Seal Beach

This activity would be to perform a study to determine if use of larger than native grain sizes for beach nourishment has caused negative impacts to surfing or habitats at East Beach in Seal Beach. The positive effects of using large grain sand in beach nourishments are understood to increase beach width and increase sand retention, thus lowering maintenance costs, but potential negative impacts are less understood.

4.26 Update Sediment Transport Studies for Southern Orange County

The sediment budget information for southern Orange County in the northern portion of the Oceanside Littoral Cell is from a *Coast of California Storm and Tidal Wave Study* (CCSTWS) published by the USACE in 1991. Physical data referenced in this CCSTWS is valid through the 1970's and 1980's which is three to four decades old at this point. This activity would be to perform sediment transport studies for southern Orange County to be more recent and relevant.

5. CONCLUSIONS

While some beaches in Orange County are wide and healthy, such as those within the Huntington Beach Littoral Cell, there are many that have chronic erosion problems, such as East Beach, Seal Beach and beaches southeast of Dana Point (e.g., Capistrano County Beach and San Clemente City Beach). Even the wide and healthy beaches from Sunset Beach to West Newport Beach are dependent on ongoing nourishment activities that may come under threat if not maintained. The Plan outlined in the current report addresses beach maintenance and other coastal needs through a multi-pronged approach ranging from small individual construction projects all the way up to changing state and federal regulations. Also, the activities within the Plan range geographically from the upland streams and rivers of Los Angeles and Riverside County, down to the beaches, and into the nearshore areas of Orange County.

Some of the recommended Plan activities can be carried out through existing institutions and do not necessarily require development of a dedicated JPA. Examples are the ongoing Surfside-Sunset Beach nourishment project and the proposed San Clemente Shoreline Project which are USACE projects. Other Plan recommendations such as development of a SCOUP for Newport Harbor may be carried out by local agencies such as the City of Newport Beach Harbor Resources Division. Beyond these small or ongoing projects, an organized effort would be required to fully implement the Plan.

The first steps associated with fully implementing the Plan are public outreach and education. This would be directed towards professionals and decision makers informing them what the Plan is and how it is to be carried out. From there, local jurisdictions should begin collaborative discussions to consider whether a JPA could be modified or formed. This JPA would have the task of implementing and updating the Plan over the next 50 years. The JPA would have the challenging tasks of introducing and explaining the Plan to the public and to decision makers, raising funds to implement the Plan during tough economic times, and then steering the Plan through the regulatory process. Given these difficulties, it is hard to imagine a group or agency taking on these efforts on a part time basis, thus the JPA would likely require full time staff and a dedicated board of directors.

While no one is certain of the future, it may be possible that many of the recommended Plan activities will be carried out through various piecemeal agencies and agendas. On the other hand, a dedicated agency would have a greater ability to press these Plan activities through the various obstacles. Likewise, it may be possible that the lower of the sea level rise scenarios will occur and upland sand bypassing will become the norm, so beaches could be maintained or widened without much organized effort. This scenario would be driven by good luck more than good governance. Good governance however requires diligent thoughtful planning. The Plan provided herein describes and recommends a range of activities that should be carried out to implement coastal RSM in Orange County.

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APPENDIX A – STAKEHOLDER MEETING MINUTES

APPENDIX A – STAKEHOLDER MEETING MINUTES

Orange County Coastal Regional Sediment Management Plan
Stakeholder Meeting 1 - Minutes

Tuesday, November 17, 2009, 10:00 AM – 1:30 PM
Southern California Coastal Water Research Project
3535 Harbor Boulevard, Suite 110, Costa Mesa, CA 92626

Agenda

1. Introductions
2. Sediment Master Plan Overview
    a. Purpose
    b. Objectives
    c. Coastal Sediment Management Workgroup
    d. Coastal Regional Sediment Management Planning
    e. Past Successes (SANDAG, BEACON, and AMBAG CRSMPs)
3. Orange County Coastal Regional Sediment Management Plan (CRSMP) Overview
    a. Purpose
    b. Objectives
    c. Scope
    d. Schedule
4. Stakeholder Outreach
    a. Goal
    b. Objectives
    c. Group Breakout
    d. Stakeholder Input
5. Schedule Next Meeting
6. Adjourn

Attendees

Last Name	First Name
Adams	Loni

Anderson	Blake
Apt	Daniel
Bonigut	Tom
Brodeur	Susan
Brown	Syd
Cannon	David
Chavez	Eric
Davenport	Clifton
Green	Karen
Innes	Seamus
King	Jerry
Ming	Susie
Pryor	David
Recupero	Michael
Schlosser	Heather
Smith	Scott
Spitz	David
Tran	Frank
West	Nate

Acronyms and Abbreviations

CDFG = California Department of Fish and Game

CNDDB = California Natural Diversity Database

CRSMP = Coastal Regional Sediment Management Plan

CSMW = Coastal Sediment Management Workgroup

Everest = Everest International Consultants, Inc.

GIS = Geographic Information Systems

HB = Huntington Beach

LiDAR = Light Detection And Ranging

M&N = Moffatt & Nichol

MLPA = Marine Life Protection Act

MMS = Minerals Management Service

NMFS = National Marine Fisheries Service (NOAA Fisheries)

OC = Orange County

SAIC = Science Applications International Corporation

SANDAG = San Diego Association of Governments

SCBPS = Southern California Beach Processes Study

SDRWQCB = San Diego Regional Water Quality Control Board

TMDL = Total Maximum Daily Load

Notes

Notes taken during the meeting are presented below according to agenda item.

Introductions

Susie M. had everyone introduce themselves, including those on the telephone.

Susan B. provided Orange County (OC) perspective. OC will take the lead in the Plan development and is seeking input from the stakeholders.

Sediment Master Plan Overview

Heather S. presented the big picture via a MS PowerPoint presentation.

- Master plan goals listed.
- Coastal Sediment Management Workgroup (CSMW) & mission.
- Not intended to be USACE or California State plan. This is Orange Co.'s plan. Just beginning other plans: LA Co., outer SF Bay, Humboldt, and Northern Monterrey Bay.
- Provided web page: http://www.dbw.ca.gov/CSMW/default.aspx.

OC CRSMP Overview

David started by passing the three existing CRSMP documents (San Diego County, Santa Barbara and Ventura Counties, and Southern Monterey Bay) around the room so stakeholders could get an idea of the content in CRSMPs.

David C. delivered a MS PowerPoint presentation focusing on the OC CRSMP effort.

Purpose & Objective

The purpose of the project is to develop a coastal regional sediment management plan (CRSMP) that provides sufficient information for decision makers to develop policies and/or execute management sub-plans for the future vitality of Orange County beaches and shoreline areas.

Objectives include:

- Obtain/Compile Existing Data/Information
- Engage Stakeholders
- Identify Key Opportunities and Constraints
- Develop CRSMP Specific to Orange County

Scope of Work

- Data collection & compilation. This is the only currently funded scope item.
- Outreach
- Plan formulation
- CRSMP preparation.

Schedule for the CRSMP

- Data Collection and Compilation Completion = February 2010
- Plan Formulation Completion = May 2010
- Draft CRSMP Preparation Completion = June 2010
- Final CRSMP Preparation Completion = September 2010
- Outreach Facilitation and Coordination Completion = September 2010

Questions and Discussion Followed

Question – Jerry King: Sediment TMDL's put in place by Regional Board. Brief review of the literature in reference to watershed management plans so he suggested making sure to include this information in the CRSMP.

Response - David C.: That will be included as part of the data collection and compilation task.

Question Conf. Call: What is difference between beach sand and inland sediment/dirt? How much sand is removed by application & enforcement of sediment TMDL regulations? How much is removed with traps?

Comment - Blake Anderson: noted that different stakeholders may have opposing objectives.

Response - Karen G: the cartoon graphic in the MS PowerPoint presentation notes this and one main purpose of the project will be to hopefully bridge those linkages.

Question - David C.: Is meeting location central & acceptable.

Response – All: General consensus was yes and there were no negative responses.

Comment - David C.: Explained that the CSMW has defined locations of beach erosion as Beach Erosion Concern Areas (BECAs) and he provided examples along the Orange County shoreline.

Question - Blake A.: is purpose to use the typical USACE benefit and cost parameters?

Response – David C.: Approach will be to list benefits & costs, to be used for prioritization, without the intent of achieving specific thresholds or B/C ratio.

Response - Heather S.: OC CRSMP will not be looking at typical USACE benefit categories. Dr. King's analysis will be broader to include county and state criteria as well.

Comment – King: please provide the PowerPoint presentations to the conference callers.

Karen G. PowerPoint Presentation

This presentation covered the biological and habitat issues associated with the CRSMP.

OC Sensitive Resources

- Beach
  - California grunion
  - Tidepools
  - California Least Tern and Western Snowy Plover
- Nearshore
  - Surfgrass, Kelp Bed Reefs
  - Commercial/Recreational Fishing
- Lagoons, Bays, Estuaries
  - Nesting Sites

- o Marine Fish Nursery & Foraging

Environmental Objectives

- Maintain Healthy Habitats
- Protect Sensitive Resources
- Avoid/Minimize Impacts

CRSMP Approach

- Constraints & Opportunities
  - o Overlay Habitat Resource Map Tools
- Maintain & Protect Resources
  - o Buffer Sensitive Resources/Piers
  - o Enhance Sandy Beach
- Adaptive Management
  - o Lessons Learned (Relevant Projects)
  - o Focused Monitoring- Feedback

Question - King: Will the CRSMP be detailing success and tracking growth of newly planted kelp beds?

Response – Karen G.: the CRSMP will consider these.

Comment - King: His group is hopeful that Upper Newport Bay will gain quality habitat soon and they are looking for data resource.

Response – Karen G.: biological constraints are important and she described how these are to be used.

Stakeholder Outreach

David C. explained the stakeholder input phase. Four large 3' x 4' color maps of the Plan area were attached to the walls. Stakeholders were to place colored dots on locations in each map and with unique letter/number identifier. The letter/number identifiers were to then be annotated on large Post-Its. The stakeholders participated in this until 12pm.

David C. & Heather S. reviewed all dots and annotations with the stakeholder group to understand their meaning and significance. See large yellow Post-It and color printed wall maps.

Comment – David C.: coastal dam is actually a covered potable water reservoir in Dana Point.

The following Issues, Groups, and Data Sources were called out from the group and noted on the large Post-Its by David and Heather.

Issues

- TMDL's impact on sediment sources should be considered.
- Project should coordinate with watershed management teams.
- Huntington Harbour impacts on docks use & their slips. City of Huntington Beach is currently in litigation with some dock owners over nourishment of interior beaches within Huntington Harbour.
- Excess sediment removal: sand mining should be considered. There may be locations where the beach is too wide, and sand mining could be possible.
- Plan Implementation & Governance Methods should be considered.
- Basic level sediment budget & sand transport should be included.
- Can the OC CRSMP extend beyond OC borders, i.e., inland, upland and offshore? Make this clear to stakeholders as we go along.

Groups & Stakeholders That Should Be Contacted

- Flood Control: Riverside, Santa Ana, Los Angeles, Orange Counties
- Surfrider: Huntington Beach and Newport Beach
- Regional Water Quality Control Board: San Diego and Santa Ana Boards
- CCC
- Los Angeles and San Gabriel River Watershed Council
- Friends of San Gabriel River
- Orange County Coast Keeper
- Cities of San Clemente, Dana Point, and Laguna
- Seal Beach Naval Weapons Station, Seal Beach National Wildlife Refuge
- Dana Point Harbor, Newport Harbor (Chris Miller)
- Beach Ecology Coalition
- Huntington Beach Wetlands Conservancy
- US Fish & Wildlife Service
- Camp Pendleton: ask Shelby Tucker of SANDAG about access to Pendleton's sand.

Data Sources to Consider

- CNDDB database California Natural Diversity Database
- MLPA sensitive habitat database

- City and county flood debris basins
- USACE LiDAR survey of Orange County ongoing. Available from the Southern California Beach Process Study (SCBPS)
- MMS data for offshore sand source
- M&N feasibility study to purchase a dredge for Orange County
- CSMW study of stopping sediment loss into offshore canyons. Regional Sediment Management related report. M&N Offshore Canyon Sand Capture Report.
- M&N report. Huntington Beach Wetlands Conservancy September 2004. Possibility of using Huntington Beach wetlands dredged sand for other uses.

Schedule & Next Meeting

David C. will communicate via e-mail for date and location of the next meeting.

Action Items

David to make the MS PowerPoint presentations available to the stakeholders.

David to communicate via e-mail for date and location of next meeting.

Everest to supply meeting notes to the stakeholder group.

Everest to begin work on the first scope item.

Orange County Coastal Regional Sediment Management Plan
Stakeholder Meeting 2 - Minutes

Monday, March 28, 2011, 1:00 – 4:00 PM
Southern California Coastal Water Research Project
3535 Harbor Boulevard, Suite 110, Costa Mesa, CA 92626

Attending:

Clifton Davenport, Greg Woodside, Heather Schlosser, Karen Green, Mark Rauscher, Nate West, Philip King, Richard Gardner, Seamus Innes, Susan Brodeur, Lonnie Adams (phone)

Heather S. began presentation & introductions.

Susan B. presented.

David C. presented.

Question: was the SONGS reef restoration caused by impacts to turbidity or temperature?

(upon research it was found that turbidity and marine entrainment were the cause)

Seamus I. presented.

Karen G. presented.

Philip K. presented. Economic benefits do not equal economic impacts. Clif commented maybe there is a way to pick out example projects for B/C analysis within the Plan. These would include recreation and storm damage reduction.

David G presented about The Plan.

Richard G. suggested including San Juan Creek Watershed Master Plan, which will be out in a few months.

Make a focus of leveraging state or federal funding. Rancho Mission Viejo sand & gravel mine takes sand from San Juan Creek. Add San Juan Creek ID on large maps. Wants a sand retention/ocean intake reef at San Juan Creek mouth to support a planned $300 million ocean desalination plant. Current plan is for 9 slant wells at great cost. Possibly dredge San Juan Creek to open flood capacity and provide sand for beaches. Aliso sewer tunnel construction project will provide many thousands of truckloads of soil for 5 years. Could be used for beach nourishment. Consider Sea Level Rise in the plan.

PEMs were discussed. CSMW has a PEM reports on their website.

Susan B. said possibly geotextile groins are a sand retention possibility.

Mark R. mentioned San Juan Creek has a sand deficit and restoring upstream sources is a more natural approach to restoring beach widths.

Greg Woodside discussed Prado Reservoir. At 30 percent level for a design/demonstration project including sediment bypassing to a downstream deposit location where material can be entrained in next large flows. Water storage capacity is filling in with sediment. Construction would be hydraulic dredging, placed downstream.

David G. closed the meeting.

Orange County Coastal Regional Sediment Management Plan
Stakeholder Meeting 3 - Minutes

Monday, May 16, 2011, 9:00 AM – 12:00 PM
Southern California Coastal Water Research Project
3535 Harbor Boulevard, Suite 110, Costa Mesa, CA 92626

Attending: Susie Ming, Susan Brodeur, Richard Gardner, Jeff Armstrong, Marsha Westropp, David Pryor, Daniel Apt, Ann Mesa, Chris Miller, David Webb, Terri Elliott, Carla Navarro, Jerry A. King., Karen Green, Seamus Innes, David Cannon,

Phone: Lonnie Adams, Rachel Grandpre, Naram (OC Flood Control).

Susie M. began introductions and presented CRSMP background.

David C. presented OC CRSMP introduction.

Seamus presented physical data collection.

Richard G. pointed out that area between Dana Point and San Mateo Point is called San Clemente Bay. Add San Juan Creek to list of potential source materials.

Karen G. presented biological data collection.

Carla N. noted that Rocky Intertidal Marine Group of the Materials Management Agency (marine.gov) has maps of rocky intertidal areas that can be added to bio maps. Susan B. suggested adding MLPA and ASBS regions to bio maps. Check to make sure groins and jetties are in the bio maps as well. Check with City of Newport Beach for eelgrass survey data.

David W. suggested we add natural gullies to list of sediment sources. Examples are found in the Laguna Littoral Cell such as Buck Gully. It may be useful to protect these sources in the future. Dave Webb knows the company OC Sediment ____ that cleans sediment traps in Orange County.

David C. presented economic data collection and plan development.

Richard G. asked that before use fees are increased it is important to identify maintenance costs to reduce the possibility of charging excessive fees for locations that require very little maintenance. The example of Trestles (San Mateo Point) was given because it requires very little maintenance; hence, there should be no fee or a very little one at the most.

Carla N. suggested the plan should include more biologists to be inclusive of other information and knowledge. Karen G. and Susie M. explained the amount of detail currently included in the

Biological Impacts Assessment report. Recommended caution when dealing with fine material impact on submerged reefs.

Jerry K. suggested using the sediment impoundment fee to remove arondo donax in an effort to free up trapped sediment in open streams.

Carla N. suggested that the plan could add pressure to remove dams.

David W. requested that the plan assist in streamlining the coastal permitting for maintenance activities. He requested ways to import more coarse material (e.g., river sand) into Newport Bay beaches so the placed material stays on the beaches longer.

Chris M. explained that Regional General Permit 54 (USACE and CCC) allows for dredging and beach nourishment activities within the harbor; however, it must be renewed every five years at great expense and effort. He requested a way to streamline the permitting process that included all agencies and takes into account the fact that much of effort is maintenance so it should be covered under an exemption in the Coastal Act. He also noted that since the catch basins are effective at trapping coarse sand, most of the material that settles in the Newport Bay is fine grained.

Richard G. suggested implementing a sand mining fee in addition to the sand impoundment fee. Add sand and gravel mining locations to source map. Can potentially use sand impoundment fee to pay for downstream erosion in addition to beach nourishment.

Daniel A. suggested reviewing the South County Hydromodification Management Plan to coordinate erosion knowledge.

David P. suggested adding Doheny to receiver sites list since it was recently nourished. Also, it would be useful to perform better monitoring to determine the benefits of these nourishment projects. He would like to know if these types of projects are worth the cost.

Richard G. suggested more monitoring would be worthwhile to determine the success of any project. Suggested additional methods for determining project cost sharing even for projects that do not involve USACE. Important to identify stockpiling locations on GIS map.

Carla N. would like to see high priority on monitoring of projects.

Richard G. would like to see greater access to database of coastal information as part of the plan. Recommended monitoring and updating of the Management Plan to make it a living document.

All agreed to allow one month after release of the draft plan prior to holding the next meeting. This should allow sufficient time for parties to review.

Richard G. and Jerry K. suggested adding Orange County Council of Governments to stakeholder distribution list.

David C. closed the meeting.

Orange County Coastal Regional Sediment Management Plan
Stakeholder Meeting 4 - Minutes

Tuesday, July 24, 2012, 6:00 PM – 8:30 PM
Seal Beach City Hall
211 8th Street, Seal Beach, California 90740

Agenda

1. Introductions
2. Sediment Master Plan Overview
3. Orange County Coastal Regional Sediment Management Plan (CRSMP) Overview
4. Adjourn

Attendees

Last Name	First Name	Organization	Contact
Adams	Loni	CDFG, San Diego	ladams@dfg.ca.gov
Brodeur	Susan	OC Parks	Susan.brodeur@ocparks.com
Cannon	David	Everest	David.cannon@everestconsultants.com
Crandall	John		Cranny777@gmail.com
Crumby	Sean	City of Seal Beach	scrumby@sealbeachca.gov
Deaton	Ellery	City of Seal Beach	Sealbeachdistrict1@gmail.com
Ferguson	Darrel	Newport Beach Chapter of the Surfrider Foundation	vicechair@newportbeach.surfrider.org
Green	Karen	SAIC	KAREN.D.GREEN@saic.com
Ho	Michael	City of Seal Beach	mho@sealbeachca.gov
Ingram	Jill	City of Seal Beach	jingram@sealbeachca.gov
Innes	Seamus	Everest	Seamus.innes@everestconsultants.com
Kalmick	Joe		joekalmick@gmail.com
Kredell	Chi		ronkredell@hotmail.com
Leipzig	Victor		vicleipzig@aol.com
Ming	Susie	USACE – Los Angeles District	susan.m.ming@usace.army.mil
Paul	Larry	Larry Paul and Associates	larry@larrypaulandassoc.com
Pryor	David	California State Parks	dpryor@parks.ca.gov
Regnier	Jon	Cal State University Long Beach	jregnier@csulb.edu
Spitz	David	City of Seal Beach	dspitz@sealbeachca.gov
Tarascio	Karen		ktarascio@gmail.com

Last Name	First Name	Organization	Contact
Toma	Lucian		tomal@san-clemente.org
Webb	Chris	Moffatt & Nichol	cwebb@moffattnichol.com

Notes

Notes taken during the meeting are presented below as they occurred in the discussion.

Introductions

David S. welcomed the audience and introduced Susie M. of the USACE.

Susan B. stated that OC is the local sponsor, taking the lead in the Plan development and is seeking input from the stakeholders.

Susie M. provided a Sediment Master Plan Overview via MS PowerPoint presentation.

The OC CRSMP presentation was provided in MSPowerPoint by David C., Seamus I. and Karen G. Comments and discussion by stakeholders occurred during the presentation. David C. mentioned that comments are due by end of August submitted to him.

Question/comment – Darrel Ferguson: since Santa Ana River is concrete lines, it should be dredged and kept clear of high quality beach sand on a regular basis. This will keep the sand on the beach and avoid possible contamination. Susie M.

Response – Susie M.: A agreed to discuss in detail with Darrel offline.

Question/comment – Chi K.: Seal Beach River has much sand that should be used.

Response – Seamus I.: This sediment source is included in the Plan.

Question/comment – Loni A.: Sediment at the mouth of San Juan Creek should be used for beach nourishment. Also consider the mouth of San Juan Creek for steelhead populations.

Response – Seamus I.: This material is included as a portion of the San Juan Creek sediment source in the Plan.

Question/comment –.: Consider adding agency name and/or funding source for existing projects.

Response – David C.: ok

Question/comment –.: Consider whether the CSMW can take up the issue of DBW loss of funding.

Response – David C.: ok

Question/comment –.: Change designation description of the Prado Dam project from “existing” to “potential.”

Response – David C.: ok

Question/comment –: A systematic approach should be taken to compare all sources against receiver sites.

Response – David C.: Discussed pros and cons of this approach. This can be added as a Plan Activity.

Question/comment – various.: Can we tax sand miners or otherwise charge fees to compensate for removing beach sand from creeks, streams, and river beds? Should this be done locally or on a statewide approach.

Response – David C.: Efforts are being made on a statewide level. A Plan Activity to develop statewide legislation to address this issue can be added.

Question/comment – Sean C. & Chi K.: There are older and newer data/reports not mentioned in the report that are available for Seal Beach. These should be referenced in the report. There is a new report by Moffatt & Nichol (2008) arguing to include East Beach in the Surfside Sunset Beach Nourishment Project. They would like to add a Plan Activity to add East Beach to the Surfside-Sunset project.

Response – Seamus I.: This material will be obtained and incorporated into the report. Project team will investigate whether this Plan Activity can be added to the report..

Question/comment – Loni A.: in regards to permitting and regulation, a separate group beyond the Dredged Material Management Team (DMMT) should be developed to with a focus on biological resources.

Response – Susie M.: This issue is being addressed by the CSMW and DMMT.

Question/comment – Sean C, David S.: Seal Beach maintenance should be high priority Plan Activity and reasons were given.

Response – Seamus I.: The change will be made to the report.

Question/comment – : Seal Beach boardwalk is used equally by tourists and locals, not “mainly tourists” as stated in the report.

Response – Seamus I.: The change will be made to the report.

Question/comment – Loni A.: Move data gaps Plan Activity to high priority. Add Pismo Clams to report per her written comments. Move biological monitoring to high priority.

Response – Seamus I.: Comments noted. Project team will investigate the comments and make priority adjustments.

Question/comment – various.: move SLR study to low priority. Leave High Fines sediment study priority. Move Update Plan to medium or low priority. Separate Talbert & Santa Ana River into separate Plan Activities.

Response – David C.: The changes will be made to the report.

Separate Baby Beach and Capo Beach into separate Plan Activities. Make both high priority or rethink weighting vs. recurrence needs.

Response – David C.: The changes will be made to the report.

Action Items

OCCC meeting on Thursday July 26.

Incorporate changes into report and re-release to public.

APPENDIX B – HABITAT/BIOLOGY

APPENDIX B – HABITAT/BIOLOGY

Direct, indirect, or cumulative impacts to biological habitats and resources may result from regional sediment management (RSM) activities. Direct impacts are "caused by the action and occur at the same time and place" (40 Code of Federal Regulations Sec. 1508). Examples of direct impacts include burial or removal of soft-bottom, benthic invertebrates during sand placement or dredging/excavation, respectively. Direct impacts also may occur to invertebrates and fish that become entrained with water that is removed or pumped during dredging operations. There also may be the potential for direct impacts to managed species, if present in the construction area.

Types of Impacts from Sediment Management Activities

Direct

- Equipment (anchors, pipelines, vehicles) damage to habitats, injury of species.
- Discharge burial of habitat and invertebrates.
- Dredge removal of habitat and invertebrates.
- Dredge entrainment of invertebrates and fish.

Indirect

- Invertebrate forage reduction.
- Disturbance or interference (noise, lights, equipment) of wildlife movement or migration.
- Turbidity effects (reduced photosynthesis, feeding, growth, or mortality).
- Sedimentation effects (reduced photosynthesis, recruitment, nutrient stimulation, or mortality).
- Enhanced sandy beach habitat and supported resources

Source: SAIC 2011b

Generally, sandy beach invertebrate assemblages recover within one year or less, but may take longer if disturbance impacts highly diverse communities, long-lived species, repetitive disturbances occur before recovery is complete, or source materials substantially differ from existing sediment (reviewed in SAIC 2011a). Subtidal invertebrate recovery takes one to three years depending on water depth and environmental conditions.

Indirect impacts are "caused by the action and are later in time or farther removed in distance, and may include ..... related effects on water and other natural systems, including ecosystems" (40 Code of Federal Regulations Sec. 1508). Indirect consequences of direct impacts to benthic organisms are reduction in forage for wildlife, the duration of which relates to benthic recovery rates. Waters are indirectly impacted by sediment disturbance or placement, primarily resulting in a temporary decrease in water clarity (turbidity); however, changes to water chemistry also may occur depending on the characteristics of the sediments. Indirect impacts to nearby invertebrates, fish, birds, marine mammals, or vegetation have the potential to occur at distances within a few hundred feet to over one mile from effects such as equipment noise, turbidity, sedimentation (settlement of suspended sediment), or sand transport away from a receiver site due to waves and tides over time.

Direct and most indirect impacts are associated with the construction phase of sediment management. Impacts of potential concern during the construction phase include (NRC 1985, 1995):

- Removal and/or damage to sensitive habitats and/or resources from equipment operation (dredges, pipelines vehicles, vessels), sand placement, or sand removal;
- Disturbance and/or interference with movement, foraging, and/or reproduction of sensitive species from equipment operation (noise, disturbance); and
- Persistent turbidity or water quality changes that interfere with foraging, respiration, recruitment, or reproduction of sensitive species or degrade vegetated habitats.
- Potential for release of contaminants and adverse effects on aquatic animals.

After sand placement or removal, the primary indirect impact relates to the recovery rate of invertebrates, which represent important forage for fish and birds. Important considerations of recovery rates include the relative change in sediment and habitat quality relative to existing conditions and project timing. Invertebrates seasonally recruit to beaches; therefore, recovery may be promoted by conducting projects outside the spring-summer peak productivity period. Recovery of subtidal invertebrate assemblage may be promoted by minimizing changes in sediment, hydrodynamics, or water quality within dredged areas (SAIC, 2011b).

The primary indirect impact concern of sand migration from the receiver site is the potential to degrade sensitive habitats, if nearby. Impacts of potential concern after construction include:

- Alteration of sediment, hydrodynamics, or habitat quality that delays invertebrate recovery rates;
- Turbidity, sedimentation or sand migration that degrades nearshore reefs or vegetated habitats of particular concern (HAPCs);
- Sand migration that increases the frequency or volume of maintenance dredging or excavation in nearby bays, creeks, or harbors.

Cumulative effects are the "impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions ..." (40 Code of Federal Regulations 1508.7). The area of potential effect may occur in the Plan area over time due to repeated effects from an action in the same area, additive effects from multiple impact sources, or a combination of effects taking place slowly over time (Peterson and Bishop, 2005).

RSM planning provides opportunity to increase the regional effectiveness of beneficial use of maintenance dredged materials, opportunistic upland sand sources, and offshore dredging and beach nourishment projects. Because RSM activities involve repetitive beach nourishment and dredging in certain areas, the potential for cumulative impacts is an anticipated issue of concern. Avoidance of repetitive disturbance within the same Plan area within the same year is recommended to promote recovery of the invertebrate prey base and minimize cumulative impacts.

Establishing a geospatial database to track projects, sediment quantities, and frequency of implementation would facilitate assessment of potential cumulative impacts on the basis of both geographical (e.g., percentage of planning area affected) and temporal (frequency) scales of

disturbance. This information in combination with monitoring would support evaluations of plan performance and possibly future adaptive refinement of implementation to optimize long-term benefits and reduce environmental impacts associated with RSM in Orange County.

Impacts of RSM projects would depend on project-specific details (sediment volume, equipment, methods), site-specific environmental conditions, and construction schedule. Project-specific impact assessments would be conducted as part of the environmental review and permitting process prior to project implementation.

Use of best practice and resource protection guidelines in project design and implementation are recommended to minimize impacts (Speybroeck, et al. 2006; SAIC, 2011a, 2011b). Construction phase measures may include buffer distances, schedule restrictions (e.g., environmental windows), equipment operational controls, best management practices (BMPs), or monitoring (SAIC, 2011b). The Regional Water Quality Control Board (RWQCB) may require monitoring of water quality to meet waste discharge requirements specified as a condition of the 401 water quality certification. Biological monitoring may be required by resource agencies to verify absence of sensitive species from the Plan area during construction, halt or redirect construction if sensitive resources enter the Plan area, ensure construction does not significantly impact sensitive resources, confirm construction remains within designated work areas, or to verify that unexpected impacts do not occur. Depending on the project-specific concerns, monitoring may be focused (e.g., eelgrass, grunion, least tern, snowy plover, Pismo clams) or may assess biological communities of particular interest (e.g., benthic invertebrate community, bird foraging-invertebrate prey interactions, hard-bottom habitat); biological indicators generally are used to monitor community level responses. Monitoring requirements may vary on a project-specific basis depending on resources within the vicinity of the proposed sediment management project. Impact verification monitoring may be required depending on level of concern or uncertainty associated with potential impacts to sensitive habitats. Monitoring requirements would be determined during environmental review and permitting. Additionally, monitoring may provide opportunities to gather additional information relative to sand placement techniques or minimization measures that would support adaptive management decision-making to improve the environmental effectiveness of plan implementation over time.

Table B1 summarizes environmental constraint periods for relevant managed and sensitive species associated with sand placement on beaches. Construction work windows are relatively unconstrained during the fall and winter except in areas with wintering concentrations of snowy plover. Construction work windows in the spring and summer are constrained by California grunion if suitable beach habitat to support spawning is present. Additional constraints also may apply if sites are located nearby nesting sites of California least tern or snowy plover. Snowy plover critical habitat is a constraint regardless of season.

The highlighted sensitive species constraint periods in Table B1 may start at the beginning or middle of the first month and run to the middle or end of the last month indicated. Constraint periods may differ in their specification among historical permits or documents; for example, the

constraint period for least tern is generally identified as April 15 to September 15 by USACE, although it is listed as April 1 to August 30 in RGP 67 (USACE, 2006). The snowy plover breeding season constraint period may be identified as March 1 to September 15 or September 30 (RGP 67). Generally, the grunion constraint period extends from March 1 through August 31. Verification of constraint periods and work windows for coastal projects conducted in Orange County should be verified during project permitting, as applicable. Different color shading in the table denotes the months associated with the referenced seasonal periods.

Table B.1 Summary of Environmental Constraint Periods by Species and Season

SEASON	MONTH											
	J	F	M	A	M	J	J	A	S	O	N	D
Fall-Winter												
Spring												
Summer												
Species	Relevant Sensitive Species Constraint Periods											
Grunion – spawning												
Least Tern – breeding/nesting												
Snowy Plover – breeding/nesting												
Snowy Plover - wintering												

For projects scheduled during the spring and summer construction window (between March 1 and September 30), pre-construction survey assessment and coordination with resource and regulatory agencies may be necessary to assess habitat suitability for grunion spawning and impact considerations for sensitive species (e.g., least terns, snowy plovers), as applicable, depending on environmental conditions and proximity to sensitive resources. Potential impact considerations include project schedule, interference with spawning, burial of eggs, sediment compatibility, constructed beach slope, and turbidity. Beach nourishment has the potential to enhance spawning habitat in erosive beach areas (SAIC, 2006).

RSM projects would require consultation between the US Army Corps of Engineers (USACE) and US Fish and Wildlife Service (USFWS) or National Marine Fisheries Service (NMFS) under Section 7 of the Endangered Species Act if activities have the potential to affect least tern or snowy plover during the breeding season, critical habitat of snowy plover, or interfere with the movement or behavior of other sensitive wildlife (e.g., endangered sea turtles). Coordination with the USFWS should occur for projects located within two miles of least tern breeding colonies. Mitigation measures (e.g., monitoring, protective measures) may be necessary to conduct beach nourishment during constraint periods depending on project- and site-specific conditions.

Pre-project coordination with resource and regulatory agencies also may be necessary during the fall-winter construction window (October 1-February 28) if there would be the potential to affect snowy plover critical habitat or wintering populations. Although several potential snowy plover wintering areas have been identified in Orange County, available survey data indicate that actual use varies among sites and years (e.g., USFWS 2007b, 2010). Coordination should include review of proximity to critical habitat and recent winter survey data, as available, and identification of whether additional mitigation measures (e.g., construction monitoring, delineate access and work areas) may be warranted.

Proximity of RSM activities to sensitive resources is an important consideration relative to the need to implement mitigation measures to avoid or minimize impacts. The RGP 67 specified that opportunistic sand placement would be restricted unless coordinated in advance with USACE and USFWS if within 1,500 feet of snowy plover nest sites or 3,000 feet of least tern nest sites (USACE, 2006). A minimum distance of 300 feet has been used to minimize impacts of dredging at major roost sites of brown pelican (SAIC, 2011b).

Proximity is an important consideration when conducting RSM projects in the vicinity of hard-bottom or vegetated habitats. The potential for turbidity, sedimentation, or sand movement after placement to result in sanding-in of sensitive reefs or reduction in surfgrass or kelp are important impact considerations. Kelp plants also are vulnerable to vessel impacts (propellers, anchoring) resulting in frond entanglement and/or dislodgement of holdfasts. Light reduction does not impact adult plants with surface canopies, but can reduce establishment of early life stages and growth of juvenile plants. Therefore, turbidity from sediment management is a potential concern if substantial and/or prolonged. Dredging, discharge, or nourishment are of concern in proximity to eelgrass. Burial, turbidity, or removal may result in habitat reduction or loss.

Several factors may contribute to the potential to impact sensitive habitats in the vicinity of RSM activities involving dredging or discharges (SAIC, 2011b), such as:

- Distance between project activities and sensitive habitat,
- Project sand volume and duration of activity,
- Prevailing current direction and oceanographic conditions during and after project implementation,
- Physical characteristics of the hard-bottom habitat (e.g., predominant reef heights, spatial extent of hard-bottom area, resource development, natural sand flow dynamics through the hard-bottom area), and
- Occurrence of barriers (e.g., groin, jetty) that may contribute to sand accumulation.

The locations of sensitive biological resources that have the potential to be impacted by sediment management activities generally are mapped and described as part of the environmental review process. According to the Southern California Eelgrass Mitigation Policy,

before and after mapping surveys of eelgrass are required if there is the potential for impact from project construction. Impact verification monitoring may be a permit requirement depending on level of concern or uncertainty associated with potential impacts to other sensitive habitats. Impacts resulting in loss or degradation of HAPC reefs, surfgrass, or kelp bed habitats would require consultation with resource and regulatory agencies to determine appropriate compensatory mitigation to avoid significant impacts. Impacts resulting in loss of HAPC eelgrass habitat would require compensatory mitigation consistent with the Southern California Eelgrass Mitigation Policy (NMFS, 2011). Eelgrass mitigation requirements differ depending on size of impact and timing of mitigation relative to impact. Generally, an eelgrass mitigation ratio of 1.2 to 1 (e.g., 20 percent increase in mitigation area relative to impacted area) is required unless the mitigation is performed three years in advance of the impact or the size of the impact is very small.

APPENDIX C – RELEVANT LAWS AND REGULATIONS

APPENDIX C – RELEVANT LAWS AND REGULATIONS

Federal and state environmental requirements relevant to RSM activities are briefly reviewed below. These regulations form the basis for environmental impact evaluations pursuant to the CEQA and NEPA and permitting of RSM projects. Additional local permits or variances to local ordinances may be required, but are not reviewed herein. Project applicants should review project-specific descriptions with appropriate agencies to confirm or identify appropriate permit requirements early in the environmental review process.

Federal Environmental Regulations

Clean Air Act of 1970, as Amended in 1990

The primary objective of the Clean Air Act is to establish federal standards for air pollutants from stationary and mobile sources and to work with states to regulate polluting emissions. The program is designed to improve air quality in areas that do not meet federal ambient air quality standards (non-attainment areas), and prevent deterioration of air quality in areas where federal standards may exceed short-term standards. The Clean Air Act includes a permitting program for construction and operation of stationary sources of hazardous air pollutants and related activities known as the Title V Operating Permit Program. The California Air Resources Board through various local authorities, such as the South Coast Air Quality Management District implements this program. As related to beach restoration projects, a Title V Operating Permit might be required for the operation of certain construction equipment (e.g., diesel-powered hydraulic dredge).

Clean Water Act of 1972

The Clean Water Act was established to restore and maintain the chemical, physical, and biological integrity of the nation's waters. Specific sections concern different aspects of protecting waters and water quality. Section 401 applies to dredging and disposal activities, and requires certification by the regional water quality control board or equivalent that the permitted project complies with State Water Quality Standards, and would not cause concentrations of chemicals in the water column to exceed these standards. Section 401 of the Clean Water Act requires a water quality certification for issuance of a 404 permit (33 United States Code 1344).

Section 404(b)(1) guidelines require that dredging and disposal activities should have no unacceptable adverse impacts. USACE issues 404 permits for the dredging and disposal of materials within the waters of the United States (dredging without aquatic or wetland disposal does not require a 404 permit or evaluation). A permit application must include an evaluation of the impacts on the affected resources, including, but not limited to: physical and chemical characteristics of the aquatic ecosystem, biological characteristics of the aquatic ecosystem, specific designated sites, where applicable and human use characteristics. Sediments are evaluated by the Inland Testing Manual (USEPA and USACE, 1998). USACE prepares

404(b)(1) evaluations for federal projects, including evaluation of alternatives and identification of the less damaging practical alternative.

Section 303(d) of the Clean Water Act requires the State to make a list of waters that are not attaining water quality standards and to develop total maximum daily loads or TMDLs for all waters and pollutants on the 303(d) list. A TMDL is the maximum load of a pollutant that can be discharged from point and nonpoint sources without exceeding water quality standards in the water body. Sediment and/or siltation are sometimes identified as pollutants on the 303(d) list, as has happened for San Diego Creek and upper Newport Bay.

Coastal Zone Management Act of 1972 and 1976 California Coastal Act

The Coastal Zone Management Act requires activities to be consistent with the enforceable policies of the approved state coastal program to the maximum extent practicable. The California Coastal Act authorizes the CCC to implement the Coastal Zone Management Act. The implementing regulations for the Coastal Zone Management Act are described in 15 Code of Federal Regulations 930, and the policies pertinent to coastal consistency determinations are included in California Public Resources Code (Cal. Pub. Res. Code) (Sections 30200-30365.5). These regulations require that the CCC prepare a coastal consistency determination for all federal projects that could affect the coastal zone. A coastal development permit is required for non federal projects.

Fish and Wildlife Coordination Act of 1958

The Fish and Wildlife Coordination Act requires any federal agency proposing any action that may affect wildlife to first consult with the USFWS and/or NMFS. The Fish and Wildlife Coordination Act establishes a consultation requirement for federal departments and agencies that undertake any action that proposes to modify any stream or other body of water for any purpose, including navigation and drainage [16 United States Code 662(a)].

Federal Endangered Species Act of 1973

The Federal Endangered Species Act protects endangered and threatened species by prohibiting federal actions that would jeopardize the continued existence of such species or result in the destruction or adverse modification of habitat of such species. Under Section 7(a)(2) of the Federal Endangered Species Act, federal agencies must consult with federal resource agencies (USFWS and NMFS) and prepare a Biological Assessment (BA) if listed species and/or critical habitat is present in an area to be impacted by project activity. The USFWS and/or NMFS then will prepare a biological opinion on how the action would affect endangered or threatened species, essential fish habitat or critical habitat of federally managed species, and will suggest reasonable and prudent measures that it believes would avoid jeopardizing the continued existence of the species or adversely modifying its critical habitat. As part of the development of federal biological opinions, reviews are conducted pursuant to the

Marine Mammal Protection Act and Magnuson-Stevens Fishery Conservation and Management Act.

Magnuson-Stevens Fishery Conservation and Management Act, as amended 1996 (Public Law 104-267)

The Magnuson-Stevens Fishery Conservation and Management Act calls for NMFS to work with regional fishery management councils to develop fishery management plans for each fishery under their jurisdiction. The Pacific Fishery Management Council develops and implements fishery management plans for the West Coast (Washington, Oregon and California). Pacific fishery management plans have been approved by NMFS for Pacific Coast groundfish, salmon, and coastal pelagic species. A fishery management plan for highly migratory species (e.g., tunas, sharks, and swordfish) was partially approved by the NMFS in 2004, and amended in 2006 and 2011 (*http://www.pcouncil.org*).

One of the required provisions of fishery management plans specifies that essential fish habitat be identified and described for the fishery, adverse fishing impacts on essential fish habitat be minimized to the extent practicable, and other actions to conserve and enhance essential fish habitat be identified. Federal agencies and permit applicants must consult with the NMFS on actions that may adversely affect essential fish habitat. Essential fish habitat is defined as those "waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."

The NMFS encourages streamlining the consultation process using review procedures under NEPA, Fish and Wildlife Coordination Act, Clean Water Act, and/or Federal Endangered Species Act provided that documents meet requirements for essential fish habitat assessments under Section 600.920(g). Essential fish habitat assessments must include (1) a description of the proposed action, (2) an analysis of effects, including cumulative effects, (3) the federal agency's views regarding the effects of the action on essential fish habitat, and (4) proposed mitigation, if applicable. Permit applicants are not necessarily required to consult via essential fish habitat; only federal agencies that fund, permit, or carry out actions that may adversely affect essential fish habitat must consult with NMFS.

Marine Mammal Protection Act of 1972

This Act protects marine mammals and establishes a marine mammal commission to regulate such protection.

Marine Protection, Research, and Sanctuaries Act

The Marine Protection, Research, and Sanctuaries Act also referred to as the Ocean Dumping Act, is divided into three parts: Title 1 – Ocean Dumping, Title 2 – Comprehensive Research on Ocean Dumping, and Title 3 – Marine Sanctuaries. Title 1 establishes the permit program for the disposal of dredged and non-dredged materials, mandates determination of impacts and alternative disposal methods, and provides for enforcement of permit conditions. The purpose

of Title 1 is to prevent or strictly limit the dumping of materials that would unreasonably affect human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities. Several agencies participate in the implementation of Marine Protection, Research, and Sanctuaries Act requirements. USEPA is the lead agency responsible for overall ocean disposal program management including site selection and management, establishes criteria for regulating waste disposal, and issues waste disposal permits other than for dredged material. USACE issues dredge disposal permits and provide recommendations regarding disposal site locations.

Migratory Bird Treaty Act of 1972

The Migratory Bird Treaty Act (16 United States Code § 703, amended 1994), between the United States and Canada, and subsequent amendments to the Act, provide legal protection for most breeding birds occurring in the United States. The Act restricts the killing, taking, collecting, selling, or purchasing of native bird species or their parts, nests, or eggs. The Convention for the Protection of Migratory Birds and Animals (1936) between the United States and Mexico offers similar protection to birds.

National Environmental Policy Act of 1969 (NEPA)

The NEPA requires federal agencies to consider environmental consequences and project alternatives before a decision is made to implement a federal project. The law requires the government to consider the consequences of major federal actions on human and natural aspects of the environment in order to minimize, where possible, adverse impacts. Equally important, NEPA established a process of environmental review and public notification for federal planning and decision-making. The Council on Environmental Quality was established under NEPA, and in 1978 issued *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* (40 Code of Federal Regulations §§ 1500-1508). Resulting documents under NEPA include environmental assessments (EAs) or environmental impact statements (EISs).

National Historic Preservation Act

Enacted in 1966, the National Historic Preservation Act created a federal program to preserve historic properties throughout the U.S. To assist the federal government in achieving program objectives, a State Historic Preservation Officer is responsible for developing and maintaining lists of prehistoric and historic places for inclusion in the National Register. Under Section 106 of the National Historic Preservation Act , the State Historic Preservation Officer consults with federal agencies on federal activities (including the issuance of certain permits) that may affect historic properties and the content and sufficiency of any plans developed to protect, manage, or reduce/mitigate harm to such properties. For beach restoration projects, the State Historic Preservation Officer would focus primarily on submerged artifacts (e.g., ship wrecks and Native American cultural resources) that might be affected by dredging operations. Projects initiated by non-federal agencies and organizations are also subject to National Historic Preservation Act .

The Section 106 review process will generally be triggered through notification requirements and interagency coordination requirements associated with Clean Water Act Section 404 and NEPA.

Rivers and Harbors Act of 1899

Section 10 of the Rivers and Harbors Act of 1899 prohibits the unauthorized obstruction or alteration of any navigable waters of the United States, and authorizes USACE to regulate all activities that would alter or modify the course, location, condition, or capacity of navigable waters of the United States. Navigable waters of the United States are defined in 33 Code of Federal Regulations Part 329 as those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. USACE may process a Section 10 permit simultaneously with a 404 permit if the applicant were going to fill and place a structure in the same project.

State Environmental Regulations

California Endangered Species Act

The CDFG (Fish and Game Code §§ 2050-2089) has regulatory authority over state-listed endangered and threatened species. The state legislature encourages cooperative and simultaneous findings between state and federal agencies. Participation by CDFG in federal consultation and adoption of a federal biological opinion is authorized by Fish and Game Code Section 2095. If the federal biological opinion is found to be inconsistent with California Endangered Species Act, the CDFG will issue its own biological opinion per Section 2090 of the Fish and Game Code and may issue a Section 2081 take permit with conditions of approval.

California Environmental Quality Act (CEQA)

CEQA requires that state and local agencies consider environmental consequences and project alternatives before a decision is made to implement a project requiring state or local government approval, financing, or participation by the State of California. In addition, CEQA requires the identification of ways to avoid or reduce environmental degradation or prevent environmental damage by requiring implementation of feasible alternatives or mitigation measures. Resulting documents under CEQA include negative declarations, mitigated negative declaration, or environmental impact reports (EIRs).

CDFG Code: Sections 1600-1616

The CDFG (Fish and Game Code §§ 1600 through 1616) regulates activities with the potential to affect fish and wildlife resources associated with lakes, rivers, and streams of the state. A streambed alteration agreement is required if there is the potential to substantially adversely affect an existing fish or wildlife resource from activities that would substantially divert or

obstruct the natural flow of, or substantially change or use any material from the bed, channel, or bank of, any river, stream, or lake. This includes any removal or discharge of sediment within such water bodies. A beach restoration project that blocked or obstructed the flow of an adjacent river or stream would also require a streambed alteration agreement . The streambed alteration agreement includes reasonable conditions necessary to protect those resources and must comply with CEQA.

Marine Life Management Act

The Marine Life Management Act was passed in 1998 by the California Legislature to ensure the conservation, restoration, and sustainable use of California's marine living resources. This Act required that Fishery Management Plans be prepared for managing the state's marine fisheries. The CDFG prepared a master plan for developing fishery management plans that lists over 375 species of fish, invertebrates, and plants managed by the state (*www.dfg.ca.gov/marine/masterplan*, CDFG 2001). Two fishery management plans have been prepared by CDFG, including the Nearshore Fishery Management Plan, which covers 19 species of finfish, and the White Seabass Fishery Management Plan (*www.dfg.ca.gov/marine*).

Marine Life Protection Act (MLPA)

The MLPA was adopted by the CDFG in 1999 (Chapter 10.5 of Fish and Game Code 2850 to 2863). The purpose of the MLPA is to design and manage a network of marine protected areas to improve protection of marine life and habitats, marine ecosystems, and marine natural heritage through the adoption of a Marine Life Protection Program and a comprehensive master plan. Specific geographic areas are designated as Marine Protected Areas (MPAs), which include marine or estuarine areas seaward of the high tide line or the mouth of a coastal river, including intertidal and subtidal habitats and associated flora and fauna. MPA classifications include marine life reserves, state marine parks, and state marine conservation areas. Maps from the CDFG (*http://www.dfg.ca.gov/mlpa/scmpas_list.asp*) showing the MPAs within the Orange County CRSMP study area are provided below.

Figure C.1 Bolsa Chica MPAs

Figure C.2 Corona del Mar to Dana Point MPAs

Figure C.3 Upper Newport Bay MPA

Porter-Cologne Water Quality Control Act of 1969 (Porter-Cologne Act)

This act represents anti-pollution legislation enacted by the California Legislature in 1970 (California Water Code §§ 13000-13999.10). It provides a framework for the regulation of waste discharges to both surface and ground waters of the state. It further provides for the adoption of water quality control plans and the implementation of these plans by adopting waste discharge requirements for individual dischargers or classes of dischargers. The Act mandates activities that may affect waters of the state shall be regulated to attain the highest quality. The regional water quality control board provides regulations for a non-degradation policy that are especially protective of waters with high quality. Section § 13142.5 includes the following additional considerations with respect to water quality as it relates to the coastal marine environment are that: (a) wastewater discharges shall be treated to protect present and future beneficial uses, and, where feasible, to restore past beneficial uses of the receiving waters. Highest priority shall be given to improving or eliminating discharges that adversely affect any of the following: (1) wetlands, estuaries, and other biologically sensitive sites, (2) areas important for water contact sports, (3) areas that produce shellfish for human consumption, and (4) ocean areas subject to massive waste discharge.

California Regional Sediment Management Plan – Orange County (CRSMP – OC) GIS Files

Filename	Data Type	Source	Description
bathymetry_layers_mod	Geodatabase	marinemap.org	Isobaths (contours) for California coastal region, 10 to 100 m.
biological_layers_mod	Geodatabase	marinemap.org	Geodatabase for biological data (Kelp 1989, 1999, 2002, 2003, 2004, 2005, 2006, 2008), western snowy plover.
cultural_layers_mod	Geodatabase	marinemap.org	Geodatabase for cultural resources of southern California - ocean outfalls, piers, shipwrecks. Original database has been modifed to exclude shapefiles not incorporated in this project (.mxd).
habitat_layers_mod	Geodatabase	marinemap.org	Various marine habitat layers - eelgrass, seagrasss_03, artificial reefs, grunion spawning, NOAA BioGeo, Substrate_highres. Original geodatabase modified to exclude shapefiles not incuded in this project (.mxd);
management_layers_mod	Geodatabase	marinemap.org	Geodatabase of managed areas in southern California coast. Database has been modified to exclude shapefiles not included in this project (.mxd); Exclusive Economic Zone (EEZ), federal marine protected area (MPA), power plant discharge.
mpa_layers_mod	Geodatabase	marinemap.org	Geodatabase of marine protected areas in southern California - state MPA, MPA-IPA (MPA integrated preferred alternative). Geodatabase modified to exclude shapefiles not incorporated in this project (.mxd).
physical_layers_mod	Geodatabase	marinemap.org	Geodatabase containing beach nourishment locations in southern California. The Geodatabase has been modified to exclude shapefiles not incorporated in this project (.mxd).
composite_ca_shoreline	Shapefile	NOAA National Ocean Service	These data were automated to provide a suitable geographic information system (GIS) data layer depicting the historical shoreline for the United States. These data are derived from shoreline data that were produced by the NOAA National Ocean Service including its predecessor agencies.
Kelp2005_nad83_albers	Shapefile	Region Nine Kelp Consortium and MBC Applied Environmental Sciences	2005 Region 9 kelp data. Most of the image file was created from Digital Multi-Spectral Video image files. Some were converted to image files from jpeg files.
Kelp3008region9	Shapefile	MBC Applied Environmental Sciences	2008 Region 9 kelp data taken for the December 31, 2008 photos.
khist_30m	Shapefile	SANDAG	SANDAG 2002 Nearshore Program, historical kelp. North San Diego/South Orange County overlap area.
Snowy Plover Wintering Areas	Shapefile	SAIC (2008)	Data layer created as part of GIS inventory for the CRSMP for the Orange County Region.
substrate_mod	Shapefile	SANDAG	SANDAG 2002 Nearshore Program, North San Diego/South Orange County overlap area.
veg	Shapefile	SANDAG	SANDAG 2002 Nearshore Program, understory kelp, North San Diego/South Orange County overlap area.
WSP_FCH_Project	Shapefile	SAIC (2008)	Data layer created as part of GIS inventory for the CRSMP for the Orange County Region.

APPENDIX D – DAM BYPASSING

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PRADO BASIN SEDIMENT MANAGEMENT DEMONSTRATION PROJECT

Orange County Water District

2011

Proponents

The Orange County Water District is the local lead agency for the proposed Prado Basin Sediment Management Demonstration Project. The Orange County Water District was formed in 1933 by a special act of the California State Legislature to protect Orange County's rights to water in the Santa Ana River. The Orange County Water District's primary responsibility is managing the vast groundwater basin under northern and central Orange County that supplies water to more than 20 cities and water agencies, serving more than 2.3 million Orange County residents. Water conservation at Prado Dam, located in Riverside County, is a major source of water for Orange County Water District's groundwater recharge efforts in Orange County.

The U.S. Army Corps of Engineers (USACE) is the federal lead agency for the proposed project. As operator and manager of the Prado Dam, USACE is responsible for evaluating requests to use federal land in the Prado Basin and to determine whether such requests are: (1) compatible with the federal Project, laws, regulations and policies and (2) when such use will be in the interest of the Government and/or the public.

Purpose

The purpose of the proposed project is to explore practical and beneficial methods to restore the flow of sediments trapped behind, and upstream, of Prado Dam to habitats and beaches downstream. The Santa Ana River Watershed is the largest in Southern California, covering 2,450 square miles. Flow from 92 percent of the watershed (2,255 of 2,450 sq.mi.) is controlled by Prado Dam. Since 1941 approximately 50,000 acre feet (af) of storage below elevation 563 has been lost due to sediment deposition in the Basin. On average, 735 af (1.19 million yd^3) of sedimentation occurs each year.

Upon the completion of Prado Dam in 1941, the sediment transport mechanics of the Santa Ana River watershed were dramatically altered. Once sediment-laden water enters the Prado Basin the velocity of the water decreases, sediment settles out of the water and then relatively clean water is released through Prado Dam. Water that is discharged from Prado Dam has the capacity to pick up existing sand and sediment below the dam and transport the material to the coast. Because the Dam is cutting off the replacement source of sediment, the river below the Dam is "sand starved". The presence of the Dam has severely altered the flow of sediments downstream, affecting natural habitats and decreasing replenishment of beach sands. The

deposition of sediments is also restricting the storage capacity behind the dam. Excessive sedimentation in, and upstream of, Prado Basin negatively impacts habitat, water conservation efforts, and civil infrastructure.

Goal

The goal of the proposed project is to demonstrate the effectiveness of sediment removal from the Prado Basin and re-entrainment of sediment into the lower Santa Ana River; while protecting civil infrastructure and improving water conservation and ecosystem restoration. The completed project will include data, conclusions and recommendations that examine the feasibility of a long-term program for ongoing sediment management of the Prado Basin and lower Santa Ana River.

Benefits In/Above Prado Basin

1. Increase water storage for flood control
2. Increase water storage for water conservation
3. Slow or reverse sedimentation rates behind the Prado Dam, thereby increasing the useful life of Prado Dam
4. Reduced sedimentation trends that threaten infrastructure (e.g., wetlands, roads and bridges, most notably River Road Bridge)
5. Increased edge under-story riparian habitat

Benefits Below Prado Dam

1. Stop and/or reverse streambed incision, thereby halting embankment erosion which results in wildlife habitat destruction
2. Providing replenishment sediment to stop streambed incision and protect infrastructure (e.g., SARI Line, CA 91 Freeway)
3. Stop and/or reverse riverbed armoring, which decreases the capacity of Orange County Water District's groundwater recharge facilities
4. Provide replenishment sediment to coastal communities

APPENDIX E – ECONOMICS

APPENDIX E – ECONOMICS

Most discussion of methodology is contained within the main text or in references cited. This appendix contains more detail on how specific data that we collected was obtained/estimated.

Attendance

Orange County, like a majority of coastal counties, is home to beaches that are administered by a myriad of agencies. The relevant agencies were identified and contacted to obtain attendance records. The primary agencies responsible for collecting annual attendance estimates in Orange County are: California State Parks, District 5; municipal public safety agencies such as lifeguards and fire personnel; and the U.S. Ocean Services, a contracted public safety organization.

Data requests were made by email. When necessary, follow-ups were made by email and/or phone. The primary goal was to obtain monthly attendance estimates for the most recent five year period (2005-2009). A number of beaches in Orange County report their annual attendance estimates to the United States Lifeguard Association. These estimates can be found at http://www.usla.org. For comparative purposes, 2005-2009 annual attendance estimates at respective Orange County beaches were extracted. In cases where agencies did not maintain monthly totals but reported aggregated annual estimates, extrapolation techniques rooted in a study by Dwight et al. (2007) were applied.

The emails requests asked for the following information:

- Monthly attendance totals for 2005-2009 or the best data available. If more detailed (e.g., daily) data is available that would be even better.
- Who collects the data and their general methodology. The researchers are already familiar with this, but it would be good to verify.
- Total length of the beach covered in a count, (by landmarks – street corners and parking lots or by latitude and longitude).

The specific source of each attendance estimate is available upon request.

Beach Attributes/Amenities

Orange County beach amenities and parking were determined from a number of sources:

- Site visits including interviews with people knowledgeable about beach amenities and habits;
- Google Earth and Google Maps;
- The California Coastal Access Guide (2003); and

- Various state, city, and tourist websites such as the California State Parks website (parks.ca.gov), LagunaBeachCity.net, ci.Huntington-Beach.ca.us, and BeachCalifornia.com.

Street Parking Capacity for Beach Use

Street parking capacity was evaluated based on observed capacity from previous high-season parking habits and interviews with people familiar with beach parking patterns. After speaking to residents and local beach users, it was determined that visitors are willing to park from two to five blocks away on a busy summer day. Each beach was evaluated separately and the information was used to construct geographical zones that encompass the area used for beach parking. The boundaries of these zones are specified in Table E1. The number of parking spaces was counted using Google Maps and/or during site visits. Parking lots for private uses were not included. The percentage of parking in the geographical zone that is available for beach use is also based on observed parking habits.

“Official parking” comprises parking lots or structures except in the case of Sunset Beach where the “greenbelt”- a median area just off the beach with interwoven parking spaces and green areas- is also counted. Parking fees are denoted per hour unless otherwise noted. The specific boundaries for street parking for each beach are listed in Table E1.

Access

A beach is considered to have bus access if a bus stop is within three blocks. A beach is considered to have train access if the train stops directly off the beach, such as at San Clemente Pier. Information was obtained from Google Maps, the Orange County Transportation Authority website (octa.net), local transit maps from the city of Laguna Beach (lagunabeachcity.net/cityhall/pw/transit/default.asp), and Amtrak and Metrolink websites (amtrak.com and metrolinktrains.com, respectively).

Table E.1 Boundaries for Street Parking

#	BEACH	NORTHERN BOUNDARY	SOUTHERN BOUNDARY	EASTERN BOUNDARY
1	West Beach, Seal Beach		to 5th Street	Central Avenue
2	East Beach, Seal Beach	5th Street		Central Avenue
3	Sunset Beach	Warner Avenue	Anderson Street	PCH
9	Huntington City Beach	Goldenwest Street	1st Street	Orange Avenue
12	West Newport Beach		29th Street	See Excel Sheet
13	Newport Beach Pier	to 28th Street	13th Street	
14	Balboa Beach	to 13th		
15-46	Newport Harbor Beaches	Available upon request		
47	Corona Del Mar State Beach	Heliotrope Avenue	Marygold Avenue	Seaview Avenue
48	Little Corona Del Mar	Narcissus Avenue		Seaview Avenue
52	Crescent Beach	Crescent Bay Drive	La Brea Street	PCH
53	Shaw's Cove	La Brea Street	Cliff Drive	Cliff Drive
54	Fisherman's Cove	Cliff Drive	Aster Drive	Cypress Drive
55	Diver's Cove / Picnic Beach/ Rockpile/ Heisler Park			
56	Laguna Beach	Cliff Drive	Legion Street	PCH / 3rd Street
57	Brooks Street Beach	Oak Street	Cress Street	Glennneyre Street (Brooks only)
58	Bluebird Coast/Pearl Beach	Agate Street	to Diamond Street	Glennneyre Street (Agate & Pearl only)
59	Wood's Cove /Ruby Street Park	Diamond Street	Moss Street	PCH
60	Victoria Beach	Victoria Drive	to Cardinal Drive	PCH
61	Treasure Island Beach	Terrace N	Aliso Circle	PCH / Wesley Drive
62	Aliso County Beach		to Camel Point Drive	PCH
63	Camel Point	Camel Point Drive	to West Street	PCH
64	Table Rock	West Street	3rd Avenue.	Virginia Avenue
65	1000 Steps	to 7th	to Point Pl	Virginia Avenue
68	Salt Creek Beach	Selva Road		to PCH
73	Capistrano County Beach		Palisades Drive	PCH
74	Poche Beach			Camino Capistrano (about 400 yds)
75	San Clemente City Beach North	to Florencia	to W Canada	Buena Vista
75	San Clemente City Beach (Pier & South)	Ave Del Mar / Esplanade / Ave Calafia		See Excel Sheet
77	Cottons	Avenida Santa Margarita to La Pala	Christianitos Road	PCH