# Harbor Beaches of Ventura County (Kiddie Beach and Hobie Beach) Bacteria Total Maximum Daily Load

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California Regional Water Quality Control Board
Los Angeles Region
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## Acronyms

| | |
|---|---|
| 303(d) list | State of California Clean Water Act section 303(d) List of Water Quality Limited Segments |
| AB411 | state Assembly Bill No. 411 (1997) |
| BMP | Best Management Practice |
| CCR | Code of California Regulations |
| CEQA | California Environmental Quality Act |
| CIH | Channel Islands Harbor |
| CIBCSD | Channel Islands Beach Community Service District |
| CWA | Clean Water Act |
| CFR | Code of Federal Regulations |
| DFG | California Department of Fish and Game |
| DHS | California Department of Health Services |
| Caltrans | California Department of Transportation |
| HBVC | Harbor Beaches of Ventura County |
| LA | Load Allocation |
| LAX | Los Angeles International Airport |
| LCB | Leo Carrillo Beach |
| M | Million |
| mL | Milliliter |
| MPN | Most probable number |
| MF(mTEC) | Membrane Filter (mTEC) method |
| MS4 | Municipal Separate Storm Sewer System |
| NPDES | National Pollution Discharge Elimination System |
| OAL | Office of Administrative Law |
| REC-1 | Water Contact Recreation |
| REC-2 | Non-contact Water Recreation |
| SHELL | Shellfish Harvesting |
| SWRCB | State Water Resources Control Board |
| TMDL | Total Maximum Daily Load |
| USC | United States Code |
| USACE | United States Army Corps of Engineers |
| USEPA | United States Environmental Protection Agency |
| USFWS | United States Fish and Wildlife Services |
| USFDA | United States Food and Drug Administration |
| VCHD | Ventura County Harbor Department |
| VCEHD | Ventura County Environmental Health Division |
| VCWPD | Ventura County Watershed Protection District |
| WLA | Waste Load Allocation |

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# 1 INTRODUCTION

This Staff Report documents the development of a Total Maximum Daily Load (TMDL) to address impairments of water quality standards for bacteria at Kiddie Beach[1] and Hobie Beach. Kiddie Beach and Hobie Beach are located in the Channel Islands Harbor (CIH). Kiddie Beach and Hobie Beach will be collectively known as the Harbor Beaches of Ventura County (HBVC) in this Staff Report. The Staff Report describes the water bodies and their beneficial uses, bacteria objectives for supporting the beneficial uses, water quality data documenting impairments, sources of bacteria and their linkage to water quality, waste load and load allocations, and sets forth an implementation plan to attain water quality standards.

Kiddie Beach and Hobie Beach are two small beaches located inside the entrance to the CIH in Ventura County. The area surrounding the two beaches and the harbor mainly consists of residential housing including the Silver Strand development. In addition, U.S. Naval Construction Battalion Center at Port Hueneme is located to the east of the harbor. The harbor includes private boat yards, commercial fishing enterprises, a Coast Guard Station, and public and private marinas.

The HBVC often experience elevated levels of indicator bacteria and frequently exceed bacteria water quality standards. Elevated levels of indicator bacteria in beach waters have been linked to disease (Pruss, 1998). The purpose of this TMDL is to restore the beneficial uses at the beaches by attaining water quality standards, thus providing a healthy environment for swimming and other forms of body contact recreation.

## 1.1 Regulatory Background

The State of California's principal water quality law is the Porter-Cologne Water Quality Act (Porter-Cologne Act). The Porter-Cologne Act is implemented in the Los Angeles Region (i.e., Los Angeles and Ventura Counties) by the California Water Quality Control Plan, Los Angeles Region (Basin Plan). The Basin Plan sets water quality standards for the Los Angeles Region, which includes beneficial uses for surface and ground water with numeric and narrative objectives necessary to support those uses, and the state's antidegradation policy. The Basin Plan also describes implementation programs to protect all waters in the region. The Basin Plan, along with the Water Quality Control Plan for Ocean Waters of California (Ocean Plan), contains numeric bacteria water quality objectives for marine waters, which apply to CIH and its beaches.

These plans are required to comply with the federal Clean Water Act (CWA). Section 303(d)(1)(A) of the CWA requires each state to conduct a biennial

[1] Kiddie Beach is also known as the Channel Islands Harbor Beach and Channel Islands Beach Park.

assessment of its waters, and identify those waters that are not achieving water quality standards. The resulting list is referred to as the 303(d) list (LARWQCB, 2006; 2003a). The CWA also requires states to establish a priority ranking for waters on the 303(d) list of impaired waters and to develop and implement TMDLs for these waters (40 CFR §130.7).

As required by the CWA and the Porter-Cologne Act, the Basin Plan includes beneficial uses for the Los Angeles regional waters, water quality objectives to protect those uses, an antidegradation policy, collectively referred to as water quality standards, and other policies necessary to implement water quality standards.

A TMDL specifies the maximum concentration of a pollutant that a water body can assimilate and meet water quality standard. A TMDL allocates pollutant loadings to point and nonpoint sources. The elements of a TMDL are described in Code of Federal Regulations, title 40, section 130.2 and section 130.7 (40 CFR §130.2 and §130.7) and Section 303(d) of the CWA, as well as in United States Environmental Protection Agency guidance (USEPA, 1991). A TMDL is defined as the “sum of the individual waste load allocations for point sources and load allocations for nonpoint sources and natural background” (40 CFR §130.2) such that the capacity of the water body to assimilate pollutant loads (the loading capacity) is not exceeded. TMDLs must take into account seasonal variations and include a margin of safety to address uncertainty in the analysis (40 CFR §130.7(c)(1)). Finally, states must develop water quality management plans to implement the TMDL (40 CFR §130.6). As they are approved, TMDL implementation plans are incorporated into the Basin Plan.

The USEPA has oversight authority for the 303(d) program and is required to review and either approve or reject the state’s 303(d) list and each TMDL developed by the state. If the state fails to develop a TMDL in a timely manner or if the USEPA disapproves a TMDL submitted by a state, EPA is required to establish a TMDL for that water body (40 CFR §130.7(d)(2)).

Los Angeles Regional Water Quality Control Board Staff (Regional Board Staff) proposes a reference system/antidegradation approach as the implementation procedure for this TMDL. The Santa Monica Bay Beaches, Marina del Rey Harbor Mothers’ Beach, and Inner Cabrillo Beach, include REC-1 (Water Contact Recreation) as a beneficial use. The recent TMDLs for these beaches use the reference system/antidegradation approach to implement the bacteria objectives of the Basin Plan (LARWQCB, 2004a; 2003b; 2002a; 2002b).

The reference system/antidegradation approach recognizes the fact that there are natural sources of bacteria that may cause or contribute to exceedances of bacteria water quality standards (Schiff *et al.*, 2005). This approach allows a certain number of days when the single sample bacteria objectives are exceeded. The number is based on historic exceedance levels at existing monitoring locations, in comparison to a reference beach. Regional Board Staff recognizes that there are overlapping beneficial uses for the water bodies such as REC-1, aquatic life, and wildlife in the CIH.

Regional Board Staff will use Leo Carrillo Beach (LCB) and its associated drainage area, Arroyo Sequit Canyon, as the local reference system until other reference systems are evaluated and found to be more appropriate. The use of other alternative reference locations must be supported by the collection of necessary data when the TMDL is reconsidered in four years (see Section 9.2). Arroyo Sequit Canyon is the most undeveloped sub-watershed in the Santa Monica Bay watershed with 98% open space and little evidence of human impact. In essence, the reference approach recognizes natural sources and focuses this TMDL to set waste load allocations and load allocations such that anthropogenic sources of bacteria do not cause or contribute to exceedances of bacteria water quality standards.

The reference beach approach ensures water quality comparable to that of the reference beach while being consistent with state and federal antidegradation policies. Antidegradation policies state that if current water quality is better than that of the reference beach then no degradation of existing water quality is permitted.

## 1.2 Environmental Setting

### 1.2.1 Geographic Setting

CIH is located on the Pacific Coast in Ventura County (see Figure 1-1). The Harbor lies on the Oxnard Alluvial Plain about halfway between the Santa Clara River and Calleguas Creek. The Oxnard Alluvial Plain was created by deposits from the Santa Clara River and Calleguas Creek over thousands of years.

The channel to the Ocean is in the southern part of CIH. The harbor splits into the West and the East Channel. The west channel travels north under Channel Islands Boulevard into Mandalay Bay. The east channel travels north under Channel Island Harbor into Mandalay Bay also but does not allow the passage of boats. Mandalay Bay travels north through the Edison Canal to the Mandalay Bay Generating Station.

The harbor is protected by one main breakwater in front of main entrance. In addition, there are two small jetties located on north and south side of the main entrance. The United States Army Corps of Engineers (USACE) created Kiddie Beach and Hobie Beach along with CIH. The beaches were "designed to absorb the impact of tidal surges, which would otherwise damage infrastructure within the harbor" (Larry Walker, 2001). Due to their original design, Kiddie and Hobie

Beach can be described as surge beaches[2] (VCHD Personal Communications, 11 December 2006).

Kiddie Beach and Hobie Beach are located at the eastern end of the main entrance. Kiddie Beach is at the end of the southern entrance jetty and Hobie beach is just north. Behind Kiddie Beach is a restroom and parking lot on Victoria Avenue.

Kiddie Beach is approximately 430 ft long and about 120 ft wide at Mean Lower Low Water (MLLW) and 70 ft wide at Mean Higher High Water (MHHW). Kiddie Beach is a sandy beach. Hobie Beach is approximately 400 ft long and varies in width from 75 to 250 ft at MLLW. At MHHW the beach is almost entirely inundated. Hobie Beach is a rocky beach.

[2] Surge beaches are beaches specifically designed and located to absorb the excess energy of wave surges that may otherwise damage facilities or boats within the harbors.

**Figure 1-1 Channel Islands Harbor Geographical Map**

### 1.2.2 Facilities

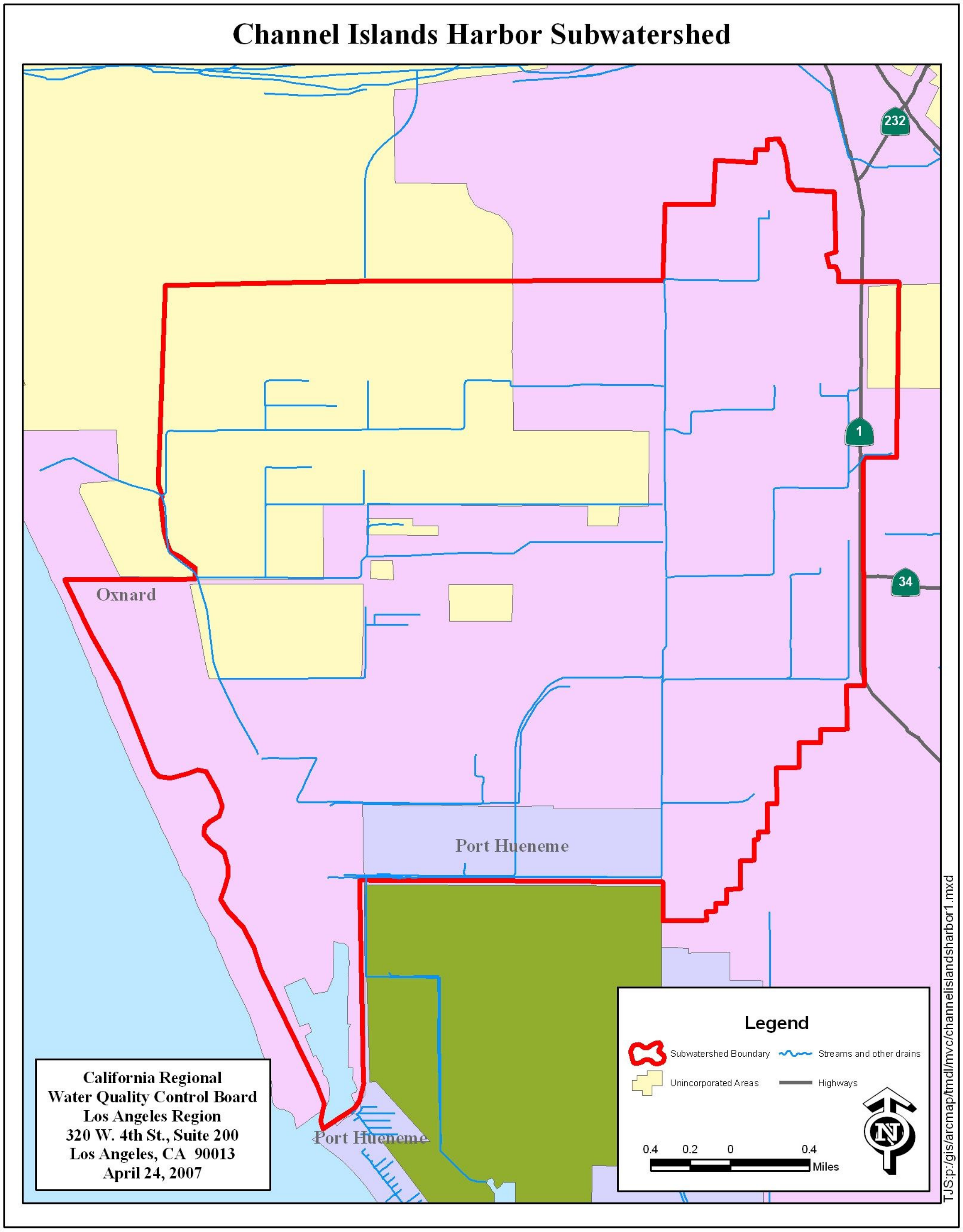
CIH was created in 1960 by USACE. In 1963 it was annexed to the City of Oxnard and is now operated under a Joint Powers Agreement between the City of Oxnard and Ventura County (County of Ventura, 1986). In 1965, 500 boat slips were created in the harbor. Currently, there are approximately 2,600 boat slips, in addition to four yacht clubs, and nine marinas. The harbor caters to these recreational boaters and to a few commercial fishing vessels (Larry Walker, 2001).

### 1.2.3 Land Use

The Channel Islands Harbor subwatershed, which includes the Oxnard West Drain, is approximately 11.38 square miles (~7,283 acres) (see Figure 1-3). The subwatershed consists residential housing (~47.2%), agricultural (26.9%), commercial (~5.8%), recreational (~3.3%), open space (~3.0~), transportation (~2.9%), mix-use (~2.4%), and industrial areas (~0.7%).

The area surrounding the two beaches and the CIH is primarily residential housing, including the Silver Strand development. In addition, the Port Hueneme Naval Base is located to the east of the harbor. The vast majority of the subwatershed is impervious (80–90%). The area within the harbor consists of 90% residential land use, primarily two story beach houses (Larry Walker, 2001). Approximately 10% of the land in the harbor consists of small commercial businesses. These businesses include restaurants, real estate offices, etc, mostly located on Roosevelt Avenue. The area within the harbor consists of 110 acres of land and 200 acres of water (County of Ventura, 1986).

**Figure 1-2 Channel Islands Harbor Subwatershed Map**



### 1.2.4 Climate

The area has a Mediterranean climate with warm summers, mild winters, and rain occurring primarily in the months of November through April. The annual average rainfall in the City of Oxnard is 14.56 inches and the annual rainfall for City of Ventura is 16.47 inches.

### 1.2.5 Habitat

A biological survey was made for the Mandalay Bay development, including CIH, in 1982. The survey was included in the Channel Islands Harbor Public Works Plan (County of Ventura, 1986). The study found a larger number of algae, invertebrates, and fish near the Harbor entrance and a fewer number in the mid- and northern part of the harbor in the Mandalay Bay area. The study suggested that the diminishment in biological diversity was due to increasing pollutant levels. The biological survey in the Public Work Plan lists the following species:

1. Fish:
   White croaker (*Genyonemus lineatus*), topsmelt (*Atherinops affinis*), jacksmelt (*Atherinops californiensis*), staghorn sculpin (*Leptocottus aramatus*), pile surfperch (*Damalichthys vacia*), and shiner surfperch (*Cymatogaster aggregate*). "Fishing is allowed in the inner Harbor, south of both West and East Channels. Most fishing occurs along the jetties at the entrance to the channel. Lower dissolved oxygen levels further into the channel limit the number of fish present" (County of Ventura, 1986).

2. Birds:
   Great blue heron (*Ardea herodias*), double-creasted cororant (*Phalacrorax uritus*), western grebe (*Aechmophorus occidentalis*), american coot (*Fulica americana*), brown pelican (*Pelicanus occidentalis*), herring gull (*Larus argentatus*) and california gull (*Larus californicus*).

3. Mammals:
   California sealion (*Zalophus californianus*).

Ventura County Harbor Department (Harbor Department) personnel have also observed California Least Terns (*Sterna antillerum browni*) and Western Snowy Plovers (*Charadrius alexandrinus nivosus*) within the area (VCHD Personal Communications, 11 December 2006) The California Department of Fish and Game (DFG) or the United States Fish and Wildlife Services (USFWS) have listed the California Brown Pelican, California Least Tern, and the Western Snowy Plover as threatened or endangered Species. The Federal Endangered

Species Act of 1973 defines a threatened species as one that is likely to become endangered within the foreseeable future and a endangered species is defined as one that is considered in danger of becoming extinct throughout all or a significant portion of its range (17USC §1531–§1544),

## 1.3 Health Risks of Bacteria Impaired Waters for Water Contact Recreation

The following section briefly discusses the health risks associated with swimming in marine water with elevated levels of indicator bacteria. The Los Angeles Regional Water Quality Control Board (Regional Board) intends to reduce these risks to public health at the HBVC through the development and implementation of this TMDL. Additionally, applicable water quality standards and the background on their development will be described.

At stake are both the health of the swimmers, fishermen, and various other people who visit the HBVC every year along with the local economic value diminished by increased healthcare costs and the potential loss of travel and tourism revenue.

Since the 1950s, numerous epidemiological studies have been conducted around the world to investigate the possible links between swimming in fecal-contaminated waters and health risks. In 1998, the World Health Organization completed a comprehensive review of 22 published epidemiological studies, 16 of which were conducted in marine waters (Pruss, 1998). Fourteen of the 16 marine water studies found a significant association between bacteria indicator densities and the rate of certain symptoms or groups of symptoms. Most significant associations were found for gastrointestinal illnesses. However, as shown in several large-scale epidemiological studies of recreational waters, other health outcomes such as skin rashes, respiratory ailments, and eye and ear infections are associated with swimming in fecal-contaminated water. The Santa Monica Bay study, discussed below, found swimming in urban runoff-contaminated waters resulted in an increased risk of chills, ear discharge, vomiting, coughing with phlegm and significant respiratory diseases (fever and nasal congestion, fever and sore throat, or coughing with phlegm).

In fact, significant respiratory disease was the most common outcome to swimmers exposed to runoff polluted water in Santa Monica Bay (Haile *et al*., 1996, 1999). Cheung *et al*. (1990) found an increased risk of skin rash, respiratory, and total illness associated with increased levels of bacteria indicator densities. Von Schirnding *et al*. (1993) found increases in the risks of respiratory and skin symptoms with increasing bacteria indicator densities. Fattal *et al*. (1986) found skin rash symptoms and "total sickness" (at least one health effect) outcomes increased with bacteria indicator densities. Corbett *et al*. (1993) found a positive linear relationship between several symptoms including respiratory, ear, and eye symptoms and water pollution levels. These studies compel the conclusion that there is a causal relationship between illness and recreational water quality, as measured by bacteria indicator densities.

### 1.3.1 Santa Monica Bay Epidemiological Study

One of the studies reviewed in Pruss (1998) was the Santa Monica Bay Restoration Project epidemiological study conducted in 1995. This was the first epidemiological study to specifically evaluate the increased health risks to people who swam in marine waters contaminated by urban runoff (Haile *et al.*, 1996, 1999). The results of Santa Monica Bay study provided much of the basis for the current recreational water quality standards for marine waters in California (e.g., standards developed by the California Department of Health Services (DHS) in response to State Assembly Bill 411 Chapter 765 (AB411). The study collected health effects data from 11,793 individuals visiting three Santa Monica Bay Beaches, including Santa Monica Beach, Will Rogers State Beach, and Surfrider Beach. Bacteria indicators measured in the study included total coliform, fecal coliform, *E. coli*, and *enterococcus*.

The epidemiological study was unique in several ways. First, the source of bacteria was not effluent from a sewage treatment plant, but instead urban runoff discharged from storm drains. Second, it examined both gastrointestinal illness and non-gastrointestinal illnesses including skin rashes and upper respiratory illnesses. Third, the study analyzed the correlation between adverse health effects and the fecal-to-total coliform ratio in addition to previously studied bacteria indicators (i.e., total coliform, fecal coliform, *E. coli* and *enterococcus*). Finally, the study compared people swimming near a flowing storm drain to other people swimming 400 meters away from the drain. Positive associations were observed between adverse health effects and the distance an individual swam from the drain. The study found that 1 in 25 people swimming in front of a storm drain will get sick and that the likelihood of getting sick is twice as high for individuals swimming in front of a storm drain. The number of excess cases of illness attributable to swimming at the drain reached into the hundreds per 10,000 exposed participants, suggesting that significant numbers of swimmers in the water near flowing storm drains is subject to increased health risks. In addition, an increased health risk was associated with increasing densities of bacteria. Table 1-1 summarizes some of the health outcomes that were significantly associated with the four bacteria indicators with the numeric targets in the TMDL.

**Table 1-1 Health Risks with the Numeric Targets (Haile *et al.*, 1996, 1999; Haile and Witte, 1997)**

| Bacteria Indicator | Health Outcome | Attr. # (per 10,000)* |
|---|---|---|
| Enterococcus | Diarrhea with blood | 27 |
| | Gastroenteritis I** | 130 |
| Total coliform | Skin rash | 165 |
| Fecal/total ratio | Nausea | 230 |
| | Diarrhea | 281 |
| | Gastroenteritis II*** | 98 |
| | Chills | 117 |
| Fecal coliform | Skin rash | 74 |

Notes: *Attributable number. **Highly credible gastrointestinal illness I with vomiting, diarrhea and fever, or stomach pain and fever. ***Highly credible gastrointestinal illness II with vomiting and fever.

Out-of-pocket health costs such as doctor visits and lost days at work due to poor bacteriological water quality ranged from $12–$23 million per year in a study of Newport and Huntington Beaches (Dwight, 2001).

In addition, there are likely to be economic losses due to bacteria contamination at beaches. Travel and tourism is a key industry in Ventura County. CIH is the gateway to the Channel Islands National Park (over 400,00 visitors in 2003) and is a tourist attraction in its own right with shopping, restaurants and art galleries and museums in addition to the recreational boating facilities.

## 1.4 Stakeholder participation

Several stakeholder meetings were held as the TMDL was developed:

1. The first public meeting was held on October 26, 2004. The Regional Board's Santa Clarita River watershed contacts and others were invited and approximately 20 people attended. The meeting included a presentation on the TMDL development process, including bacteria standards for Kiddie and Hobie Beach.

2. The second public meeting was held on March 01, 2005. After this second meeting, development of the TMDL was postponed due to the need for Regional Board Staff to be assigned to develop more urgent TMDLs.

3. A public meeting was held on November 16, 2006 to modify and reintroduce the TMDL. Harbor Cove Beach was added to the TMDL and notice was sent to the Regional Board contact lists for “Miscellaneous Ventura Coastal”, “Ventura River”, and “Basin Planning Amendment,” totaling 264 email recipients and 72 standard mailing recipients. A separate notice was sent to approximately 19 email addresses, including some participants of previous meetings. Approximately 25 people attended the meeting.

4. The California Environmental Quality Act (CEQA) Scoping meeting was held on January 10, 2007. Notice was sent to the Regional Board contact lists for “Miscellaneous Ventura Coastal”, “Ventura River”, and “Basin Planning Amendment,” totaling 259 email recipients and 72 standard mailing recipients. A separate notice was sent to approximately 24 email addresses, including the participants of previous meetings. Approximately 18 people attended. The meeting included a brief presentation of the TMDL and an analysis of potential environmental impacts associated with implementation of the TMDL, reasonably foreseeable methods of compliance, and mitigation measures.

5. A meeting was held with the the Harbor Department on December 11, 2006.

6. An implementation meeting was held with the CIH stakeholder group on February 06, 2007.

# 2 PROBLEM IDENTIFICATION

## 2.1 Water Quality Impairments

Water quality standards for CIH are established in the Basin Plan. These water quality standards are made up of beneficial uses for surface and ground water, the numeric and narrative objectives necessary to support those uses, and the state’s antidegradation policy.

The HBVC does not attain water quality standards due to high densities of indicator bacteria. Kiddie Beach and Hobie Beach are listed on the 2006 State of California Clean Water Act section 303(d) list of water quality limited segments (303(d) list). Additionally, the harbor is listed for Lead and Zinc (LARWQCB, 2006). Impairments due to Lead and Zinc will be addressed by a separate TMDL.

Beach reports cards can be used as an illustration of the degree to which the HBVC have been unable to attain standards. The environmental group, Heal the Bay, calculates a “report card” for California beaches. The grades calculated for

Kiddie Beach[3] and Hobie Beach by Heal the Bay are sometimes “A”s and “B”s but often “D”s and “F”s. Heal the Bay has listed Kiddie Beach and or Hobie Beach as one of California’s ten worst beaches for five years running (1999–2004) (Heal the Bay, 2004; 2003; 2002; 2001; 2000). Kiddie and Hobie Beach were not listed on the subsequent 2005 and 2006 ten worst beaches list (Heal the Bay, 2006; 2005).

## 2.2 Water Quality Standards

### 2.2.1 Beneficial Uses

The Basin Plan designates beneficial uses for water bodies in the Los Angeles Region. These uses are recognized as existing (E), potential (P), or intermittent (I) uses. All beneficial uses, whether E, P or I, must be protected.

The Basin Plan lists beneficial uses for the CIH, which includes Kiddie and Hobie Beaches (see Table 2-1). REC-1 and REC-2 beneficial uses are the focus of this TMDL as each use requires numeric bacteria objectives.

The REC-1 beneficial use is defined in the Basin Plan as “Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs”.

The REC-2 beneficial use is defined in the Basin Plan as: “Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.”

[3] Kiddie Beach is referenced as Channel Islands Harbor Beach Park in Heal the Bay’s Annual Report Card.

**Table 2-1 Beneficial Uses for Channel Islands Harbor**

| Watershed | Hydro Unit No. | IND | NAV | REC1 | REC2 | COMM | MAR | WILD | RARE | MIGR | SPWN | SHELL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ventura County Coastal Nearshore+ | | E | E | E | E | E | E | E | E | E | E | E |
| Channel Islands Harbor | 403.11 | E | E | E | E | E | E | E | | | | |

| | |
|---|---|
| IND | Industrial Service Supply |
| NAV | Navigation |
| REC-1 | Water contact recreation |
| REC-2 | Non-contact Recreation |
| COMM | Commercial and Sport Fishing |
| MAR | Marine Habitat |
| MIGR | Migration of Aquatic Organisms |
| SPWN | Spawning, Reproduction, and/or Early Development |
| SHELL | Shellfish Harvesting |
| WILD | Wildlife Habitat |
| RARE | Rare, Threatened or Endangered Species |

### 2.2.2 Water Quality Objectives

The Basin Plan contains bacteria water quality objectives to protect the REC-1 and REC-2 beneficial uses and the Ocean Plan also contains bacteria water quality objectives.

On October 25, 2001, the Regional Board adopted a Basin Plan Amendment updating the bacteria objectives for waters designated as REC-1 (LARWQCB, 2001). The State Board approved the Regional Board's Basin Plan amendment on July 18, 2002 (State Board Resolution 2002-0142), the Office of Administrative Law approved the amendment on September 19, 2002 (OAL File No. 02-0807-01-S), and the USEPA approved the amendment on September 25, 2002. The amended objectives include geometric mean limits and single sample bacteria indicator limits: including total coliform, fecal coliform, the fecal-to-total coliform ratio, and *enterococcus*.

The Ocean Plan's standards for "Water-Contact" are: "within a zone bounded by the shoreline and a distance 1,000 feet from the shoreline or the 30-foot depth contour, whichever is further from the shoreline and in areas outside this zone used for water contact sports, as determined by the Regional Board (i.e., waters designated as REC-1) but including all kelp beds, the following bacteria objects shall be maintained throughout the water column…"

The 2005 Ocean Plan (SWRCB, 2005) mirrors the Basin Plan water quality objectives (LARWQCB, 2001).

These objectives are the same as those contained in state regulations (17 CCR §7958) implementing state Assembly Bill No. 411 (1997), which relied upon the Santa Monica Bay epidemiological study (see Section 1.3.1). AB411 resulted in changes to DHS regulations for public beaches and public water contact sports areas. These changes included (1) setting minimum protective bacteriological standards for waters adjacent to public beaches and public water contact sports areas based on four bacteria indicators (total coliform, fecal coliform, *enterococcus*, and fecal-to-total coliform ratio) and (2) altering the requirements for monitoring, posting, and closing certain coastal beaches based on these four single sample bacteria indicator limits. The objectives are also consistent with, but augment, USEPA guidance (1986), which recommends the use of *enterococcus* in marine water based on national epidemiological studies (LARWQCB, 2001; Cabelli, 1983).

These objectives are based on health risk in marine recreational waters of 19 illnesses per 1,000 exposed individuals (USEPA, 1986). Based on the findings of the Santa Monica Bay epidemiological study, the health risk associated with these objectives ranges from 7 illnesses per 1,000 (fecal coliform objective) to 28 illnesses per 1,000 (fecal-to-total coliform ratio objective) (see Table 1-1).

The Basin Plan objectives for marine waters designated for Water Contact Recreation (REC-1) are as follows:

1. Rolling 30-day Geometric Mean Limits
    a. Total coliform density shall not exceed 1,000/100 mL.
    b. Fecal coliform density shall not exceed 200/100 mL.
    c. Enterococcus density shall not exceed 35/100 mL.

2. Single Sample Limits
    a. Total coliform density shall not exceed 10,000/100 mL.
    b. Fecal coliform density shall not exceed 400/100 mL.
    c. Enterococcus density shall not exceed 104/100 mL.
    d. Total coliform density shall not exceed 1,000/100 mL, if the ratio of fecal-to-total coliform exceeds 0.1.

The REC-1 bacteria objectives also state that "[t]he geometric mean values should be calculated based on a statistically sufficient number of samples (generally not less than 5 samples equally spaced over a 30-day period)" (LARWQCB, 2001).

Single sample bacteria exceedances are used to determine impairments. This method is practical and appropriate in issuing warnings and postings. 30-day rolling geometric mean limits are also used to determine impairments.

Protecting REC-1 beneficial uses will result in the protection of REC-2 beneficial uses because REC-1 bacteria objectives are more stringent than REC-2 bacteria objectives.

### 2.2.3 Implementation Provisions for Bacteria Objectives

Implementation provisions for bacteria objectives were amended to the Basin Plan on December 12, 2002 (Regional Board Resolution No. R02-022) and these procedures have been used in the Santa Monica Bay Beaches Wet-Weather Bacteria TMDL, the Marina del Rey Harbor Mothers' Beach and Back Basins Bacteria TMDL and the Los Angeles Harbor Bacteria TMDL (Inner Cabrillo Beach and Main Ship Channel).

This Basin Plan Amendment states:

> The single sample bacteriological objectives shall be strictly applied except when provided for in a Total Maximum Daily Load. In all circumstances, including in the context of a TMDL, the geometric mean objectives shall be strictly applied. In the context of a TMDL, the Regional Board may implement the single sample objectives in fresh and marine waters by using a 'reference system/antidegradation approach' or 'natural sources exclusion' approach subject to the antidegradation policies as discussed below. A

reference system is defined as an area and associated monitoring point that is not impacted by human activities that potentially affect bacteria densities in the receiving water body.

These approaches recognize that there are natural sources of bacteria, which may cause or contribute to exceedances of the single sample objectives for bacteria indicators. They also acknowledge that it is not the intent of the Regional Board to require treatment or diversion of natural water bodies or to require treatment of natural sources of bacteria from undeveloped areas. Such requirements, if imposed by the Regional Board, could adversely affect valuable aquatic life and wildlife beneficial uses supported by natural water bodies in the Region.

Under the ‘reference system/antidegradation’ implementation procedure, a certain frequency of exceedance of the single sample objectives shall be permitted on the basis of the observed exceedance frequency in the selected reference system(s) or the targeted water body. The ‘reference system/antidegradation’ approach ensures that bacteriological water quality is at least as good as that of a reference system and that no degradation of existing bacteriological water quality is permitted where existing bacteriological water quality is better than that of the selected reference system(s).

Under the natural sources exclusion implementation procedure, after all anthropogenic sources of bacteria have been controlled such that they do not cause or contribute to an exceedance of the single sample objectives and natural sources have been identified and quantified, a certain frequency of exceedance of the single sample objectives shall be permitted based on the residual exceedance frequency in the specific water body. The residual exceedance frequency shall define the background level of exceedance due to natural sources. The ‘natural sources exclusion’ approach subject to the antidegradation policies may be used if an appropriate reference system cannot be identified due to unique characteristics of the target water body. These approaches are consistent with the State Antidegradation Policy (State Board Resolution No. 68-16) and with federal antidegradation requirements (40 CFR §131.12).

TMDLs and associated waste load allocations (WLAs) and load allocations (LAs) (see Section 6-1) are vehicles for implementing water quality standards.

Therefore, the appropriateness of a reference system/antidegradation approach will be evaluated within the context of TMDL development for a specific water body. WLAs will be incorporated into National Pollution Discharge Elimination System (NPDES) permits for Municipal Separate Storm Sewer System (MS4), non-storm water general NPDES permits, general industrial storm water permits, and general and individual permits. LAs for nonpoint sources will be implemented according to the “Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program” (SWRCB, 2004a) within the context of the TMDL and in the Conditional Waiver for Dischargers from Irrigated Lands (Ag Waiver).

The reference system/antidegradation approach is the approach proposed in this TMDL. However, Regional Board Staff recognizes the most appropriate reference system may not be identified for the HBVC. The proposed TMDL schedule allows the Regional Board time to re-consider this issue after the effective date of the TMDL. New information will be considered by Regional Board Staff when assessing more appropriate reference systems.

### 2.2.4 Antidegradation

Both the State of California and the federal government have antidegradation policies for water quality. The State policy is formally referred to as the “Statement of Policy with Respect to Maintaining High Quality Waters in California” (State Board Resolution No. 68-16). This policy restricts degradation of surface or ground waters and protects water bodies where existing quality is higher than is necessary for the protection of beneficial uses. The federal Antidegradation Policy (40 CFR §131.12) was developed under the Clean Water Act. This TMDL complies with antidegradation policies by not setting any WLAs and LAs above existing numbers of exceedance days.

## 2.3 Summary of Available Data

### 2.3.1 County of Ventura

The majority of the bacteria data for HBVC were taken by the County of Ventura Environmental Health Division (VCEHD). This data were collected to demonstrate compliance with AB411.

At Kiddie Beach, samples were tested for total coliform, fecal coliform, and *enterococcus*. From 2000 to 2004, three samples were taken twice a week. From November 2004 to March 2006, during the winter months (i.e., November to March), only one sample was taken once a week. During the summer months (i.e., April to October) of 2005 and 2006, three samples were taken twice a week. In some cases, as many as 19 samples were taken in a single day.

At Hobie Beach, samples also were also tested for total coliform, fecal coliform, and *enterococcus*. From 1999 to 2000, samples were taken twice a week. From

2001 to 2004, only one sample was taken once a week. Sometimes as many as three samples were taken in a single day. Sampling and testing was not conducted in the winter months, from 2004 to 2006.

### 2.3.2 Special Studies

Several specials studies have been conducted at the HBVC, some funded by Clean Beaches Initiative grant from the State Board. These studies include:

1. Channel Islands Beach Park Draft Action Plan for Improving Water Quality (Larry Walker, 2001).
2. Channel Islands Harbor Circulation Improvement Study (Everest, 2003)
3. Bacteria Source Study for Channel Islands Harbor (URS, 2004).

## 2.4 Data Analysis

### 2.4.1 Single Sample Exceedances

Bacteria data collected from the City of Ventura and the County Ventura are summarized in Table 2-2 to Table 2-7. The data are expressed in terms of exceedance days of the Basin Plan REC-1 water quality objectives, which is also consistent with the Ocean Plan and AB411 standards. Exceedance days are days in which sample bacteria densities exceed bacteria water quality objectives for the REC-1 beneficial use.

The data are separated into wet and dry-weather and summer and winter seasons for single sample limits. Summer months are months which beaches are visited most frequently and cover the months of April through October which is consistent with the beach water testing period in AB411 (17 CCR §7961(a)). Winter months are months in which beaches are less frequently visited and cover the months of September through March. Wet-weather days are defined as days which experience 0.1 inches of rain or more and the three following days (LARWQCB, 2002b).

For days where multiple samples were taken at the same sampling location, the arithmetic mean was calculated for those samples. The resulting arithmetic mean was used to determine exceedances of single sample limits, consistent with temporal representation guidelines in the 303(d) listing policy (SWRCB, 2004b).

Table 2-2 through Table 2-7 illustrates the degree of impairment at the HBVC when compared to Leo Carrillo Beach (LCB), the reference beach.

Exceedances occur more frequently in the winter than in the summer and in wet-weather rather than dry-weather. Summer exceedances are significant despite existing control measures like enclosed trash cans and posted signs encouraging pet dropping clean-up.

Typically exceedances occur when sample bacteria densities exceed any of the indicator bacteria limits. Table 2-3, Table 2-5, and Table 2-7 contain a more detailed break-down of specific bacteria indicator exceedances. On occasion, samples exceeded more than one numeric limit.

LCB is listed as the reference beach. Based on single sample test results for LCB, no exceedances of single sample limits occurred during summer dry-weather. The beach exceeded single sample limits 3% of the time during winter dry-weather. During wet-weather, the beach exceeded single sample limits 22% of the time.

**Table 2-2 Summer Dry-Weather Single Sample Exceedances at the Harbor Beaches of Ventura County**

| Summer Dry-Weather | | |
|---|---|---|
| **Site** | April 1999–October 2005 (7 Summers/49 Months) | April 2003–October 2005 (3 Summers/21 Months) |
| | Exceedance Percentage | Exceedance Percentage |
| **Kiddie Beach** | 18.93% (64/338) | 15.82% (25/158) |
| **Hobie Beach** | 25.57% (56/219) | 12.79% (11/86) |
| **Leo Carrillo Beach** | 0.00% | |

- The exceedance percentage is calculated by taking the quotient of the sample exceedance count (samples that exceeded numeric limits) compared to the total sample count (total number of samples taken).
  - For example:
    Kiddie Beach Summer Dry-weather
    18.93% (64/338)

(Exceedance Percentage) (Sample Exceedance Count) ● (Total Sample Count)

**Table 2-3 Summer Dry-Weather Single Sample Bacteria Indicator Exceedances at the Harbor Beaches of Ventura County**

| Summer Dry-Weather | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Site** | April 1999–October 2005 (7 Summers/49 Months) | | | | April 2003–October 2005 (3 Summers/21 Months) | | | |
| | Total Coliform | Fecal Coliform | Enterococcus | Fecal-to-Total Coliform Ratio | Total Coliform | Fecal Coliform | Enterococcus | Fecal-to-Total Coliform Ratio |
| | Exceedance % | Exceedance % | Exceedance % | Exceedance % | Exceedance % | Exceedance % | Exceedance % | Exceedance % |
| **Kiddie Beach** | 1.18% (4/338) | 7.99% (27/338) | 13.31% (45/338) | 8.88% (30/338) | 1.90% (3/158) | 3.80% (6/158) | 8.23% (13/158) | 6.33% (10/158) |
| **Hobie Beach** | 0.93% (2/215) | 12.96% (28/216) | 21.92% (48/219) | 11.27% (24/213) | 0.00% (0/86) | 6.98% (6/86) | 9.30% (8/86) | 6.98% (6/86) |

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**Table 2-4 Winter Dry-Weather Single Sample Exceedances at the Harbor Beaches of Ventura County**

| Winter Dry-Weather | | |
|---|---|---|
| Site | November 1999–March 2006 (7 Winters/35 Months) | November 2003–March 2006 (3 Winters/15 Months) |
| | Exceedance Percentage | Exceedance Percentage |
| **Kiddie Beach** | 31.72% (46/145) | 22.81% (13/57) |
| **Hobie Beach*** | 28.95% (22/76) | 20.45% (9/44) |
| **Leo Carrillo Beach** | 3.00% | |

**Table 2-5 Winter Dry-Weather Single Sample Bacteria Indicator Exceedances at the Harbor Beaches of Ventura County**

| Winter Dry-Weather | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Site | November 1999–March 2006 (7 Winters/35 Months) | | | | November 2003–March 2006 (3 Winters/15 Months) | | | |
| | Exceedance Percentage (Exceedance Day/Total Days | | | | Exceedance Percentage (Exceedance Day/Total Days | | | |
| | Total Coliform | Fecal Coliform | Enterococcus | Fecal-to-Total Coliform Ratio | Total Coliform | Fecal Coliform | Enterococcus | Fecal-to-Total Coliform Ratio |
| **Kiddie Beach** | 0.00% (0/145) | 12.41% (18/145) | 28.28% (41/145) | 9.66% (14/145) | 0.00% (0/57) | 5.26% (3/57) | 22.81% (13/57) | 5.26% (3/57) |
| **Hobie Beach**** | 4.00% (3/75) | 16.00% (12/75) | 27.63% (21/76) | 12.00% (9/75) | 2.27% (1/44) | 6.82% (3/44) | 20.45% (9/44) | 6.82% (3/44) |

*VCEHD did not sample Hobie Beach in the winter months from 2004-2006. The data analysis was adjusted from 1999 to 2004 and 2001 to 2004 for the winter months.

**Table 2-6 Wet-Weather Single Sample Exceedances at the Harbor Beaches of Ventura County**

| Wet-Weather | | |
|---|---|---|
| **Site** | April 1999–March 2006 (7years/84 Months) | April 2003–March 2006 (3years/36 Months) |
| | Exceedance Percentage | Exceedance Percentage |
| **Kiddie Beach** | 50.62% (41/81) | 37.14% (13/35) |
| **Hobie Beach** | 42.50% (17/40) | 27.78% (5/18) |
| **Leo Carrillo Beach** | 22.00% | |

**Table 2-7 Wet-Weather Single Sample Bacteria Indicator Exceedances at the Harbor Beaches of Ventura County**

| Wet-Weather | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Site** | April 1999–March 2006 (7 Years/84 Months) | | | | April 2003–March 2006 (3 Years/36 Months) | | | |
| | Exceedance Percentage (Exceedance Day/Total Days | | | | Exceedance Percentage (Exceedance Day/Total Days | | | |
| | Total Coliform | Fecal Coliform | Enterococcus | Fecal-to-Total Coliform Ratio | Total Coliform | Fecal Coliform | Enterococcus | Fecal-to-Total Coliform Ratio |
| **Kiddie Beach** | 22.22% (18/81) | 17.28% (14/81) | 48.15% (39/81) | 12.35% (10/81) | 20.00% (7/35) | 22.86% (8/35) | 34.29% (12/35) | 11.43% (4/35) |
| **Hobie Beach** | 12.82 (5/39) | 25.00% (10/40) | 37.50% (15/40) | 12.82% (5/39) | 5.56% (1/18) | 11.11% (2/18) | 27.78% (5/18) | 5.56% (1/18) |

*VCEHD did not sample Hobie Beach in the winter months from 2004-2006. The data analysis was adjusted from 1999 to 2004 and 2001 to 2004 for the winter months.

### 2.4.2 Geometric mean exceedances

The Basin Plan does not differentiate between wet- and dry-weather for geometric mean limits. As a result, the data were separated seasonally prior to analysis for exceedances of geometric mean limits.

The calculation of the rolling 30-day geometric mean requires at least five equally spaced samples to be statistically significant (LARWQCB, 2001). The County of Ventura and City of Ventura does not always sample five or more times per 30 day period. On days when multiple samples were taken, the arithmetic mean of those samples was calculated. Then the arithmetic mean was used to calculate the rolling 30-day geometric mean.

Geometric mean exceedances suggest continued high bacteria concentrations.

LCB is listed as the reference beach. Exceedances of summer or winter 30-day rolling geometric mean limits at LCB were not observed.

**Table 2-8 Summer Geometric Mean Exceedances at the Harbor Beaches of Ventura County**

| Summer Weather | | |
|---|---|---|
| Site | April 1999–October 2005 (7 Summers/49 Months) | April 2003–October 2005 (3 Summers/21 Months) |
| | Exceedance Percentage | Exceedance Percentage |
| **Kiddie Beach** | 29.55% (73/247) | 23.26% (30/129) |
| **Hobie Beach** | 42.86% (66/154) | 18.33% (11/60) |
| **Leo Carrillo Beach** | 0.00% | |

**Table 2-9 Summer, Geometric Mean, Indicator Bacteria Exceedances at the Harbor Beaches of Ventura County**

| Summer Weather | | | | | | |
|---|---|---|---|---|---|---|
| Site | April 1999–October 2005 (7 Summers/49 Months) | | | April 2003–October 2005 (3 Summers/21 Months) | | |
| | Exceedance Percentage (Exceedance Day/Total Days | | | Exceedance Percentage (Exceedance Day/Total Days | | |
| | Total Coliform | Fecal Coliform | Enterococcus | Total Coliform | Fecal Coliform | Enterococcus |
| **Kiddie Beach** | 3.24% (8/247) | 4.05% (10/247) | 27.94% (69/247) | 6.20% (8/129) | 3.10% (4/129) | 20.16% (26/129) |
| **Hobie Beach** | 2.03% (3/148) | 6.54% (10/153) | 42.21% (65/154) | 1.67% (1/60) | 0.00% (0/60) | 16.67% (10/60) |

**Table 2-10 Winter Geometric Mean Exceedances at the Harbor Beaches of Ventura County**

| Winter Weather | | |
|---|---|---|
| Site | November 1999–March 2006 (7 Winters/35 Months) | November 2003–March 2006 (3 Winters/15 Months) |
| | Exceedance Percentage | Exceedance Percentage |
| **Kiddie Beach** | 75.00% (111/148) | 68.97% (40/58) |
| **Hobie Beach**** | 74.00% (37/50) | 57.14% (16/28) |
| **Leo Carrillo Beach** | 0.00% | |

**Table 2-11 Winter, Geometric Mean, Indicator Bacteria Exceedances at the Harbor Beaches of Ventura County**

| Winter Weather | | | | | | |
|---|---|---|---|---|---|---|
| Site | November 1999–March 2006 (7 Winters/35 Months) | | | April 2003–October 2005 (3 Winters/15 Months) | | |
| | Exceedance Percentage (Exceedance Day/Total Days | | | Exceedance Percentage (Exceedance Day/Total Days | | |
| | Total Coliform | Fecal Coliform | Enterococcus | Total Coliform | Fecal Coliform | Enterococcus |
| **Kiddie Beach** | 17.57% (26/148) | 10.14% (15/148) | 74.32% (110/148) | 24.14% (14/58) | 0.00% (0/58) | 67.24% (39/58) |
| **Hobie Beach*** | 18.00% (9/50) | 16.00% (8/50) | 74.00% (37/50) | 3.57% (1/28) | 0.00% (0/28) | 57.14% (16/28) |

*VCEHD did not sample Hobie Beach in the winter months from 2004-2006. The data analysis was adjusted from 1999 to 2004 and 2001 to 2004 for the winter months.

# 3 NUMERIC TARGETS

The TMDL includes multiple numeric targets based on the bacteria objectives for marine waters designated REC-1 (LARWQCB, 2001). These objectives are the same as those specified in the California Code of Regulations, Title 17, Section 7958 "Bacteriological Standards" and consistent with those recommended in "Ambient Water Quality for Bacteria – 1986" (USEPA, 1986). There are a total of seven numeric targets and four single sample bacteria indicator limits: total coliform, fecal coliform, *enterococcus*, and fecal-to-total coliform ratio (see Section 2.2).

For the TMDL, the numeric targets will apply to existing monitoring sites, with samples taken at ankle- to knee-high depth, consistent with 17 CCR §7961(b). These targets apply during both dry- and wet-weather, since there is water contact recreation throughout the year.

To implement single sample bacteria objectives for waters designated REC-1 and to set allocations based on the single sample limits, this TMDL sets an allowable number of exceedance days for each location. Allowable exceedance days only apply to days in which single sample limits are exceeded and does not apply to days where geometric mean limits are exceeded. Numeric targets are expressed as allowable exceedance days due to the relevance of bacteria densities and frequency of single sample exceedances to public health.

## 3.1 Alternative Targets Considered

Three alternatives were considered for developing the appropriate numeric targets: (1) strict application of the water quality objectives as listed in the Basin Plan with no exceedance, (2) Natural Sources Exclusion Approach, and (3) Reference System/Antidegradation Approach with specific exceedance day frequencies. The criteria used for selecting recommended alternative include:

- Consistency with state and federal water quality laws and policies.
- Level of beneficial use protection.
- Consistency with current science regarding water quality necessary to protect the beneficial uses.
- Practicability for the Harbor Beaches of Ventura County.

## 3.2 Recommended Alternative

These alternatives recognize that there are natural sources of bacteria, which may cause or contribute to exceedances of the water quality objectives for bacteria indicators (Schiff *et al.*, 2005). Regional Board Staff acknowledge that it is not the intention of the Regional Board to require treatment or diversion of natural water bodies or to require treatment of natural sources of bacteria from undeveloped areas.

For this TMDL, alternative (3) is the recommended alternative because this alternative allows the Regional Board to avoid imposing requirements to divert natural coastal creeks or treat natural sources of bacteria from undeveloped areas. This approach includes allowable exceedance levels during summer dry-weather, winter dry-weather and wet-weather. This approach will be explored in greater detail in latter parts of the Staff Report.

The recommended numeric targets will be assessed as allowable number of single sample exceedance days for each site because the frequency of single sample exceedances is most relevant to public health. The USEPA allows states to select the most appropriate measure to express the TMDL. Allowable exceedance days are considered an “appropriate measure” consistent with the definition in 40 CFR §130.2(i). The number of allowable exceedance days is calculated from the reference beach while observing strict antidegradation policies. Targets will apply at monitoring locations, with samples taken at ankle- to knee-high depth (17 CCR §7961(b)).

Alternative 1 requires strict application of the water quality objectives as listed in the Basin Plan with no exceedance. This alternative is not recommended. Strict application of objectives would fail to consider natural sources of bacteria and required treatment in excess of natural water quality levels.

Alternative 2 is a natural source exclusion approach. This approach calls for an identification and quantification of naturally-occurring sources of bacteria. All anthropogenic sources must be removed first. Once quantified, natural source levels become the baseline bacteria level. The exceedances caused by natural sources are used to quantify the allowable exceedance frequency and becomes the background exceedance frequency. However, to completely removing all anthropogenic sources from a heavily utilized and highly urbanized setting may be nearly impossible.

# 4 SOURCE ASSESSMENT

This section discusses the probable and potential sources of bacteria contamination contributing to bacteria exceedances at the HBVC. The source assessment is based on VCEHD monitoring data and special studies, principally funded by Clean Beaches Initiative grant from the State Board. These data sources are listed in Section 2.3.

## 4.1 Point Sources

### 4.1.1 Point Source Discharges

As of December 2006, there are four active NPDES permits for discharges to the CIH and associated canals (see Table 4.1)

**Table 4-1 Active NPDES Permits discharging to the Channel Islands Harbor as of December 2006**

| Discharging to Channel Islands Harbor | | | | |
|---|---|---|---|---|
| | Permit No. | Discharger | Facility | Permit Type |
| | R4-2002-0125 | Ventura County Department of Airports | Former Condor Luft Site | General NPDES Treated Groundwater from Cleanup of Petroleum Fuel |
| | 00-108 | Ventura County Watershed Protection District and co-permittee cities | Municipal Separate Storm Sewer (MS4) | Individual NPDES |
| Discharging to Edison Canal | | | | |
| | R4-2004-0096 | Reliant Energy Mandalay | Edison Canal Maintenance. Dredging | WDR |
| | R4-2003-0141 | D.R. Horton Los Angeles Holding | Oly Mandalay Bay Sea Bridge | Individual NPDES |

Other than the storm water discharges associated with the Ventura County MS4 permit and the Statewide MS4 Permit for the California Department of Transportation (Caltrans), discharges from permits listed above are not expected to be a significant source of bacteria.

The Ventura County MS4 permit was issued in August 2000. The principal permittee is the Ventura County Watershed Protection District (VCWPD) and the co-permittees are the Cities of Camarillo, Fillmore, Moorpark, Ojai, Oxnard, Port Hueneme, Ventura, Santa Paula, Simi Valley and Thousand Oaks. Together the VCWPD and associated cities form the Ventura County Storm Water Quality Management Program. Storm water is discussed in Section 4.2.

## 4.2 Storm water

### 4.2.1 Storm water Contributions to the Harbor Waters

The Oxnard West Drain is the main storm water conduit to the CIH (VCWPD, 2004). The Oxnard West Drain drains an area of approximately 2,800 acres of commercial, retail and residential areas. The drain begins near West 5th Street, runs south along Ventura Road, and turns west along Channel Islands Boulevard where the drain connects with Wooley Road Drain (at Patterson Road). The drain then discharges into Mandalay Bay, north of the bridge over East Channel (the conventional separation between CIH and Mandalay Bay) (see Figure 1-1 and Figure 1-3). The US Naval Construction Battalion Center does not appear to drain into the Oxnard West Drain.

Another large storm drain enters Mandalay Bay at Hemlock and Victoria Ave and numerous other small storm drains drain into CIH.

There are two storm drains located in the vicinity of Kiddie Beach and Hobie Beach:

1. The Silver Strand Pump Station discharged dry-weather flows into the southern jetty at the southern end of Kiddie Beach (see Figure 1-1). Dry-weather flows were diverted to the sanitary sewer from October 1999 to October 2000, leading to lower total and fecal concentration at southern end of Kiddie Beach. A short four hour dye study in December 2000, found no leaks at the pump station (Larry Walker, 2001). Dry-weather flows were permanently diverted in 2003.

2. A storm drain adjacent to the sheetpile groin along the southern boundary of the US Coast Guard Station, at the northern end of Hobie Beach, appears to drain the adjacent street (see Figure 1-1).

Storm water flows from other parts of the harbor are a potential source of bacteria. The Los Angeles Harbor Bacteria TMDL established a relationship between bacteria concentrations in storm drain effluent and bacteria concentrations in the adjacent harbor waters (LARWQCB, 2004a). A dispersion test conducted near the harbormaster office, across the entrance channel from Kiddie Beach, and in the center of the entrance channel demonstrated relative fast dissipation. The dissipation rate suggest that bacteria originating from these locations could be a potential source, but only high initial concentration levels at those locations would affect the bacteria concentration levels at the HBVC (Everest, 2003).

Bacteria concentrations in the storm drains have not been fully characterized. Storm drain data, from January 1999 to August 2001, is referenced in the CIH Circulation Improvement Study (Everest, 2003), but the data are not discussed and data sources are listed as "unknown."

In 1999, a force main dye study was conducted in the sewer line that runs along Victoria Ave, behind the beaches. The study did not show a connection to storm drains. Smoke tests and dye studies were not conducted beyond the force main.

## 4.3 Nonpoint Sources

The HBVC have a series of special studies, primarily funded by the Clean Beaches Initiative grant by the State Board, for the purpose of identifying potential source of bacteria loading. Included in these studies are the bacteria source study, action plan, and circulation improvement study (see Section 2.3.1).

### 4.3.1 Marina Activities

1. Boat deck and slip washing:
   Regular maintenance at the CIH includes washing bird feces off the docks and into harbor waters. Ventura Coast Keeper has specifically requested that this practice be stopped. The Harbor Department indicated that a physical wash is only done when manual cleaning is impractical and minimized when possible (VCHD Personal Communication, 11 December 2006).

2. Waste disposal from boats:
   Slips are available for approximately 2,600 boats in the CIH. The harbor is a "no discharge" harbor, which is a harbor that restricts septic and other illicit discharges (LWA, 2001). Pump-out facilities are located at both of the guest docks, located on the east dock and the peninsula, and are maintained by County of Ventura. These pump-out facilities are provided at no cost to the public. The free pump-out service is provided to encourage the public to pump their septic and holding tanks rather than discharging into harbor waters. Pump-out facilities include a battery recycle center and hazardous disposal center. Despite these efforts, some boats may still discharge their septic and holding tank waste directly in the harbor waters (VCHD Personal Communication, 11 December 2006)

   Larry Walker Associates (2001) conducted a one day survey in September 2000 of harbor waters and several samples were taken from the boat slip areas. These eight sites were found to be below bacteria standards. However, there is no estimate of bacteria contributions to the harbor from boats.

3. Fishing wastes from boats:
   Fishermen at the CIH often clean their fish in the main channel of the harbor behind the break water due to the decreased of wave action (VCHD Personal Communication, 11 December 2006). Most of the fishing wastes are properly disposed, but some of waste can be found in trashcans at the harbor or directly discharged into harbor waters. Commercial fishing boats are not allowed to discharge fish waste within the harbor.

Harbor waters do not often exceed the REC-1 standards. The Harbor Department has conducted sporadic sampling of harbor Waters one, two, or three times a year, in each of the large channels (Main, East, and West). Between 1998 and 2002 no exceedances were found (Everest, 2003). For most sampling events, only total and fecal coliform were tested, and *enterococcus* was measured only twice in 2002.

The main entrance is tested weekly by Ventura County Environmental Health Division (VCEHD). From 1999 to 2002, exceedances occurred for total coliform and fecal coliform two, three, or four times a year, and about six times a year for *enterococcus*. These exceedances occurred during wet months (Everest, 2003).

If the weekly sampling by VCEHD is returning a reasonably accurate estimation of the percent of days that harbor waters exceed standards (3 out of 52 samples ~5%) then the frequency with which the harbor department samples harbor waters is insufficient to observe any of the exceedances in less than10 years of sampling.

A summary of the available data suggest a higher magnitude and frequency of bacteria exceedances during wet-weather as opposed to dry-weather (see Section 2.4). As observed in other harbors in Southern California, storms tend to elevate bacteria levels in the entire harbor.

### 4.3.2 Beach Sources

URS Corporation's Bacteria Source Study (2004) indicates some human source loading. The human source loading was identified through ribosomal RNA (Ribonucleic acid) typing and matching with a known DNA (Deoxyribonucleic acid) library. The potential sources of human contribution are unknown. Certain human activities like swimmer wash-off, trash, and direct excretion from children (i.e., diapers) may account for the loading. However, there were cases where human matches were identified during low bacteria levels and no human matches during high bacteria levels (URS, 2004).

DNA matching is useful as a "snapshot" of bacteria loading. To gain an accurate picture of bacteria source contributions, DNA testing frequencies should coincide with normal bacteria testing. However, increasing DNA testing to obtain a bacteria source loading trend may be cost prohibitory.

The Oxnard West Drain is the main storm water conduit in CIH. Trash in the harbor is primarily distributed via storm drains and catch basin during wet and dry flows (VCWPD, 2004). Wind blown trash is also a potential source of trash into harbor waters. Certain types of trash act as a nutrient source for bacteria during decomposition as well as a food source for animals which promotes increased fecal loading.

The URS study (URS, 2004) identified feral cats and domestic dogs as a source of bacteria loading. Feral cats have been spotted in the rocks on the southern edge of the main channel. The County of Ventura has a contract with the Greyfoot Cat Rescue, a local cat relocation group, for removing the feral cats that have migrated or have been abandoned on those rocks (Larry Walker, 2001). The cat population is kept to a manageable level and the remaining cats act as a rodent source control. Only the most aggressive cats are kept, and neutered or spaded, to dissuade other cats from habituating the rocks. However, local residents are often found feeding the cats (VCHD, Personal Communication, 11 December 2006). Frequent residential feedings contribute additional feral cat loading.

Local residents also walk their dogs on the shores of the HBVC. Though residents are encouraged to pick up after their pets, through signs and disposable mitts, domestic dog loading at the beaches still occurs.

### 4.3.3 Natural Sources

Bird species were observed to have the highest contribution to local source loading. The ratio of bird fecal loading compared to all other species at Kiddie Beach is almost 3 to 1. At Hobie Beach the ratio is closer to 1 to (URS, 2004). Birds are a significant source of bacteria loading for other marine beaches within the region (LAWQCB 2004a; 2003b; 2002b; 2002a).

The source identification study did not identify any marine mammal loading at Kiddie Beach. At Hobie Beach 7% of loading was contributed to combined marine mammals. For the subset of water samples exceeding numeric limits, approximately 25.5% were identified as combined marine mammals (URS, 2004).

### 4.3.4 Ground Sources

A recent study by Lee *et al.* suggests that “beach sediments can act as a favorable environment for fib [(fecal indicator bacteria)] survival and growth” (Lee *et al*., 2006). Due to the “favorable environmental”, Langier and Taggart suggest that “[b]each sand and sediment may host significant populations of indicator bacteria and thus may act as a reservoir and proximal source of overlying waters” (Langier and Taggart, 2006). The survivability rate of this bacteria, the optimal growing conditions, the health affects associated with contact with contaminated beach sand, and the deposition and regrowth of uncontaminated beach sediment are unknown. Lee *et al.,* suggests further research, especially in enclosed beaches.

A series of transect samples of beach pore water were taken by UC Davis in 2000 (Larry Walker, 2001). These samples were taken in shallow waters (6 to 8 inches) and only a few samples were taken. The samples showed exceedances at the surf zone but found no exceedances in deeper water. A sediment disturbance study was done in July 2000 and showed no difference in bacteria geometric means due to the resuspension of sands (Larry Walker, 2001).

The County of Ventura monitored seepage from the rock riprap area near the north edge of Hobie Beach. These seepages are observed during very low tides. The County of Ventura sampled the seepages and found exceedances of bacteria standards in 6 of 15 samples (Larry Walker, 2001).

### 4.3.5 Agricultural Sources

Agriculture is the leading industry in Ventura County. Agricultural land use accounts for approximately 26.9% of that total land usage in the CIH subwatershed (see Section 1.2.3). Agricultural lands do not directly discharge water into the HBVC, but are significant portion of the subwatershed. Nonpoint source discharges from agricultural lands tend to contain higher quantities of nutrients like nitrogen and phosphorus, which promote bacterial growth. Nonpoint source discharges from agriculture (i.e., irrigated drainage and wet-weather run-off) may impact bacteria concentrations at the HBVC. However, the bacteria source loading potential for agriculture has not been characterized in the CIH subwatershed.

# 5 LINKAGE ANALYSIS

For the HBVC, certain concepts of the linkage analysis are the same and or similar to the other Los Angeles Region bacteria TMDLs.

1. In Southern California, in dry-weather, local sources of bacteria principally drive exceedances (LARWQCB, 2002a; 2003b; 2004a).

2. In Southern California, in wet-weather, up-stream or watershed sources principally cause the bacteria exceedances (LARWQCB, 2002b; 2003b; 2004a).

3. Based on three experiments conducted by Nobel *et al.* (1999) to mimic natural conditions in or near Santa Monica Bay, two in marine water and one in fresh water, bacteria degradation was shown to range from hours to days (Noble *et al*., 1999b). Based on the results of the marine water experiments, the model assumes a first-order decay rate for bacteria of 0.8 d-1 (or 0.45 per day). Degradation rates were shown to be as high as 1.0 d-1 (Noble *et al*., 1999b).

The transport time for discharges into CIH. In CIH Everest found that bacteria "[d]ecay plays a relatively insignificant role in the dispersion of contaminants compared to tidal currents, M[andalay] B[ay] G[enerating] S[tation] pumping outflows, and winds" (Everest, 2003). As a result, bacteria degradation rates are insufficient to influence bacteria densities in the wave wash during wet-weather.

## 5.1 Harbor Beaches of Ventura County

Regional Board Staff reviewed three studies sufficient to provide a linkage analysis between bacteria sources and water quality at the HBVC. These studies are described in Section 2.3.

Several surveys and studies were conducted in the Larry Walker study (Larry Walker, 2001) to identify bacteria sources and to recommend control strategies and actions. The study made some of the following conclusions:

- Elevated levels of indicator bacteria were found only in the surf zone.
- The highest bacteria mean concentrations and the highest percentage of bacteria standards exceedances occurred during rising and high tides.
- Observations of tidal and hydraulic effects indicated that there is a lack of circulation in the immediate near-shore area of Kiddie Beach, creating an

environment capable of supporting high bacteria densities by providing favorable conditions and organic material from natural and man-made sources.

- Bacteria sampling indicated that bacteria exceedances at Kiddie Beach were not the result of any single point source; i.e., in-harbor activities, the Silver Strand Pump Station, or discharges (including leakage) from other storm drains or sanitary sewers.

- There are a significant number of human and animal activities occurring at or near the beach that could promote direct or indirect bacteria growth and resulting exceedances. These include:
  - Feces from birds, cats and dogs (and potentially children);
  - Food and trash left on the beach or in uncovered trash cans; and
  - Dumping of bait and fish waste.

The Larry Walker Study recommended conducing a circulation study at the HBVC. The circulation study was conducted by Everest International Consultants. The study was designed to define existing circulatory conditions, gauge the ability of enhanced circulation to affects and reduce bacteria exceedances, and to determine the means of enhancing circulation. Bacteria sampling and testing, water current measurements, and a dye study was conducted in support of the circulation study. The study draws some of the following conclusions:

- “The numerical modeling and site observations indicated that the velocities within Kiddie Beach and Hobie Beach are relatively slow resulting in poor circulation compared to the entrance channel and inner harbor areas…”

- “The effect of the Mandalay Bay Generating Station pumping outflow on circulation and contaminant dispersal was found to be significant relative to the water quality at Kiddie Beach and Hobie Beach, although the effect was found to be secondary to the tidal currents. Wind was also found to play a significant role in the dispersal of contaminants originating from Kiddie Beach and Hobie Beach and the effect was found to be strongly dependent on the magnitude and direction of the winds at any given time…”

- “Circulation improvements can be effective at improving water quality through reductions in bacteria exceedances if there is a local source of bacteria. If non-local sources (e.g., inner harbor) are providing a substantial portion of the bacteria loading to the system, then circulation improvement may actually degrade water quality by bringing more contaminated water in to the beach area. The results of the study revealed that the dry weather bacteria exceedances are probably due to local sources, therefore circulation improvement could be effective at improving water quality impairments associated with the local source during dry weather.”

Everest recommended conducting a bacteria source study. The purpose of the study was to determine bacteria sources contributing to the observed elevated levels of bacteria at the HBVC. URS Corporations conducted the source study. Waters and fecal samples were collected and analyzed through ribosomal RNA typing and matching with a known DNA library to identify bacteria sources. The study concluded:

- "The findings demonstrated that combined Avian species represent the most prevalent source among those samples tested, and that they were the only species source reported to be present in water samples collected for each sampling dates over a six-week period. Other species sources were observed with significantly lower frequency."

- "Other species matches were comprised of human and domestic/feral species sources in roughly equal proportions (18% and 14%, respectively), and marine mammal species (4% of all matches)…"

- "Approximately one-half of the 56 total combined Human/Sewage source matches are attributable to humans and one-half to sewage. The precise source of human sewage matches is not known. Based on the information provided in previous studies, there are no known sources of direct sewage discharge to the study area (Larry Walker, 2001)."

For dry-weather, an analysis of the data and findings from the three studies listed above is sufficient to establish a linkage between a combination of diffuse nonpoint sources (i.e., local sources including birds), poor circulation in the swim zone of the HBVC, and elevated levels of bacteria measured at the HBVC.

For wet-weather, an analysis of the studies above and well-understood storm drain and sheet flow contributions demonstrate that storm drains and upstream sources are the primary source of bacteria loading (LARWQCB, 2004a; 2003b; 2002a).

# 6 ALLOCATIONS

## 6.1 Introduction

Waste Load Allocations (WLAs) are allocations of bacteria loads to point sources and Load Allocations (LAs) are allocations of bacteria loads to nonpoint sources. WLAs and LAs are expressed as the number of daily or weekly sample days that may exceed single sample limits (see Section 2) at appropriate monitoring sites. WLAs and LAs are expressed as allowable exceedance days because the bacteria density and frequency of single sample exceedances are the most relevant to public health protection. Allowable exceedance days are "appropriate measures" consistent with the definition in 40CFR §130.2(i).

For each monitoring site, allowable exceedance days are set on an annual basis as well as for three other time periods. These three periods are (1) summer dry-weather (April

1 to October 31), (2) winter dry-weather (November 1 to March 31), and (3) wet-weather (defined as days of 0.1 inch of rain or more plus three days following the rain event).

### 6.1.1 Interim Allocations

The HBVC are assigned interim WLAs and LAs upon the effective date of the TMDL. These allocations are assigned for the duration of the phased implementation schedule (see Section 9.2 and 9.3), and no exceedances of interim WLAs and LAs are allowed during that period. Interim WLAs and LAs are calculated based on the historical bacteria exceedance probability at the existing monitoring locations (see Table 6-3). Interim WLAs and LAs for single sample exceedances and geometric mean exceedances are calculated and summarized in Table 6-1 and Table 6-2.

**Table 6-1 Interim Allocations for Single Sample Exceedances**

| Location | Allowable no. of summer dry-weather exceedance days (daily sampling) | Allowable no. of summer dry-weather exceedance days (weekly sampling) | Allowable no. of winter dry-weather exceedance days (daily sampling) | Allowable no. of winter dry-weather exceedance days (weekly sampling) | Allowable no. of wet-weather exceedance days (daily sampling) | Allowable no. of wet-weather exceedance days (weekly sampling) |
|---|---|---|---|---|---|---|
| Hobie Beach | 54 | 8 | 23 | 3 | 32 | 5 |
| Kiddie Beach* | 40 | 6 | 25 | 4 | 38 | 6 |

*Kiddie Beach is also known as Channel Islands Beach Park or Channel Islands Harbor Beach (see Section 1).

**Table 6-2 Interim Allocations for Geometric Mean Exceedances**

| Location | Allowable no. of summer weather exceedance days (daily sampling) | Allowable no. of summer weather exceedance days (weekly sampling) | Allowable no. of winter weather exceedance days (daily sampling) | Allowable no. of winter weather exceedance days (weekly sampling) |
|---|---|---|---|---|
| Hobie Beach | 55 | 12 | 92 | 13 |
| Kiddie Beach* | 80 | 8 | 91 | 14 |

General NPDES permits, individual NPDES permits, the Statewide Industrial Storm Water General Permit, the Statewide Construction Activity Storm Water General Permit, and WDR permittees in the Channel Islands Harbor subwatershed are assigned WLAs of zero (0) days of allowable exceedances for all three time periods and for the single sample limits and the rolling 30-day geometric mean.

The winter dry-weather LAs are expressed jointly with the winter dry-weather WLAs as allowable exceedances listed in Table 6-4.

The wet-weather LAs and wet-weather WLAs are expressed together and listed in Table 6-5.

The County of Ventura, the Ventura County Watershed Protection District (VCWPD) and associated Municipal Separate Storm Sewer System (MS4) permittees, the City of Oxnard, and Caltrans are the responsible parties in CIH subwatershed and assigned WLAs. In addition, the County of Ventura and the City of Oxnard are assigned LAs.

The VCWPD manages the Silver Strand Pump Station located on the southeast end of Kiddie Beach and the Channel Islands Beach Community Service District (CIBCSD) manages the sanitary sewer system located adjacent to the channel entrance. A low-flow diversion was installed at the Silver Strand Pumping Station in 2003. This diversion redirects low-flows into the sanitary sewer system that would otherwise discharge onto the beach. A subsequent dye test on the pump station sump found no leaks (Larry Walker, 2001). With good management practices and routine inspection and maintenance, the diversion and sanitary sewer system is not a potential load contributor. As a result, the CIBCSD is given WLAs and LAs of zero (0) allowable exceedance days for all time periods including the rolling 30-day geometric means.

The United States Navy operates a Construction Battalion Center in City of Port Hueneme. The center is located east of CIH. The center is not a potentially significant source of bacteria loading. The center is therefore assigned WLAs and LAs of zero (0) allowable exceedances for all time periods including the rolling 30-day geometric means.

Agriculture lands are a significant portion of the CIH subwatershed. Nonpoint source loading from irrigated discharge and wet-weather discharges into the CIH. Due to the nonpoint discharges, agriculture lands are a potential source of bacteria loading. Though potential load contributions of agriculture have not been characterized, monitoring and new data may better quantify the bacteria loading potential of agriculture and be incorporated into the Conditional Waiver for Dischargers from Irrigated Lands (Ag Waiver).

LAs for summer dry-weather and the rolling 30-day geometric mean for all three time periods are zero (0) days of allowable exceedances (see Table 6-3). The winter dry-weather LAs is expressed jointly with the winter dry-weather WLAs as allowable exceedances and listed in Table 6-4. The wet-weather LAs and wet-weather WLAs are expressed together and listed in Table 6-5.

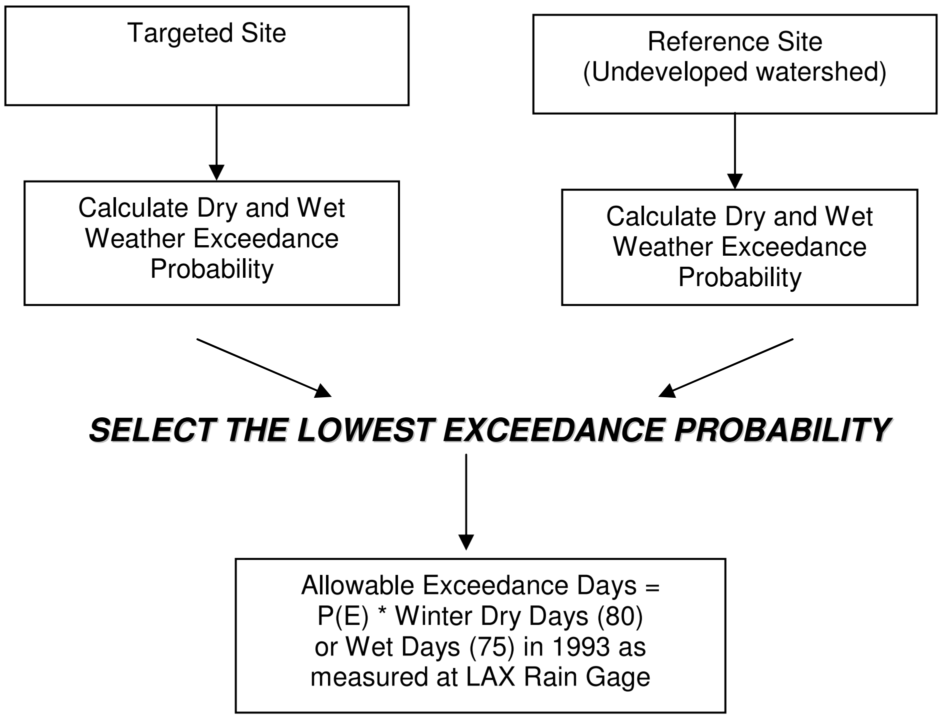
Any future enrollees under a general NPDES permit, individual NPDES permit, the Statewide Industrial Storm Water General Permit, the Statewide Construction Activity Storm Water General Permit, and WDR in the CIH subwatershed will be subject to a WLAs and LAs of zero days of allowable exceedances for summer dry-weather and the 30-day rolling geometric mean. Winter dry-weather and wet-weather WLAs and LAs for future enrollees are listed in Table 6-5. If a nonpoint source is directly impacting bacteriological water quality and causing an exceedance of the numeric targets, the permittee(s) under the MS4 Permits are responsible through these permits.

## 6.2 Allowable Exceedance Days

This TMDL sets the number of allowable exceedance days for each monitoring site to ensure that two criteria are met (1) bacteriological water quality is at least as good as that of a largely undeveloped system, and (2) there is no degradation of existing bacteriological water quality. The number of allowable exceedances days is based on the exceedance frequency at the reference beach, Leo Carrillo Beach.

Regional Board Staff ensures that the two criteria above are met by using the smaller of two exceedance probabilities for any monitoring site multiplied by the number of dry days or wet days for the critical condition (see Section 8). An exceedance probability, P(E), is simply the probability that one or more single sample limits, described in Section 2.2.2, will be exceeded at a particular monitoring site, based on historical data. The flow diagram below illustrates the decision-making process for determining allowable exceedance days at a monitoring site.

**Figure 6-1 Decision-Making Process for Determining Waste Load Allocations (expressed as allowable exceedance days)**




For any one monitoring site, two exceedance probabilities are compared and the lowest one is selected (1) the dry-weather or wet-weather exceedance probability in the reference system, P(E)R and (2) the dry-weather or wet-weather exceedance probability based on historical bacteriological data at that particular site, P(E)i. If the P(E)R is greater than P(E)i, then P(E)i will apply to that particular site (i.e., the site-specific exceedance probability would override the “default” exceedance probability of the reference system). Next, the chosen dry-weather or wet-weather exceedance probability is multiplied by the dry or wet days in the reference year of the reference system as measured at the LAX meteorological station if the P(E)R is lower than P(E)i.

Listed in the following sections is the background information and justification for the two steps in the process described above. First, the dry and wet-weather exceedance probabilities for the monitoring sites were calculated. Then these exceedance probabilities were translated into allowable exceedance days for each time period at the targeted monitoring site, including justifications for the proposed reference beach and reference year.

### 6.2.1 Calculating Dry-Weather and Wet-Weather Exceedance Probabilities

The dry-weather exceedance probability is simply the probability that one or more single sample limits will be exceeded on a dry-weather day at a particular location. The wet-weather exceedance probability is simply the probability that one or more single sample limits will be exceeded on a wet-weather day (see Section 2.4) at a particular location.

Monitoring data from November 1, 1995 to October 31, 2001 were used to determine the exceedance probability of the reference beach for each of the three time periods of concern (i.e., summer dry-weather, winter dry-weather, and wet-weather). Samples were identified as dry- or wet-weather samples using rainfall data from LAX.

For the HBVC, the most recent six or seven years of monitoring data (April 1999 to March 2006) were used to determine the exceedance probability for summer dry-weather, winter dry-weather, and wet-weather. Samples data were classified as wet- or dry-weather samples using the rainfall data from VCWPD.

**Table 6-3 Summary of Calculated Exceedance Probabilities**

| Exceedance Probability | | | | |
|---|---|---|---|---|
| Location ID | Monitoring Location | Summer dry-weather exceedance probability | Winter dry-weather exceedance probability | Wet-weather exceedance probability |
| DHS (010)[4] | Leo Carrillo Beach, at 35000 PCH | 0.00 | 0.03 | 0.22 |
| VCEHD (36000) | Hobie Beach | 0.26 | 0.29 | 0.43 |
| VCEHD (37000) | Kiddie Beach* | 0.19 | 0.31 | 0.51 |

*Kiddie Beach is also known as Channel Islands Beach Park or Channel Islands Harbor Beach (see Section 1).

[4] The Department of Health Services sampled monitoring station DHS (010) weekly from November 1995 to October 2001.

### 6.2.2 Calculating Allowable Exceedance Days at a Targeted Location

To determine allowable exceedance days, the smaller of the two exceedance probabilities, that of the targeted site or the reference site, is selected to use in subsequent calculations.

Regional Board Staff proposes using LCB as the reference site. To translate the exceedance probabilities into allowable exceedance days and exceedance-day reductions, Regional Board Staff proposes to use the number of wet-weather days and the number of dry-weather days in the 90$^{th}$ percentile storm year, based on rainfall data from the Los Angeles International Airport (LAX) meteorological station. Justification for this decision is provided below.

### 6.2.3 Justification for reference beach

Three criteria were used to rate candidate sites for selection as the reference beach. These were (1) percentage of undeveloped land in the watershed, (2) presence of a freshwater outlet to the beach, and (3) availability of historical monitoring data. LCB and its associated drainage, Arroyo Sequit Canyon, best met these criteria. Arroyo Sequit Canyon has the largest percentage of land area in open space (98%) relative to all other Santa Monica Bay subwatersheds, LCB has a freshwater outlet (Arroyo Sequit) to the beach, and there is an existing monitoring site at the beach (see Table 6-2). Furthermore, field surveys by Regional Board Staff have confirmed that there is very little evidence of anthropogenic impact in most of this relatively large subwatershed. The reference system will be re-evaluated as part the Regional Board Re-evaluation listed in the implementation schedules of the TMDL (see Section 9.2 and 9.3).

### 6.2.4 Justification for critical condition (reference year)

Based on an examination of historical rainfall data from the Los Angeles International Airport (LAX) meteorological station[5], Regional Board Staff propose using the 90$^{th}$ percentile storm year[6] in terms of wet-weather days as the critical condition for determining the allowable wet-weather exceedance days. The reference year of 1993 was chosen because it is the 90$^{th}$ percentile year in terms of wet-weather days, based on 54 storm years (1948-2001) of rainfall data from LAX (see Appendix A). In the 1993 storm year, there were 75 wet-weather days; therefore, there were 290 dry days, 80 of which occurred during the winter

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[5] The LAX meteorological station was used, since the station has the longest historical rainfall record in the Los Angeles region.
[6] The "storm year" is defined as November 1 to October 31, in order to be consistent with AB411.

months[7]. By selecting the 90th percentile year, we avoid creating a situation where the reference beach frequently exceeds its allowable exceedance days (i.e., 9 years out of 10, the number of exceedance days at the reference beach should be less than the "allowable" exceedance days at the reference beach)[8].

## 6.3 Translating exceedance probabilities into estimated exceedance days during the critical condition

The estimated number of exceedance days during the critical condition (reference year) was calculated for each site by multiplying the site-specific exceedance probability by the estimated number of dry or wet days in the reference year. The site-specific exceedance probability is taken directly from the historical data analysis, as listed in Table 6-1. Based on 54 storm years of rainfall data from LAX meteorological station, 1993 is the reference year for both dry and wet-weather.

$$E_{CC} = P(E)_i * days_{1993} \qquad \text{(Equation 6.1)}$$

Where $E_{CC}$ is the estimated number of exceedance days under the critical condition and $P(E)_i$ is the average probability of exceedance for any site. The average exceedance probability is appropriate since the weekly sampling is systematic and the rain events are randomly distributed; therefore, sampling will be evenly spread over the dry-weather and wet-weather events (i.e., the rain day, day after, 2nd day after, 3rd day after)[9].

To estimate the number of exceedance days during the reference year *given a weekly sampling regime*, the number of days was adjusted by solving for *x* in the following equation:

$$\frac{days_{1993}}{365 \text{ days}} = \frac{x}{52 \text{ weeks}} \qquad \text{(Equation 6.2)}$$

Using Equation 6.1 and Equation 6.2, the exceedance probability of the reference beach is translated to exceedance days as follows. Analysis of historical monitoring data for LCB, the reference beach, shows that summer dry-weather exceedance probability is 0.00, the winter dry-weather exceedance probability is 0.03, and the wet-weather exceedance probability is 0.22. Per Equation 6.1, the number of summer dry-weather exceedance days is zero (0) at LCB, therefore, no exceedances are allowed at any site during summer dry-

[7] For comparison, in the 1993 storm year, there were 41 *days of rain*, which represented the 75th percentile, and 22.93 *inches of rain*, representing the 94th percentile, for the historical rainfall record at LAX.
[8] If the 10th percentile year, in terms of wet days, were selected to set the allowable exceedance days, the reference beach could foreseeably exceed the allowable exceedance days 9 years out of 10.
[9] Also, note that the Southern California Coastal Water Research Project found no correlation between the day of the week and the percentage of samples exceeding the single sample objectives (Schiff *et al*., 2002).

weather. The exceedance probability of 0.03, for winter dry-weather, is multiplied by 80 days, the number of winter dry-weather days in the 1993 storm year, per Equation 6.1 resulting in three (3) exceedance days when daily sampling is conducted. The exceedance probability of 0.22, for wet-weather, is multiplied by 75 days, the number of wet-weather days in the 1993 storm year at, per Equation 6.1 resulting in 17 exceedance days when daily sampling is conducted.

Regional Board Staff recognizes that the number of winter dry-weather days and wet-weather days will change from year-to-year and, therefore, the exceedance probabilities of 0.03 for winter dry-weather and 0.22 for wet-weather will not always equate to 3 or 17 days, respectively. However, Regional Board Staff proposes setting the allowable number of exceedance days based on the reference year rather than adjusting the allowable number of exceedance days annually based on the number of dry or wet days in a particular year. This is because it would be difficult to design diversion or treatment facilities to address such variability from year to year. Regional Board Staff expects that by designing facilities for the 90th percentile storm year, during drier years there will most likely be fewer exceedance days than the maximum allowable.

To estimating the number of exceedance days at LCB in the reference year under a weekly sampling regime for winter dry-weather and wet-weather, the number of days was adjusted by solving for *x* in Equation 6.2 as follows:

$$\frac{80\ days}{365\ days} = \frac{x}{52\ weeks} \qquad \text{(Equation 6.2 for winter dry-weather)}$$

$$\frac{75\ days}{365\ days} = \frac{x}{52\ weeks} \qquad \text{(Equation 6.2 for wet-weather)}$$

For winter dry-weather, solving for *x* equals 11.4, which is then multiplied by 0.03, resulting in one (1) exceedance day during winter dry-weather when weekly sampling is conducted. For wet-weather, *x* equals 10.7 multiplied by 0.22, results in three (3) exceedance days during wet-weather when weekly sampling is conducted.

The estimated exceedance days for the other sites are calculated, in the same manner, using the site-specific exceedance probabilities for each time period.

For illustrative purposes, in Tables 6-3 through 6-5, for each monitoring site (and assuming a weekly sampling regime), Regional Board Staff present the estimated number of exceedance days under the critical condition, the allowable number of exceedance days calculated as described above, and the necessary exceedance-day reduction for each time period.

**Table 6-4 Estimated Summer Dry-Weather Exceedance Days in Critical Year, Allowable Exceedance Days, and Exceedance-Day Reductions, by Site**

| Monitoring Location | Estimated no. of summer dry-weather exceedance days in critical year (daily sampling) | Estimated no. of summer dry-weather exceedance days in critical year (weekly sampling) | Allowable no. of summer dry-weather exceedance days (daily sampling) | Allowable no. of summer dry-weather exceedance days (weekly sampling) | Estimated final summer dry-weather exceedance day reduction (daily sampling) | Estimated final summer dry-weather exceedance day reduction (weekly sampling) |
|---|---|---|---|---|---|---|
| Leo Carrillo Beach, at 35000 PCH | 0 | 0 | 0 | 0 | 0 | 0 |
| Hobie Beach | 54 | 8 | 0 | 0 | 54 | 8 |
| Kiddie Beach | 40 | 6 | 0 | 0 | 40 | 6 |

The WLAs of zero (0) exceedance days for summer dry-weather is further supported by the fact that the California Department of Health Services has established minimum protective bacteriological standards, the same as the numeric targets listed in this TMDL. The WLAs of zero (0) exceedance days applies to both daily and weekly sampling. When standards are exceeded, from of April 1 through October 31, beaches are posted with health hazard warnings (17 § 7958(a). In order to fully protect public heath and prevent beach postings during this period, Regional Board Staff does not propose to change the zero exceedance days during summer dry-weather.

**Table 6-5 Estimated Winter Dry-Weather Exceedance Days in Critical Year, Allowable Exceedance Days, and Exceedance-Day Reductions, by Site**

| Monitoring Location | Estimated no. of winter dry-weather exceedance days in critical year (daily sampling) | Estimated no. of winter dry-weather exceedance days in critical year (weekly sampling) | Allowable no. of winter dry-weather exceedance days (daily sampling) | Allowable no. of winter dry-weather exceedance days (weekly sampling) | Estimated final winter dry-weather exceedance-day reduction (daily sampling) | Estimated final winter dry-weather exceedance-day reduction (weekly sampling) |
|---|---|---|---|---|---|---|
| Leo Carrillo Beach, at 35000 PCH | 3 | 1 | 3 | 1 | 0 | 0 |
| Hobie Beach | 23 | 3 | 3 | 1 | 19 | 2 |
| Kiddie Beach | 25 | 4 | 3 | 1 | 21 | 3 |

The estimated exceedance-day reductions during winter dry-weather represent an 83% to 84% reduction in the expected number of exceedance days that would occur under the defined critical condition.  For individual locations, the exceedance-day reductions for daily sampling range from a maximum of 2 days to 21 days for daily sampling. Exceedance-day reductions for weekly sampling are 2 days to 3 days.  The allowable winter dry-weather exceedance days at all sites are a maximum of three (3) days for daily sampling and (1) day for weekly sampling.

**Table 6-6 Estimated Wet-Weather Exceedance Days in Critical Year, Allowable Exceedance Days, and Exceedance-Day Reductions, by Site**

| Monitoring Location | Estimated no. of wet-weather exceedance days in critical year (90th percentile and daily sampling) | Estimated no. of wet-weather exceedance days in critical year (90th percentile and weekly sampling) | Allowable no. of wet-weather exceedance days (daily sampling) | Allowable no. of wet-weather exceedance days (weekly sampling) | Estimated final wet-weather exceedance-day reduction (daily sampling) | Estimated final wet-weather exceedance-day reduction (weekly sampling) |
|---|---|---|---|---|---|---|
| Leo Carrillo Beach, at 35000 PCH | 17 | 3 | 17 | 3 | 0 | 0 |
| Hobie Beach | 32 | 5 | 17 | 3 | 15 | 2 |
| Kiddie Beach | 38 | 6 | 17 | 3 | 20 | 3 |

The estimated exceedance-day reductions during winter dry-weather represent a 47% to 53% reduction in the expected number of exceedance days that would occur under the defined critical condition. For individual locations, the exceedance-day reductions range from a maximum of 15 days to 20 days for daily sampling. Exceedance-day reductions for weekly sampling are 2 days to 3 days. The allowable winter dry-weather exceedance days at all sites are a maximum of three (17) days for daily sampling and (2) day for weekly sampling.

# 7 MARGIN OF SAFETY

An explicit margin of safety has been incorporated as the load allocations will allow exceedances of the single sample standards no more than 5% of the time on an annual basis, based on the cumulative allocations for dry- and wet-weather in Section 6. The Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List (SWRCB, 2004b) concludes that there are water quality impairments using a binomial distribution method which lists waterbodies when the exceedances are between approximately 8 and 10 percent.

## 7.1 Bacteria Degradation

In addition, an implicit margin of safety has been included by conservative assumptions which have been made in the development of this TMDL. This TMDL assumes there is no significant decay or degradation of bacteria between the sources and the beaches.

Based on three experiments conducted to mimic natural conditions in or near Santa Monica Bay, two in marine water and one in fresh water, bacteria degradation was shown to range from hours to days. Based on the results of the marine water experiments, the model assumes a first-order decay rate for bacteria of 0.8 d-1 (or 0.45 per day). Degradation rates were shown to be as high as 1.0 d-1 (Noble *et al.*, 1999b).

The transport time for discharges into CIH is short. In CIH Everest found that bacteria "[d]ecay plays a relatively insignificant role in the dispersion of contaminants compared to tidal currents, [Mandalay Bay Generation Station] pumping outflows, and winds" (Everest, 2003). Therefore, the conclusion is that bacteria degradation is not fast enough to greatly affect bacteria densities in the wave wash during wet-weather.

# 8 CRITICAL CONDITIONS

The critical condition is wet-weather and, in particular, the 90$^{th}$ percentile storm year is the critical wet-weather year.

The critical condition in a TMDL defines an extreme condition for the purpose of setting allocations to meet the TMDL numeric targets. The critical condition may also be thought of as an additional margin of safety because the allocations are set to meet the numeric target during an extreme (or above average) condition[10]. Unlike many TMDLs, the critical condition for bacteria loading is not during low flow conditions or summer months, but rather during wet-weather. This is because intermittent loading sources such as surface runoff will have the

[10] Critical conditions are often defined in terms of flow, such as the seven-day-ten-year low flow (7Q10), but may also be defined in terms of rainfall amount, days of measurable rain, etc.

greatest impacts at high (i.e. storm) flows (USEPA, 2001). Local and regional shoreline monitoring data show a higher percentage of daily exceedance of the single sample targets during wet-weather, rather than dry-weather. In addition, more severe bacteriological impairments (indicated by higher magnitude exceedances and exceedances of multiple indicators) are also observed in wet-weather (Noble *et al*., 1999a, Schiff *et al*., 2001).

To identify the critical condition within wet-weather, in order to set the allowable number of exceedance days, described in Section 7, staff propose using the 90$^{th}$ percentile storm year in terms of wet days as the reference year[11]. Staff selected the 90$^{th}$ percentile year for several reasons. First, selecting the 90$^{th}$ percentile year avoids an untenable situation where the reference system is frequently out of compliance. Second, selecting the 90$^{th}$ percentile year allows responsible jurisdictions and responsible agencies to plan for a 'worst-case scenario', as a critical condition is intended to allow. Finally, Regional Board Staff expects that there will be fewer exceedance days in drier years, since structural controls will be designed for the 90$^{th}$ percentile year.

The 90$^{th}$ percentile storm year in terms of wet days was identified by constructing a cumulative frequency distribution of annual wet-weather days using historical rainfall data from LAX from 1947-2001. This rainfall database was chosen due to the extent of the database and to maintain consistency with the other bacteria TMDLs in the Los Angeles Region. With a 90$^{th}$ percentile storm year, only 10% of years should have more wet days than the 90$^{th}$ percentile year. The 90$^{th}$ percentile year in terms of wet days was 1993, which had 75 wet days. The number of wet days was selected instead of total rainfall because a retrospective evaluation of data showed that the number of sampling events, during which greater than 10% of samples exceeded the fecal coliform objective on the day after a rain, was nearly equivalent for rainstorms less than 0.5 inch and those greater than 0.5 inch, concluding that even small storms represent a critical condition (Noble *et al*., 2000). This is particularly true since the TMDL's numeric target is based on number of days of exceedance, not on the magnitude of the exceedance.

# 9 IMPLEMENTATION

## 9.1 Implementation Strategies

The Regional Board is prohibited from specifying the exact manner of compliance with its regulations (Water Code §13360). As a "certified regulatory program,"[12] the Regional Board must satisfy the substantive requirements of 23

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[11] The storm year is defined as November 1 to October 31 to be consistent with the periods specified in AB411.

[12] The Secretary of Resources has certified the State and Regional Boards' basin planning process as exempt from certain requirements of the California Environmental Quality Act (CEQA), including preparation of an initial study, negative declaration, and environmental impact report (14 CCR §15251(g)).

CCR § 3777(a), which requires a written report that includes a description of the proposed activity, an alternatives analysis, and an identification of mitigation measures to minimize any significant adverse impacts. Alternatives are discussed in Section 3 and the discussion of mitigation measures is beyond the scope of the Staff Report. Mitigation measures and the CEQA checklist are included in the Substitute environmental Documents of the TMDL.

Nonpoint sources tend to be more difficult to control compared to point sources and may require the cooperation of several different entities. A variety of strategies exist to reduce bacteria concentration and loading at the HBVC. Rather than any single strategy, a combination of strategies may be required to reduce bacteria exceedances to acceptable levels. These strategies are loosely categorized as Structural Best Management Practices (BMPs) and non-structural BMPs.

### 9.1.1 Structural Best Management Practices

Structural BMPs are designed to target specific lands uses, time periods or events, as well as sources to comply with the listed WLAs and LAs (see Section 6.1). Dry-weather structural BMPs vary in size and complexity and can be categorized further as infrastructure improvements and beach structures.

#### 9.1.1.1 Dry-Weather Structural BMPs

##### 9.1.1.1.1 Infrastructure Improvements

Several infrastructure improvements have been used, are currently used, and have been proposed as an implementation strategy.

1. The Santa Monica Bay Epidemiological Study has concluded a positive association between high indicator bacteria densities from urban storm drain discharges and illness (see Section 1.3). While direct storm drain discharges into the swim zone are diverted at the HBVC, low-flow discharges into harbor waters are still present. The storm drain near U.S. Coast Guard facility is a potential source of bacteria loading at the HBVC. Bacteria loading from other storm drains in the inner harbor are likely if the initial concentration is high (Everest, 2003). Low-flow diversions will reduce bacteria loading associated with these sources and are utilized in several beaches throughout the region including the Santa Monica Bay Beaches, Mother’s Beach in the Marina del Ray Harbor, and Inner Cabrillo Beach in the port of Los Angeles (LARQWCB 2004a, 2003b, 2002b, 2002a). Low-flow diversions are designed to divert low-flows to the local Publicly-Owned Treatment Works for treatment rather than discharging into surface waters.

2. Recent studies suggest that beach sediment can act as a favorable environment for bacteria growth and a reservoir for indicator bacteria (Langier and Taggart, 2006; Lee *et al.,* 2006). Beach sand replacement is an employable strategy to reduce bacteria loading via beach sediment bacteria leaching. Beach sand replacement has been recommended as a corrective measure at Inner Cabrillo Beach in the Port of Los Angeles to "increase permeability and flushing" (City of Los Angeles, 2006b; 2006a). Beach sand replacement consist of replacing the existing finer sand types with coarser types of sand (Langier and Taggart, 2006).

3. To further increase the permeability and infiltration rate of beach sand, resurfacing of the HBVC with gravel or other larger particle-sized rock aggregates could be considered as a potential implementation strategy.

4. Beach sand sanitation is a direct means of reducing and eliminating bacteria growth in beach sand. Thermal sanitation is a method of directly reducing bacteria concentrations in beach sand. A steam generator can be applied directly to the beach to increase the temperature of the sand, thus reducing bacteria concentrations.

5. Retention, filtration, biorentention, and biofiltration are discussed further in Section 9.1.1.2.

###### 9.1.1.1.2 Beach Structures

Beach structures are physical structures built on or near the beach as a means of controlling and reducing the bacteria loading in swimmable waters. The following sections describe structures that have been used, examined, or proposed as an implementation strategy.

1. Nonpoint sources are a significant source of bacteria loading in beach waters (see Section 4.3). Avian (bird) sources remain one of the primary local sources of bacteria loading. Birds naturally inhabit the California coastline. Bird excluders are designed to reduce the amount of birds congregating at the tidal zones of the beach. The structures consist of galvanized fence polls with Dacron braids strung between the polls in a grid-like fashion (City of Los Angeles, 2006a). Bird excluders were installed on Inner Cabrillo beach in the Port of Los Angeles to reduce the bird fecal loading in the swim zone. A bird excluder effectiveness study, conducted by City of Los Angeles, concluded a 65% reduction in bacteria exceedances (Dalkey and Bahariance, 2003). A subsequent study conducted in 2006 by the City of Los Angeles concluded that the devices had a significant impact in

the reduction of violations of bacteria water quality standards (City of Los Angeles, 2006a).

2. Squawkers are another BMP designed to reduce bird fecal loading, when strategically located. Squawkers are devices that produce sound levels significantly higher than ambient levels. The sounds emitted by these devices bare a faint resemblance to the "squawking" noise produced by startled birds, hence the name Squawker. These devices have been piloted by the Harbor Department at the HBVC (VCHD Personal Communications, 11 December 2006).

3. The HBVC are enclosed beaches located at the entrance of a Harbor. Being enclosed beaches they share the distinction of poor circulation. Enhancing circulation at the HBVC is an implementation strategy designed to improve the mixing capacity at these beaches, decreasing the ambient bacteria densities. Mechanical circulation is the recommended alternative for enhancing circulation at the HBVC (Everest, 2003). Enhanced circulation is also a listed implementation strategy in the Inner Cabrillo Beach Bacteria TMDL and Mother's Beach Bacteria TMDL (LARWQCB, 2004a; 2003b).

   Largier and Taggart suggest that increasing water circulation at enclosed beaches may improve water quality (Largier and Taggart, 2006). Listed below are some devices that were studied and piloted by different companies and municipalities throughout California.

   a. The City of Dana Point conducted a study piloting Oloids™, developed by WTC technologies, for enhancing circulation at Baby Beach (Everest, 2006). Oloids™ are water agitators designed to enhance circulation throughout the water column. The devices have a mixing capacity of 1.9 to 7.6 million gallons per day (MGD). Baby Beach experienced improved circulation as a results of these devices, however the study suggest that optimal siting could improve the results in future studies.

   b. The City of Newport Beach conducted a study at the Newport Dunes Lagoon to pilot a horizontal-flow enhanced circulation device (Everest, 2002). The InStreem™ units, patented by Battelle Memorial Institute, have a flow rate of 3 to 6 MGD. The study found that the units "substantially improve[d] water circulation and mixing at the Newport Dunes Lagoon."

   c. Circulations pumps are another structural BMP that can significantly enhance circulation in the swim zone, when optimally located. Circulation studies conducted at Inner Cabrillo correlated a significant improvement in water quality through enhanced circulation with manual pumps (City of Los Angeles, 2006a; LARWQCB, 2004b).

#### 9.1.1.2 Wet-Weather Structural BMPs

Storm water washes pollutants off roof-tops, pavement, streets, agricultural fields, and lawns. Wet-weather flow is a much more difficult problem to control then dry-weather. Sources are diffuse and often require sub-regional and regional coordination and cooperation to control.

##### 9.1.1.2.1 Sub-Regional Structural BMPs

Sub-regional structural BMPs consist of a single or a series of BMPs designed to treat wet-weather flows for limited sub-regions within the subwatershed. Sub-regions can vary in size from small parking lot to several city blocks. These sub-regional implementation strategies often have multiple pollutant treatment potential (MdR, 2007). Listed below are a few sub-regional structural BMPs and brief description of each:

- Vegetated biofiltration systems include swales, filter strips, bioretention areas, and storm water planters (McCoy *et al.*, 2006a). Vegetated systems involve the use of soils and vegetation to filter and treat storm water prior to discharge.. Additional bioslopes, infiltration trenches, soil grading alterations, bioretention ponds, and the use of selective vegetation can further increase the efficiency of vegetative biofiltration systems.

- Local retention and infiltration improvements, like porous paving, retention ponds, cisterns, and infiltration pits, can promote retention and added infiltration of storm water rather then run-off over impervious surfaces (McCoy *et al.*, 2006a).

##### 9.1.1.2.2 Regional Structural BMPs

Regional structural BMPs contain many similarities to sub-regional regional structural BMPs but differ in both the scope and scale of the implementation strategy. Treatment areas can range from several sub-regions to the entire subwatershed. Regional structural BMPs retain the multiple treatment potential of sub-regional BMPs. Listed below are a few regional structural BMPs and a brief description of each:

- Regional biofiltration systems, including surface flow and sub-surface flow wetlands, promote hydrolysis, oxidation, rhizodegradation, filtration through the aerobic and anaerobic zones of the soil matrix (Halverson, 2004). These systems can treat a variety of different pollutants and can be utilized for flood mitigation.

- Regional infiltration and detention systems, including detention and infiltration basin, help reduce flow volume in lower stream areas and promote sedimentation (McCoy *et al.*, 2006a).

### 9.1.2 Non-structural Best Management Practices

Non-structural BMPs is a broad-based description of implementation strategies not of an extensive structural nature. Non-structural BMPs are further categorized as administrative controls and outreach and education.

#### 9.1.2.1 Administrative Controls

Administrative controls are a highly variable implementation strategy. Administrative controls require less initial investment of time, compared to structural BMPs, due to the lack of planning of and capital required for dry-weather implementation. However, continuous implementation may be more time intensive. These actions include better enforcement of harbor ordinances, existing pet disposal ordinances, existing litter ordinances, posting additional signage, continuing feral cat population control, proposing stricter penalties, and other actions of an administrative nature for dry-weather.

Wet-weather administrative controls tend to be more costly and have a far greater scope. New developments and redevelopments in the Ventura County have to comply with the terms of the MS4 permit. This includes meeting the current Ventura County Storm Water Quality Urban Impact Mitigation Plan standards for appropriate post-construction storm water BMPs and the use of Low Impact Development (LID). Sub-regional and Regional wide plans for sheet-flow diversion may need to be developed. A green building program similar to one developed in the City of Santa Monica can help promote sustainability (McCoy and Hartwich, 2006).

#### 9.1.2.2 Outreach and Education

Outreach and education is potentially the most effective long-term implementation strategy for ensuring compliance with bacteria water quality standards. Information regarding the adverse impacts associated with illicit boat discharges, fishing waste, litter, and feral cat and birds feeding should be made readily available to the general public. Outreach and education efforts should target local-area residents and frequent visitors for dry-weather at the HBVC given the higher risk levels experienced by these groups. For wet-weather outreach and education should target local planning groups, community groups, and agricultural organizations due to the region wide effort necessary to control wet-weather bacteria loading.

### 9.1.3 Existing Compliance Strategies

The Harbor Department has piloted the use of squawkers for controlling bird populations on the HBVC. Varying degrees of success where observed with the devices (VCHD Personal Communications, 11 December 2006). In September 1999 a temporary diversion was installed at the Silver Strand Pumping Station (Larry Walker, 2001). In 2003 a permanent low-flow diversion was installed at the station to divert dry-weather flows to the nearby sanitary sewer system.

The Harbor Department conducted a cat removal project in July 2000 to address the large population of feral cats living in the rocks adjacent to the HBVC. The Harbor Department also entered into an annual contract with the Greyfoot Cat Rescue to maintain the cat population (Larry Walker, 2001). These administrative controls were conducted prior to the source study identifying feral cats as a significant source of bacteria loading at the HBVC. Other existing non-structural BMPs include trashcan lids, “pet pick-up mitt” dispensers, posted signage discouraging cat and bird feeding, and fish cleaning restrictions (VCHD Personal Communications, 11 December 2006). Figure 9-1 and 9-2 are pictures of the installed trashcan lids and “pet pick-up mitt” dispenser.

**Figure 9-1 Trashcan Lids**

**Figure 9-2 Pick-up Mitt Dispenser**


## 9.2 Implementation Schedule

The proposed implementation schedule shall consist of a phased approach as discussed below. To differentiate between the different stakeholder groups for each site, separate implementation schedule are listed for the HBVC. Refer to Table 9-2 and Table 9-3 for the implementation schedule. The final allowable exceedance days are evaluated in a weekly and daily manner in Table 9-1.

**Table 9-1 Final Allowable Exceedance Days by Location**

| Location Name | Summer dry-weather* | | Compliance Deadline | Winter dry-weather | | Compliance Deadline | Wet-weather** | | Compliance Deadline |
|---|---|---|---|---|---|---|---|---|---|
| | Daily sampling (No. days) | Weekly sampling (No. days) | | Daily sampling (No. days) | Weekly sampling (No. days) | | Daily sampling (No. days) | Weekly sampling (No. days) | |
| Hobie Beach | 0 | 0 | Five years after effective date of the TMDL*** | 3 | 1 | Five years after effective date of the TMDL | 17 | 3 | Ten years after effective date of the TMDL |
| Kiddie Beach | 0 | 0 | Five years after effective date of the TMDL | 3 | 1 | Five years after effective date of the TMDL | 17 | 3 | Ten years after effective date of the TMDL |

*A dry day is defined as a non-wet day.
**A wet day is defined as a day with 0.1-inch or more of rain and the three days following the rain event.
***The effective date of the TMDL is the date in which the TMDL is approved and included in the Basin plan. The TMDL must first be adopted by the Regional Board, approved by the State Board, approved by the Office of Administrative Law, and finally approved by USEPA before the TMDL is included in the Basin and becomes enforceable.

Interim WLAs and LAs are assigned at the effective date of the TMDL (see Table 6-1 and 6-2). Compliance monitoring for the HBVC are based on existing monitoring protocols and locations. Monitoring shall continue at sampling locations (VCEHD 36000 and VCEHD 37000) and at the current weekly monitoring frequency, consistent with AB411 compliance monitoring. Bacteria monitoring at the HBVC shall be conducted on year-round basis.

Six months after the effective date of the TMDL, responsible parties shall submit a draft work plan to implement source control and BMPs, including but not limited to structural and non-structural BMPs, at the HBVC during dry-weather for Executive Officer[13] approval. The draft work plan for wet-weather is due one year and six months after the effective date of the TMDL. The final work plan for dry-weather is due three years and six months after the effective date of the TMDL and the final work plan for wet-weather is due four years after the effective date of the TMDL. Compliance reports shall be submitted for Executive Officer approval six, eight, and ten years after the effective date of the TMDL. Compliance Reports shall include an evaluation of compliance with dry-weather allocations, interim wet-weather allocations, and rolling 30-day geometric mean targets.

The Regional Board is prohibited from specifying the exact manner of compliance with its regulations (Water Code §13360). Responsible parties are not specifically required to conduct pilot projects for BMPs, though conducting pilot projects are within their discretion. The Regional Board recognizes the long duration required to conduct a pilot project. As such, time is allocated in the implementation schedule for the option of piloting structural BMPs, which include but are not limited to enhanced circulation devices. The work plan piloting structural BMPs shall be submitted to the Executive Officer for approval one year and six months after the effective date of the TMDL. Pilot projects are to be completed two years and six months after the effective date of the TMDL. Refer to Table 9-2 for the detailed implementation schedule and Table 9-3 for the implementation chart.

The Regional Board shall reconsider this TMDL four years after the effective date of the TMDL for the Harbor Beaches of Ventura County to re-evaluate WLAs and LAs based on monitoring data; to re-evaluate the implementation schedule based on results from pilot projects; to re-evaluate allowable exceedance levels, including whether the allowable number of exceedance days maybe adjusted based on a Ventura County rainfall record; to re-evaluate the selection of the reference beach if additional, appropriate reference beach options have been developed; and to assigned LAs to agricultural lands in the Chanel Islands Harbor subwatershed based on monitoring in the Conditional Waiver for Dischargers from Irrigated Lands.

Five years after the effective date of the TMDL, there shall be no allowable exceedances of the single sample limits, in excess of the allowable exceedances listed in Table 9-1, at any monitoring location at the Harbor Beaches of Ventura County during summer dry-weather, winter dry-weather, and the rolling 30-day geometric mean targets

[13] The Executive Officer is the ranking administrative officer at the Regional Board.

shall be achieved.  Ten years after the effective date of the TMDL there shall be no allowable exceedances of the single sample limits, in excess of the allowable exceedances listed in Table 9-1, at any monitoring location during dry-weather or wet-weather at the Harbor Beaches of Ventura County, and the rolling 30-day geometric mean targets shall be achieved.

**Table 9-2 Harbor Beaches of Ventura County Bacteria TMDL: Implementation Table**

| Implementation Action | Responsible Parties | Date |
|---|---|---|
| Compliance (WLAs):<br>There shall be no exceedances of the interim WLAs (see Section 6.1.1). | 1. County of Ventura<br>2. Ventura County Watershed Protection District (VCWPD) and associated MS4 Co-permittees in the Channel Islands Harbor (CIH) Subwatershed[14]<br>3. City of Oxnard<br>4. California Department of Transportation (Caltrans) | Effective date of the TMDL. |
| Compliance (LAs):<br>There shall be no exceedances of the interim LAs (see Section 6.1.1). | 1. County of Ventura<br>2. City of Oxnard | Effective date of the TMDL. |
| Monitoring:<br>Continue monitoring at stations VCEHD 36000 and VCEHD 37000, at a weekly monitoring frequency, and on a year-round basis. Extend the monitoring period for Hobie Beach to include winter months. | 1. County of Ventura<br>2. VCWPD and associated MS4 Co-permittees in the CIH subwatershed<br>3. City of Oxnard<br>4. Caltrans | Effective date of the TMDL. |
| Monitoring[15]:<br>Submit a monitoring plan for the Harbor Beaches of Ventura County (HBVC) for approval by the Executive Officer. | 1. County of Ventura<br>2. VCWPD and associated MS4 Co-permittees in the CIH subwatershed<br>3. City of Oxnard<br>4. Caltrans | Prior to the modification of existing monitoring locations or frequencies. |
| Implementation:<br>Submit draft work plan to implement source control and BMPs, including but not limited to structural and non-structural | 1. County of Ventura<br>2. VCWPD and associated MS4 Co-permittees in | Six months after the effective date of the TMDL. |

[14] Co-permittees of Municipal Separate Storm Sewer System (MS4) permit for Channel Islands Harbor subwatershed include the County of Ventura and incorporated cities therein. The incorporated cities for Channel Islands Harbor subwatershed include the City of Oxnard.
[15] Submittal of a monitoring plan is required if additional monitoring stations are added or if changes are made to the sampling frequencies or existing monitoring locations VCEHD 36000 and VCEHD 37000).

**Table 9-2 Harbor Beaches of Ventura County Bacteria TMDL: Implementation Table**

| Implementation Action | Responsible Parties | Date |
|---|---|---|
| BMPs, at the HBVC during dry-weather for Executive Officer approval. | the CIH subwatershed<br>3. City of Oxnard<br>4. Caltrans | |
| Monitoring:<br>Submit monitoring plan for agricultural discharges into the Channel Islands Harbor subwatershed for approval by the Executive Officer. | 1. Agricultural Dischargers | One year after the effective date of the TMDL. |
| Monitoring:<br>Monitor agricultural discharges at the frequency and monitoring locations approved by the Executive Officer in the monitoring plan. | 1. Agricultural Dischargers | One year and six months after the effective date of the TMDL. |
| Pilot Project:<br>Submit a work plan piloting Structural BMPs, including but not limited to enhanced circulation devices, for Executive Officer approval (optional). | 1. County of Ventura<br>2. VCWPD and associated MS4 Co-permittees in the CIH subwatershed<br>3. City of Oxnard<br>4. Caltrans | One year and six months after the effective date of the TMDL. |
| Implementation:<br>Submit draft work plan to implement source control and BMPs, including but not limited to structural and non-structural BMPs, at the HBVC during wet-weather for Executive Officer approval. | 1. County of Ventura<br>2. VCWPD and associated MS4 Co-permittees in the CIH subwatershed<br>3. City of Oxnard<br>4. Caltrans | One year and six months after the effective date of the TMDL. |
| Pilot Project:<br>Completion of Structural BMP pilot projects, including but not limited to enhanced circulation devices (optional). | 1. County of Ventura<br>2. VCWPD and associated MS4 Co-permittees in the CIH subwatershed<br>3. City of Oxnard<br>4. Caltrans | Two years and six months after the effective date of the TMDL. |
| Implementation:<br>Submit final work plan; to implement source control and BMPs, including but not | 1. County of Ventura<br>2. VCWPD and associated | Three years and six months after |

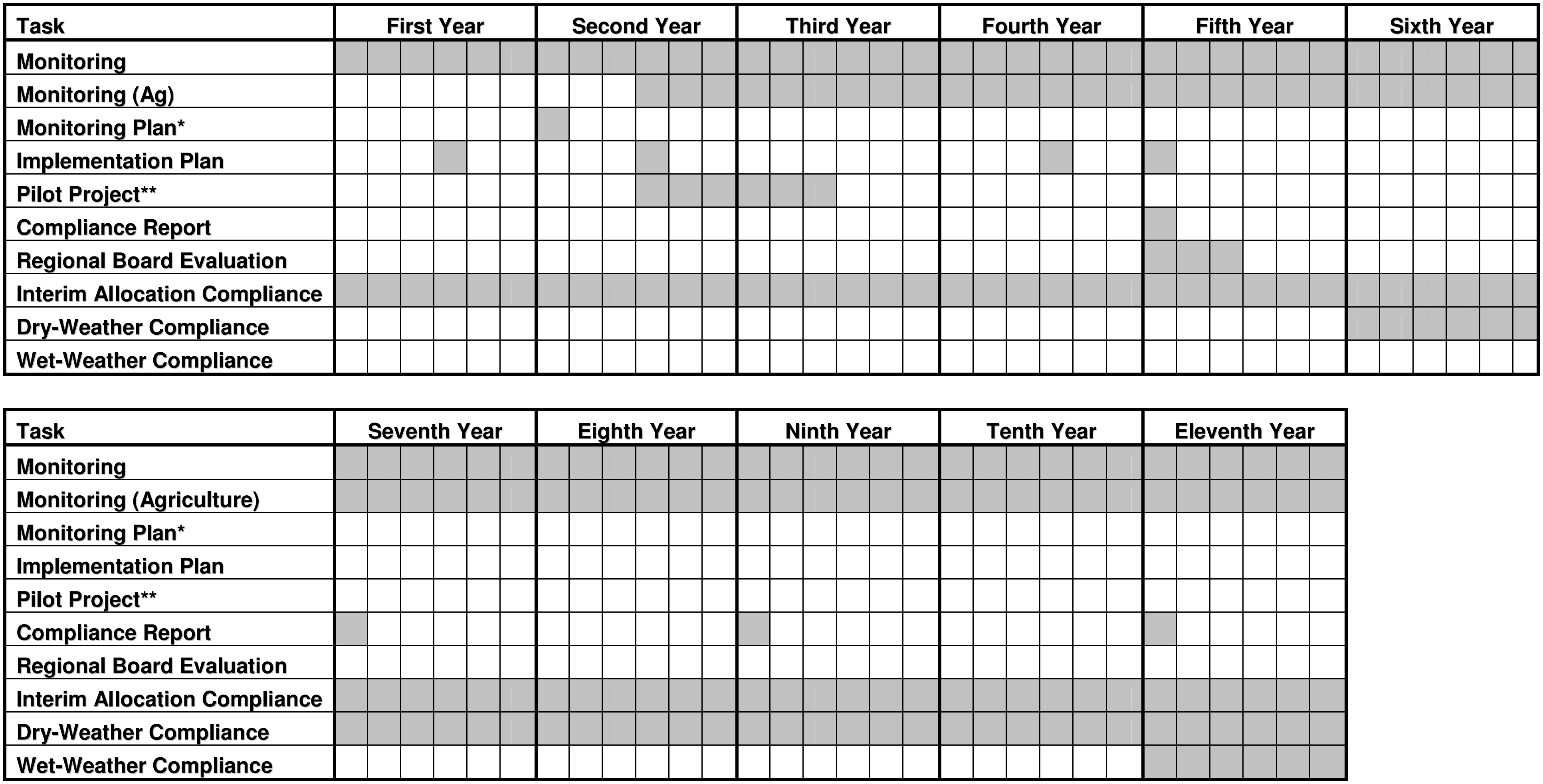
**Table 9-2 Harbor Beaches of Ventura County Bacteria TMDL: Implementation Table**

| Implementation Action | Responsible Parties | Date |
|---|---|---|
| limited to structural and non-structural BMPs, at the HBVC during dry-weather for Executive Officer approval. | MS4 Co-permittees in the CIH subwatershed<br>3. City of Oxnard<br>4. Caltrans | the effective date of the TMDL. |
| Regional Board Reconsideration:<br>a. Re-evaluate WLAs and LAs based on data.<br>b. Re-evaluate the implementation schedule based on results from pilot projects.<br>c. Re-evaluate allowable exceedance levels, including whether the allowable number of exceedance days maybe adjusted based on a Ventura County rainfall record.<br>d. Re-evaluate the selection of the reference beach if additional, appropriate reference beach options have been developed.<br>e. Assign LAs to agricultural lands in the Channel Islands Harbor subwatershed based on monitoring in the Conditional Waiver for Dischargers from Irrigated Lands. | Regional Board | Four years after effective date of the TMDL. |
| Implementation:<br>Submit final work plan to implement source control and BMPs, including but not limited to structural and non-structural BMPs, at the HBVC during wet-weather for Executive Officer approval. | 1. County of Ventura<br>2. VCWPD and associated MS4 Co-permittees in the CIH subwatershed<br>3. City of Oxnard<br>4. Caltrans | Four years after the effective date of the TMDL. |
| Compliance (WLAs):<br>There shall be no exceedances in excess of the numbers in Table 9-1 of the single sample limits at any location during dry-weather, and the rolling 30-day geometric mean targets shall be achieved. | 1. County of Ventura<br>2. VCWPD and associated MS4 Co-permittees in the CIH subwatershed | Five years after the effective date of the TMDL. |

**Table 9-2 Harbor Beaches of Ventura County Bacteria TMDL: Implementation Table**

| Implementation Action | Responsible Parties | Date |
|---|---|---|
| | 3. City of Oxnard<br>4. Caltrans | |
| Compliance (LAs):<br>There shall be no exceedances in excess of the numbers in Table 9-1 of the single sample limits at any location during dry-weather, and the rolling 30-day geometric mean targets shall be achieved. | 1. County of Ventura<br>2. City of Oxnard | Five years after the effective date of the TMDL. |
| Compliance:<br>Submit Compliance Report for Executive Officer approval. The Compliance Report shall include an evaluation of compliance with dry-weather allocations, interim wet-weather allocations, and rolling 30-day geometric mean targets. | 1. County of Ventura<br>2. VCWPD and associated MS4 Co-permittees in the CIH subwatershed<br>3. City of Oxnard<br>4. Caltrans | Six and Eight years after the effective date of the TMDL. |
| Compliance:<br>Submit Final Compliance Report for Executive Officer approval. The Compliance Report shall include an evaluation of compliance with dry-weather allocations, wet-weather allocations, and the rolling 30-day geometric mean targets. | 1. County of Ventura<br>2. VCWPD and associated MS4 Co-permittees in the CIH subwatershed<br>3. City of Oxnard<br>4. Caltrans | Ten years after the effective date of the TMDL. |
| Final Compliance (WLAs):<br>There shall be no allowable exceedances of single sample limits in excess of the numbers listed in Table 9-1 of the single sample limits at any location during any periods and the rolling 30-day geometric mean targets shall be achieved. | 1. County of Ventura<br>2. VCWPD and associated MS4 Co-permittees in the CIH subwatershed<br>3. City of Oxnard<br>4. Caltrans | Ten years after the effective date of the TMDL. |
| Final Compliance (LAs):<br>There shall be no allowable exceedances of single sample limits in excess of the numbers listed in Table 9-1 of the single sample limits at any location during any periods and the rolling 30-day geometric mean targets shall be achieved. | 1. County of Ventura<br>2. City of Oxnard | Ten years after the effective date of the TMDL. |

**Table 9-3 Implementation Chart for Harbor Beaches of Ventura County**




*A monitoring plan is required if additional monitoring stations are added or if changes are made to the sampling frequencies or existing monitoring locations VCEHD 36000 and VCEHD 37000). Submittal of a monitoring plan, for agricultural dischargers, is mandatory.

**Responsible parties are not specifically required to conduct pilot projects for BMPs, though conducting pilot projects are within their discretion.

## 9.3 Monitoring

Compliance and monitoring at the HBVC is based on existing monitoring protocols and locations.

Monitoring shall continue at sampling locations (VCEHD 36000, and VCEHD 37000) and current weekly monitoring frequency, consistent with AB411 compliance monitoring. Monitoring shall be conducted on a year-round basis at the current monitoring locations including the summer months (i.e., April to October) and winter months (i.e., November to March). Bacteria sampling shall be conducted in ankle- to knee-high water pursuant to 17 CCR §7961(b). However, if additional monitoring stations are added or if changes are made to the sampling frequencies or existing monitoring locations, then submittal of a monitoring plan is required for Executive Officer approval.

For agricultural dischargers, the Conditional Waiver for Dischargers from Irrigated Lands shall be revised to include monitoring for enrollees in the Channel Islands Harbor subwatershed.

## 9.4 Special Studies

Special studies are not required for implementation of the TMDL, though conducting pilot projects are within the discretion of responsible parties. Responsible parties may choose to conduct special studies at the HBVC to address information gaps and to better comply with the final WLAs and LAs.

## 9.5 Cost Considerations

To estimate the cost of implementing the TMDL, Regional Board Staff has approximated all the costs given the information available at the time. These costs include dry- and wet-weather structural BMP costs and non-structural BMP costs.

### 9.5.1 Structural Best Management Practices

#### 9.5.1.1 Dry-Weather Structural Best Management Practices

##### 9.5.1.1.1 Storm Drain Diversion

The cost estimates for storm drain diversion are based on the cost analysis for the Santa Monica Bay Beaches Wet-Weather Bacteria TMDLs, the Marina del Rey Harbor Mothers' Beach and Back Basins Bacteria TMDL, and the Los Angeles Harbor Bacteria TMDL (Inner Cabrillo Beach and Main Ship Channel). "The annualized capital cost to construct 10 low-flow diversions is estimated at $717,386, assuming financing for 20 years at 7 percent. The operation and maintenance costs, for all 27 diversions, are estimated at $1.7 million"

(LARWQCB, 2004a; 2003b; 2002b; 2002a). Based on a simple scaling ration, the operation and maintenance costs of diverting 10 storm drains is $0.63 million (M), and the total annualized cost for 10 storm drains is estimated at $1.34 M.

The number of low-flow diversions necessary at the harbors are unknown. Flow modeling may determine the optimum number of low-flow diversions necessary to comply with the dry-weather targets. Based on the estimated annualized capital cost of $1.34 M per 10 storm drains, the cost per storm drain diversion is roughly $0.13 M.

###### 9.5.1.1.2 Enhanced Circulation

Cost estimates for enhanced circulation devices vary due to the number of devices available and the corresponding pricing. Listed below is a cost comparison of some available enhanced circulation devices.

- The City of Dana Point piloted six Oloid™ enhanced circulation devices in the water's of Baby Beach. Capital and construction costs for six units are estimated at $0.25 M. The Operations and maintenance (O&M) cost[16] is estimated at 2% of the capital and construction cost annually. Using a conservative estimate of six units for the HBVC, the estimated total cost of six Oloid™ enhanced circulation devices at the HBVC including 10 years of O&M is $0.30 M. The estimated cost does not include design, review, permitting, or contingency costs.

- InStreem™ enhanced circulation devices were the selected mechanical flow devices for analysis in the CIH circulation study (Everest, 2003). The study found that two InStreem™ enhanced circulator devices would be sufficient to enhance circulation at the HBVC. Capital and construction costs are estimated at $0.28 M for two units. The O&M cost is estimated at $0.4 M for 20 years and $0.2 M for 10 years. The total costs for two units at the HBVC are estimated at $0.48 M, including 10 years of O&M.

- The City of Los Angeles Proposition O Report conducted a cost analysis for two pumps for enhancing circulation at Inner Cabrillo Beach (City of Los Angeles, 2006b). The Proposition O Report estimated the total project cost, excluding dredging and Eel grass removal, at $0.55 M. The O&M cost are estimated at 2% of the capital and construction cost annually. Assuming that two units are sufficient for the HBVC, the total estimated cost of two units, including 10 years of O&M, is estimated at $0.66 M.

The estimated total cost of enhanced circulation devices range between $0.30 M to $0.66 M including 10 years of O&M. Regional Board Staff acknowledges that a more accurate cost estimate for enhanced circulation cannot be made without

[16] O&M cost are based on continuous operation 24 hours a day and 365 days a year with allowances for maintenance and repair.

first analyzing and determining the optimal configuration and quantities of devices needed to sufficiently enhance circulation.

#### 9.5.1.2 Wet-Weather Structural Best Management Practices

The Marina del Rey Bacteria TMDL Implementation Plan estimates the cost of sub-regional structural BMPs to vary between $1M to $2M per site depending on the BMP selected (MdR, 2007). The number sub-regional structural BMPs required to achieve compliance with the wet-weather bacterial targets is unknown.

Regional structural BMP costs vary between different BMPs, total treatment area, flow potential, and treatment capacity. The Malibu Creek and Lagoon Bacteria TMDL Implementation Plan estimates the cost of regional structural BMPs at $31M for capital and O&M cost. The Malibu Creek and Lagoon subwatershed is estimated at 109 square miles (~69,760 acres) (McCoy *et al.*, 2006b). The CIH subwatershed is estimated at ~11.38. Using a scaling ration, the regional structural BMPs cost is estimated at $3.24 M for CIH subwatershed. Land acquisition costs were excluded from the cost estimate.

### 9.5.2 Non-structural BMPs

Cost estimates for non-structural BMPs at the HBVC, including administrative controls and outreach and education, are referenced from the Marina del Rey Harbor Bacteria TMDL Implementation Plan (MdR, 2007). The Marina del Ray Harbor subwatershed is approximately 1,855 acres (~2.9 square miles). The implementation plan discusses cost for institutional control and public participation programs similar to the administrative controls and outreach and education mentioned in Section 9.1.2. The estimated cost for administrative controls ranges from $0.1 to $0.5 M per year and the estimate cost for outreach and education are $0.25 M per year at the Marina del Rey watershed. The CIH subwatershed is estimated at ~11.38 miles. Based a simple scaling ration, the total cost is estimated for the CIH subwatershed to range from $0.39 M to $1.96 M for administrative controls and $0.98 M for outreach and education.

# 10 **REFERENCES**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