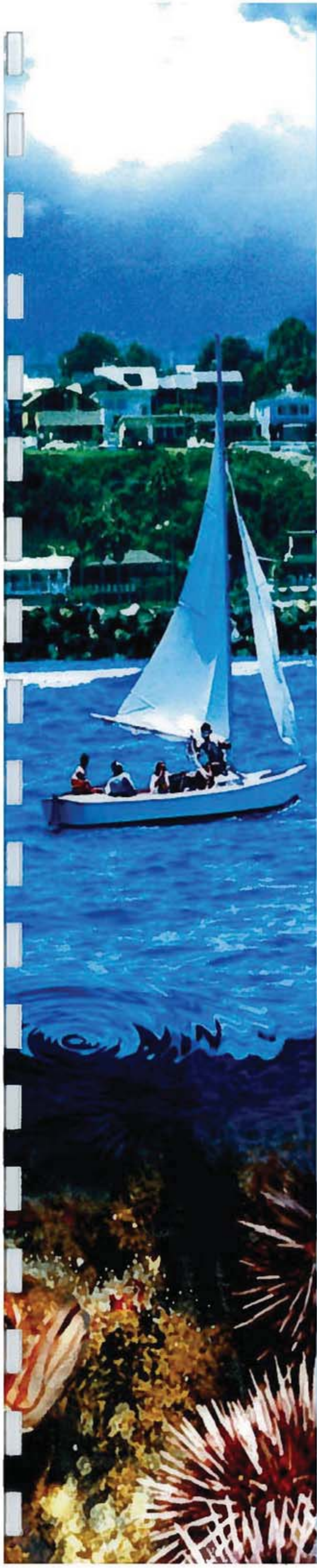

Draft

ORANGE COUNTY SANITATION DISTRICT 1999 STRATEGIC PLAN

Program Environmental Impact Report

June 1999

Prepared for:

Orange County Sanitation District

ESA Environmental Science Associates

In Association with
MEC Analytical Systems, Inc.
&
KP Lindstrom, Inc.

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960436

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SUMMARY

SUMMARY

S.1 INTRODUCTION

This Draft Environmental Impact Report (EIR) assesses the potential impacts of the Orange County Sanitation District 1999 Strategic Plan. This document has been prepared in accordance with the California Environmental Quality Act (CEQA) statues and guidelines, as amended through 1998. The Orange County Sanitation District (OCSD or District) is the lead agency for this CEQA process. Inquiries about the project should be directed to:

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10844 Ellis Avenue
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S.2 BACKGROUND AND OBJECTIVES

Approximately 2.2 million people are served by the District's wastewater system in a 450-square mile area consisting of northern Orange County. The District presently serves 23 cities, including Anaheim, Brea, Buena Park, Costa Mesa, Cypress, Fountain Valley, Fullerton, Garden Grove, Huntington Beach, Irvine, La Habra, La Palma, Los Alamitos, Newport Beach, Orange, Placentia, Santa Ana, Seal Beach, Stanton, Tustin, Villa Park, Westminister, and Yorba Linda. Treatment and collection facilities are located throughout the service area. In addition, small portions of Long Beach, Lakewood, Cerritos, La Mirada, La Habra Heights, and other very small portions of Los Angeles, Riverside, and San Bernardino Counties are also served by the District. These existing facilities are at or nearing capacity and, under current conditions, cannot meet anticipated long-term (year 2020) wastewater conveyance in the region.

The objectives of the Strategic Plan are:

(1) To plan for wastewater collection, treatment, and disposal facilities to serve the needs of the OCSD service area through 2020;

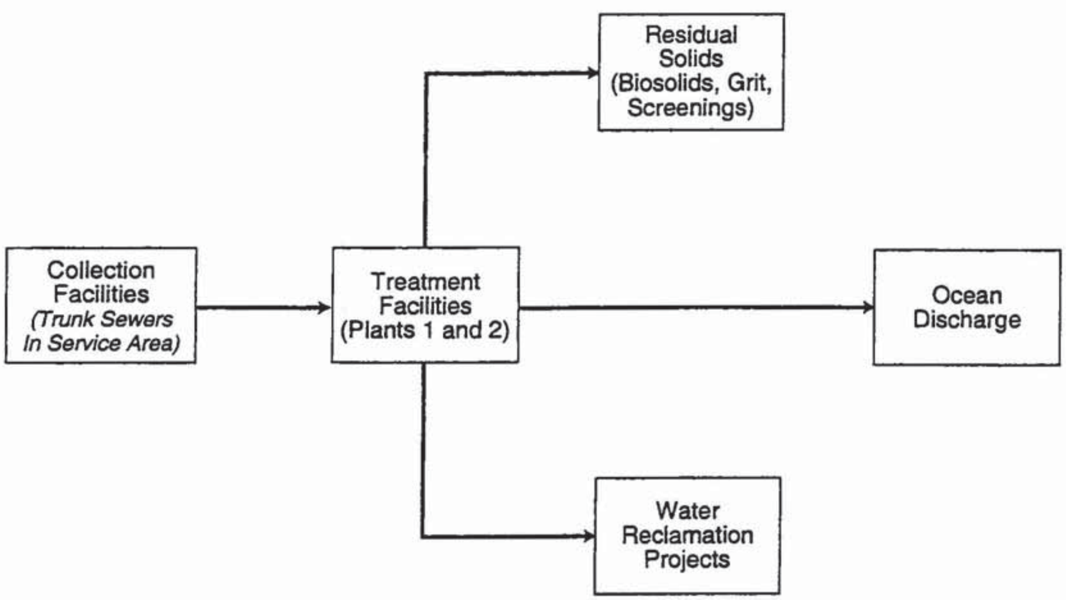
(2) To ensure compliance with existing and anticipated ocean discharge permit conditions, including the requirements of the 301(h) modified (secondary treatment waiver) National Pollutant Discharge Elimination System (NPDES) permit for discharge (the largest waiver permitted in the U.S. and one of four waiver holders in California);

(3) To recommend projects that meet the community's needs, protect public health, are technically feasible, and are cost effective and environmentally responsible; and

(4) To maximize the use of treated effluent for water recycling.

S.3 STRATEGIC PLAN OVERVIEW

The District has prepared a new Strategic Plan to identify projects needed to accommodate projected population growth in its service area and to comply with changing future regulations that affect treatment facilities and effluent quality. The Strategic Plan addresses all aspects of the OCSD system facilities and operation as shown in the **Figure S-1** schematic. Projects are planned to replace and rehabilitate sewer collection systems, expand and upgrade the District's two wastewater treatment plants, provide adequate discharge capacity for projected peak flows, provide additional treated wastewater to the Orange County Water District (OCWD) for expanded water reuse, and study the feasibility of other improvements. Numerous individual projects are planned for various years between 2000 and 2020.



SOURCE: Environmental Science Associates

OCSD Strategic Plan Program EIR / 960436 ■

Figure S-1
System Components

The Strategic Plan comprises the following volumes

Volume 1	Executive Summary
Volume 2	Summary Report
Volume 3	Collection System
Volume 4	Joint Treatment Works
Volume 5	Regulatory Requirements
Volume 6	On-site Stormwater Plan
Volume 7	Water Reuse and Water Conservation
Volume 8	Biosolids Management
Volume 9	Urban Design Element

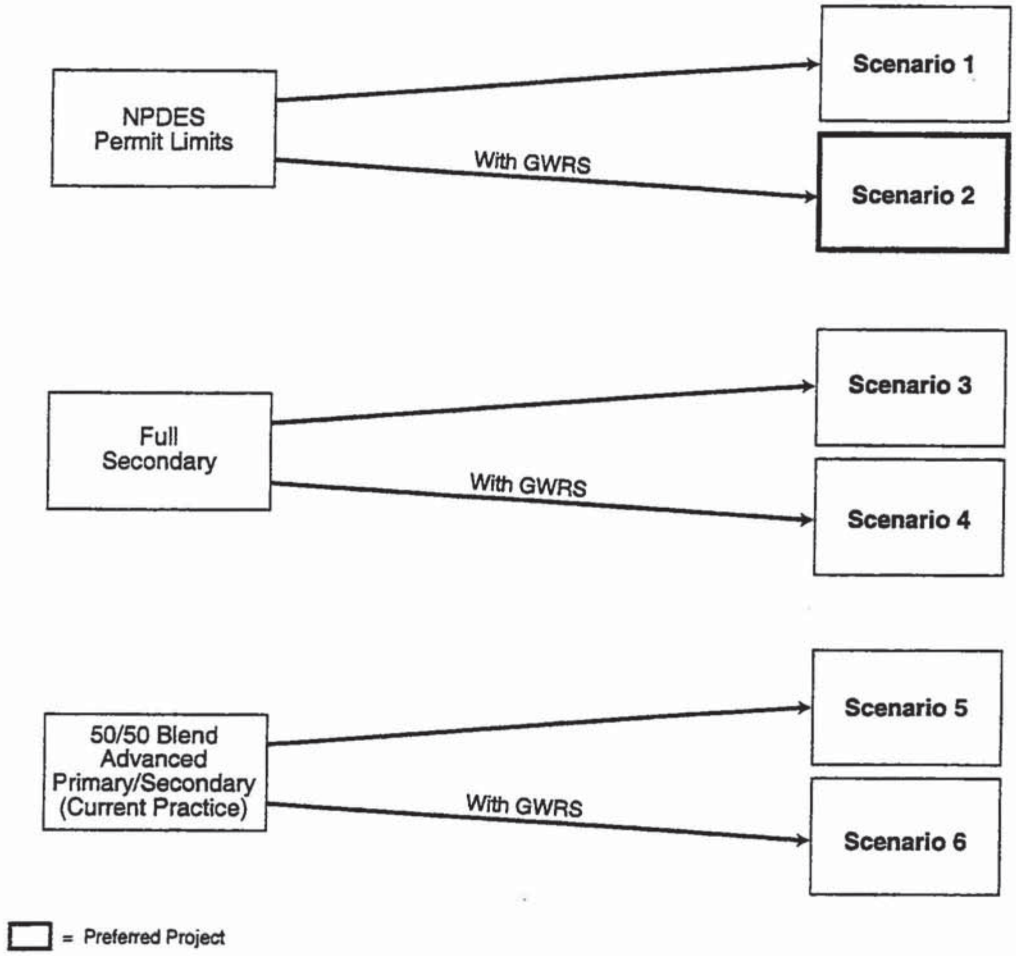
The key drivers guiding the Strategic Plan development of alternatives for future system expansion and operation are: reduced service area future flow estimates, management of peak wet weather flows, effluent quality requirements of ocean discharge, and participation in the Groundwater Replenishment (GWR) System project. The GWR System project is an ambitious water reclamation project planned cooperatively with the Orange County Water District (OCWD).

Management of peak wet-weather flows involves an integrated plan of improvements to: (1) the collection system to provide greater capacity to convey and temporarily store high volumes without any sewage spills, (2) the treatment plant to provide adequate on-site storage to hold high flows for treatment, and (3) the discharge and reuse systems to dispose of peak flow in a controlled manner.

The level of treatment provided to wastewater and the additional facilities needed to obtain those levels are influenced by in flow volume, the ocean discharge permit requirements, and by whether or not OCSD participates in the GWR System project with OCWD.

There are six treatment scenarios identified in the Strategic Plan and evaluated in this EIR at an equal level of detail. These six scenarios are combinations of three treatment level options with and without implementation of the GWR System Project, as shown in **Figure S-2**. These scenarios are summarized below.

The District's NPDES permit includes a waiver from the federal Clean Water Act requirement that all of the flow receive secondary treatment prior to ocean discharge. The permit allows for only some of the flow to receive secondary treatment and to be blended with the remaining flow that receives advanced primary treatment prior to ocean discharge as long as the overall effluent quality meets NPDES permit requirements, which include compliance with the provisions of the California Ocean Plan. The District's current policy is to provide discharge of a blend of 50 percent advanced primary effluent and 50 percent secondary effluent. Finally, as a condition of the permit waiver, the District must also provide a back-up plan for full secondary treatment of 100 percent of the effluent.



SOURCE: Environmental Science Associates

OCSD Strategic Plan Program EIR / 960436 ■

Figure S-2

Level of Treatment Alternatives

Thus, the District has considered three treatment level alternatives (the secondary/advanced primary effluent blend associated with each is shown in parenthesis):

- NPDES Permit Compliance (The effluent blend would vary (between approximately 20 and 35 percent secondary and 65 and 80 percent primary). This alternative does not have a set requirement for the percentage of secondary effluent; the focus is on compliance with specific permit requirements rather than a specified effluent blend.)
- Current Condition (Represents a 50/50 effluent blend adopted as OCSD's Board of Directors policy with the previous 1989 Mater Plan)
- Full Secondary (Represents 100 percent secondary effluent for ocean discharge)

Also affecting the level of treatment alternatives is whether or not OCSD participates in the GWR System Project with OCWD. OCSD is an equal partner with OCWD in the project planning and preliminary design of the GWR System project. The GWR System project requires secondary treated effluent for further treatment using the advanced treatment processes of micro-filtration and reverse osmosis.

The GWR System has been designed for implementation in three phases. Each phase would increase the volume of secondary effluent necessary from OCSD. The District is considering approval of only Phase 1 at this time. Phase 1 would require an average dry weather flow of secondary effluent ranging from 50 to 80 mgd and would produce approximately 65,000 acre-feet per year (AFY) of demineralized water. The recycled water supply represents about 10 percent of OCWD's project water demand in the year 2010. Ultimately, in Phase 3 the GWR System project will require up to 110 mgd (summer peak is 165 mgd) average dry weather flow of secondary effluent. The GWR System project is also being designed to accommodate up to 100 mgd of peak wet-weather flow in Phase 1 to assist OCSD in managing peak flows and delaying the need for a second ocean outfall. In GRW System Phase 3, the amount of peak wet-weather flow capacity would increase to 175 mgd. Although the District may choose not to implement Phase 2 and 3 of the GWR System project, the analysis in this document of the Preferred Alternative assumes that each phase of the GWR System would be implemented as currently planned.

OCSD participation in the GWR System project will affect the amount of secondary treatment facilities needed to meet both GWR System project needs and ocean discharge needs under the three effluent blend options. Participation in the GWR System will reduce the amount of secondary effluent available for ocean discharge. Through preparation of the Strategic Plan, the District has identified the following treatment scenarios:

Action Scenarios

- **Scenario 1: NPDES Permit Compliance without GWR System Project.** Provide a level of treatment necessary to meet the NPDES permit conditions and the California Ocean Plan. All wastewater would receive advanced primary treatment with a percentage also receiving secondary treatment prior to ocean discharge. Under this Scenario, the GWR System would not be implemented, thereby increasing the percentage of secondary effluent available for ocean discharge. The amount of secondary treatment would be governed by the NPDES permit limits.

- **Scenario 2: NPDES Permit Compliance with GWR System Project**. Provide the level of treatment necessary to meet the NPDES permit conditions and the California Ocean Plan. All wastewater would receive advanced primary treatment with a percentage also receiving secondary treatment prior to ocean discharge. In coordination with OCWD, 50-80 mgd average daily flow and up to 100 mgd peak wet weather flow of secondary effluent would be diverted from OCSD to the GWR

System. The amount of secondary treatment in the ocean discharge would be governed by needs of the GWR System and by the NPDES permit limits.

- **Scenario 3: Full Secondary Treatment without GWR System Project**. Provide full secondary treatment to all wastewater prior to ocean disposal. Under this Scenario, the GWR System project would not be implemented. The capacity for secondary treatment within both Plants 1 and 2 would be increased to accommodate projected peak flows. The existing facilities would be optimized through flow diversions to minimize the construction of new facilities.

- **Scenario 4: Full Secondary Treatment with GWR System Project**. Provide full secondary treatment to all wastewater prior to ocean disposal. In coordination with OCWD, 50-80 mgd average daily flow and up to 100 mgd peak wet weather flow of secondary effluent would be diverted from OCSD to the GWR System. The capacity for secondary treatment within both Plants 1 and 2 would be increased to accommodate projected peak flows. The existing facilities would be optimized through flow diversions to minimize the construction of new facilities.

No Project/Existing Conditions

- **Scenario 5: 50:50 Blend without GWR System Project**. Maintain the level of treatment currently provided. All wastewater would receive advanced primary treatment with about 50 percent also receiving secondary treatment prior to ocean discharge. Under this Scenario, the GWR System would not be implemented.

- **Scenario 6: 50:50 Blend with GWR System Project**. Maintain the level of treatment currently provided. All wastewater would receive advanced primary treatment. In coordination with OCWD, 50-80 mgd average daily flow and up to 100 mgd peak wet weather flow of secondary effluent would be diverted from OCSD to the GWR System. Half of the remaining ocean discharge would require secondary treatment.

Table S-1 provides comparisons between each of these scenarios with respect to operational capacities and potential environmental impacts.

TABLE S-1
COMPARISON OF TREATMENT LEVEL SCENARIO ALTERNATIVES AT 2020

IMPACT	Current NPDES Permit Limits		Full Secondary Treatment		50:50 Effluent Blend	
	Scenario 1 w/o GWR	Scenario 2 w/ GWR	Scenario 3 w/o GWR	Scenario 4 w/ GWR	Scenario 5 w/o GWR	Scenario 6 w/ GWR
		Preferred			*No Project*	*No Project*
OCEAN DISCHARGE / MARINE*						
Effluent Discharge volume (annual average mgd) Current: 255 mgd	324.1	243.6	324.1	243.6	324.1	243.6
Amount of Secondary effluent to ocean (annual average mgd) Current: 123 mgd	139.9	41.5	324.1	243.6	162.5	121
Amount of water to reclamation (assumes Phase I GWR System) (annual average mgd) Current: 5.4 mgd	34	80	34	80	34	80
Brine to outfall from reclamation treatment process (assumes Phase III of GWR System for Scenarios 2, 4, and 6) (annual average mgd) Current: 0.25 mgd	1.1	16	1.1	16	1.1	16
Meets NPDES Permit requirements for ocean discharge established to be fully protective of the marine environment.	Yes	Yes	Yes	Yes	Yes	Yes
Total Suspended Solids - mass load (annual average lbs/day) Current: 106,000 lbs/day	120,500	116,481	63,449	48,228	119,772	86,664
Oil and Grease (annual average lbs/day) Current: 34,900 lbs/day	47,676	49,617	18,974	14,221	47,224	35,694
Ammonia (annual average lbs/day) Current: 51,000 lbs/day	56,434	55,513	52,609	50,799	54,631	50,315
Total Metals (annual average lbs/day) Current: 229 lbs/day	303.4	379.1	226.5	260.7	301.0	325.6
Infrequent use of 78-inch outfall during winter peak wet-weather events would require beach closure	Yes	Yes	Yes	Yes	Yes	Yes

TABLE S-1 (continued)
COMPARISON OF TREATMENT LEVEL SCENARIO ALTERNATIVES AT 2020

IMPACT	Current NPDES Permit Limits		Full Secondary Treatment		50:50 Effluent Blend	
	Scenario 1 w/o GWR	Scenario 2 w/ GWR	Scenario 3 w/o GWR	Scenario 4 w/ GWR	Scenario 5 w/o GWR	Scenario 6 w/ GWR
		Preferred			*No Project*	*No Project*
FACILITIES / LAND USE						
Additional treatment facilities (square feet)	280,000	300,000	570,000	635,000	420,000	525,000
Construction Activity	Least	Least	Most	Most	Midway	Midway
Number of construction truck trips For excavation hauling	3,584	3,824	5,972	6,592	4,751	5,590
Construction disruption: Noise, vibration, dust	Least	Least	Most	Most	Midway	Midway
Increase views of facilities from surrounding areas	Least	Least	Most	Most	Midway	Midway
BIOSOLIDS / LAND USE						
Generates additional biosolids for land application and/or disposal (wt/year) Current: 180,000 wt/yr	323,000	342,000	397,000	421,000	360,000	394,000
Land acreage needed for reuse (acres) Current: 3,600 acres	6,500	6,800	8,000	8,500	7,250	7,950
Haul truck trips (trips/year) Current: 7,200 per year	12,920	13,680	15,880	16,840	14,400	15,766
AIR QUALITY						
Generates additional air emissions	Least	Least	Most	Most	Midway	Midway
ENERGY						
Energy use (KW) Current: 11,742 KW	18,745	17,819	22,790	23,448	19,583	21,734

* Estimated figures are based on the most recent planning numbers and are subject to updates in subsequent design plans. These numbers may differ slightly from the GWR System EIR and the Strategic Plan.

GWR = Groundwater Replenishment System

PREFERRED ALTERNATIVE

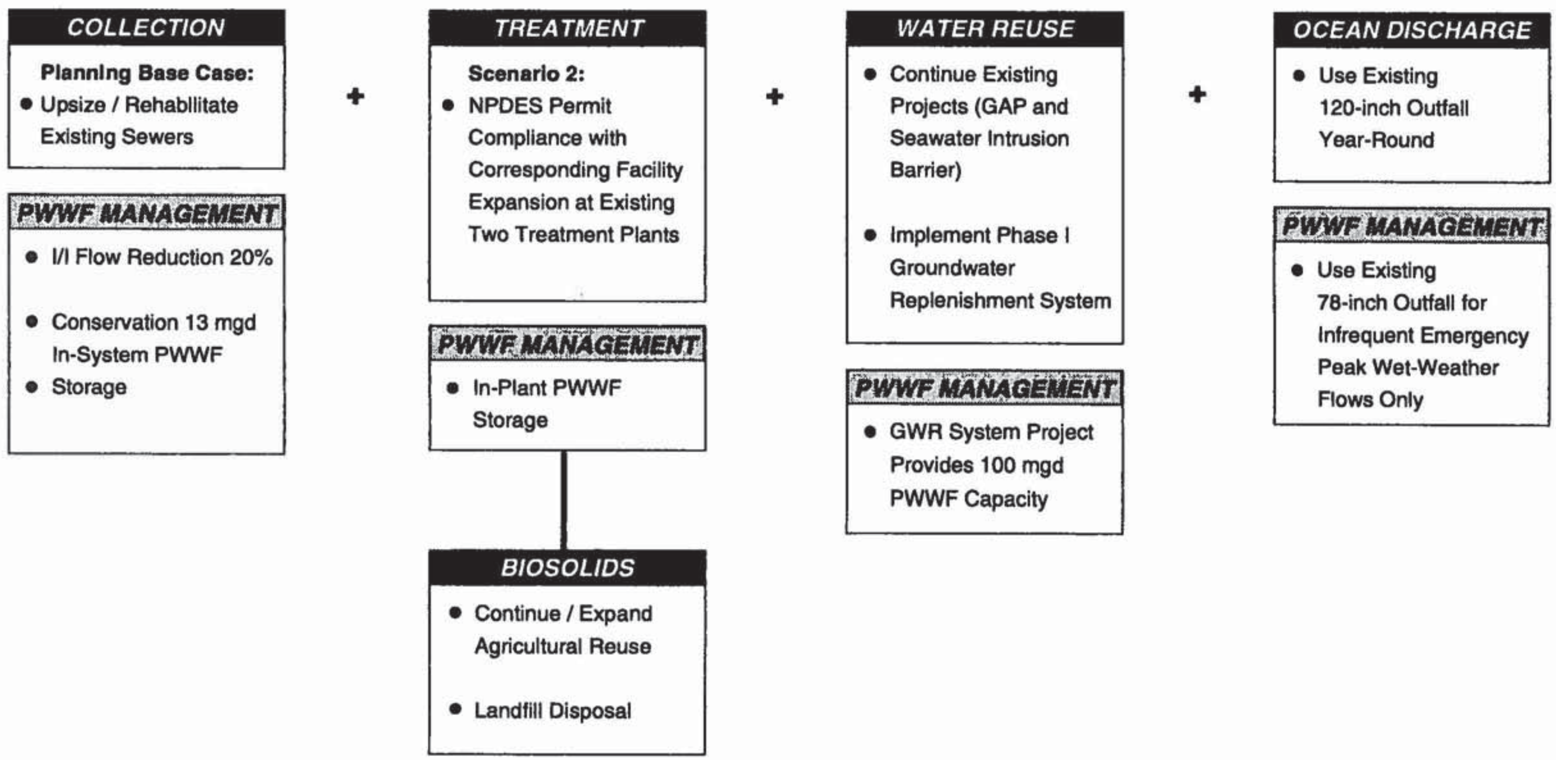
The Preferred Alternative in the 1999 Strategic Plan is Treatment Scenario 2 – providing sufficient secondary treatment to meet the needs of the GWR System Project and to comply with NPDES permit requirements for ocean discharge. In order to meet the treatment goals of this scenario, the Strategic Plan identifies capital improvements for both the collection system and the treatment plants. In conjunction with the preferred alternative, the District plans to use the existing 78-inch diameter outfall to accommodate emergency peak flows in excess of current discharge capacity. **Figure S-3** illustrates the preferred alternative identified in the Strategic Plan for each component of the District's wastewater system.

As a means to optimize flexibility and to comply with permit requirements, the facility improvements identified in the Strategic Plan for the Preferred Scenario do not prevent the subsequent implementation of any of the other Scenarios. The switch from the preferred scenario to another future condition could happen at any time, depending on OCSD's future effluent requirements, regulatory directives, and/or technology changes. The Strategic Plan assumes an adaptable approach to planning future capital improvements based on the possibility of changing operational needs. The implementation program of the proposed capital improvements for both the collection system and the treatment facilities accommodates each scenario while optimizing existing facilities. For example, although the full secondary treatment required of Scenarios 3 and 4 would require extensive new facilities, none of the planned upgrades proposed for the preferred alternative will prevent OCSD from obtaining full secondary treatment capacity in the future.

The preferred alternative was selected through the combination of technical feasibility studies prepared by OCSD and their consultants, community participation through the implementation of a Planning Advisory Committee (PAC), and decision making techniques tailored to incorporate the local community and the District's needs.

Treatment Plant Expansion: Under all six treatment scenarios, all proposed additional treatment facilities would be located within the existing property boundaries of the District's Reclamation Plant No. 1 and Treatment Plant No. 2. Under the No Project Alternatives, Scenarios 5 and 6, the District would continue operating under the conditions agreed to in the 1989 Master Plan and EIR. That is to say, the capital improvements necessary to accommodate projected flows including repairs and upgrades to the collection system and the construction of secondary treatment facilities capable of treating at least 50 percent of the effluent would be implemented in any case. For this reason, the No Project Alternatives will require more capital improvements than Scenarios 1 and 2 but less than Scenarios 3 and 4.

In light of this fact, much of the analysis in this report considers the No Project Alternatives to be bracketed by the Full Secondary and the NPDES Permit Compliance alternatives, falling in between the four other treatment alternatives with respect to required secondary treatment



SOURCE: Environmental Science Associates

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Figure S-3
Strategic Plan-Preferred Alternative - Key Components

facilities. For purposes of analyzing land-side impacts under CEQA, Scenarios 1 and 2 together constitute the minimum number of proposed additional facilities whereas Scenarios 3 and 4 require the maximum capital improvement effort. However, there are large differences between Scenarios 5 and 6. Scenario 6 would require additional secondary treatment facilities to accommodate 100 mgd for GWR System while still providing secondary treatment for 50 percent of the remaining effluent discharge. As highlighted in Table S-1, resources necessary for Scenario 6 would be closer to the full secondary scenarios while Scenario 5 would be closer to the NPDES permit scenarios.

The project also proposes the construction of a new secondary effluent pump station and pipeline to carry water from the secondary treatment facilities at Treatment Plant No. 2 to Reclamation Plant No. 1 for delivery to the Orange County Water District and various proposed reclamation projects. The pipeline will be located within the District's existing 30-foot-wide right-of-way adjacent to the Santa Ana River, where other interplant pipelines are located.

Ocean Outfall: The existing 120-inch diameter outfall's rated capacity of 480 mgd has been exceeded on five separate occasions since its installation in 1971, reaching 550 mgd during a storm event in 1995. During each event, the outfall was able to accommodate all the effluent without requiring emergency discharge at either of the alternative two discharge points. Due to increased development and projected population growth within the service area, peak wet weather flows are estimated to reach 775 mgd by the year 2020 (see Section 3.4). To reconcile the discharge capacity deficiencies during peak flow periods, the District has evaluated three alternatives to increase ocean discharge capacity: (1) construction of a new 120-inch diameter outfall, (2) construction of a new barrel parallel to the existing 120-inch outfall that ties into the existing diffuser, or (3) use of the existing 78-inch diameter outfall for infrequent peak flow discharges.

Collection System: Due to the modeled pipeline deficiencies by the year 2020 within the system, OCSD proposes to replace and rehabilitate pipelines to meet future needs. In addition, five pump stations were determined to be in need of equipment upgrades. Nearly 47 miles of pipeline replacements (separated into 32 individual projects) are planned almost exclusively within developed city streets. Open trench and jack-and-bore construction would be employed.

Biosolids Program: The Strategic Plan recommends no immediate changes in the method of biosolids processing or disposal, however, a number of studies of the system are proposed. The Strategic Plan outlines several process changes which could potentially increase biosolid quality and operational efficiency. None of these technologies are recommended for immediate implementation, but the District will continue to play an active role in researching new technologies and monitoring studies performed nation-wide. The District will need to develop additional land applications for the projected increase in biosolids. The District will continue to research land acquisitions dedicated to biosolids recycling.

S.4 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Summary tables located at the end of this chapter present a summary of the significant impacts and associated mitigation measures identified for the proposed projects for each major component of the OCSD system addressed in the Strategic Plan as follows: **Table S-2** summarizes impacts associated with the proposed Ocean Discharge (Chapter 5.0). **Table S-3** summarizes impacts associated with Treatment facilities expansion (Chapter 6.0) and includes the Growth Inducement Impact (Chapter 11.0). **Table S-4** summarizes impacts associated with Collection system Projects (Chapter 7.0). **Table S-5** summarizes the impacts associated with Biosolids Management (Chapter 8.0). Impacts that were determined to be less than significant, requiring no mitigation, are not included in this table. The significance criteria for each topic issue are discussed in each of the technical sections of this EIR.

The key summary points regarding project impacts are:

- Most of the project impacts result from construction activities. These are temporary impacts that can be mitigated to less than significant levels with the mitigation measures identified in the EIR.
- Ocean discharge under any of the six treatment scenario alternatives would comply with the District's current NPDES permit governing effluent discharge.
- Oil and Grease effluent levels would comply with numeric permit limits under Scenarios 1, 2, and 5 but would potentially create observable floating particles which would be a permit violation. This impact would be mitigated through monitoring and treatment to achieve and maintain compliance.
- Implementation of the GWR System, along with other regional desalting projects, would contribute brines that cumulatively would decrease the initial dilution rate at the District's outfall and increase constituent concentrations. This could increase toxicity and result in standards violation, which would be a potentially significant impact. Additional analysis of this is required to clarify the extent of the impact and its significance. This impact would be mitigated to less than significant through monitoring and measures such as dilution, treatment, or alternate disposal.
- Use of the 78-inch outfall for infrequent discharge of peak wet weather flows would result in elevated pathogen levels that would cause short-duration exceedances of water quality standards and require beach closure. This would be a significant impact to beneficial recreation uses in the nearshore area around the outfall.
- Construction and operation of the Strategic Plan projects, under any of the six treatment scenarios (including the Preferred Project –Scenario 2) would result in the following significant unavoidable impacts.
    - Significant noise, vibration and air quality impacts during construction at the treatment plants, including significant cumulative construction impacts in conjunction with concurrent GWR System construction.

- Air quality impacts due to emissions from mobile sources that exceed SCAQMD thresholds for criteria pollutants.
- Some of the secondary effects of growth planned by the cities and County land use agencies within the District have been determined to be significant and unavoidable by those agencies. These impacts include, but are not limited to, traffic congestion, air quality impacts, and loss of open space.

The impact summary **Tables S-2** through **S-5** do not compare the alternatives to one another or indicate which alternative has the greater or lesser impact. For example, Table S-3 indicates that treatment plant facilities construction for Scenario 2 and Scenario 4 could result in temporary but significant noise impacts. The same mitigation measures to reduce this impact to less than significant are identified for both alternatives. However, Table S-3 does not indicate that Scenario 2 has much less impact on adjacent land use than does Scenario 4. This is because there are less new facilities associated with Scenario 2 than Scenario 4, and therefore the duration of construction could be decreased. The comparison of alternatives is discussed in the following section and summarized in **Table S-1.**

S.5 ALTERNATIVE COMPARISON AND ENVIRONMENTALLY SUPERIOR ALTERNATIVE

ALTERNATIVE COMPARISON

The key alternatives considered in this EIR, the six alternative treatment scenario and two alternative discharge options, are evaluated at equal level of detail and are discussed in the main body of the EIR. Chapter 9.0, Alternatives describes other alternatives to the Preferred Project considered during development of the Strategic Plan. Chapter 9.0 presents a comparison of the potential environmental impacts of the various project alternatives to that of the Preferred Strategic Plan Alternative (see Figure S-3). In most cases, the alternatives for each of these system components have similar construction and operation impacts and the same mitigation requirements. All alternatives share the same three significant unavoidable impacts, as noted above:

- Significant noise, vibration and air quality impacts during construction at the treatment plants.
- Significant air quality emissions from increased mobile sources (i.e., vehicles for deliveries and hauling).
- Some of the secondary effects of growth planned by the cities and County land use agencies within the District have been determined to be significant and unavoidable by those agencies. These impacts include, but are not limited to, traffic congestion, air quality impacts, and loss of open space.

Except for these significant unavoidable impacts that are common to each alternative, the impacts associated with each alternative can be reduced to less than significant levels with mitigation. Thus, the alternatives are not clearly distinguished by the number or type of significant impacts they generate. The distinction among the alternatives is the degree of impact.

Table S-5 presents a brief summary of the key characteristics and impacts of each alternative. Scenarios 1, and 2 represent the least facilities alternatives, and provide the least amount of secondary treatment facilities. Scenarios 3 and 4, Full Secondary, represent the most facilities alternatives and provide the most secondary treatment (100% for all flows). Scenario 2 and Scenario 4 bracket the high end and low end of the range of possible project changes and therefore are the focus of the EIR analysis to assess the range of potential impacts and benefits. Scenarios 5 and 6 represent the District's current policy to provide sufficient secondary treatment facilities to maintain a 50:50 blend of primary and secondary effluent for ocean discharge. The proposed actions and impacts of Scenarios 5 and 6 fall in between those described for Scenario 2 and 4. As illustrated in Table S-1 the six treatment scenario alternatives pose environmental impact trade-offs regarding cross-media impacts to land, air and water resources.

ENVIRONMENTALLY SUPERIOR ALTERNATIVE

OVERVIEW

The environmentally superior alternative includes most of the components of District's preferred alternative with the exception of the proposed use of the 78-inch outfall for peak wet weather discharges, which results in beach closures. The alternatives to use of the 78-inch outfall are construction of a new 120-inch outfall or increased storage and peak wet weather management efforts. These would be the environmentally superior alternatives because they would avoid beach closure.

TREATMENT LEVELS

With respect to the six treatment level alternatives, Preferred Alternative Scenario 2 – Current NPDES Permit Limits with GWR System (Phase 1) with mitigation, is the environmentally superior alternative. Scenarios 3, 4, 5, and 6 do propose more secondary treatment and discharge of a higher percentage of secondary effluent to the ocean than does Scenario 2. Nonetheless, the EIR analysis shows that under Scenario 2 the District's effluent discharged to the ocean will comply with the current NPDES permit limits that have been established to insure the effluent discharge is fully protective of the marine environment and its designated beneficial uses. This treatment scenario alternative will not result in significant impacts to the marine environment or public health and will have less impact to land and air resources than the other alternatives.

The NPDES permit requires an extensive routine monitoring and reporting program to the RWQCB, which will continue under this preferred alternative. The District must adjust treatment as needed to insure effluent compliance with the active NPDES permit. The impact analysis indicated that, in the future, brine disposal may affect metals concentrations and toxicity, and that oil and grease levels may approach permit limits. The required monitoring program will give the District and the RWQCB advance notice if there is a need to adjust treatment procedures to maintain full compliance. The District will implement additions/improvements to its treatment facilities and processes as needed to maintain full permit compliance. The District continues to research the latest technology for inclusion in its treatment process.

Scenario 2 is environmentally superior to Scenario 4 (Full Secondary with GWR System) and Scenario 6 (50:50 Blend with GWR System) because it generates less impact to land and air resources. As discussed in Chapter 10.0 – Cross-Media Environmental Trade-offs and summarized in Table S-1, the other scenarios involve construction and operation of more facilities, with greater construction and operation disruption to the communities, including more noise, vibration, dust, odor, truck traffic, and visual impact. Operation of more secondary treatment facilities substantially increase energy consumption and air quality emissions. Further, Scenario 2 generates substantially less biosolids that must be hauled by truck for reuse offsite, thereby reducing traffic and air quality impacts. The South Coast Basin is a non-attainment area for air quality standards and the District is a major facility contributing to the regional emissions. Scenario 2 minimizes additional air quality emission compared with Scenarios 3, 4, 5, and 6.

Scenario 2 is environmentally superior to the Scenarios 1, 3, and 5 because it provides for implementation of the GWR System project to recycle up to 50,000 AFY in Phase 1 (100 mgd during peak wet weather flow) and the other scenarios do not. Implementation of the GWR System project has significant environmental benefits for the Orange County region and beyond. First, it substantially reduces the annual wastewater effluent disposal to the ocean. With the GWR System Project, the volume of OCSD's annual effluent discharge to the ocean won't increase much over current levels. Most of the growth in wastewater volume will be recycled. Second, the GWR System project will increase water supply in the Orange County area, reduce dependence on supply importation, increase supply reliability, and reduce the need to increase surface water diversions from the supply-limited State Water Project/Delta and Colorado River systems –using a renewable resource – recycled water. In addition, the GWR System Project will help further protect regional groundwater quality by expanding the saltwater intrusion barrier program.

OCEAN DISCHARGE / PEAK WET WEATHER MANAGEMENT

The District has adequate discharge capacity in the existing 120-inch deepwater outfall for disposal of average dry weather flows. The rated design capacity of this outfall is 480 mgd and the projected year 2020 flow is 352 mgd. However, the existing outfall does not have adequate capacity for future projected peak wet-weather flows, which could reach up to 775 mgd by 2020. The District has included several measures in the preferred alternative to reduce peak wet weather flows, including:

- Flow reduction via water conservation of up to 13 mgd by 2020
- Inflow and Infiltration (I/I) flow reduction of extraneous water entering the collection system by up to 20% by 2020
- Utilize and maximize existing in-plant storage (7 mg)
- Participate in GWR System – Phase 1 (50 mgd average daily flow and 100 mgd peak wet weather flow diversion for reuse)
- Add stormwater detention storage at the treatment plants
- Use the 78-inch outfall for infrequent wet weather discharges, only when the capacity provided by all of the above measures is exceeded

The District proposes using the 78-inch outfall for peak wet-weather flow discharge as the last response. Modeling of peak flows based on the 20-years of rainfall data was conducted to predict the need for use of the 78-inch outfall. The modeling indicates that by the year 2020 the probability of discharge through the 78-inch outfall would be once every three years and the discharge would last from one to several hours. Although infrequent and for a short duration, the discharge of treated effluent from the 78-inch outfall could contribute elevated pathogen levels to the nearshore environment and therefore would require short-term beach closures to protect public health.

The District considered several alternatives storage and discharge options including:

- Construction of a new 120-inch deepwater outfall
- Construction of a parallel barrel for the existing 120-inch outfall that ties into the diffuser
- Discharge to the Santa Ana River
- Off-site storage within the collection system
- Increased storage at the treatment plants (beyond 7 MG)
- Increased conservation and I/I flow reduction (greater than 20%)

As discussed in EIR Chapter 9, Alternatives, only construction of the a new 120-inch deepwater outfall is a feasible alternative for peak wet weather flow management. Installation and use of a new outfall would eliminate the need for use of the 78-inch outfall during peak wet-weather events and avoid the need for beach closure. As with the existing 120-inch outfall, effluent discharge from the deepwater location would not affect the nearshore environment and necessitate beach closure. Because this alternative would avoid the potential need for beach closures, it is considered the environmentally superior alternative. Also, this alternative program component would be needed sooner if the GWR System Project is not implemented.

Although detailed siting studies for a new deepwater outfall have not been conducted, a program-level impact analysis of this alternative is presented in Chapter 5.0 of this EIR. Installation of a new outfall would cause potentially significant but temporary disruption impacts to the marine communities along the alignment. Eventually, marine organisms would recolonize the outfall area and the new outfall structure would provide substantial new artificial reef habitat. Based on the 13 years of marine monitoring data evaluated for the District's existing 120-inch outfall, the new outfall would have similar, less than significant impact on the marine environment.

The new outfall alternative is one of the most expensive hydraulic wet-weather relief options considered by the District (in the cost range of $150-200 million). A new, second deepwater outfall would substantially increase the District's average dry-weather discharge capacity as well as peak wet weather discharge capacity. With this new outfall, the District would have discharge capacity well beyond the projected needs in year 2020, and for peak wet weather management purposes it would only be need an estimated once every three years. Thus, in considering this alternative for peak wet-weather flow management, the District Board of Directors must weigh the impacts of construction a new deepwater outfall five miles into the ocean, the potential growth inducement impacts of providing significant additional average dry weather flow disposal capacity far in advance of projected need, and the cost of this facility (construction and operation) to current rate payers against the infrequent but significant impact of closing local beaches for short periods during high rainfall events.

COLLECTION SYSTEM

Upsizing the existing trunk sewers is the environmental superior collection system alternative compared to the super sewers option. The super sewers would have similar significant construction impacts to the proposed project. Although construction may affect fewer streets with the super sewer alternative, the duration and magnitude of impacts would be greater for construction of these major pipeline facilities. The super sewers alternative does not reduce or avoid the impacts of the proposed project. Upsizing the existing trunk sewers generates less environmental impact than the alternative of constructing upstream storage. the upstream storage alternative would still require similar trunk sewer upsizing as proposed with the project but would create additional impacts from construction of storage facilities. Installation of raw sewage storage facilities would generate operational and odor impacts as well.

TABLE S-2
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR OCEAN DISCHARGE

RESOURCE TOPIC/IMPACT	APPLICABLE PROJECT COMPONENT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
Impact 5-3. Oil and Grease effluent levels would comply with numeric permit limits under Scenarios 1, 2, and 5 but would potentially create observable floating particles which would be a permit violation. Less than significant with mitigation.	Scenarios 1, 2, and 5	**Measure 5-3:** Monitor receiving waters and, if floating particulates from the discharge are observed in surface receiving waters, modify treatment to reduce oil and grease in the effluent.	Less than significant
Impact 5-5. Increased discharge of brine under any scenario but particularly under Scenarios 2, 4, and 6 with the GWR System would reduce initial dilution and increase metals concentrations. This could result in potentially significant toxicity impacts. Potentially significant.	Scenarios 2, 4, and 6	**Measure 5-5:** Study and monitor the effect of brine disposal on initial dilution and toxicity. If non-compliance occurs, and/or adverse marine life impacts are observed District will implement additional analysis, such as a Toxicity Identification Evaluation (TIE) and appropriate source control measures in accordance with its NPDES permit.	Less than significant
Impact 5-9: Effluent discharge to the 78-inch outfall at a rate of once every three years would result in significant impacts to levels of pathogens in the nearshore waters used for water-contact activities or where shellfish are harvested.	All Scenarios	**Measure 5-9:** Mitigation would involve pathogen reduction of the wastewater prior to discharge to the 78-inch outfall along with beach closure. Pathogen reduction may be accomplished by disinfection, which is not approved by the Regional Water Quality Control Board at the present time, or by micro-filtration and other new technologies.	Significant, unavoidable
Impact 5-11: Clean out of the existing 120-inch outfall, if needed, to remove accumulated sediments and debris would move sediments into the marine environment, which could result in short-term water quality and sediment impacts affecting marine organisms.	All Scenarios	**Measure 5-11:** If necessary, the District will develop plans to clean out the outfall using appropriate methods approved by the RWQCB to protect water quality in accordance with regulations. The plan will include methods to contain floatables and disperse the sediments so that impacts to benthic communities and water quality are minimized.	Less than significant

TABLE S-2 (Continued)
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR OCEAN DISCHARGE

RESOURCE TOPIC/IMPACT	APPLICABLE PROJECT COMPONENT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
Impact 5-12. Laying pipeline for the new outfall would result in the permanent loss of hundreds of thousands of square feet of soft-bottom, benthic habitat. Adjacent communities would be temporarily disrupted by increased sedimentation. Disturbance of bottom sediment may result in the short-term release of contaminants into the water column. Potentially significant but can be mitigated.	All Scenarios	**Measure 5-12**: The District would conduct additional detailed, site-specific studies for the siting of a new second 120-inch ocean outfall. These studies would clarify the extent of marine resources that would be affected by construction and identified appropriate mitigation measures to minimize the area of disturbance.	Less than significant
Impact 5-13: Use of the 78-inch outfall for peak wet weather discharges would contribute to significant cumulative pollutant loads (particularly pathogens) to the nearshore environment during wet weather events in combination with non-point source pollution. Significant.	All Scenarios	**Measure 5-13:** To mitigate the cumulative contribution from use of the 78-inchg outfall, the District will implement Mitigation Measure 5-9, above to provide additional pathogen reduction as allowed and/or required by the RWQCB.	Significant, unavoidable

TABLE S-3
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR TREATMENT SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
Land Use		
Impact 6.1-1. Expansion of the OCSD treatment facilities, as proposed under Scenarios 2 and 4, would require the construction of additional facilities at Reclamation Plant No. 1 and at Treatment Plant No. 2. Project construction would result in short-term disturbance of adjacent land uses. Less than Significant with Mitigation Measures.	**Measure 6.1-1a:** The District will comply with local ordinances and restrict construction activities to daylight hours or as specified in encroachment permits. **Measure 6.1-1b:** The District should provide notices of construction activities to adjacent property owners and provide a contact and phone number of a District staff person to be contacted regarding questions or concerns about construction activity.	Less than significant
Impact 6.1-3. Expansion and operation of the proposed facilities for both Scenarios 2 and 4 could adversely alter existing visual character of the site with installation of tall structures and the removal of trees. In additional project implementation could introduce new sources of light and glare. Less than Significant with Mitigation Measures.	**Measure 6.1-3a:** The District will implement the Urban Design Element of the Strategic Plan in order to improve the visual appearance of the site. Recommendations from the Landscape Master Plans (of the Urban Design Element) include the development of buffer zones, planting of trees at the perimeter of the plants along sensitive visual corridors (e.g. Santa Ana bikeway), and maintaining and enhancing the appearance of existing buffer zones. **Measure 6.1-3b:** The District will ensure that all permanent exterior lighting is directed downward and oriented to insure that no light source is directly visible from neighboring residential areas. In addition, highly reflective materials and/or finishes shall not be used in the design of proposed structures. In accordance with Measure 6.1-3a, above, landscaping shall be provided to minimize off-site light and glare onto surrounding areas.	Less than significant
Traffic		
Impact 6.2-1: Periods of peak construction will increase traffic along local access streets. Less than Significant with Mitigation Measures.	**Measure 6.2-1:** For each major project or construction period, the District would complete a detailed construction schedule and notify the Cities of Fountain Valley and Huntington Beach. Construction vehicles should be run on a schedule to minimize travel on the regional transportation facilities during peak traffic periods.	Less than significant

TABLE S-3 (Continued)
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR TREATMENT SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
Traffic (cont.)		
Impact 6.2-2: Additional traffic would be generated from the ongoing operations of the facilities at Reclamation Plant No. 1 and Treatment Plant No. 2. Sources of new traffic include chemical truck deliveries, trips by new District's employees, and increased biosolids hauling truck trips. Less than Significant with Mitigation Measures.	**Measure 6.2-2a:** The Districts will continue the existing ride-sharing program to encourage employees to join a carpool and use transit. **Measure 6.2-2b:** Chemical delivery trucks and screenings and grit and biosolids disposal trucks will avoid operating during peak traffic hours when possible.	Less than significant
Impact 6.2-3: Increased biosolids and chemical truck trips would impact regional transportation systems including freeways, especially I-405 and I-5. Less than Significant with Mitigation Measures.	**Measure 6.2-3:** The District should arrange for the transport of biosolids by trucks during off-peak travel hours when possible to reduce truck travel times and minimize impacts to the regional transportation system.	Less than significant
Noise		
Impact 6.4-1: Construction activities related to the proposed treatment plant improvements at Reclamation Plant No. 1 and Treatment Plant No. 2 would intermittently and temporarily generate noise levels above existing ambient levels in the project vicinity. Significant and Unavoidable.	**Measure 6.4-1a:** Construction activities will be limited to between the hours of 7:30 a.m. and 5:30 p.m. and as necessary to comply with local ordinances. Any nighttime or weekend construction activities would be subject to local permitting. **Measure 6.4-1b:** All equipment used during construction should be muffled and maintained in good operating condition. All internal combustion engine driven equipment should be fitted with intake and exhaust mufflers that are in good condition.	Significant, unavoidable

TABLE S-3 (Continued)
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR TREATMENT SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
Noise (cont.)		
Impact 6.4-1: (cont.)	**Measure 6.4-1c:** OCSD shall hire an acoustical engineer to evaluate other alternatives for mitigating impacts from extensive pile driving activities.	
	Measure 6.4-1d: OCSD shall employ alternative foundation designs to avoid a need for pilings, or use cast-in-place pilings constructed in boreholes.	
	Measure 6.4-1e: Nearby sensitive receptors affected by construction shall be notified concerning the project timing and construction schedule, and shall be provided with a phone number to call with questions or complaints.	
	Measure 6.4-1f: Temporary sound barriers (blankets on pile drivers) will be required during the construction period at Reclamation Plant No. 1 to eliminate a nuisance condition to the closest residences when pile driving is taking place.	
Impact 6.4-2: Operation of proposed new equipment at Reclamation Plant No. 1 and Treatment Plant No. 2 would generate noise levels above existing ambient levels in the project vicinity. Less than Significant with Mitigation Measures.	**Measure 6.4-2:** OCSD should establish a performance noise standard for operational noise at Reclamation Plant No. 1 and Treatment Plant No. 2. The performance standard should apply to the property line of each plant and should prohibit hourly average noise levels in excess of 55 dBA between the hours of 7:00 a.m. to 10:00 p.m. and 50 dBA between the hours of 10:00 p.m. and 7:00 a.m., as required by the Fountain Valley and Huntington Beach Noise Ordinances. Available mitigation to achieve the performance standard consists of locating noise sources away from sensitive receptors, installation of acoustical enclosures around noise sources, installation of critical application silencers and sequential mufflers for exhaust noise, installation of louvered vents, directing vent systems away from nearby residences, and constructing soundwalls at the property lines.	Less than significant

TABLE S-3 (Continued)
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR TREATMENT SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
<u>Noise</u> **(cont.)**		
Impact 6.4-3: Workers at Reclamation Plant No. 1 and Treatment Plant No. 2 may be exposed to excess noise levels from the operation of new facilities. Less than Significant with Mitigation Measures.	**Measure 6.4-3:** Noise control measures should be incorporated into the design of the facility. Once the facility is operational, a certified industrial hygienist or other qualified individual should measure the noise levels to which workers are exposed. If the OSHA 8-hour time weighted average exposure for any worker exceed the 85 dBA threshold, a hearing conservation program must be initiated and appropriate administrative and engineering controls must be put in place to reduce the noise to OSHA accepted levels.	Less than significant
<u>Air Quality</u>		
Impact 6.5-1: Project development under any of the six project scenarios would generate short-term emissions of air pollutants, including dust and criteria pollutants, from demolition, construction and/or restoration activities. Significant and Unavoidable.	**Measure 6.5-1a:** General contractors should maintain equipment engines in proper tune and operate construction equipment so as to minimize exhaust emissions. Such equipment shall not be operated during second stage smog alerts. **Measure 6.5-1b:** During construction, trucks and vehicles in loading or unloading queues should be kept with their engines off, when not in use, to reduce vehicle emissions. Construction activities shall be phased and scheduled to avoid emissions peaks, and discontinued during second-stage smog alerts. **Measure 6.5-1c:** General contractors should use reasonable and typical watering techniques to reduce fugitive dust emissions. All unpaved demolition and construction areas shall be wetted at least twice a day during excavation and construction, and temporary dust covers shall be used to reduce dust emissions and meet SCAQMD District Rule 403.	Significant, unavoidable

TABLE S-3 (Continued)
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR TREATMENT SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
Air Quality (cont.)		
Impact 6.5-1: (cont.)	**Measure 6.5-1d:** Soil binders should be spread on site, unpaved roads, and parking areas.	
	Measure 6.5-1e: Ground cover should be re-established on the construction site through seeding and watering.	
	Measure 6.5-1f: Trucks should be washed off prior to leaving the construction site.	
Impact 6.5-2: Emissions at both treatment plants under any of the project scenarios would continue to result from stationary sources. Increasingly restrictive air quality regulations are anticipated in the near future to comply with federal air quality standards, making air emissions permits for new and modified equipment more difficult to obtain. This impact would be less than significant with mitigation measures.	**Measure 6.5-2a:** The District will research ways of reducing NO_x and air toxics emissions from stationary sources, including non-combustion sources to meet future emission reductions that will be imposed by the SCAQMD.	Less than significant
	Measure 6.5-2b: The District will comply with existing and future air quality regulations including SCAQMD Rules and permit requirements. As air quality regulations become more restrictive in the South Coast Air Basin coinciding with increased operational demand, the District will be required to reduce emissions through process modifications or by implementing new control technologies.	
Impact 6.5-3: Emissions at both treatment plants under any of the project scenarios would continue to result from mobile sources. Mobile sources are projected to exceed the SCAQMD nitrous oxides significance threshold of 55 lbs/day. This would result in a significant impact to air quality.	**Measure 6.5-3a:** The District will maintain its ride-share programs to reduce commuter traffic and air quality impacts.	Significant, unavoidable
	Measure 6.5-3b: The District will complete the implementation of CNG stations and encourage contractors to employ CNG-powered engines on residual solids haul trucks through contract incentives where possible.	

TABLE S-3 (Continued)
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR TREATMENT SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
Air Quality (cont.)		
Impact 6.5-3: (cont.)	**Measure 6.5-3c:** Alternative fuels should be considered for biosolids haul trucks including low NO_x emitters.	
	Measure 6.5-3d: The District should initiate research on alternative methods of transporting biosolids to land application sites including electric vehicles and rail.	
Impact 6.5-4: Modifying the current CGS or adding new power-generating equipment would require SCAQMD permit modifications. Energy requirements greater than the permitted CGS capacity of 18 MW would require permit modifications. Less Than Significant impact with Mitigation.	**Measure 6.5-4a:** The District will purchase energy from off-site sources if air emissions permit modifications are denied.	Less than significant
	Measure 6.5-4b: The District will continue to research clean-burning engines for the CGS, in an effort to increase power output while reducing criteria and toxic pollutants.	
	Measure 6.5-4c: The District will install Best Available Control Technology if necessary to comply with SCAQMD Rules.	
Impact 6.5-5: The project under each of the treatment scenarios could generate objectionable odors in the project vicinity and in other areas located downwind from the treatment facilities. Less Than Significant after Mitigation Measures.	**Measure 6.5-5a:** The District will evaluate the need for odor control equipment for future facilities to reduce fugitive foul odors and include odor control when necessary. The District will also periodically review air emissions from existing solids handling to determine if odor control is necessary.	Less than significant
	Measure 6.5-5b: When dewatering is required during excavation, the District shall provide odor control systems to reduce construction odor impacts when necessary.	

TABLE S-3 (Continued)
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR TREATMENT SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
Geology		
Impact 6.6-1: Project facilities, under any of the treatment scenarios, would be located in areas susceptible to primary and secondary seismic hazards (groundshaking, liquefaction, settlement). Damage to facilities could result in the event of a major earthquake. Less than Significant with Mitigation Measures.	**Measure 6.6-1a:** During the project design phase for all facilities, the District will perform design-level geotechnical evaluations. The geotechnical evaluations will include subsurface exploration and review of seismic design criteria to ensure that design of the facilities meet seismic safety. **Measure 6.6-1b:** The District will design and construct new facilities in accordance with District seismic standards and/or meet or exceed seismic, design standards in the most recent edition of the California Building Code.	Less than significant
Impact 6.6-2: Groundshaking could cause spills of raw sewage, causing a significant impact to public health. Less than Significant impact with Mitigation Measures.	**Measure 6.6-2a:** The District will implement the Spill Prevention Containment and Countermeasures Plan (SPCC). **Measure 6.6-2b:** Secondary containment, such as berms, will be used to contain and divert toxic chemicals from wastewater flows and isolate damaged facilities to reduce contamination risks.	Less than significant
Hydrology		
Impact 6.7-1: Construction of any of the treatment system scenarios could result in an increase in erosion and siltation into surface waters. Construction could also result in chemical spills (e.g., fuels, oils, or grease) to stormwater, and increase turbidity and decrease water quality in waters of the U.S. Less than Significant with Mitigation Measures.	**Measure 6.7-1a:** The District will implement Best Management Practices (BMPs) as outlined in the SWMP. **Measure 6.7-1b:** The District will train construction and operation employees in storm water pollution prevention practices. Individual contractors performing construction at each treatment facility shall be required to comply with provisions of the SWMP. **Measure 6.7-1c:** The District will inspect and maintain all on-site storm water drains and catch basins on plant property regularly.	Less than significant

TABLE S-3 (Continued)
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR TREATMENT SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
Hydrology (cont.)		
Impact 6.7-1: (cont.)	**Measure 6.7-1d:** The District will apply the SARWQCB's recommended BMPs during construction and operation as specified in the SWMP.	
	Measure 6.7-1e: For construction involving disturbance greater than five acres of land, the District will incorporate into contract specifications the following requirements:	
	The contractor(s) will comply with the RWQCB requirements of the NPDES General Permit for Discharges of Storm Water Associated with Construction Activity. The contractor will implement control measures that are consistent with the General Permit and with the recommendations and policies of the RWQCB. This would include submitting a Notice of Intent and site map to the RWQCB, developing a Storm Water Pollution Prevention Plan, and implementing site-specific best management practices to prevent sedimentation to surface waters.	
Impact 6.7-2: Pile driving and excavation activities at Reclamation Plant No. 1 and Treatment Plant No. 2 may encounter groundwater, and local dewatering may be required. Less than Significant with Mitigation Measures.	**Measure 6.7-2a:** Construction contractors will comply with the District's Dewatering Specifications.	Less than significant
	Measure 6.7-2b: Water from dewatering operations will be disposed of in a suitable manner in conformance with the NPDES permit, as approved by the RWQCB.	

TABLE S-3 (Continued)
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR TREATMENT SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
Hydrology (cont.)		
Impact 6.7-3: Reclamation Plant No 1. and Treatment Plant No. 2 are located in the 100-year floodplain of the Santa Ana River. New facilities proposed under any of the scenarios considered would expose structures and people to a 100-year flood event and/or effects of a tsunami. Less than Significant With Mitigation Measures.	**Measure 6.7-3a:** The District should construct and maintain secondary containment berms to protect against release of toxic chemicals in an event of a spill from flooding. **Measure 6.7-3b:** The District should coordinate with the Army Corp of Engineers to ensure levees located adjacent to Reclamation Plant No. 1 and Treatment Plant No. 2 continue to provide adequate protection for a 100-year flood event. **Measure 6.7-3c:** The District should adhere to the Emergency Contingency Plan and the Flood Protection Plan to minimize the affects of flooding and tsunamis to Reclamation Plant No.1 and Treatment Plant No. 2. These measures should include hazard awareness notifications to neighborhoods downstream from Reclamation Plant No. 1. **Measure 6.7-3d:** The District should adhere to Orange County's flood protection program as implemented by the Orange County Flood Control District.	Less than significant
Impact 6.7-4: Construction and long-term operation of the proposed improvements to both treatment plants would increase the area of impervious surface and result in an incremental increase in surface runoff in these areas. Less than Significant with Mitigation Measures.	See **Mitigation Measures 6.7-1a** through **6.7-1e**	Less than significant

TABLE S-3 (Continued)
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR TREATMENT SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
Hazardous Materials		
Impact 6.9-1: Increasing quantities of hazardous materials stored on site could impact public health in the event of a catastrophic spill or explosion. Increasing liquid oxygen storage could increase the hazard. Less than Significant with Mitigation Measures.	**Measure 6.9-1a:** Worker safety training should emphasize hazards of liquid oxygen and stored methane. Routine safety measures including hazard communication should be adopted and strictly enforced in hazardous areas. Hazard training and communication should include laboratory operations and routine process chemical use.	Less than significant
	Measure 6.9-1b: If additional liquid oxygen storage facilities are installed, the District should research explosion and fire potential to determine explosion arc perimeters. If neighboring land uses are not adequately distant, the District should reconfigure the oxygen storage facility to remove explosion hazards on neighboring land uses.	
	Measure 6.9-1c: Liquid oxygen operations should be included in the District's Risk Management Program.	
Cumulative		
Impact 6.11-1: Cumulative impacts to air quality and noise could occur as a result of treatment facility construction activities coupled with the construction of the GWR System treatment facilities. Significant, unavoidable.	**Measure 6.11-1a:** Coordinate construction activities with OCWD to minimize PM_{10} emissions, construction vehicle exhaust, and cumulative noise impacts during excavation and pile driving activities.	Significant, unavoidable

TABLE S-3 (Continued)
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR TREATMENT SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
<u>**Growth-Inducement**</u>		
Impact 11-1: By removing wastewater treatment capacity as one barrier to growth, the District would have indirect, growth-inducement potential to support planned development within the Service Area that is consistent with and within the levels of development approved in the adopted General Plans. Less the Significant with Mitigation Measures.	**Measure 11-1a:** The project's phased design helps minimize growth inducement potential. The Strategic Plan allows for the incremental expansion of treatment capacity, allowing Service Area cities to re-evaluate and revise long-term needs before completing full "build out." **Measure 11-1b:** The District revises its Strategic Plan periodically allowing the treatment facilities to best meet the actual needs of the Service Area. The implementation of this Strategic Plan was based on a projected decrease influent flow and serves to decrease anticipated capacity requirements. Future revisions every five years will assist the District in maintaining service for reasonably foreseeable planned growth levels.	Less than significant
Impact 11-2: The OCSD Strategic Plan would accommodate planed growth in the Service Area. Implementation of planned growth would result in secondary environmental effects. The effects of planned growth have been identified and addressed in the EIRs on Regional Plans, General Plans for Service Area cities, and associated Specific Plans. Some of the secondary effects of growth which have been identified as significant and unavoidable include air quality and traffic congestion.	**Measure 11-2:** OCSD does not have the authority to make land use and development decisions, nor does it have the authority or jurisdiction to address many of the identified significant, secondary effects of planned growth. Authority to implement such measures lies with the County and cities which enforce local, state, and federal regulations through the permit process. Other agencies with authority to require mitigation or with responsibility to implement measures to mitigate the effects of planned growth include regional and state agencies such as the South Coast Air Quality management District (SCAQMD), Regional Water Quality Control Board (RWQCB), California Department of Fish and Game (CDFG), California Department of Health Services (DHS), California Department of Transportation (Caltrans), and federal agencies including U.S. Fish and Wildlife Service (USFWS), U.S. Environmental Protection Agency (EPA), and the U.S. Corps of Engineers (USACE).	Significant, unavoidable

TABLE S-4
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR COLLECTION SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
Land Use		
Impact 7.1-1: Construction activities associated with the trunk sewer systems would involve the rehabilitation and replacement of existing pipelines. Construction activities would result in short-term disturbance of adjacent land uses. Less than Significant with Mitigation Measures.	**Measure 7.1-1a:** The District will comply with local ordinances and restrict construction activities to daylight hours or as specified in encroachment permits. **Measure 7.1-1b:** The District should provide notices of construction activities to adjacent property owners and provide a contact and phone number of a District staff person to be contacted regarding questions or concerns about construction activity. **Measure 7.1-1c:** The District should coordinate with officials of adjacent fire station and the Fountain Valley Regional Hospital to ensure that 24-hour emergency access is available. **Measure 7.1-1d:** To minimize disruption of access to driveways to adjacent land uses, the District or its contractor(s) should maintain steel-trench plates at the construction sites to restore access across open trenches. Construction trenches in streets will not be left open after work hours. **Measure 7.1-1e:** The District should provide temporary signage indicating that businesses are open.	Less than significant
Traffic		
Impact 7.2-1: Construction activities during trenching in city streets will impact traffic circulation during construction period. Less than Significant with Mitigation Measures.	**Measure 7.2-1a:** Traffic control plans will be prepared by a qualified professional engineer, prior to the construction phase of each sewer line project as implementation proceeds. **Measure 7.2-1b:** Traffic control plans will consider the ability of alternative routes to carry additional traffic and identify the least disruptive hours of construction site truck access routes, and the type and location of warning signs, lights and other traffic control devices. Consideration will be given to maintaining access to commercial parking lots, private driveways and sidewalks, bikeways and equestrian trails, to the greatest extent feasible.	Less than significant

TABLE S-4 (Continued)
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR COLLECTION SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
<u>Traffic</u> (cont.) **Impact 7.2-1: (cont.)**	**Measure 7.2-1c:** Encroachment permits for all work within public rights-of-way will be obtained from each involved agency prior to commencement of any construction. Agencies involved include Caltrans, the Orange County Public Facilities and Resources Department (Development Services Section) and the various cities where work will occur. The District will comply with traffic control requirements, as identified by Caltrans and the affected local jurisdictions. **Measure 7.2-1d:** Traffic control plans will comply with the Work Area Traffic Control Handbook and/or the Manual of Traffic Controls as determined by each affected local agency, to minimize any traffic and pedestrian hazards that exist during project construction. **Measure 7.2-1e:** The construction technique for the implementation of the proposed sewer lines, such as tunneling, cut and cover with partial street closure, or cut and cover with full street closure, should include consideration of the ability of the roadway system, both the street in question and alternate routes, to carry existing traffic volumes during project construction. If necessary, adjacent parallel streets will be selected as alternate alignments for the proposed sewer improvements. As required by local jurisdictions, trunk sewers will be jacked under select major intersections, to avoid traffic disruption and congestion. **Measure 7.2-1f:** Public streets will generally be kept operational during construction, particularly in the morning and evening park hours of traffic. Lane closures will be minimized during peak traffic hours. **Measure 7.2-1g:** Public roadways will be restored to their existing condition after project construction is completed. **Measure 7.2-1h:** The Districts will attempt to schedule construction of relief facilities to occur jointly with other public works projects already planned in the affected locations, through careful coordination with all local agencies involved	

TABLE S-4 (Continued)
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR COLLECTION SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
Traffic (cont.)		
Impact 7.2-1: (cont.)	**Measure 7.2-1i:** Emergency service purveyors will be contacted and consulted to preclude the creation of unnecessary traffic bottlenecks that will seriously impede response times. Additionally, measures to provide an adequate level of access to private properties shall be maintained to allow delivery of emergency services.	
	Measure 7.2-1j: OCTA will be contacted when construction affects roadways that are part of the OCTA bus network.	
Biology		
Impact 7.3-1: Based on conceptual alignment information for OCSD's proposed collection system projects, construction of the collection pipeline system improvements would occur in previously disturbed, developed areas, primarily public streets. No impact to biological resources would occur if projects occur within paved areas. However, if final project alignments are revised to include an undeveloped area or open space, potential impacts to biological resource could occur; in these cases OCSD would conduct additional CEQA as needed to clarify and address impacts to biological resources.	**Measure 7.3-1:** If in the future, as OCSD develops the design of each specific collection system project for implementation, a project alignment includes unpaved, undeveloped park or open space area, OCSD will conduct additional CEQA review as needed to clarify and address potential impacts to biological resources.	Less than significant

TABLE S-4 (Continued)
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR COLLECTION SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
Noise		
Impact 7.4-1: Construction activities related to the proposed collection system improvements would intermittently and temporarily generate noise levels above existing ambient levels in the project vicinity. Less than Significant with Mitigation Measures.	**Measure 7.4-1a:** Construction activities should be limited to between the hours of 7:30 a.m. and 5:30 p.m. and as necessary to comply with local ordinances. Any nighttime or weekend construction activities would be subject to local permitting.	Less than significant
	Measure 7.4-1b: All equipment used during construction should be muffled and maintained in good operating condition. All internal combustion engine driven equipment should be fitted with intake and exhaust mufflers that are in good condition.	
	Measure 7.4-1c: Contractors should use vibratory pile drivers instead of conventional pile drivers where feasible and effective in reducing impact noise from shoring of jack-pit locations in close proximity to residential areas, where applicable.	
	Measure 7.4-1d: Sensitive receptors affected by pipeline replacement projects, and manhole rehabilitation activities should be notified concerning the project timing and construction schedule, and should be provided with a phone number to call with questions or complaints.	

TABLE S-4 (Continued)
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR COLLECTION SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
<u>Air Quality</u>		
Impact 7.5-1: The proposed improvements to OCSD's collection systems would generate short-term emissions of air pollutants, including dust and criteria pollutants, from excavation, installation and/or replacement activities. This is considered a short-term significant impact that would cease at the completion of construction activities. Construction emission impacts are estimated to occur for an average of three to four weeks within one block of any given property. Less than Significant with Mitigation Measures.	**Measure 7.5-1a:** The District should require the contractors to implement a dust abatement program that would reduce fugitive dust generation to lessen impacts to nearby sensitive receptors. The dust abatement program shall include the following measures: ▪ Water all active construction sites at least twice daily. ▪ Cover all trucks having soil, sand, or other loose material or require all trucks to maintain at least two feet of freeboard. ▪ Apply water three times daily, or apply non-toxic soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites. ▪ Sweep daily (with water sweepers) all paved access roads, parking areas and staging areas at construction sites. ▪ Sweep daily (with water sweepers) if visible soil material is carried into adjacent streets. ▪ Hydroseed or apply non-toxic soil stabilizers to inactivate construction areas (previously graded areas inactive for ten days or more). ▪ Water twice daily or apply non-toxic soil binders to exposed soil stockpiles. ▪ Limit traffic speeds on unpaved roads to 15 mph.	Less than significant

TABLE S-4 (Continued)
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR COLLECTION SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
Air Quality (cont.)		
Impact 7.5-1: (cont.)	**Measure 7.5-1b:** Contractors should maintain equipment engines in proper working order and operate construction equipment so as to minimize exhaust emissions. Such equipment should not be operated during first or second stage smog alerts. **Measure 7.5-1c:** During construction, trucks and vehicles in loading or unloading queues should be kept with their engines off, when not in use, to reduce vehicle emissions. Construction activities shall be discontinued during second-stage smog alerts.	
Geology		
Impact 7.6-1: Project facilities would be located in areas susceptible to primary and secondary seismic hazards (groundshaking, liquefaction, settlement). Damage to facilities could result in the event of a major earthquake. Less than Significant with Mitigation Measures.	**Measure 7.6-1a:** The District will design and construct new facilities in accordance with District seismic standards and/or meet or exceed seismic, design standards in the most recent edition of the California Building Code. **Measure 7.6-1b:** Soils surveys shall be conducted to determine the liquefaction potential along the collection system improvements route.	Less than significant

TABLE S-4 (Continued)
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR COLLECTION SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
<u>Hydrology</u>		
Impact 7.7-1: Construction activities could result in erosion and siltation into nearby surface waters, leading to degradation of water quality or flooding hazards. Construction could also result in chemical spills (e.g., fuels, oils, or grease) to stormwater, and increase turbidity and decrease water quality in waters of the U.S. Less than Significant with Mitigation Measures.	**Measure 7.7-1a:** Construction contractors will implement Best Management Practices to prevent erosion and sedimentation to avoid significant adverse impacts to surface water quality. **Measure 7.7-1b:** In addition, open-trench installation of pipelines across open drainage channels and the interplant connector should be limited to the dry season. **Measure 7.7-1c:** The District should coordinate with the Orange County Public Facilities and Resources Department (Orange County Flood Control District) Planning Section to ensure compatibility and joint use feasibility with existing and future projects. **Measure 7.7-1d:** The District should incorporate into contract specifications the requirement that the contractor(s) enforce strict on-site handling rules to keep construction and maintenance materials out of receiving waters. The rules will include measures to: ▪ Store all reserve fuel supplies only within the confines of a designated construction staging area. ▪ Refuel equipment only within designated construction staging area. ▪ Regularly inspect all construction vehicles for leaks.	Less than significant

TABLE S-4 (Continued)
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR COLLECTION SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
<u>Hydrology (cont.)</u>		
Impact 7.7-1: (cont.)	**Measure 7.7-1e:** The District should incorporate into contract specifications the requirement that the contractor(s) prepare a Spill Prevention, Control, and Countermeasure Plan. The plan would include measures to be taken in the event of an accidental spill.	
	Measure 7.7-1f: The District should incorporate into contract specifications the requirement that the construction staging areas be designed to contain contaminants such as oil, grease, and fuel products so that they do not drain towards receiving waters or storm drain inlets. If heavy-duty construction equipment is stored overnight adjacent to a potential receiving water, drip pans will be placed beneath the machinery engine block and hydraulic systems.	
	Measure 7.7-1g: The District will contact the Orange County Flood Control District prior to excavation activities involved with the construction of the interplant connector to ensure the integrity of the flood control system along the Santa Ana River.	
<u>Public Services</u>		
Impact 7.8-1: Construction of the collection pipeline system could result in short-term disruption of emergency services in the vicinity of the project area. Less than significant with Mitigation Measures.	**Measure 7.8-1a:** The contractor should provide a copy of the Traffic Control Plan to the Sheriff's Department local police departments and fire departments prior to construction. The District should provide 72-hour notice of construction to the local service providers of individual pipeline segments.	Less than significant

TABLE S-4 (Continued)
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR COLLECTION SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
Public Services (cont.)		
Impact 7.8-1: (cont.)	**Measure 7.8-1b:** Access to fire stations and emergency medical facilities must be maintained on a 24-hour basis and at least one access to medical facilities should be available at any one time during construction. The District should notify appropriate officials at the medical facility regarding construction schedule.	
	Measure 7.8-1c: Trenches should be promptly backfilled after pipeline installation. If installation is incomplete, steel trench plates should be used to cover open trenches.	
Impact 7.8-2: Construction of the collection system projects would create a public safety hazard in the vicinity of the construction area. Less than Significant with Mitigation Measures.	**Measure 7.8-2a:** Construction contractors should ensure that adequate barriers would be established to prevent pedestrians from entering open trenches of an active construction area. Warnings shall also be posted sufficient distances from the work area to allow pedestrians to cross the street at controlled intersections rather than having to jaywalk.	Less than significant
	Measure 7.8-2b: Construction contractors should be responsible for providing appropriate security measures, including the provision of security guards, for all equipment staging and/or storage areas needed for the project.	
	Measure 7.8-2c: Construction contractors should dispose of construction refuse at approved disposal locations. Contractors should not be permitted to dispose of construction debris in residential or business containers.	
Impact 7.8-3: Construction of the collection pipeline system could result in short-term disruption of utility service and may require utilities relocation. Less than Significant with Mitigation Measures.	**Measure 7.8-3a:** A detailed study identifying utilities along the pipeline routes should be conducted during the design stages of the project. For segments with adverse impacts the following mitigation measures should be implemented.	Less than significant

TABLE S-4 (Continued)
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR COLLECTION SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
<u>Public Service (cont.)s</u> **Impact 7.8-3: (cont.)**	▪ Utility excavation or encroachment permits shall be required from the appropriate agencies. These permits include measures to minimize utility disruption. The District and its contractors should comply with permit conditions and such conditions should be included in construction contract specifications. ▪ Utility locations should be verified through field survey. ▪ Detailed specifications should be prepared as part of the design plans to include procedures for the excavation, support, and fill of areas around utility cables and pipes. All affected utility services would be notified of the District's construction plans and schedule. Arrangements should be made with these entities regarding protection, relocation, or temporary disconnection of services. **Measure 7.8-3b:** In order to reduce potential impacts associated with utility conflicts, the following measures should be implemented in conjunction with 7.8-3a. ▪ Disconnected cables and lines would be promptly reconnected. ▪ The District shall observe Department of Health and Safety (DHS) standards which require a 10-foot horizontal separation between parallel sewer and water mains; (2) one foot vertical separation between perpendicular water and sewer line crossings. In the event that the separation requirements cannot be maintained, the District shall obtain DHS variance through provisions of water encasement, or other means deemed suitable by DHS; and (3) encasing water mains in protective sleeves where a new sewer force main crosses under or over an existing sewer main.	

TABLE S-4 (Continued)
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR COLLECTION SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
Impact 7.8-3: (cont.)	**Measure 7.8-3c:** The construction contractor should comply with District requirements and specification to protect existing utility lines.	
	Measure 7.8-3d: The District should coordinate with the Orange County Public Facilities and Resources Department to ensure compatibility and joint use feasibility with existing and future projects.	
<u>Aesthetics</u>		
Impact 7.9-1: Project implementation could result in short-term visual impacts resulting from construction activities. Less than Significant after Mitigation Measures.	**Measure 7.9-1a:** The District should ensure that its contractors restore disturbed areas along the pipeline alignment to their pre-project condition such that short-term construction disturbance does not result in long-term visual impacts.	Less than significant
	Measure 7.9-1b: Construction contractors should be required to keep construction and staging areas orderly, free of trash and debris.	
<u>Cultural Resources</u>		
Impact 7.10-1: Implementation of the proposed collection system improvements may affect known, significant archaeological resources. Less than Significant with Mitigation Measures.	**Measure 7.10-1:** During project design, within the area of the 6 recorded archaeological sites within proposed project alignments, a qualified archaeologist should conduct a subsurface testing program to determine whether intact significant deposits exist in the excavation area. Should testing indicate that areas of significant deposits do exist, the deposits would be preserved in place, if feasible. If preservation in place is not feasible, a Data Recovery Plan would be prepared to address the removal of those deposits and would be implemented before the beginning of construction. The Plan would define how and when mechanical and manual excavation would be conducted, the anticipated volume of recovered soils, artifact analysis, cataloging and curation, and monitoring and reporting requirements. For the three sites where human remains have been recorded (CA-ORA-85, CA-ORA-87, and CA-ORO-300), the District would enter into a written agreement between an archaeological consultant, to be retained by the District, and a Native American representative prior to construction in the vicinity of these sites.	Less than significant

TABLE S-4 (Continued)
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR COLLECTION SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
<u>Cultural Resources (cont.)</u>		
Impact 7.10-2: Implementation of the proposed collection system improvements may affect unknown, potentially significant archeological resources. Less than Significant with Mitigation Measures.	**Measure 7.10-2a:** Subsurface construction has a low to very high potential for exposing significant subsurface cultural resources. Due to the likelihood of encountering cultural resources, the District should implement the following prior to project construction: ▪ Language should be included in the General Specifications section of any subsurface construction contracts alerting the contractor to the potential for subsurface cultural resources and trespassing on known or potential resources adjacent to the project. ▪ Prior to construction, contractors and District staff will receive an archaeological orientation from a professional archaeologist regarding the types of resources which may be uncovered and how to identify these resources during construction activities. The orientation shall also cover procedures to follow in the case of any archaeological discovery. **Measure 7.10-2b:** If cultural resources are encountered at any time during project excavation, construction personnel would avoid altering these materials and their context until a qualified archaeologist has evaluated the situation. Project personnel would not collect or retain cultural resources. Prehistoric resources include, but are not limited to, chert or obsidian flakes, projectile points, mortars, and pestles; and dark, friable soil containing shell and bone, dietary debris, heat-affected rock, or human burials. Historic resources include stone or adobe foundations or walls; structures and remains with square nails; and refuse deposits (glass, metal, wood, ceramics), often found in old wells and privies.	Less than significant

TABLE S-4 (Continued)
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR COLLECTION SYSTEM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
Cultural Resources (cont.)		
Impact 7.10-2: (cont.)	**Measure 7.10-2c:** In the event of accidental discovery or recognition of any human remains, the County Coroner would be notified immediately and construction activities shall be halted. If the remains are found to be Native American, the Native American Heritage Commission would be notified within 24 hours. Guidelines of the Native American Heritage Commission shall be adhered to in the treatment and disposition of the remains.	
Cumulative		
Impact 7.11-1: Construction activities of the collection system projects in conjunction with other projects would result in short-term cumulative impacts. Less than Significant with Mitigation Measures.	**Measure 7.11-1a:** The District will continue to coordinate construction activities with the county and city public works and planning departments and other local agencies to identify overlapping pipeline routes, project areas, and construction schedules. To the extent feasible, construction activities should be coordinated to consolidate the occurrence of short-term construction-related impacts.	Less than significant

TABLE S-5
SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES FOR BIOSOLIDS MANAGEMENT PROGRAM

RESOURCE TOPIC/IMPACT	MITIGATION MEASURE	LEVEL OF SIGNIFICANCE AFTER MITIGATION
Impact 8-2: The projected increase in residual solids volumes would increase truck traffic on local roadways. Less than Significant with Mitigation.	**Measure 8-2:** The District shall limit truck trips associated with the transport of residual solids to off-peak hours when possible as a means of reducing truck travel times and minimizing congestion impacts to the regional transportation system.	Less than significant
Impact 8-3: The projected increase in residual solids volumes and related truck traffic would increase ambient noise levels at nearby sensitive receptor locations. Less than Significant with Mitigation Measures.	**Measure 8-3a:** The District shall limit truck trips associated with the transport of residual solids at Treatment Plant No. 2 to non-noise sensitive (daytime) and non-peak hour periods as a means of reducing exposure of residences to truck-related noise whenever possible. **Measure 8-3b:** The District shall investigate options for reducing the number of biosolids truck trips at Treatment Plant No. 2. The study could focus on evaluating such practices as using underground pipelines to pump biosolids from Plant 2 up to Plant 1 and rail-hauling the materials from the site.	Less than significant
Impact 8-5: The projected increase in biosolids production from POTWs in the Southern California region could present a cumulative impact on the availability of land application sites. Less than Significant with Mitigation.	**Measure 8-5a:** The District will continue to research land application sites in the region and consider the management options including the acquisition of dedicated application sites. **Measure 8-5b:** The District will continue to coordinate with other POTWs in the region to cooperatively research innovative ways to solve land availability issues.	Less than significant

CHAPTER 1

INTRODUCTION

CHAPTER 1
INTRODUCTION

1.1 LEGAL BASIS FOR THE PEIR

The project evaluated in this Draft Program Environmental Impact Report (PEIR) updates the 1989 Master Plan with a new Strategic Plan to identify projects needed to accommodate projected population growth in its service area and to comply with changing future regulations that affect treatment facilities and effluent quality. Projects are planned to replace and rehabilitate sewer collection systems, expand and upgrade the District's two wastewater treatment plants, provide adequate discharge capacity for projected peak flows, provide additional treated wastewater to the Orange County Water District (OCWD) for expanded water reuse, and study the feasibility of other improvements. Numerous individual projects are planned for various years between 2000 and 2020.

1.2 PURPOSE OF THE PEIR

The District, as the lead agency, has prepared this PEIR to provide the public, and responsible and trustee agencies reviewing this project, with information about the potential effects, both beneficial and adverse, of the Strategic Plan on the local and regional environment. This PEIR was prepared in compliance with the California Environmental Quality Act (CEQA) of 1970 (as amended), the state EIR guidelines, and California Administrative Code, Title 14, Chapter 3.

The PEIR describes the environmental impacts of the various components of the Districts operations including collection system upgrades, treatment facility upgrades, discharge location options, peak wet weather management options, and biosolids management options. Mitigation measures are identified for reducing those impacts. The impact analysis in this report has been based on a variety of sources, including District strategic analysis, agency consultation, archaeological reports on the project sites, and field surveys completed by Environmental Science Associates and MEC Analytical Systems.

The primary purpose of the document is to present an overview of potential areas of impact resulting from planned improvements. The program-level analysis focuses on policy issues such as treatment level scenarios and peak-wet weather contingencies to plan for future individual construction projects. As such, the document provides long-term impact analysis of broad planning strategies. This program-level approach will allow the District to avoid duplicative and overlapping environmental documentation for individual projects, and will allow for more streamlined and focused environmental reviews in the future, including the use of tiering analysis as defined in CEQA. The document provides project-level analysis for projects anticipated to occur in the near-term of the planning period, that is to say up to the year 2005. Impacts from projects already designed and planned are analyzed throughout the document. Should the design or project description as identified in this document change substantially for any of the near-term projects, subsequent project-level impact evaluation will be necessary.

1.3 ORGANIZATION OF THE PEIR

This PEIR is structured similarly to the OCSD 1989 Master Plan. The chapters are organized by system components, as indicated below:

Chapter 1:	Introduction
Chapter 2:	Background and Existing Facilities and Operation
Chapter 3:	Project Description
Chapter 4:	Regional Setting
Chapter 5:	Ocean Discharge Setting, Impacts, and Mitigation
Chapter 6:	Treatment System Setting, Impacts, and Mitigation
Chapter 7:	Collection System Setting, Impacts and Mitigation
Chapter 8:	Residual Solids/Biosolids Management Setting, Impacts, and Mitigation
Chapter 9:	Alternatives to the Proposed Project
Chapter 10:	Cross-Media Environmental Trade-offs
Chapter 11:	Growth Inducement / Secondary Effects of Growth
Chapter 12:	Report Preparers and Persons and Organizations Consulted
Chapter 13:	List of Acronyms

1.4 CEQA EIR PROCESS

1.4.1 NOTICE OF PREPARATION

In accordance with Sections 15063 and 15082 of the CEQA *Guidelines*, the District prepared a Notice of Preparation (NOP) for this PEIR (**Appendix A**). The NOP was circulated to local, state, and federal agencies and other interested parties for 30 days, on October 23, 1997. The NOP provided a general description of the Strategic Plan Project, a review of Plan components, and a preliminary list of potential environmental impacts.

1.4.2 PUBLIC SCOPING

A public scoping meeting was held in the City of Fountain Valley on November 13, 1997. The purpose of the meeting was to present the proposed project to interested parties and to solicit their input as to the scope and content of this PEIR. Public notices were placed in local newspapers informing the general public of the scoping meeting.

ISSUES RAISED

A variety of issues and concerns were raised during the scoping period for the Strategic Plan Project. These issues are summarized in table format in **Appendix B**. Responses to the NOP and comments from the scoping meeting are also included in **Appendix B**.

1.4.3 DRAFT PROGRAM EIR

This document constitutes the Draft Program Environmental Impact Report. It contains a description of the project, description of the environmental setting, identification of project impacts, and mitigation measures for impacts found to be significant as well as an analysis of project alternatives.

Significance criteria have been developed for each environmental issue analyzed in this PEIR and are defined at the beginning of each impact analysis section. Impacts are categorized as follows:

- significant, unavoidable
- significant, but can be mitigated to a less-than-significant level
- less than significant (mitigation is not required under CEQA, but may be recommended)
- no impact

1.4.4 PUBLIC REVIEW OF DRAFT PEIR

This document is being circulated to local, state, and federal agencies and to interested organizations and individuals who may wish to review and comment on the report. Publication of this PEIR marks the beginning of a 45-day public review period, during which written comments may be sent to the OCSD, 10844 Ellis Avenue. During this 45-day review period, the District will conduct a public hearing to answer questions about, and to receive oral comments on, the PEIR. Written and oral comments received on this Draft PEIR will be addressed in a Response to Comments document which, together with this Draft PEIR, will constitute the Final PEIR.

1.4.5 FINAL PEIR

After the Final PEIR has been completed, the OCSD Board of Directors will then consider PEIR certification at a regularly scheduled Board meeting. Upon PEIR certification, the District may proceed with project approval actions.

1.4.6 MITIGATION MONITORING AND REPORTING

State law requires lead agencies to adopt a reporting and mitigation monitoring program for the changes to the project which it has adopted or made a condition of project approval in order to mitigate or avoid significant effects on the environment. The specific reporting or monitoring program is not required by CEQA *Guidelines* to be included in the PEIR. Throughout this PEIR, however, proposed mitigation measures have been clearly identified and presented in language that will facilitate establishment of a monitoring program. All measures adopted by the District will be included in a Mitigation Monitoring and Reporting Program to verify compliance.

CHAPTER 2

OCSD EXISTING FACILITIES AND OPERATIONS

CHAPTER 2.0

OCSD EXISTING FACILITIES AND OPERATIONS

2.1 SERVICE AREA

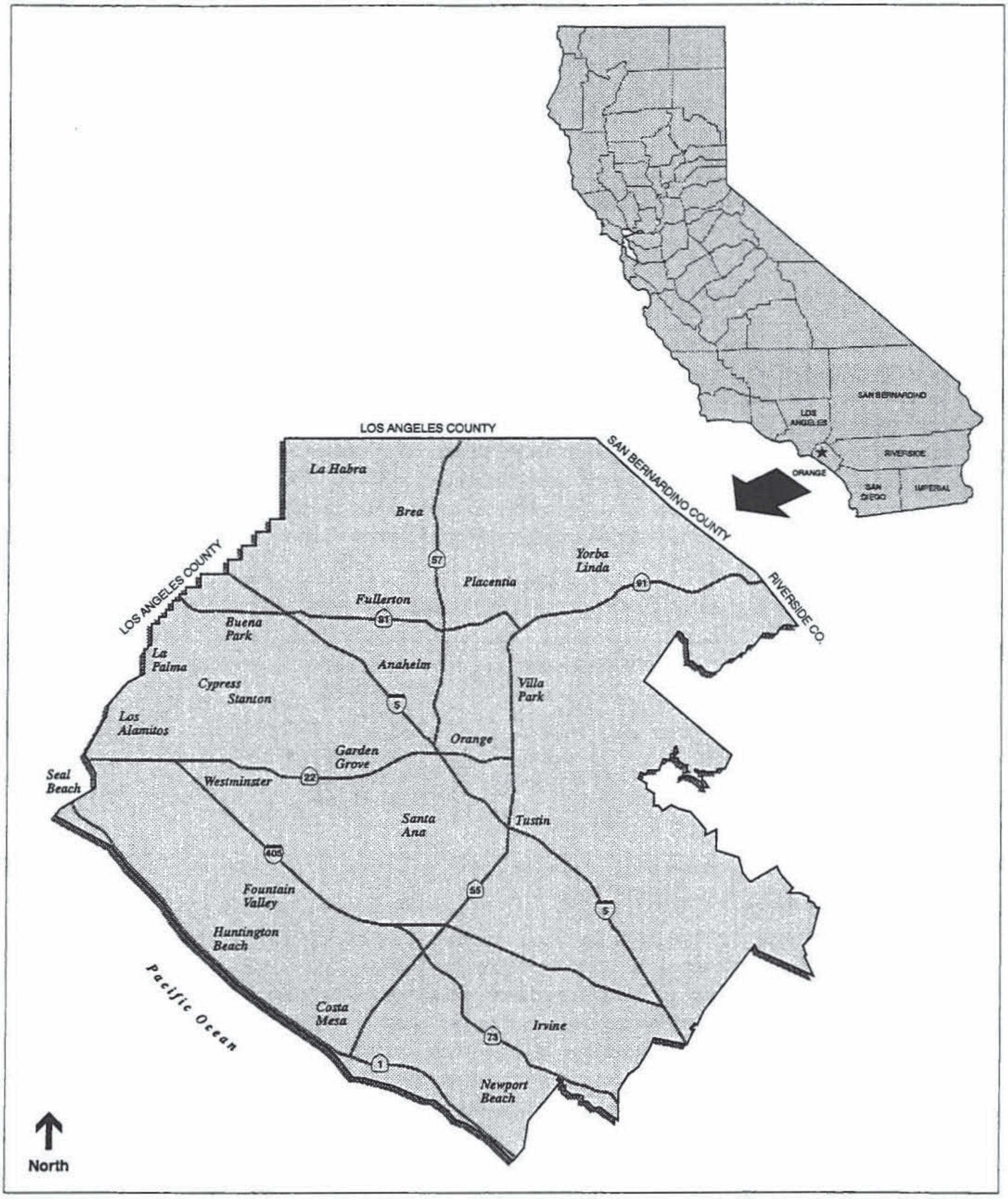
The District provides wastewater services for more that 2.2 million residents in 23 cities within a 450-square mile portion of northern Orange County (**Figure 2-1**). **Table 2-1** indicates the cities included within the District. Unincorporated areas within the service area are administered through Orange County. The service area encompasses slightly more than half of the land area of Orange County, serving more than 87 percent of the population in Orange County. This population is projected to increase to over 2.8 million by the year 2020. The District operates and maintains over 400 miles of sewer trunk lines within its service area. Local municipalities operate and maintain the localized sewer branches which feed into the District's trunk system.

TABLE 2-1
CITIES INCLUDED WITHIN THE OCSD SERVICE AREA

Anaheim	Huntington Beach	Santa Ana
Brea	Irvine	Seal Beach
Buena Park	La Habra	Stanton
Costa Mesa	La Palma	Tustin
Cypress	Los Alamitos	Villa Park
Fountain Valley	Newport Beach	Westminister
Fullerton	Orange	Yorba Linda
Garden Grove	Placentia	

2.2 MASTER PLAN HISTORY

The District was formed in 1946 under the County Sanitation District Act of 1923 as a single purpose entity, providing wastewater treatment for northern Orange County. As the county has developed over the years from agricultural to primarily urban with an expanding population, the District has adapted to increase its treatment and discharge capacity. In 1954, the District began full operation with a network of trunk sewers, two treatment plants, and a new 7,200-foot long, 78-inch diameter ocean outfall terminating at a depth of 60 feet. The initial flow was approximately 18 mgd generated by a population of 200,000. The 78-inch diameter outfall has a



SOURCE: CDM Camp Dresser & McKee.

Figure 2-1
OCSD Service Area

capacity of 250 mgd. A new 120-inch outfall with a design capacity of 480 mgd was installed and first put into service in 1971. This outfall, currently in service, extends approximately four miles into the ocean, where it connects with a diffuser extending another 6,000 feet northward. The new outfall greatly enhanced the quality of the Orange County shoreline from Corona del Mar to Seal Beach.

The District until recently has consisted of nine individual wastewater districts. In July of 1998, the District became a consolidated agency changing its name from the County Sanitation Districts of Orange County to the Orange County Sanitation District. The old district boundaries now generally constitute individual "Revenue Areas" within the larger consolidated District service area.

Major planning efforts including CEQA documentation were undertaken beginning in the early 1970s. In 1977, the District completed an extensive Environmental Impact Statement for their wastewater management program. Collection system Master Plans for each of the nine districts were prepared every five to ten years. Districts experiencing faster growth updated their Master Plans more frequently. The Joint Works Treatment and Disposal Facility Master Plans have historically been prepared every five years, to plan for orderly development of necessary new facilities. In 1987, the District began a comprehensive master plan which included collection, treatment and disposal facilities called the 30-year Master Plan for Waste Water Collection, Treatment, and Disposal Facilities (1989 Master Plan). This Plan was part of a larger planning effort referred to as the "Action Plan for Balanced Environmental Management: Protecting Orange County's Coastal Waters" (Action Plan). The Action Plan incorporated the following six elements:

- A scientific review of the District's coastal ocean water monitoring program
- A 30-year Facilities Master Plan for Wastewater collection, Treatment, and Disposal Facilities through the year 2020
- A financial plan for each individual district and for the joint Districts.
- A Program Environmental Impact Report (EIR) to assess the impacts and provide mitigation for all projects identified in the 1989 Master Plan
- A public participation program for information and feedback during the planning effort
- An application to the EPA for a new 301(h) NPDES permit

In 1994, the District completed a "tune up" of the 1989 Master Plan that projected influent flows about 10% less than projected in 1989. Based on the need to revise projected capital improvement needs, the District initiated the Strategic Plan process to project flows based on the 1994 regional population projections, including a review of the collection, treatment, and the disposal facilities. The new Strategic Plan was completed in 1999.

2.3 PAC AND RAC

As part of the Strategic Plan process, a Planning Advisory Committee (PAC) was organized from interested parties in the community to assist in the decision making process for future operations and facilities. Several decision modeling exercises were conducted by the PAC to direct the District's future activities using criteria weights which included public and coastal health, cost, water supply reuse, community impacts, and timing.

In addition, the planning and decision making process included the establishment of a Rate Advisory Committee (RAC) set up specifically to review costs to rate payers and the District's financial obligations. The information gathered from PAC and RAC was incorporated into the 1999 Strategic Plan's final decision making process.

2.4 EXISTING TREATMENT FACILITIES

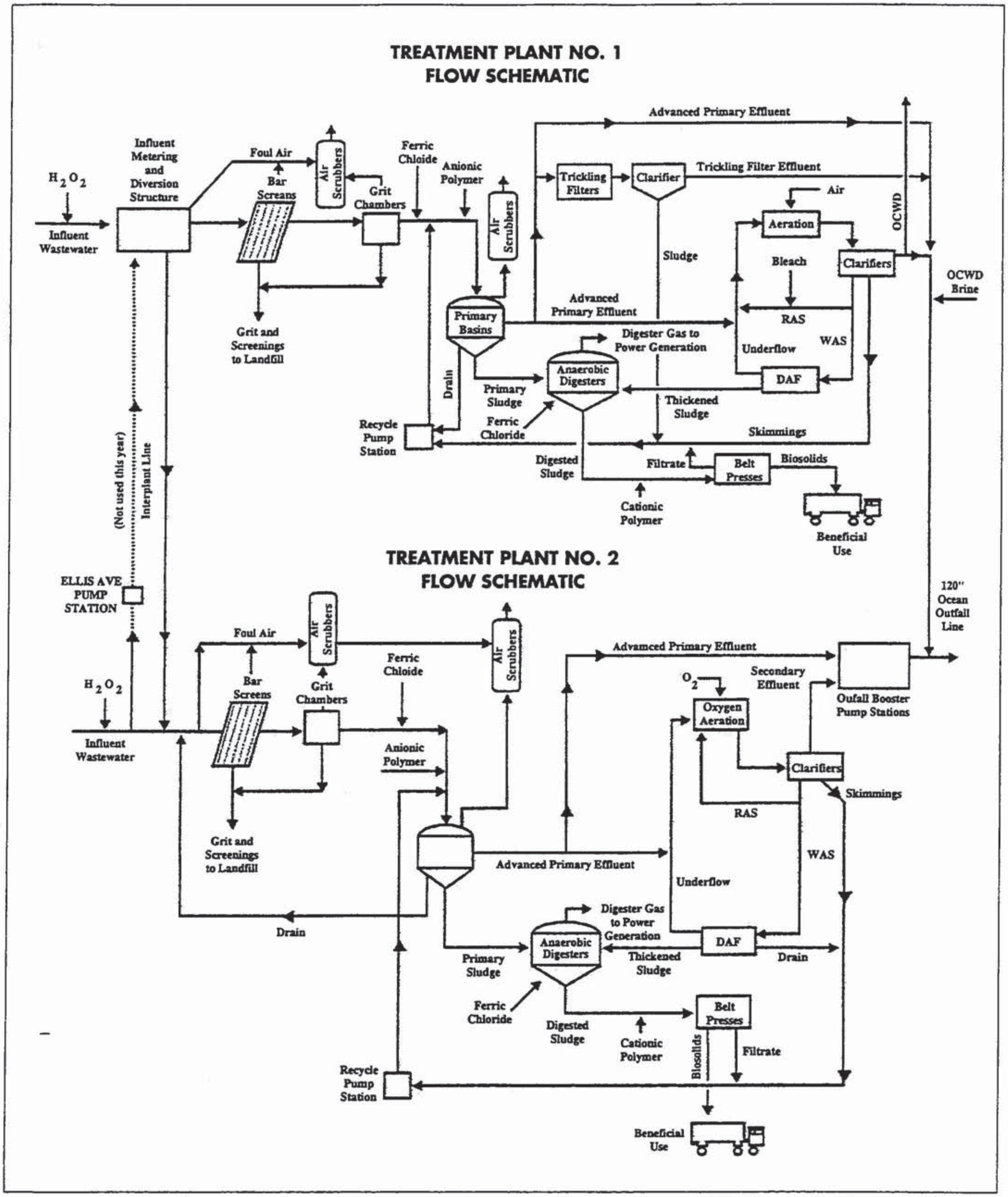
The District operates the third largest wastewater system on the west coast, consisting of over 500 miles of trunk sewers and 200 miles of subtrunk sewers, two regional wastewater treatment plants, and an ocean disposal system.

The effluent discharged to the ocean is a blend of advanced primary and secondary treated wastewater in accordance with the District's National Discharge Elimination System (NPDES) permit issued jointly by the Santa Ana Regional Water Quality Control Board (RWQCB) and the U.S. Environmental Protection Agency under the provisions of a federal Clean Water Action section 301(h) waiver of the requirement to discharge full secondary treated wastewater. Section 2.8 below describes the District's NPDES permit in more detail. The District submits an Annual Operations and Maintenance Report to the RWQCB, summarizing the treatment facilities' operations including influent volumes treated, treatment levels provided, and energy and chemical usage.

The District's oldest wastewater treatment plant, Reclamation Plant No. 1, is located Fountain Valley about 4 miles northeast of the ocean and adjacent to the Santa Ana River. The plant provides advanced primary and secondary treatment and supplies secondary treated water to the Orange County Water District (OCWD) which further treats and distributes the water for various uses, including irrigation, groundwater recharge, and operation of a coastal seawater barrier system.

Figure 2-2 provides a schematic of the process units at each plant. The existing treatment facilities are summarized in **Table 2-2** below.

Plant No. 1 treats raw wastewater that is conveyed from residential, commercial, and industrial sources via six major sewer pipes, often called "interceptors" or "trunk lines." The sewers include the Santa Ana River Interceptor (SARI), which conveys flows from the Santa Ana Watershed Project Area (the upper Santa Ana River basin), and the Sunflower Trunk, which receives raw wastewater from Irvine Ranch Water District (OCSD, 1999a). Plant No. 1 also receives backwash brine from the OCWD's Water Factory 21 treatment plant.



SOURCE: County Sanitation Districts of Orange County, Annual Report 1998.

OCSD Strategic Plan Program EIR / 960436 ■

Figure 2-2

Process Flow Diagram of Reclamation Plant No. 1 and Treatment Plant No. 2 for Fiscal Year 1997/98

TABLE 2-2
EXISTING OCSD TREATMENT FACILITIES (1999)

Facility	Quantity
Plant No.1	
Metering and Diversion Structure	1
Headworks	2
Primary Clarifier Basins	15
Trickling Filters	4
Trickling Filter Clarifier	1
Secondary Aeration Basins	10
Secondary Clarifiers	24
Dissolved Air Flotation Thickeners	3
Anaerobic Digesters	12
Belt Filter Presses	8
Solids Storage Bins	4
Digester cleanings drying beds	12
Digester Gas Holding Tank	1
Generators (digester gas or natural gas)	3
Standby Generators	9
Flares (for surplus digester gas)	3
Plant No. 2	
Metering Structure	1
Headworks	2
Primary Clarifiers	14
Primary Effluent Pumps	4
Secondary Aeration Basins	8
Secondary Clarifiers	12
Pure Oxygen Generating Plants	2
Dissolved Air Flotation Thickeners	4
Anaerobic Digesters	18
Belt Filter Presses	15
Solids Storage Bins	2
Digester cleanings drying beds	20
Generators (digester gas or natural gas)	5
Standby Generators	12
Flares (for surplus digester gas)	3
Ocean Outfall Booster Station	1
Foster Outfall Booster Station (back-up)	1

After passing through flow meters, the raw wastewater influent is pumped to the headworks facility, where large and non-organic materials are trapped and removed by bar screens and heavy material such as coffee grounds and sand are remove in grit chambers. The wastewater then flows to the advanced primary treatment facilities where particulate matter and floatable materials are removed in large sedimentation tanks. The addition of chemical coagulants improves the settling of solids. The primary treated effluent is routed to either the ocean discharge system or to the secondary treatment facilities. The secondary facilities consist of trickling filters, where the flow receives biological treatment as it passes through a media and contacts microbiological organisms, or an activated sludge system where the flow contacts microbes in large aeration tanks and the solid materials are removed in settling basins. The secondary effluent is then either blended with the advanced primary effluent and routed to the ocean disposal system, or is sent to the OCWD facility for advanced treatment and recycling. The plant has an odor control system and reuses some of the secondary effluent on-site.

The solid materials removed in the primary and secondary treatment systems are processed in large tanks called "digesters" which facilitate natural decomposition. Half of the material is converted to methane, which is burned as fuel in the energy recovery system. An interplant digester gas line connects the two plants. The remaining solids, which after treatment are termed "biosolids," are dewatered for use as a soil amendment or used to make fertilizer or fertilizer-like material. Currently, the biosolids are hauled away by three contractors to locations in Kern, Kings, Riverside, and San Diego Counties.

Treatment Plant No. 2, located in Huntington Beach adjacent to the Santa Ana River and about 1,500 feet from the ocean, provides a mix of advanced primary and secondary treatment. The plant receives raw wastewater from five major sewers. In addition, flows from Reclamation Plant No. 1 can be diverted to the plant through an interplant pipeline. The treatment processes at this plant are similar to Reclamation Plant No. 1. Approximately 33 percent of the influent receives secondary treatment through an activated sludge system. All of the effluent from this plant is discharged to the ocean disposal system.

Both plants operate an odor control system comprised of the following elements:

- Chemical treatment of incoming trunk lines using hydrogen peroxide and caustic soda
- Covers over primary clarifier basins
- Air collection ducts from the preliminary treatment facilities, primary clarifier basins, and solids handling equipment
- Air scrubbers utilizing caustic soda

2.5 OPERATIONS

2.5.1 STAFFING

The District currently employs 515 full-time employees. Construction projects, monitoring programs, special research projects, and some regulatory compliance projects involve a substantial number of additional contracted employees.

2.5.2 CHEMICAL USAGE

As an integral part of wastewater treatment, large quantities of chemicals used in the treatment process are stored on site including ferric chloride and anionic polymers used to enhance primary sedimentation and control digester sulfide, cationic polymers used to assist in the sludge thickening and dewatering processes, caustic soda used in the air scrubbers, and hydrogen peroxide used for odor control. Liquid oxygen is used in the activated sludge facility. The use of gaseous chlorine was discontinued in 1993. In 1994, ferric chloride replaced ferrous chloride to reduce hydrogen sulfide in the digesters. These chemicals are stored in above-ground storage tanks equipped with spill alarms, overflow prevention devices, and secondary containment. Current chemical usage quantities are included in **Table 2-3**.

TABLE 2-3
ANNUAL MONTHLY AVERAGE CHEMICAL USAGE FOR 1997/98

Chemical	Purpose/Use	Quantity (gallons)
Hydrogen Peroxide	Sulfide and Odor Control	13,300
Caustic Soda	Odor control	2,710
Ferric Chloride	Primary Treatment and Sulfide Control	110,000
Anionic polymer	Primary Treatment	80,000
Sodium Hypochlorite	Disinfection	8,300
Cationic Polymer	Biosolids dewatering	40,000
Cationic Polymer	Solids removal aid for DAF – dissolved air flotation thickeners	4,170

2.5.3 ENERGY SUPPLY

The District's energy supplies are derived from four sources: digester gas, natural gas purchased from off-site suppliers, electricity purchased from Southern California Edison (SCE), and electricity produced by the on-site central generation facility. The District has converted its operating machinery to natural gas or electric power. However, emergency back-up generators are equipped to operate on diesel fuel. Many on-site vehicles use electric power or compressed natural gas.

Since 1993, the District has operated central generation systems (CGS) at each plant. The CGS operate on natural gas and digester gas. The District imported a total of 4,457,000 therms from market suppliers for the 1997/98 fiscal year.

Imported electricity levels have dropped dramatically since the implementation of the CGS in 1993. In the 1997/98 fiscal year, the District imported a total of 4,790,000 kwh. **Table 2-4** summarizes the historic amounts of electricity imported from SCE. The decrease in imported electricity since 1994 is the result of improving CGS efficiency. **Table 2-5** summarizes the total amount of energy consumed in the 1997/98 fiscal year.

TABLE 2-4
IMPORTED ELECTRICITY AND NATURAL GAS

Fiscal Year	Imported Electricity Monthly Average (1000 kWh) Plant 1	Plant 2	Imported Natural Gas Monthly Average (therms) Plant 1	Plant 2
1992-93	2,264	3,754	39,279	21,420
1993-4	445	142	353,987	107,056
1994-5	375	37	303,000	44,000
1995-6	344	10	313,300	63,800
1996-7	78	9	313,300	84,900
1997-8	23	9	219,600	73,600

TABLE 2-5
ELECTRICITY USAGE 1997/98

Reclamation Plant No. 1	Monthly Average (100kW)	Daily Ave use 100kW	Annual Use, kwh
Imported for process equipment	23	0.77	27,983
Imported for buildings	3770	125.67	4,586,833
Total Imported	3794	126.47	4,616,033
Exported	3322	110.73	4,041,767
Generated by CGS	28950	965.00	35,222,500
Total Usage Plant 1			**35,796,767**
Treatment Plant No. 2	**100kW**	**Daily Ave use 100kW**	
Imported for process equipment	90	3.00	109,500
Imported for buildings	0	0.00	0
Total Imported	90	3.00	109,500
Exported	5428	180.93	6,604,067
Generated by CGS	60460	2015.33	73,559,667
Total Usage Plant 2			**67,065,100**
Grand Total			**102,861,867**

Note: The total electricity usage figures were calculated by adding the total amount of power generated by the central generation plants with the total amount of electricity imported from SCE minus the electricity exported to SCE.

SOURCE: OCSD, 1998 Operations and Maintenance Annual Report, 1998.

2.5.4 POTABLE WATER

Operational processes at both Plants use plant water, reclaimed water from OCWD, and potable water. Potable water is purchased for use as domestic water, steam boiler make-up, and polymer mixing/chemical dilution. The District purchases potable water for Plant No. 1 from the City of Fountain Valley and for Plant No. 2 from the City of Huntington Beach. **Table 2-6** summarizes potable water usage for Plants 1 and 2.

Because potable water is used for process (industrial) purposes as well as for potable purposes, there is a potential hazard from the cross-connection of the plant water system to the potable water system. Because of this, the District has divided the city water system into three independent systems. Two separate systems serve the plant process areas south of the North Perimeter Road at Plant 1 through air break tanks and are designated as potable water and

TABLE 2-6
CITY WATER CONSUMPTION (KCU FT)

Fiscal Year	Plant 1	Plant 2
1993-4	652	1,186
1994-5	612	1,076
1995-6	568	1,159
1996-7	481	1,243
1997-8	459	1,294

industrial water, respectively. A third system (potable) is connected directly to the city water main and serves the "administration" area north of North Perimeter Road.

In the process area of Plant No. 1, south of North Perimeter Road, chemical mixing, foul air scrubbers, etc., are served by the industrial water system. Lavatories, eye wash stations, showers or any location with direct personnel contact are served by the potable water system. **Table 2-6** summarizes historic potable water usage for both plants.

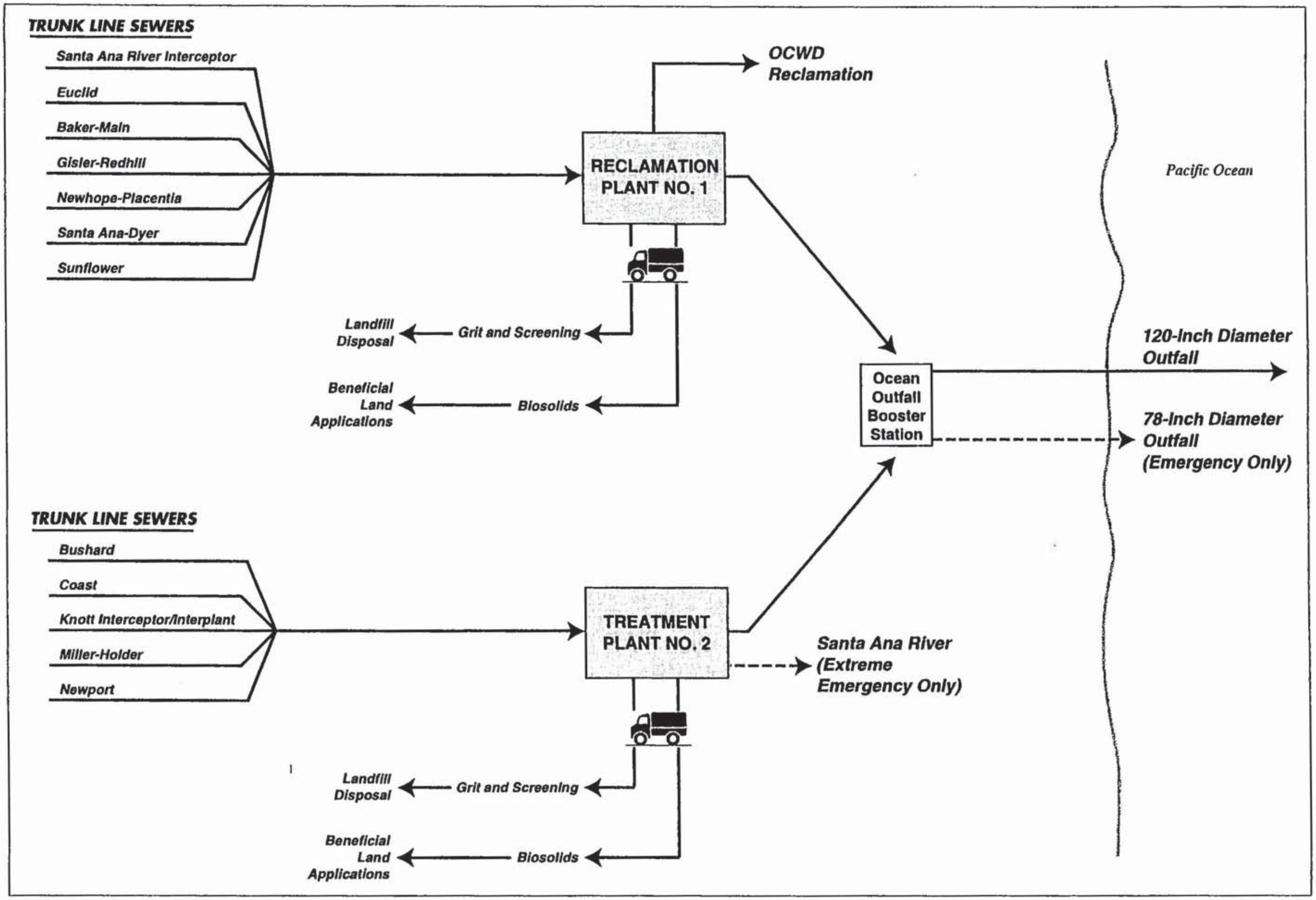
2.6 COLLECTION SYSTEM

The sewerage system collects wastewater through an extensive system of gravity flow sewers, pump stations, and pressurized sewers (force mains). The sewer system consists of 12 trunk sewer systems ranging in size from 12 to 96 inches in diameter and collectively over 500 miles long (OCSD, 1999b). Additionally, there are 39 sewer interconnections and 87 diversions to maximize the conveyance of flows through the system. Twenty pump stations are used to pump sewage from lower lying areas to the treatment plants. **Table 2-7** lists the 12 trunk sewer systems and their service areas, 1995 populations, and lengths. **Figure 2-3** provides a schematic overview of the Districts collection, treatment and ocean discharge facilities.

TABLE 2-7
SEWER SYSTEM CHARACTERISTICS

Trunk	Communities Served	Drainage Area (acres)	1995 Population	Length (feet)
Plant No.1				
Baker-Main	Costa Mesa, Newport Beach, Irvine	10,447	91,056	45,766
Euclid	Brea, Fullerton, Anaheim, Garden Grove, Santa Ana, Fountain Valley	14,087	139,967	198,380
Gisler-Redhill	Costa Mesa, Tustin, Santa Ana, Orange	12,549	106,082	209,710
Newhope-Placentia	Brea, Fullerton, Placentia, Orange, Anaheim, Garden Grove, Santa Ana, Fountain Valley	17,674	226,687	165,498
Santa Ana River Interceptor	Santa Ana, Anaheim, Orange, Villa Park, Placentia, Brea, Yorba Linda	55,662	247,478	364,107
Santa Ana Trunk	Santa Ana, Tustin	9,790	179,933	137,941
Sunflower	Tustin, Orange, Santa Ana	11,077	130,822	190,613
Plant No. 1 Total		**131,316**	**1,122,025**	**1,312,015**
Plant No. 2				
Bushard	Fullerton, Buena Park, Stanton, Garden Grove, Anaheim, Westminster, Fountain Valley, Huntington Beach	1,137	178,467	118,101
Coast	Huntington Beach	4,696	49,968	58,802
Knott Interceptor/Interplant	Fullerton, Buena Park, Cypress, Stanton, Anaheim, Garden Grove, Westminster, Seal Beach, Huntington Beach, Fountain Valley	37,255	376,003	378,058
Miller-Holder	La Habra, Fullerton, Buena Park, La Palma, Cypress, Los Alamitos, Westminster, Garden Grove, Fountain Valley, Huntington Beach	23,380	266,771	199,977
Newport	Newport Beach, Costa Mesa	13,750	115,694	163,687
Plant 2 Total		**80,218**	**986,903**	**918,625**
Grand Total		***211,534***	***2,108,928***	***2,230,640***

Source: OCSD Strategic Plan 1999



SOURCE: Environmental Science Associates

OCSD Strategic Plan Program EIR / 960436

Figure 2-3
Existing Facilities Schematic

2.7 OCEAN DISCHARGE

The ocean discharge system consists of booster pumps, surge towers, a four-mile, 120-inch outfall pipe with a 6,000-foot terminal diffuser, a one-mile emergency 78-inch outfall with a 1,000-foot diffuser, and an emergency overflow system to discharge to the Santa Ana River. Two booster pump stations pump a mixture of advanced primary and secondary effluent to the ocean outfalls. The two surge towers, 88 and 98 feet in elevation, allow for flexibility in hydraulically operating the system.

The primary outfall is a 120-inch diameter reinforced concrete pipe approximately 21,400 feet in length. At the end of the pipe is a 6,000-foot long diffuser. The diffuser pipe ranges from 120 inches to 78 inches in diameter and contains 500 circular ports and a flap gate at the end of the pipe. The effluent is dispersed through the ports at an average depth of 188 feet. The 78-inch outfall was the primary outfall for the plants prior to construction of the 120-inch outfall in 1971. The outfall is 7,000 feet long with a 1,000-foot diffusers discharging through ports at an average depth of 60 feet. The 78-inch outfall has not been used since the 120-inch outfall was placed into service and is designated as emergency use by the District's NPDES permit. Additionally, the District has the capability to discharge to the Santa Ana River through two 50-foot overflow weirs at Plant No. 2. This discharge facility is designated for extreme emergency use only by the District's NPDES permit. The Strategic Plan analyzes the potential use of the SAR for emergency use but proposes to eliminate the outfall option from the planning scenario. None of the alternatives analyzed in the Strategic Plan will employ the emergency weir to the SAR as a planned over flow option. The ocean discharge system, shown in **Figure 2-3**, is located at Treatment Plant No. 2 and serves both Reclamation Plant No. 1 and Treatment Plant No. 2.

2.8 OCEAN DISCHARGE PERMIT

Treated wastewater is discharged to the Pacific Ocean under a permit issued jointly by the Environmental Protection Agency (EPA) and the Regional Water Quality Control Board (RWQCB), Santa Ana Region. These two agencies administer the federal Clean Water Act, a law enacted by Congress in 1972 with a goal of achieving fishable and swimmable waters throughout the United States. Through enactment of the Clean Water Act, Congress imposed a requirement for secondary treatment for all wastewater discharges, regardless of inland or coastal location. This requirement was questioned, especially for West Coast discharges into deep ocean waters. Considerable scientific and technical data were presented to Congress in support of less stringent treatment requirements for ocean discharges.

In 1977, after considerable discussion by Congress, the Clean Water Act was amended by the addition of Section 301(h). This section (sometimes referred to as the ocean waiver provision) gives the EPA Administrator the authority to grant permits for a high quality, but less than full secondary-treated, wastewater effluent. Full secondary treatment as defined in the CWA, includes the removal of 85% biochemical oxygen demand (BOD) and 75% total suspended solids (TSS) or an effluent concentration for either constituent of 30 mg/l as a 30-day average, which ever is more restrictive. Applicants are required to meet all other environmental protection regulations imposed by federal and state agencies and to prove that the marine environment will not be adversely impacted. In California, the State Water Resources Control Board (SWRCB) promulgates the California Ocean Plan, which specifies detailed ocean quality standards and treatment plant performance criteria. **Table 2-8** summarizes the effluent quality limitations of full secondary treatment.

In 1985, the Sanitation Districts received a 301(h) modified ocean discharge permit jointly issued by the Regional Water Quality Control Board (RWQCB) and the EPA for a 5-year period, in accordance with all of the provisions of the California Ocean Plan and the federal Clean Water Act. The permit established stringent limitations for toxicants and requires 75 percent removal of wastewater suspended solids. This permit expired in 1990, and the District continued operations under a permit extension until the EPA and SWRCB issued a new permit in 1998.

The new NPDES permit (No. CA01110604, Order No. 98-5) includes a 301(h) waiver for BOD and TSS. The effluent limit for TSS is currently 60 mg/l as a 12-month average concentration or a mass emission rate of 20,000 metric tons per year (MT/yr) which ever is more restrictive. The effluent BOD limits are 100 mg/l as a 90 day average concentration or 30 % removal from influent which ever is more restrictive. **Table 2-9** summarizes OCSD's NPDES permit effluent quality limitations.

The permit requires an extensive ocean monitoring program to assess marine conditions off Orange County's coast. Results of that monitoring form the basis for the impact evaluation in Chapter 5 of this EIR, "Ocean Discharge Impacts." Section 2.12 below provides a discussion on the monitoring program.

2.9 INFLUENT/EFFLUENT QUALITY

2.9.1 INFLUENT

Influent volume displayed a steady rise from 31 mgd at the inception of the facility in 1954 to 269 mgd in 1991. However, influent volume decreased beginning in 1992 to 227 mgd due primarily to water conservation measures implemented during the drought period of the early 1990s. Since 1992, the District's influent volume has steadily increased to the current 255 mgd in 1997/98.

Influent quality since 1992/93 is summarized in **Tables 2-10 and 2-11**. In the early and mid 1980s, industrial effluent from the Anaheim Citrus Products (ACP) plant and the Beatrice Hunt-Wesson (BHW) tomato processing facility contributed significantly to the District's BOD in-flow. The ACP would increase BOD levels during the winter processing season, and BHW would increase BOD levels in the summer. In 1988, the Anaheim Citrus Products plant installed a treatment plant for it's effluent, significantly reducing BOD input to the District. BHW is currently shutting down, eliminating their BOD input.

TABLE 2-8
FULL SECONDARY TREATMENT DISCHARGE LIMITATIONS

Constituent	30-Day Average	7-Day Average	Instantaneous Maximum
BOD, mg/l	30	45	50
BOD, % removal	85	-	-
Suspended solids, mg/l	30	45	50
Suspended solids, % removal	75	-	-
Grease and oil, mg/l	25	40	75
Settleable solids, ml/l	1.0	1.5	3.0
Acute Toxicity Tμa	1.5	2.0	2.5
Turbidity, NTU	75	100	225

Constituent	6-Month Median	Daily Maximum	Instantaneous Maximum
Arsenic, μg/l	8	32	80
Cadmium, μg/l	1	4	10
Hexavalent chromium, μg/l	2	8	20
Copper, μg/l	3	12	30
Lead, μg/l	2	8	20
Mercury, μg/l	0.04	0.16	0.4
Nickel, μg/l	5	20	50
Silver, μg/l	0.7	2.8	7
Zinc, μg/l	20	80	200
Cyanide, μg/l	1	4	10
Total chlorine residual, μg/l	2	8	60
Ammonia-N. μg/l	600	2,400	6,000
Phenolic compounds (nonchlorinated), μg/l	30	120	300
Phenols (chlorinated), μg/l	1	4	10
Aldrin and dieldrin, μg/l	-	0.000022	-
Chloradane and related compounds, μg/l	-	0.000023	-
DDT and derivatives, μg/l	-	0.00017	-
Endrin, μg/l	0.002	0.004	0.006
HCH (BCH), μg/l	0.004	0.008	0.012
PCB's, μg/l	-	0.000019	-
Toxaphene, μg/l	-	0.00021	-
Radioactivity	Not to exceed limits specified in Title 17, Chapter 5, Subchapter 4, Group 3, Article 3, Section 30269 of the California administrative Code.		

SOURCE: SWRCB, 1997 California Ocean Plan

2.9.2 EFFLUENT

The District currently discharges a blended effluent consisting of a 50 percent mix of advanced primary and secondary effluent to the ocean outfall as stipulated in their 1989 Master Plan. Without a waiver, additional secondary treatment would have to be constructed. Monitoring stations within the flow line take monthly composite samples from the effluent as required by the NPDES permit. These samples are analyzed following approved EPA analysis methods, and the results are reported to the Santa Ana Regional Water Quality Control Board on a monthly basis. The final effluent quality has been in consistent compliance with local, state, and federal requirements as set forth in the District's NPDES Permit for the past two years. The District's effluent quality has been in compliance for every analyzed parameter for the past thirteen years excluding the following four exceptions:

- an ammonia exceedance in 1986
- a DDT exceedance in fiscal year 1992
- a toxicity exceedance in 1994/95
- a settleable solids exceedance in 1995/96

Appendix E presents background information on OCSD's past effluent quality and highlights the measured trends, which indicate substantial effluent quality improvement over the last several years.

TABLE 2-9
NPDES DISCHARGE LIMITATIONS

301(h) Limitations

Constituent	12 month average (mg/l)	90-day average (mg/l)	30-day average (mg/l)	7-day average (mg/l)	12-month average (MT/year)
BOD	n/a	100	n/a	150	n/a
	As 30-day average, 30% removal from influent stream				
Suspended Solids	60	n/a	72	109	20,000
	As 30-day average, 75% removal from influent stream or 60 mg/l, whichever is higher				

Major Wastewater Constituents and Properties Limitations

Constituent	30-Day Average	7-Day Average	Maximum at any time
Grease and Oil			
mg/L	25	40	75
lb/day	61,500	98,400	184,000
Settleable Solids, mg/L	1.0	1.5	3.0
Acute Toxicity, TU_a	1.5	2.0	2.5
Turbidity, NTU	75	100	225
pH	Within 6.0 to 9.0 at all times		

Toxic Materials Limitations for the Protection of Marine Aquatic Life

Constituent	6-month median	Daily Maximum	Instantaneous maximum
Chronic Toxicity TU_c	n/a	181	n/a
Radio Activity	Not to exceed limitations specified in Title 17, Division 1, Chapter 5, Subchapter 4, Group 3, Article 3, Section 32069 of the CCR		

Toxic Materials Limitations for the Protection of Human Health (Carcinogens)

Constituent	30 day average (ug/l)	30 day average (lbs/day)
Aldrin	0.00398	0.00960
Bis(2-ethylhexyl)phthalate	634	1560
Chlordane	0.00416	0.0101-
DDT	0.0308	0.0758
Heptachlor	0.130	0.320
Hexachlorobenzene	0.0380	0.0935
PAHs	1.59	3.91
Toxaphene	0.0380	0.0935

Note: mg/l = milligrams per liter; MT/yr = metric tons per year; ug/l = micrograms per liter; lbs/day = pounds per day; NTU =nepthelmetric units; TU = toxicity units

Source: NPDES Permit No. CA0110604, Order No. 98-05

TABLE 2-10
OCSD INFLUENT AND EFFLUENT WATER QUALITY DATA (1993 - 1998)

Constituent	1993/1994	1994/1995	1995/1996	1996/1997	1997/1998
Total Suspended Solids					
Influent					
mg/L	220	222	224	231	226
lb/day	424,000	450,000	443,000	470,000	481,000
Effluent					
mg/L	43	44	46	49	50
lb/day	84,000	90,000	89,000	99,000	106,000
BOD					
Influent					
mg/L	220	220	230	220	220
lb/day	424,000	446,000	455,000	448,000	468,000
Effluent					
mg/L	73	72	80	73	77
lb/day	140,000	150,000	155,000	147,000	164,000
Ammonia					
Influent					
mg/L	23	21	22	22	24
lb/day	44,000	43,000	43,000	45,000	51,000
Effluent					
mg/L	24	23	23	23	24
lb/day	47,000	47,000	45,000	46,000	51,000

Note: mg/L = milligram per liter; lb/day = pounds per day

Source: OCSD, Operations and Maintenance 1998 Annual Report, 1998.

TABLE 2-11
AVERAGE METAL CONCENTRATIONS AND MASS IN THE INFLUENT AND EFFLUENT (1993 - 1998)

Constituent	1993/1994	1994/1995	1995/1996	1996/1997	1997/1998
Cadmium					
Influent					
mg/L	0.0025	0.0019	0.0019	0.0017	0.0019
lb/day	5	4	4	3	4
Effluent					
mg/L	0.0008	0.0006	0.0005	0.0004	0.0004
lb/day	2	1	1	1	1
Chromium					
Influent					
mg/L	0.017	0.016	0.0133	0.0128	0.016
lb/day	33	32	26	26	35
Effluent					
mg/L	0.005	0.005	0.004	0.004	0.006
lb/day	10	10	8	8	13
Copper					
Influent					
mg/L	0.101	0.113	0.125	0.122	0.124
lb/day	190	229	246	248	264
Effluent					
mg/L	0.030	0.030	0.036	0.034	0.037
lb/day	58	61	70	68	79
Lead					
Influent					
mg/L	0.010	0.011	0.009	0.008	0.008
lb/day	20	22	18	16	18
Effluent					
mg/L	0.002	0.002	0.002	0.001	<0.002
lb/day	4	4	4	2	<4
Nickel					
Influent					
mg/L	0.030	0.028	0.027	0.030	0.034
lb/day	58	56	53	61	73
Effluent					
mg/L	0.020	0.017	0.019	0.021	0.022
lb/day	39	35	37	42	47
Silver					
Influent					
mg/L	0.009	0.008	0.007	0.008	0.007
lb/day	17	16	14	15	15
Effluent					
mg/L	0.002	0.002	0.002	0.002	0.002
lb/day	4	4	4	4	4
Zinc					
Influent					
mg/L	0.134	0.126	0.137	0.133	0.130
lb/day	258	254	271	270	276
Effluent					
mg/L	0.044	0.034	0.044	0.040	0.040
lb/day	86	69	85	81	85

TABLE 2-11 (continued)
AVERAGE METAL CONCENTRATIONS AND MASS IN THE INFLUENT AND EFFLUENT (1993 - 1998)

Note: mg/L = milligram per liter; lb/day = pounds per day
1993/94: Influent mass based on 231 MGD; Effluent mass based on 233 MGD[1]
1994/95: Influent mass based on 243 MGD; Effluent mass based on 244 MGD[1]
1995/96: Influent mass based on 237 MGD; Effluent mass based on 232 MGD
1996/97: Influent mass based on 244 MGD; Effluent mass based on 242 MGD
1997/98: Influent mass based on 255 MGD; Effluent mass based on 255 MGD

[1] There was more effluent than influent due to in-plant construction dewatering which was discharged downstream of the influent metering.

Source: OCSD, Operations and Maintenance 1998 Annual Report, 1998.

2.10 WATER RECLAMATION/CONSERVATION

2.10.1 RECLAMATION

The District is involved with several water reclamation projects in the region, in cooperation with the Orange County Water District (OCWD). OCWD operates a year-round water reclamation project called the Green Acres Project (GAP), providing reclaimed water for industrial customers and landscape irrigation in Fountain Valley, Santa Ana, Cosa Mesa, Newport Beach, and Huntington Beach. The project currently receives approximately 7.5 mgd of reclaimed water during the summer months. During the winter months demand is reduced. In the 1997/98 fiscal year the annual average was less than 2 mgd. Secondary effluent from Reclamation Plant 1 is pumped to OCWD's Water Factory 21 for this purpose, where it receives additional treatment before being reused.

In addition to the GAP, the OCWD operates a groundwater injection system, providing a seawater intrusion barrier with approximately 3.5 mgd of reclaimed water from Factory 21. This water is also supplied to OCWD as secondary effluent from Reclamation Plant No. 1. Through years of urban and agricultural use, the Orange County Groundwater Basin has been reduced to such an extent that the groundwater gradient has shifted inland, allowing saltwater to invade from the west. The injected reclaimed water acts as a hydraulic barrier between the freshwater and seawater aquifers. Factory 21 provides a tertiary level of treatment including reverse osmosis and microfiltration before injection into the ground.

The District is considering committing up to 165 mgd of secondary effluent to a new reclamation project proposed jointly with OCWD to recharge the Orange County Groundwater Basin. Reclaimed water would be pumped to percolation ponds in Anaheim where it would seep into the groundwater basin. This Groundwater Replenishment (GWR) System project is currently undergoing CEQA review, and the first phase of the project could be implemented as early as

2003. Further information regarding this proposed reclamation project is contained in Section 3.12 of this report.

2.10.2 CONSERVATION

The District has actively participated in community outreach programs to promote water conservation within its service area. Several projects including "Think Earth," an educational program concerning water conservation, and low-flow toilet and shower conversion incentives have been employed. During the drought years of the early 1990s, the District's influent volume was reduced significantly, from 269 mgd to 227 mgd, due in large part to water conservation efforts of the regions water and wastewater agencies raising awareness within the service area. The District has actively supported regional conservation efforts including the Memorandum of Understanding Regarding Urban Water Conservation in California which provides 16 best management practices (BMPs) for water users to reduce consumption and increase community awareness.

2.11 EMERGENCY CONTINGENCY PLANS

The District has prepared numerous emergency contingency plans to ensure successful operation of the collection, treatment, and disposal facilities while protecting public health and safety from exposure to untreated wastewater. If the conveyance of sewage is impaired, a backup into homes and overflow onto streets could result, creating a public health hazard. The Flood Protection Plan identifies facility improvements, and emergency response measures needed to ensure public safety from the possibility of inundation during a major flood event. The last major flood occurred in1938 when Reclamation Plant No. 1 was inundated with more than six feet of water. The District has constructed a perimeter flood wall around each plant site designed to delay inundation and to mitigate damage from flood-induced hydraulic loadings. The Orange County Flood Control District and the U.S. Army Corps of Engineers have developed flood-protection plans for the Santa Ana River Basin, incorporating river channel reinforcement and a concrete lining in the vicinity of the two wastewater treatment plants capable of accommodating a flow of 45,000 cubic feet per second during a 100-year flood event.

The District has also implemented methods to ensure fail-safe operations by utilizing three separate sources of electricity to power influent and effluent pumps. The three sources of electricity include the central generation systems (CGS) at each plant, Southern California Edison connections, and diesel driven emergency generation. The CGS system utilizes both natural gas and digester gas, methane derived from the treatment process.

The Biosolids Contingency Plan ensures that biosolids are promptly managed and stockpiling is minimized. Several drying beds exist on site for this purpose. In addition, the Storm Water Management Plan provides Best Management Practices (BMPs) for clean and orderly biosolids and grit truck-loading operations.

The District has the capacity to discharge peak over-flows to the 78-inch diameter outfall in the event that the 120-inch diameter outfall reaches capacity. In addition, emergency overflow weirs to the Santa Ana River provide engineering controls for emergency overflow, discharging to the river basin flowing to the ocean thereby protecting city streets in the event of a disaster.

The District has conducted disaster planning and preparedness studies and has developed several contingency plans to counteract the potential threat to public health. The District's Annual Report, submitted annually to the RWQCB, identifies the major components of the plan. In addition, the District has implemented an Integrated Emergency Response Program (IERP) which includes seismic retrofits for buildings, machinery, and pipelines. Much of the District's hazardous materials and health and safety training and management planning are covered by the IERP.

In addition, the District has implemented a worker safety program to protect employees from industrial hazards including exposure to untreated wastewater. A Spill Prevention Containment and Countermeasure (SPCC) Plan required by the RWQCB provides contingencies for chemical and wastewater spills including secondary containment and spill alarms.

2.12 OCEAN MONITORING PROGRAM (OMP)

The District conducts an extensive ocean monitoring program of the coastal environment to assess effects from the wastewater discharges on water quality, bottom conditions, biological organisms, and human health. The program has been a required element of compliance with the District's NPDES permit, first issued in 1985. The new NPDES permit issued in 1998 includes an updated monitoring program. The new permit has reorganized the program elements and redesigned some of the sampling methods and locations, drawing from 13 years of experience and data. The new monitoring program went into effect in July of 1998.

The new monitoring program is divided into three primary elements:

- Core Monitoring
- Strategic Process Studies
- Regional Monitoring

The Core Monitoring program element has been designed to provide evidence of permit compliance as well as track long-term trends:

- Water quality sampling occurs over three consecutive days at 16 sampling locations on a weekly basis. Twelve additional sampling stations have been added to the new program.
- Benthic sampling occurs at 10 quarterly and 39 annual stations for sediment chemistry and biologic community analysis.
- Trawl sampling occurs at nine stations for biologic community assessments including tissue analysis and disease assessments.

- New analysis methods have been added to the program, replacing EPA's priority pollutant list 301(h) Methods with National Oceanic and Atmospheric Administration (NOAA) Status and Trends analyte list performance based Methods.

Strategic Process Studies assist in evaluating specific questions to clarify observed conditions and evaluate the District's contribution to perceived impacts:

- Water quality sampling occurs at 42 stations for the Central Bight Water Quality project.
- Additional studies under consideration include analysis of currents, plume delineation, and water and sediment transport issues within the Newport Submarine Canyon.

Regional Monitoring assists in improving existing information or conditions off the Southern California coast, placing the District's observed impact in a regional perspective:

- Benthic sampling occurs at 31 stations.
- Trawl sampling occurs at 20 stations.
- Toxicity testing is conducted on up to 60 sediment samples.

Data generated by the monitoring program are submitted to the EPA national database (Ocean Data Evaluation System) which is accessible by government agencies and the public. Ocean monitoring program results are presented in Annual Reports of Marine Monitoring and submitted to the Regional Water Quality Control Board and the U.S. EPA. The District conducts additional public outreach and informational programs year-round to provide the public with analysis results and conclusions on the health of the coastal waters.

REFERENCE – OCSD BACKGROUND AND EXISTING FACILITIES AND OPERATION

Orange County Sanitation District (OCSD), *Master Plan*, 1989.

OCSD, *Strategic Plan*, Volumes 1 and 9, 1998

Snow, Tama and Dawes, Tom, Orange County Water District, Memorandum on GWR System, March 22, 1999

CHAPTER 3

PROJECT DESCRIPTION

CHAPTER 3.0

PROJECT DESCRIPTION

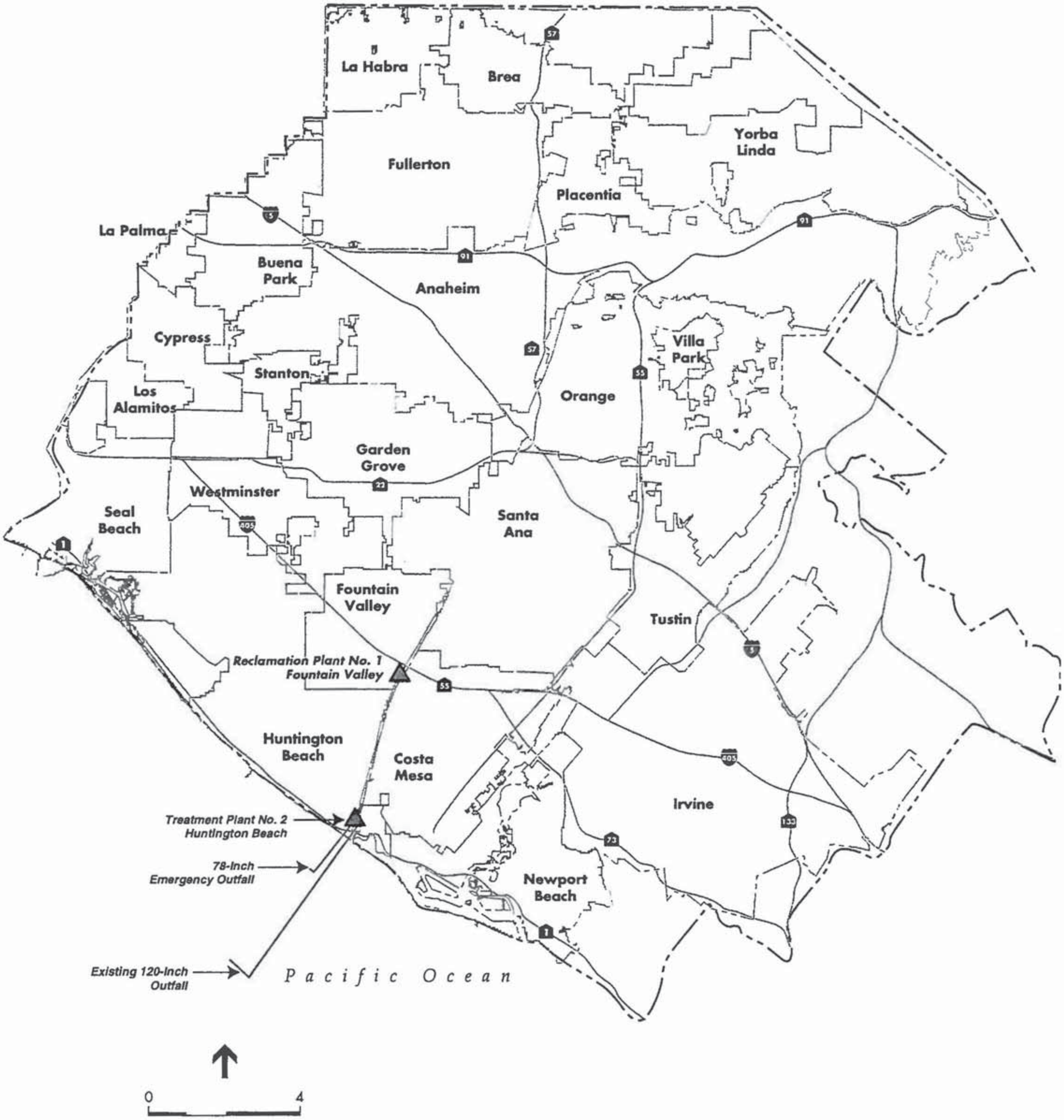
3.1 OVERVIEW

The Orange County Sanitation District (District or OCSD) has prepared a new 1999 Strategic Plan to identify projects needed to accommodate projected population growth in its Service Area and to comply with changing future regulations that affect treatment facilities and effluent quality. Projects are planned to replace and rehabilitate sewer collection systems, expand and upgrade the District's two wastewater treatment plants, provide adequate discharge capacity for projected peak flows, provide additional treated wastewater to the Orange County Water District (OCWD) for expanded water reuse, and study the feasibility of other improvements. Numerous individual projects are planned for various years between 2000 and 2020. **Figure 3-1** provides an overview of the project locations for the proposed Strategic Plan facilities.

3.2 NEED FOR PROJECT

The District needs to update its 1989 Master Plan to respond to changes in flows generated in the Service Area, particularly wet weather flows. The current estimate of 2020 Service Area population projection is still largely consistent with the estimate used in the District's 1989 Master Plan. However, since then the per capita wastewater generation factor has dropped such that revised wastewater flow projections for the year 2020 are about 10 percent lower than those used in the previous 1989 plan. While average annual flow projections have been reduced, peak wet weather flows are projected to exceed the current outfall capacity by the year 2020. The District's peak wet weather discharge alternatives reviewed in the Strategic Plan include constructing a second five-mile-long 120-inch diameter outfall or utilizing the existing 78-inch diameter, 7,000-foot outfall for flows in excess of current capacity.

Another driving factor for the new Strategic Plan was the renewal of the District's National Pollutant Discharge Elimination System (NPDES) permit in 1998. The new permit provides some flexibility in treatment processes enabling the District to participate in the regional Groundwater Replenishment (GWR) System described in Section 3.12. If this GWR System is implemented, the District will commit to supplying the reclamation project with 100 mgd (annual average net yield) of water by the year 2003. Only water having received secondary treatment will be supplied to the GWR System, thereby reducing the percentage of secondary effluent in the ocean discharge below the current fifty percent mandated by the Board of Director's policy adopted in July 1989.



SOURCE: Camp Dresser Mckee, Environmental Science Associates

OCSD Strategic Plan Program EIR / 960436 ■

Figure 3-1
Service Area with Existing Facilities

3.3 PROJECT OBJECTIVES

The objectives for the Strategic Plan of 1999 are:

- To plan for wastewater collection, treatment, and disposal facilities to serve the needs of the OCSD Service Area through 2020.
- To ensure compliance with existing and anticipated permit conditions, including the requirements of the 301(h) modified (secondary treatment waiver) NPDES permit for discharge (the largest in the U.S. and one of four in California).
- To recommend projects that meet the community's needs, protect public health, are technically feasible, and are cost effective and environmentally responsible.
- To maximize the use of treated effluent for water recycling.

3.4 PROJECTED WASTEWATER FLOWS

AVERAGE FLOWS

The District receives untreated wastewater from its core Service Area through 12 trunk sewer lines collecting wastewater from 23 separate municipalities. In addition, the District has entered into contractual agreements with several local entities including the Santa Ana Watershed Project Authority (SAWPA), the Irvine Ranch Water District (IRWD), County Sanitation Districts of Los Angeles County (CSDLAC), the City of Long Beach, Seal Beach Naval Weapons Station, the Sunset Beach Sanitary District, and the Sandlewood Maintenance District. These contracted influent connections are called point sources in the Strategic Plan.

The Strategic Plan provides projections of wastewater influent from the Service Area based both on estimates of land use changes and on population growth projections. The estimated 2020 Service Area population (based on data from the Center for Demographic Research at the California State University in Fullerton) is projected to be 2,421,479, not including the City of Irvine, and 2,859,331 with Irvine included. These estimates are consistent with those developed by the Southern California Association of Governments (SCAG) for use in regional planning, particularly for the Regional Air Quality Management Plan. The IRWD currently contributes approximately 8 mgd to the OCSD system and is projected to contribute 32 mgd by the year 2020. However, the IRWD treats the bulk of the City's wastewater, and relies on OCSD for capacity primarily during wet weather events. In addition to wastewater, IRWD sends all its solids to OCSD for treatment and reuse/disposal.

Based on a trend analysis, the amount of wastewater generated per person in the year 2020 is projected to decline from 132 gallons per capita per day (gpcd) used in the 1989 Master Plan to 125 gpcd. These projected water usage decreases are attributed to the conservation efforts conducted by the District, the Orange County Water District, and local Orange County governments, coinciding with a growing awareness in the region toward water conservation. Improvements to the wastewater collection system are expected to further reduce flows by reducing the infiltration and inflow (I/I) of rain water and groundwater to the sewer system through cracks in the pipes and manholes.

Based on the revised average volume of wastewater generated per capita, and the updated population projections for the Service Area, including the City of Irvine, the projected average annual daily flow (ADAF) for the year 2020 as projected in the Strategic Plan is 352 mgd. This number includes the contractual agreements with the point sources listed above as well as the anticipated 13 mgd reduction from water conservation efforts. The 1989 Master Plan projected 399 mgd. The current wastewater flow projections are reduced approximately 10 percent from those considered in the 1989 Master Plan. However, the Strategic Plan includes an ultimate influent flow projection for the District's Service Area reflecting ultimate build-out of the region. **Table 3-1** summarizes the projected influent volumes.

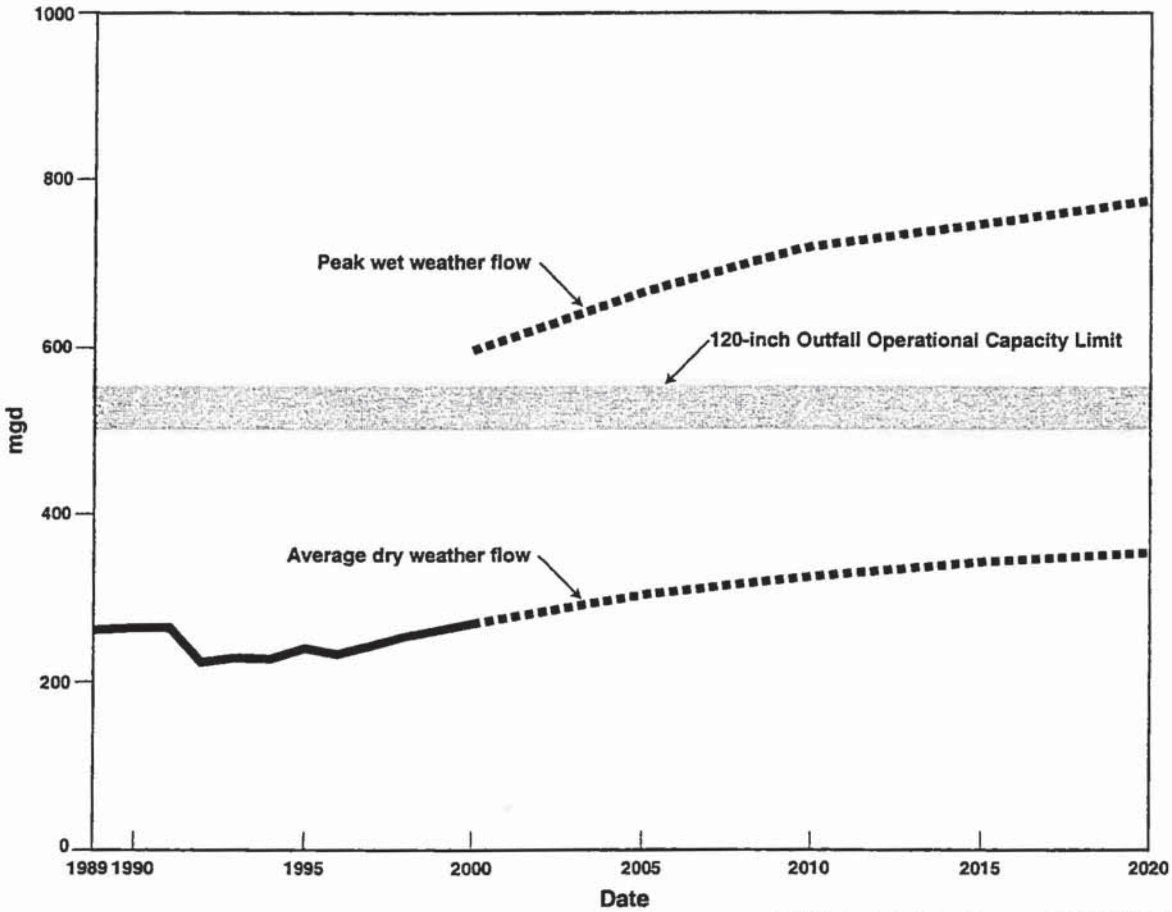
TABLE 3-1
SUMMARY OF POPULATION-BASED INFLUENT PROJECTIONS THROUGH 2020 PROJECTED ANNUAL AVERAGE FLOW (MGD)

	2000	2005	2010	2015	2020	Ultimate
OCSD and other point sources	252	276	276	297	303	433
IRWD	10	15	21	26	32	32
SAWPA	13	18	23	29	30	30
Total	**275**	**309**	**336**	**351**	**365**	**495**
Projected conservation	3	6	8	11	13	23
Total with conservation	**272**	**303**	**328**	**340**	**352**	**472**

PEAK FLOWS

Peak flows occur from daily peaks in wastewater generated by the homes and businesses in the Service Area and from seasonal rainfall runoff that incidentally enters the pipes during storms. Wet weather peak flows are generally short in duration, lasting only a few hours. Daily dry weather peak flows generally follow the water usage patterns of the community, elevating in the morning hours and peaking in the late afternoon to midnight. The 120-inch diameter outfall has a design capacity of 480 mgd. This capacity has been exceeded five times since the outfall's installation in 1971, reaching a maximum of 550 mgd during a storm event in January of 1995. The outfall has accommodated these wet weather peaks with minimal structural impact.

The Strategic Plan provides peaking factors based on historical data to predict future peak flows based on projected average flows. A daily dry weather peaking factor of 1.3 was selected to determine peak dry weather flow (PDWF). The District assumes the PDWF for the year 2020 to be 458 mgd. The daily wet weather peaking factor used to determine the peak wet weather flow (PWWF) is 2.2. Multiplying this factor by the ADAF for the year 2020 gives a PWWF of 775 mgd for the year 2020. For planning purposes, the District has rounded this number up, assuming the PWWF for the year 2020 to be 775 mgd. **Figure 3-2** displays historic average daily influent volumes per year since 1989 and projected ADAF and PWWF values to the year 2020.



SOURCE: OCSD Strategic Plan, volume 3.

OCSD Strategic Plan Program EIR / 960346 ■

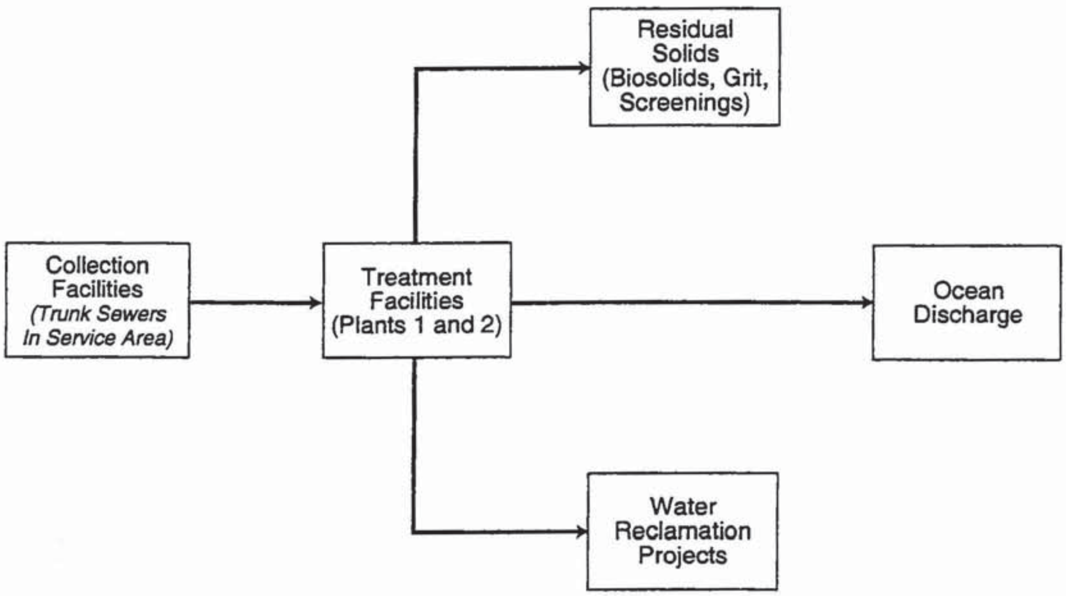
Figure 3-2
Existing and Projected Flows

3.5 STRATEGIC PLAN – OVERVIEW

The 1999 Strategic Plan updates the 1989 Master Plan and identifies expansion and facility upgrades required to collect, treat, and dispose of increasing wastewater flows from the Service Area through the year 2020. The Strategic Plan also identifies the new treatment facilities needed to provide the Orange County Water District (OCWD) with the quantity of secondary effluent needed for the Groundwater Replenishment System Project (GWR System) proposed jointly by the District and OCWD. The Strategic Plan addresses all aspects of the OCSD system facilities and operation as shown in the **Figure 3-3** schematic. The Strategic Plan's contents are summarized below:

Volume 1	Executive Summary
Volume 2	Summary Report
Volume 3	Collection System

Volume 4	Joint Treatment Works
Volume 5	Regulatory Requirements
Volume 6	On-site Stormwater Plan
Volume 7	Water Reuse and Water Conservation
Volume 8	Biosolids Management
Volume 9	Urban Design Element



SOURCE: Environmental Science Associates

OCSD Strategic Plan Program EIR / 960436 ■

Figure 3-3
System Components

As highlighted in Section 3.2 – Project Need, the key drivers guiding the Strategic Plan development of alternatives for future system expansion and operation are: reduced Service Area future flow estimates, management of peak wet weather flows, effluent quality requirements of ocean discharge, and participation in the GWR System project.

Management of peak wet-weather flows involves an integrated plan of improvements to: (1) the collection system to provide greater capacity to convey and temporarily store high volumes without any sewage spills, (2) the treatment plant to provide adequate on-site storage to hold high flows for treatment, and (3) the discharge and reuse systems to dispose of peak flow in a controlled manner.

Effluent quality requirements affecting options for level treatment and facilities needed are affected by the ocean discharge permit requirements and by whether or not OCSD participates in the major water recycling project – the GWR System project, with OCWD.

Sections 3.6 through 3.7 below, describe each of the wastewater system components and review the proposed facility and operational alternatives considered in the Strategic Plan and the Preferred Alternative recommended through the Strategic Plan process.

3.6 LEVEL OF TREATMENT

The level of treatment alternatives address the question of how much of the effluent flow will receive advanced primary treatment only and how much will receive secondary treatment in addition. The District's NPDES permit for ocean discharge establishes the regulatory treatment requirements for effluent disposal. (Section 2.8 reviews the District's permit history and the conditions of the current NPDES Permit issued in June 1998.) The District's NPDES permit includes a waiver from the requirement that all of the flow for ocean discharge receive secondary treatment. The permit allows for only some of the flow to receive secondary treatment and to be blended with the remaining flow that receives advanced primary treatment prior to ocean discharge as long as the overall effluent quality meets NPDES permit requirements, which include compliance with the provisions of the California Ocean Plan. The District's current policy is to provide discharge of a blend of 50 percent advanced primary effluent and 50 secondary effluent. Finally, as a condition of the permit waiver, the District must also provide a back-up plan for full secondary treatment of 100 percent of the effluent.

Thus, the District has considered treatment level alternatives that address the three different secondary/primary effluent blend scenarios for ocean discharge:

- NPDES Permit Compliance (The effluent blend would vary (between approximately 20 and 35 percent secondary and 65 and 80 percent primary). This alternative does not have a set requirement for the percentage of secondary effluent; the focus is on compliance with specific permit requirements rather than a specified effluent blend.)
- Current Condition (Represents a 50/50 effluent blend adopted as Board policy with the previous 1989 Mater Plan)
- Full Secondary (Represents 100 percent secondary effluent for ocean discharge)

Also affecting the level of treatment alternatives is whether or not OCSD participates in the GWR System Project with OCWD. As described in Section 3.12, the GWR System project requires secondary treated effluent for further treatment using the advanced treatment processes of micro-filtration and reverse osmosis. Ultimately, in Phase 3 the GWR System project will require up to 110 mgd (summer peak is 165 mgd) average dry weather flow of secondary effluent. The GWR System project is also being designed to accommodate up to 100 mgd of peak wet-weather flow in Phase 1 to provide OCSD assistance in managing peak flows. This amount could increase to 175 mgd during peak wet weather flows in Phase 3 of the GWR System implementation. Although the District may choose not to implement Phase 2 and 3 of the GWR System project, the analysis in this document of the Preferred Alternative assumes that each phase of the GWR System would be implemented as currently planned. OCSD participation in the GWR System project will affect the amount of secondary treatment facilities needed to meet both GWR System project needs and ocean discharge requirements under the three effluent blend options.

Participation in the GWR System will reduce the amount of secondary effluent available for ocean discharge.

Thus, considering each of the three treatment level options with and without GRW System implementation, there are six scenarios for possible treatment level/facilities considered in this EIR: These six scenarios are summarized below and illustrated in **Figure 3-4.** These six scenarios are evaluated at an equal level of detail in this EIR.

Action Scenarios

- **Scenario 1: NPDES Permit Compliance without GWR System Project.** Provide a level of treatment necessary to meet the NPDES permit conditions and the California Ocean Plan. All wastewater would receive advanced primary treatment with a percentage also receiving secondary treatment prior to ocean discharge. Under this Scenario, the GWR System would not be implemented, thereby increasing the percentage of secondary effluent available for ocean discharge. The amount of secondary treatment would be governed by the NPDES permit limits.

- **Scenario 2: NPDES Permit Compliance with GWR System Project**. Provide the level of treatment necessary to meet the NPDES permit conditions and the California Ocean Plan. All wastewater would receive advanced primary treatment with a percentage also receiving secondary treatment prior to ocean discharge. In coordination with OCWD, 50-80 mgd average daily flow and up to 100 mgd peak wet weather flow of secondary effluent would be diverted from OCSD to the GWR System. The amount of secondary treatment in the ocean discharge would be governed by needs of the GWR System and by the NPDES permit limits.

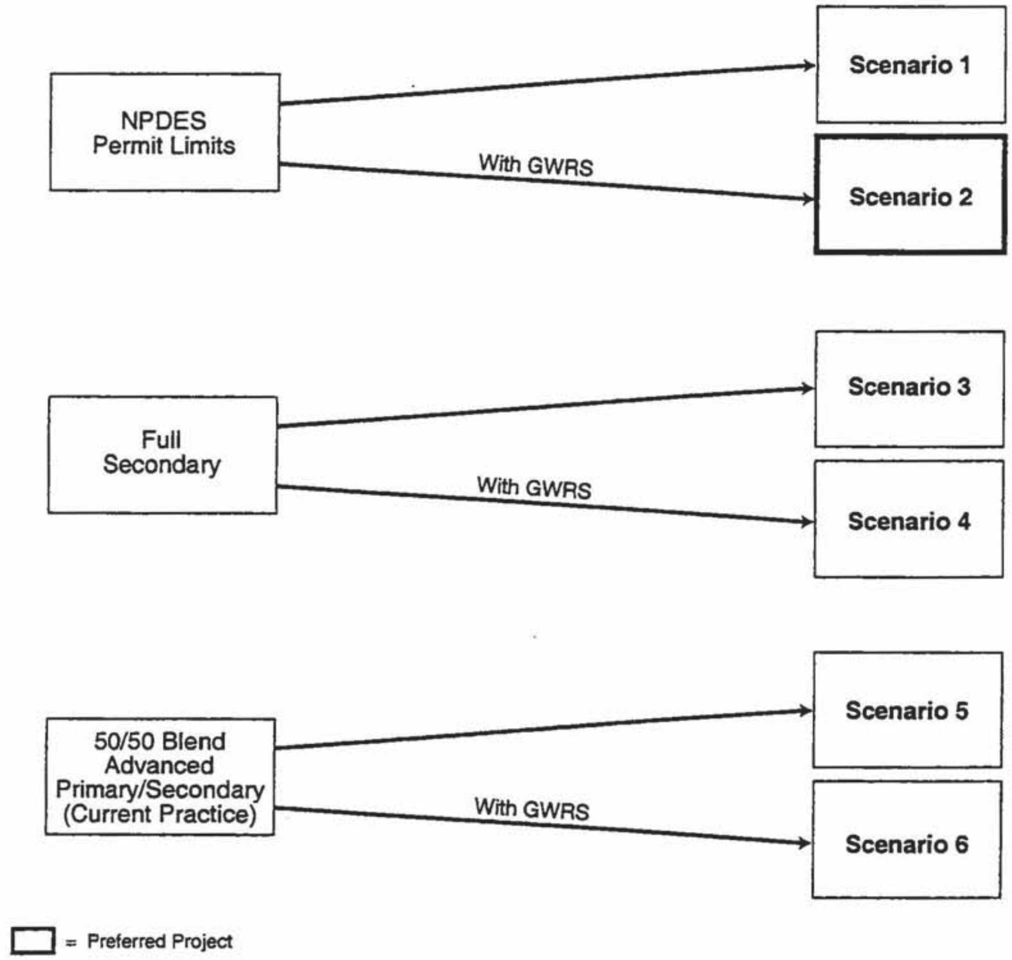
- **Scenario 3: Full Secondary Treatment without GWR System Project**. Provide full secondary treatment to all wastewater prior to ocean disposal. Under this Scenario, the GWR System project would not be implemented. The capacity for secondary treatment within both Plants 1 and 2 would be increased to accommodate projected peak flows. The existing facilities would be optimized through flow diversions to minimize the construction of new facilities.

- **Scenario 4: Full Secondary Treatment with GWR System Project**. Provide full secondary treatment to all wastewater prior to ocean disposal. In coordination with OCWD, 50-80 mgd average daily flow and up to 100 mgd peak wet weather flow of secondary effluent would be diverted from OCSD to the GWR System. The capacity for secondary treatment within both Plants 1 and 2 would be increased to accommodate projected peak flows. The existing facilities would be optimized through flow diversions to minimize the construction of new facilities.

No Project/Existing Conditions

- **Scenario 5: 50:50 Blend without GWR System Project**. Maintain the level of treatment currently provided. All wastewater would receive advanced primary treatment with about 50 percent also receiving secondary treatment prior to ocean discharge. Under this Scenario, the GWR System would not be implemented.

- **Scenario 6: 50:50 Blend with GWR System Project.** Maintain the level of treatment currently provided. All wastewater would receive advanced primary treatment. In coordination with OCWD, 50-80 mgd average daily flow and up to 100 mgd peak wet weather flow of secondary effluent would be diverted from OCSD to the GWR System. Half of the remaining ocean discharge would require secondary treatment.



SOURCE: Environmental Science Associates

OCSD Strategic Plan Program EIR / 960436

Figure 3-4
Level of Treatment Alternatives

Under the No Project Alternatives, Scenarios 5 and 6, the District would continue operating under the conditions agreed to in the 1989 Master Plan and EIR. That is to say, the capital improvements necessary to accommodate projected flows including repairs and upgrades to the collection system and the construction of secondary treatment facilities capable of treating at least 50 percent of the influent would be implemented in any case. For this reason, the No Project Alternatives will require more capital improvements than Scenarios 1 and 2 but less than Scenarios 3 and 4.

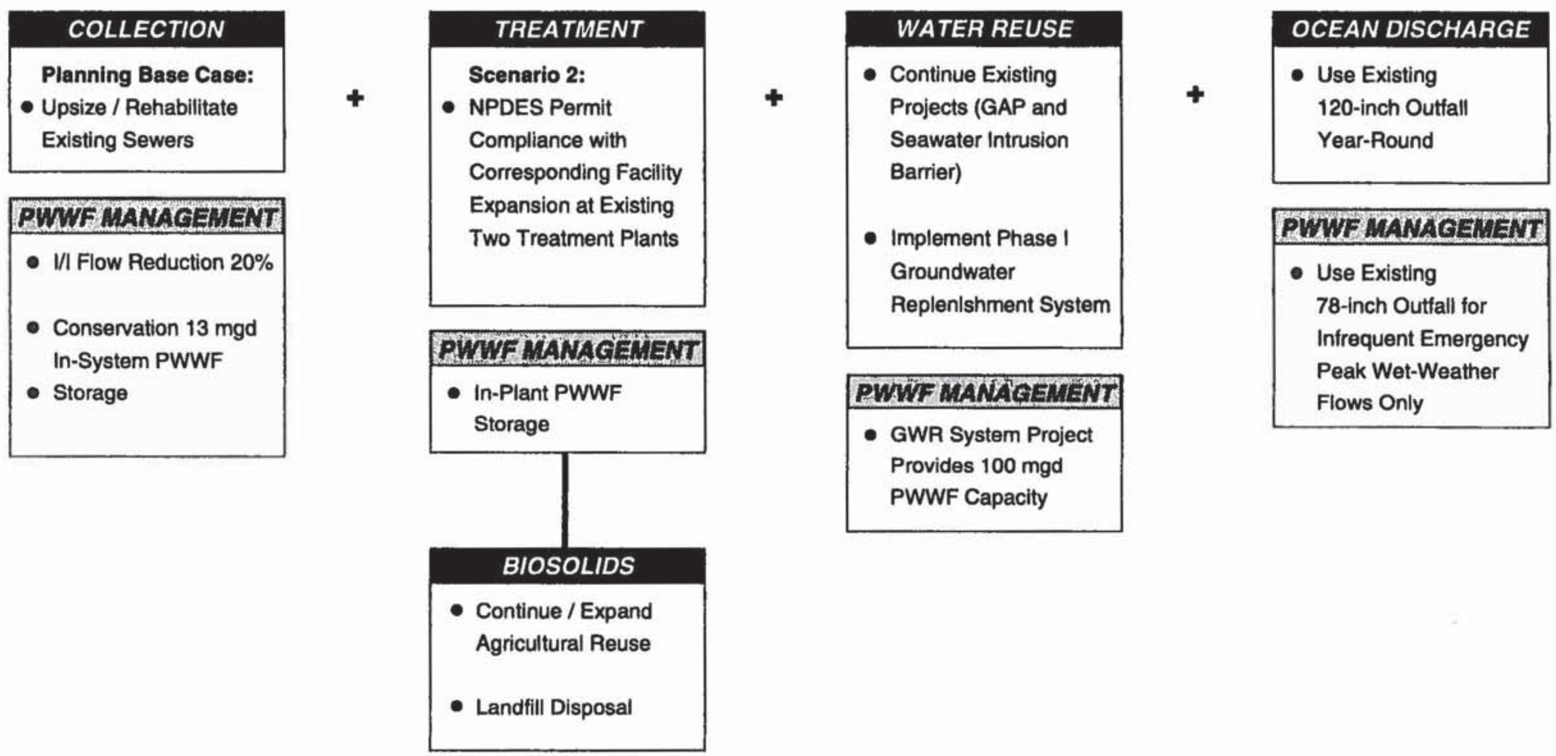
In light of this fact, much of the analysis in this report considers the No Project Alternatives to be bracketed by the Full Secondary and the NPDES Permit Compliance alternatives, falling in between the four other treatment alternatives with respect to required secondary treatment facilities. For purposes of analyzing land-side impacts under CEQA, Scenarios 1 and 2 together constitute the minimum number of proposed additional facilities whereas Scenarios 3 and 4 require the maximum capital improvement effort. However, there would be large differences between Scenarios 5 and 6. Scenario 6 would require additional secondary treatment facilities to accommodate 100 mgd for GWR System while still providing secondary treatment for 50 percent of the remaining effluent discharge.

PREFERRED ALTERNATIVE

The Preferred Alternative in the 1999 Strategic Plan is Treatment Scenario 2 – providing sufficient secondary treatment to meet the needs of the GWR System Project and to comply with NPDES permit requirements for ocean discharge. In order to meet the treatment goals of this scenario, the Strategic Plan identifies capital improvements for both the collection system and the treatment plants. These improvements are described in detail in the following sections. In conjunction with the preferred treatment Scenario alternative, the District plans to use the existing 78-inch diameter outfall to accommodate peak flows in excess of current discharge capacity. **Figure 3-5** illustrates the Preferred Alternative identified in the Strategic Plan for each component of the District's wastewater system.

As a means to optimize flexibility, the facility improvements identified in the Strategic Plan for the Preferred Scenario do not preclude implementation of the other Scenarios. The switch from the preferred scenario to another future condition could happen at any time, depending on OCSD's future effluent requirements or directions. The Strategic Plan assumes an adaptable approach to planning future capital improvements based on the possibility of changing operational needs. The implementation program of the proposed capital improvements for both the collection system and the treatment facilities accommodates each scenario while optimizing existing facilities. For example, although the full secondary treatment required of Scenarios 3 and 4 would require extensive new facilities, none of the planned upgrades proposed for the Preferred Alternative will prevent OCSD from obtaining full secondary treatment capacity in the future.

The Preferred Alternative was selected through the combination of technical feasibility studies prepared by OCSD and their consultants, community participation through the implementation of a Planning Advisory Committee (PAC) decision making techniques tailored to incorporate the local community and the District's needs.



SOURCE: Environmental Science Associates

OCSD Strategic Plan Program EIR / 960436 ■

Figure 3-5

Strategic Plan-Preferred Alternative - Key Components

3.7 PROPOSED TREATMENT FACILITIES

3.7.1 ALTERNATIVES

As part of the Strategic Plan development process, the District performed detailed systems analysis for each treatment process, evaluating existing equipment and identifying needed upgrades. The Plan identifies additional treatment facilities based on projected dry and wet weather flows to the year 2020 for treatment scenarios 1 through 4 (see description of treatment scenarios in Section 3.6, above). **Tables 3-2** and **3-3** summarize the proposed year 2020 facility improvements at Plant No. 1 and Plant No. 2 respectively for these four scenarios. All proposed additional treatment facilities would be located within the existing property boundaries of the District's Plants No. 1 and No. 2.

Scenarios 1 and 2 both provide treatment facilities adequate to fully comply with the District's existing NPDES permit. As shown on **Tables 3-2 and 3-3**, these two scenarios have very similar requirements for additional facilities. These two scenarios require construction of the fewest new or expanded facilities and represent the "least facilities" alternative. On the other hand, Scenarios 3 and 4, which both include treatment facilities to provide full secondary treatment for all effluent, involve construction of the most new or expanded facilities and represent the "most facilities" alternative.

These two sets of scenarios bracket the range of new and expanded facilities that could be developed at the District's two plants. Scenarios 5 and 6, which provide treatment facilities to produce 50 percent primary effluent and 50 percent secondary effluent for ocean discharge, require a level of facilities addition and/or expansion that falls between the Scenarios 1 and 2 (least or fewest facilities) and Scenarios 3 and 4 (most facilities). In fact, many of the proposed facility additions and improvements are common to each scenario and vary only in terms of the number or size of the units to be added. Therefore for purposes of impact analysis, this EIR analyses Scenario 2 – the Preferred Alternative and Scenario 4 – Full Secondary with GWR System to adequately address the range of potential impacts that could result from treatment facilities construction and operation under any of the six scenarios.

3.7.2 RECLAMATION PLANT NO. 1

Figure 3-6 presents an aerial view of the existing Plant No. 1, which is approximately 108 acres in area. The District's administrative offices are located at the northern end of the plant site along Ellis Avenue, while the treatment facilities cover the eastern portion of the plant adjacent to the Santa Ana River. The western portion of the site, about one-third of the plant property, is currently undeveloped or leased for other uses, such as the auto parts/wrecking yard along Garfield Avenue. **Figure 3-7** shows the plant layout for Reclamation Plant No.1 with Strategic Plan projects implemented in phases for Scenario 2 and **Figure 3-8** presents phased facility expansion for Scenario 4 – Full Secondary. The following improvements are proposed.

TABLE 3-2
PLANNING YEAR 2020 TREATMENT FACILITY REQUIREMENTS FOR PLANT NO. 1

	EXISTING		PROPOSED							
			NPDES Permit Level Of Treatment				Full Secondary Treatment			
			Scenario 1		Scenario 2		Scenario 3		Scenario 4	
	Number of units	Existing capacity (mgd)	New Units	Capacity Increase (mgd)	New Units	Capacity Increase (mgd)	New Units	Capacity Increase (mgd)	New Units	Capacity Increase (mgd)
Bar Screens	4	312	2	156	2	156	2	156	2	156
Headworks pumping	7	410	7(1)	220	7(1)	220	7(1)	220	7(1)	220
Grit chambers	7	112	6	104	6	104	6	104	6	104
Primary Clarifier basins	15	112	23	138	26	156	23	138	26	156
Trickling filters rehabilitated	4	30	4	0	4	0	4	0	4	0
Trickling filter clarifiers	1	10	5	20	5	20	8	30	8	30
Aeration basins (diffused air)	10	168	0	0	0	0	6	75	7	88
Blowers	2	107	0	0	0	0	1	53.5	2	107
Secondary clarifier basins	14	96	0	0	0	0	32	112	36	126
DAF thickeners	3	158	3	158	3	158	6	316	6	316
Clarifier for BFP underflow	0	0	1	3	1	3	1	3	1	3
Solids Handling										
Digesters	10	98,148 cy	6	63,333 cy	6	63,333 cy	10	105,555 cy	12	126,666 cy
Holding tanks	2	15,555 cy	0	0	0	0	1	7,732 cy	1	7,732 cy
Belt filter presses	8	1.8 cy/mgd	8	1.8 cy/mgd	9	1.8 cy/mgd	12	1.8 cy/mgd	13	1.8 cy/mgd
Cake storage hoppers	4	1,800 cy	5	2,250 cy	6	2,700 cy	8	3,600 cy	9	4,050 cy

NOTES:
Number of units shown includes stand-by units and the capacity increase also includes standby capacity.
(1) Replacing older pumps with new larger pumps. Total number of units remains unchanged.
Abbreviations: mgd – million gallons per day   cy – cubic yards

SOURCE: OCSD 1999 Strategic Plan, Volume 4: Table 9-2, Table 9-12, Table 16-2, Table 16-6, Figure 16-6, Appendix E, and Section 18

TABLE 3-3
PLANNING YEAR 2020 TREATMENT FACILITY REQUIREMENTS FOR PLANT 2

	EXISTING		PROPOSED							
			NPDES Permit Level of Treatment				Full Secondary Treatment			
			Scenario 1		Scenario 2		Scenario 3		Scenario 4	
	Existing units	Existing capacity (mgd)	New Units	Capacity Increase (mgd)	New Units	Capacity Increase (mgd)	New Units	Capacity Increase (mgd)	New Units	Capacity Increase (mgd)
Bar Screens	5	284	0	0	0	0	0	0	0	0
Headworks pumping	10	548	0	0	0	0	0	0	0	0
Grit chambers	8	91	3	52	3	52	3	52	3	52
Primary Clarifier basins	14	172	0	0	0	0	0	0	0	0
Aeration basins (pure oxygen)	3	96	0	0	0	0	8	74	8	74
Blowers	0	0	0	0	0	0	3	160	3	160
Secondary clarifier basins	12	109	3	11	0	0	17	60	17	60
DAF thickeners	3	132	0	0	0	0	2	88	2	88
Clarifier for BFP underflow	0	0	1	5	1	5	1	5	1	5
Solids Handling										
Digesters	15	100,745 cy	2	19,232 cy	3	28,848 cy	4	38,465 cy	4	38,465 cy
Holding tanks	5	30,740 cy	0	0	0	0	0	0	0	0
Belt filter presses	15	1.8 cy/mgd	0	0	0	0	0	0	0	0
Cake storage hoppers	2	1,800 cy	4	3,600 cy	4	3,600 cy	5	4,500 cy	5	4,500 cy

NOTES:
Number of units shown includes stand-by units and the capacity increase also includes standby capacity.
Abbreviations: mgd – million gallons per day cy – cubic yards

SOURCE: OCSD 1999 Strategic Plan, Volume 4: Table 9-2, Table 9-12, Table 16-2, Table 16-6, Figure 16-7, Appendix F, and Section 18

PRELIMINARY TREATMENT

Preliminary Treatment provides for removal of large materials with bar screens and grit chambers. Also included in this classification are pumps to elevate the raw sewage prior to entering the treatment facilities. The Strategic Plan proposes installing headworks pumps to increase pumping capacity from the current 410 mgd to 630 mgd by 2020 (**Table 3-4**).

Two new barscreens will be required by 2001. Two new grit chambers with minimum detention times of 3.0 minutes will be required by 2003. Four additional grit chambers will be required by 2020. These upgrades would be common to each treatment scenario.

TABLE 3-4
PLANT NO. 1 HEADWORKS PUMPING CAPACITY
(INCLUDING STANDBY UNITS)

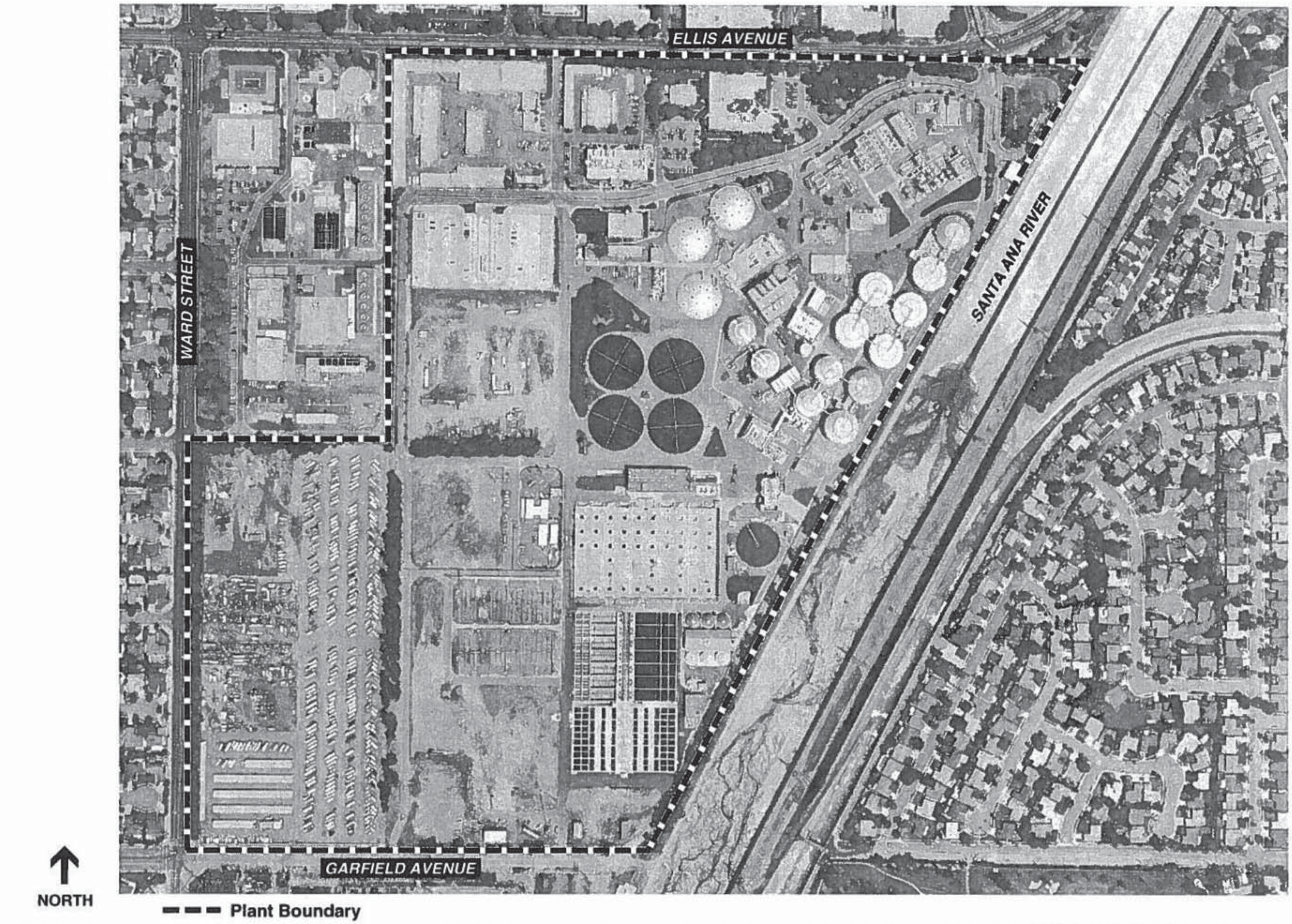
Installed Capacity (mgd)	Year Required in Service
549	2006
576	2009
603	2013
630	2020

PRIMARY TREATMENT

Primary treatment removes settleable solids and floatable materials through large tanks called clarifiers. The Strategic Plan proposes to add primary clarifiers to increase the primary treatment capacity at Plant 1 from the existing capacity of 112 mgd to 138 mgd without the GWR System and 156 mgd with the GWR System. These upgrades would be similar for each Scenario.

SECONDARY TREATMENT

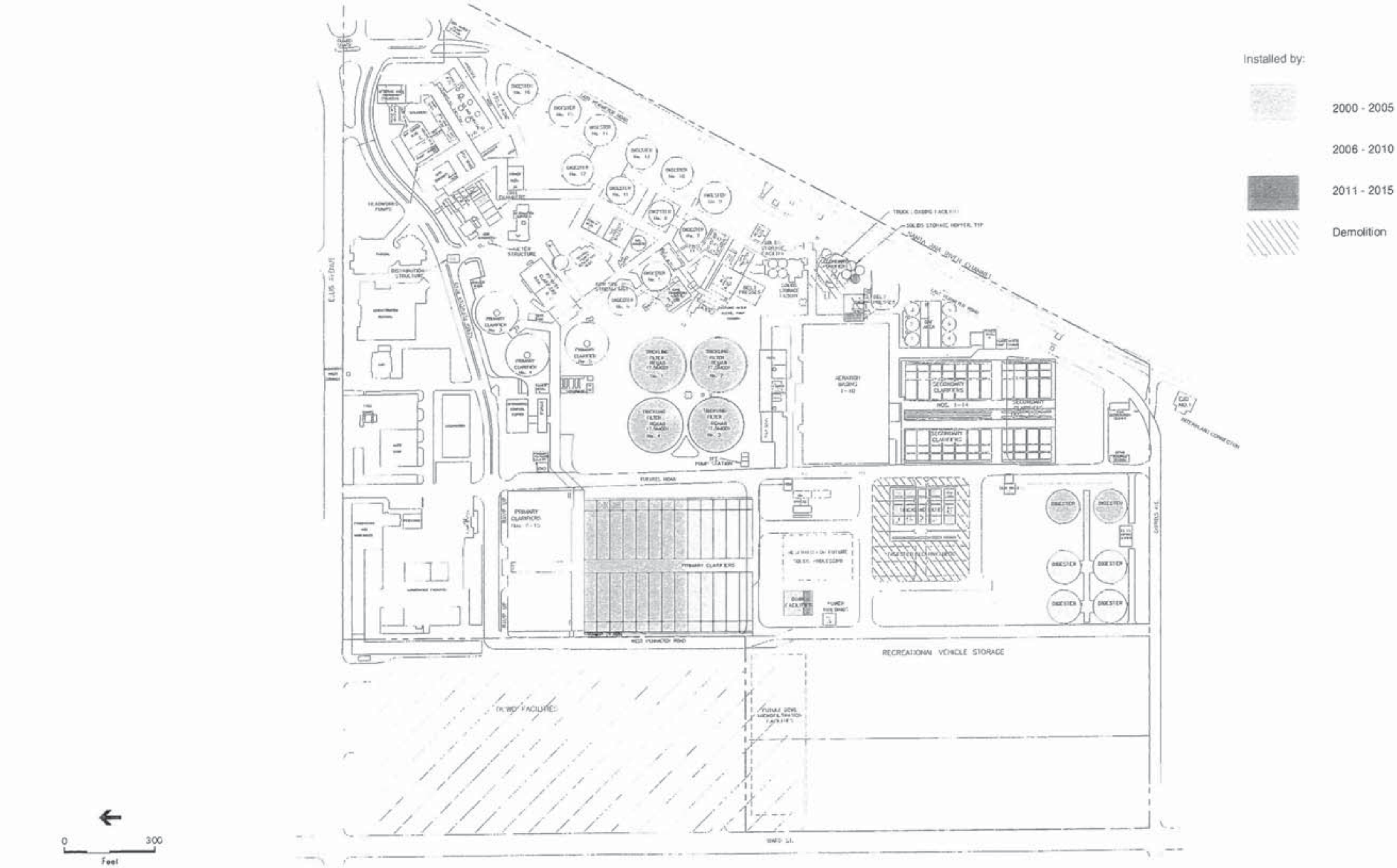
Secondary treatment provides consumption of organic material by microbes in either trickling filters or aeration tanks. The Strategic Plan proposes to rehabilitate four existing trickling filters and to add up to five new trickling filter clarifiers for Scenarios 1 and 2 increasing capacity by 20 mgd and eight for Scenarios 3 and 4 increasing capacity by 30 mgd. For Scenarios 3 and 4 requiring full secondary treatment, 32 to 36 new secondary clarifiers will be installed increasing capacity by a range of 112 mgd to 126 mgd by the year 2020.



SOURCE: OCSD

OCSD Strategic Plan Program EIR / 960436

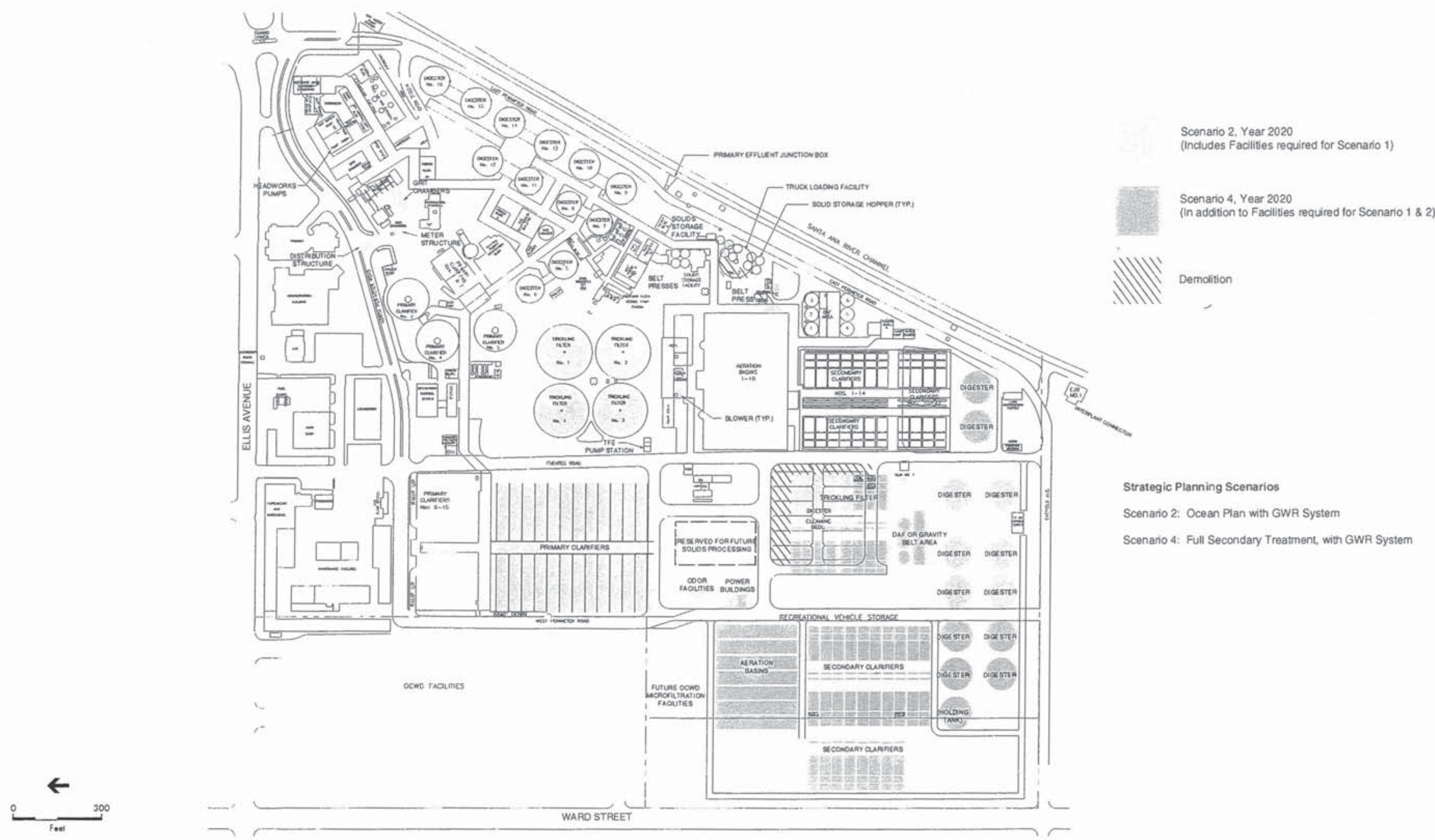
Figure 3-6
Reclamation Plant No. 1 Boundary and Vicinity



SOURCE: Camp Dresser Mckee, Environmental Science Associates

OCSD Strategic Plan Program EIR / 960436

Figure 3-7
Reclamation Plant No. 1
Future Facilities Site Plan (Scenario 2)



SOURCE: Camp Dresser Mckee, Environmental Science Associates

Figure 3-8
Reclamation Plant No. 1 Future Facilities Site Plan
(Scenarios 2 and 4)

SOLIDS HANDLING AND DEWATERING

These facilities treat the solid materials removed in the primary and secondary processes. Digesters facilitate decomposition of the sludge by retaining and heating the material in large concrete tanks. Belt filter presses are used to remove water from the treated sludge to achieve a cake-like consistency called biosolids. The extracted water is returned to the treatment process. Digesters are cleaned approximately once per year and the cleanings are placed in drying beds to de-water for approximately six months. The Strategic Plan proposes to add digesters, belt filter presses, and cake storage hoppers. The quantities of equipment vary for each treatment scenario. **Tables 3-2** and **3-3** summarize the proposed solids handling facilities for each scenario.

WASTE SIDESTREAM MANAGEMENT

Belt filter presses assist in the dewatering process for digested sludge. The filtrate and washwater from the presses is presently returned to the treatment process as underflow. A new three mgd clarifier for the existing belt filter press underflow will be constructed under each Scenario to remove finer solids from the treatment system.

MISCELLANEOUS PROJECTS

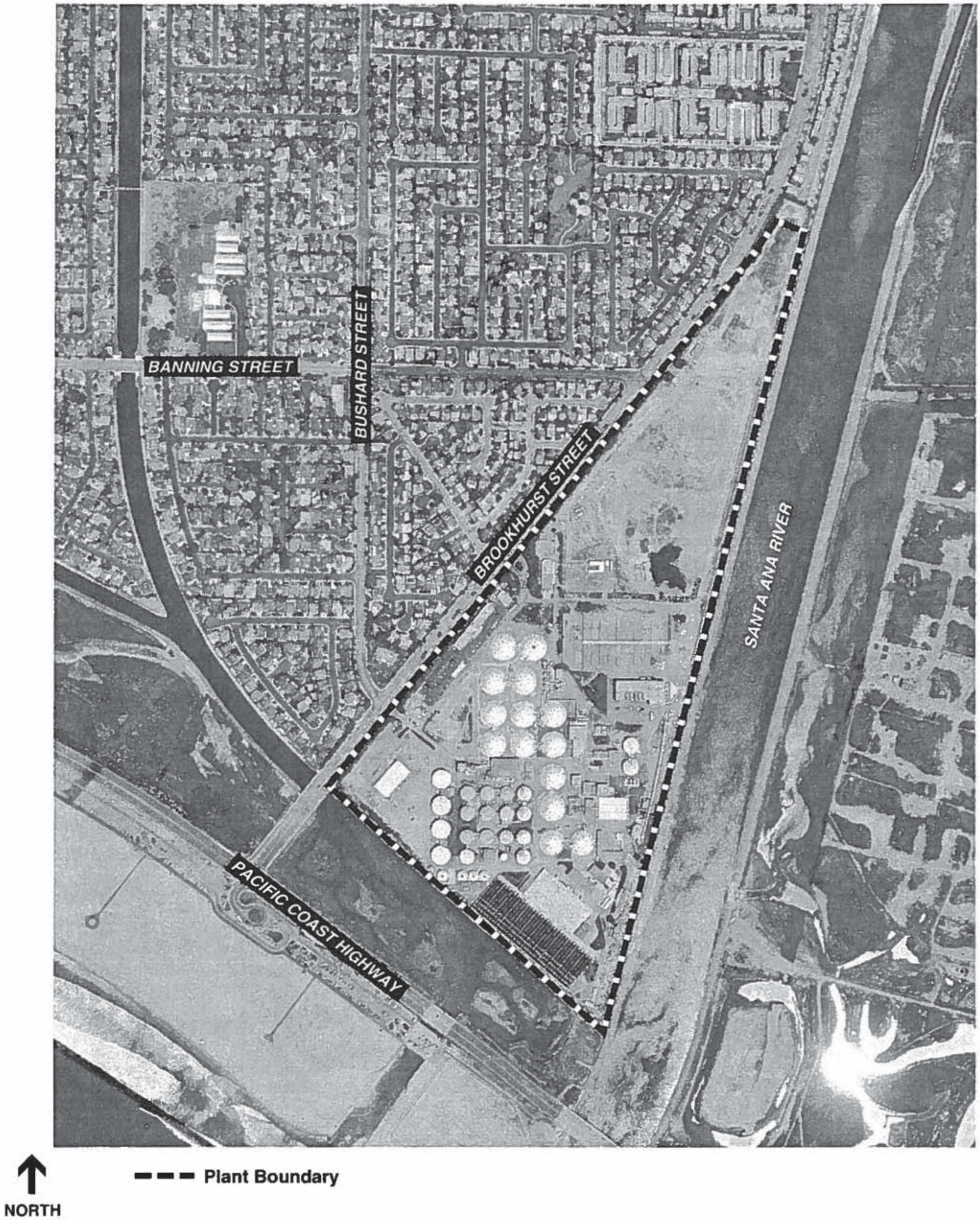
At Reclamation Plant No. 1, several support projects are planned through the planning period. The chemical facilities will be modified from chlorine-based odor control and disinfection facilities to hydrogen peroxide and bleach facilities. Miscellaneous projects also include odor control improvements projected for future facilities. These improvements would be implemented under each Scenario.

3.7.3 TREATMENT PLANT NO. 2

Plant No. 2. occupies approximately 110 acres and is shown in aerial view on **Figure 3-9**. The existing treatment facilities occupy the southern two-thirds of the site, with the area to the northeast remaining undeveloped. Under the full secondary treatment scenario the remainder of the site would be developed with facilities. **Figure 3-10** illustrates the phased addition of facility and final layout plan at 2020 for Scenario 2 and **Figure 3-11** shows this for Scenario 4. The following projects are proposed:

PRELIMINARY TREATMENT

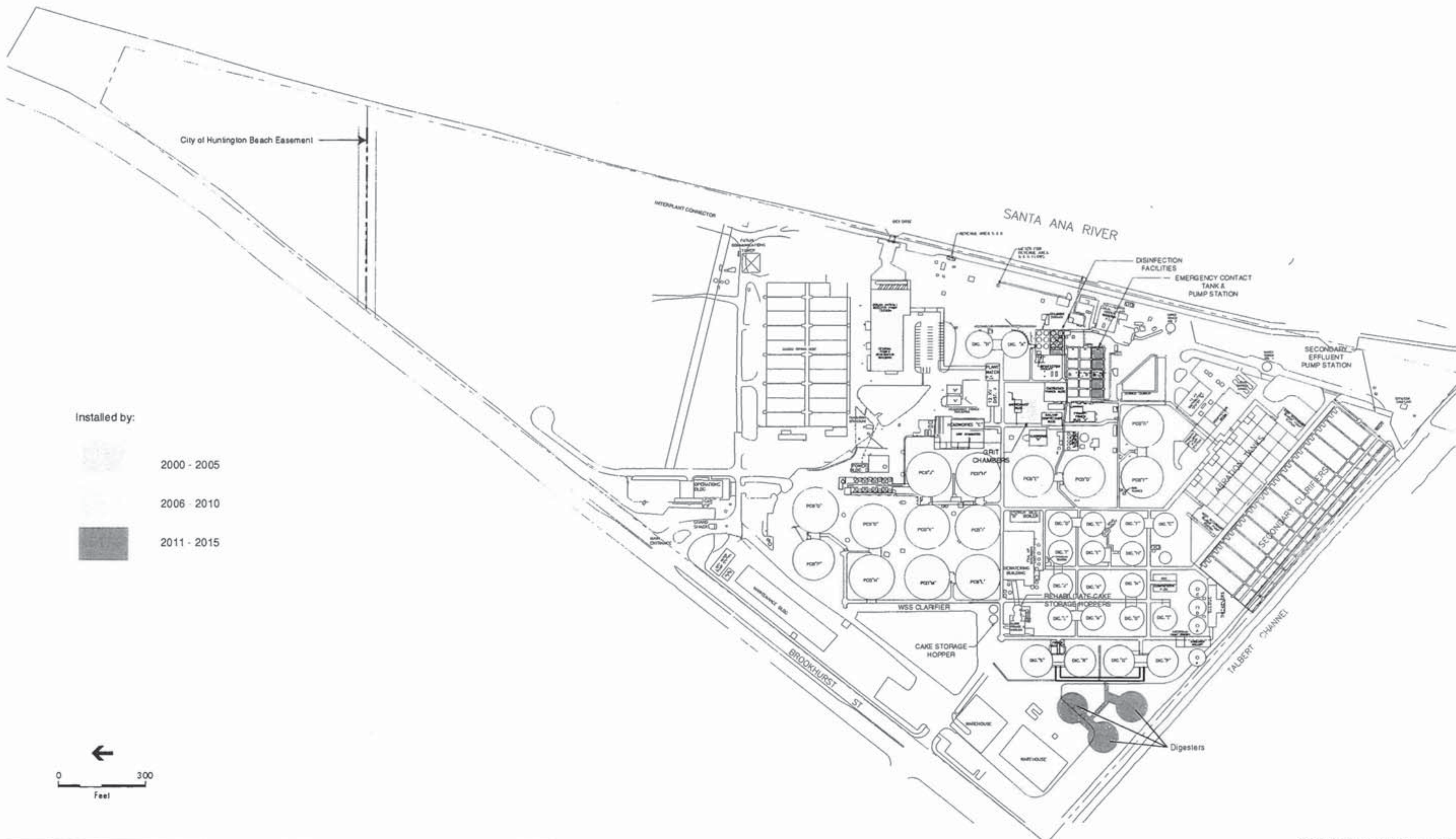
Three new grit chambers are proposed for Plant No. 2 to increase capacity from 91 mgd to 143 mgd under each Scenario. No new headworks pumping capacities have been proposed.



SOURCE: OCSD

OCSD Strategic Plan Program EIR / 960436

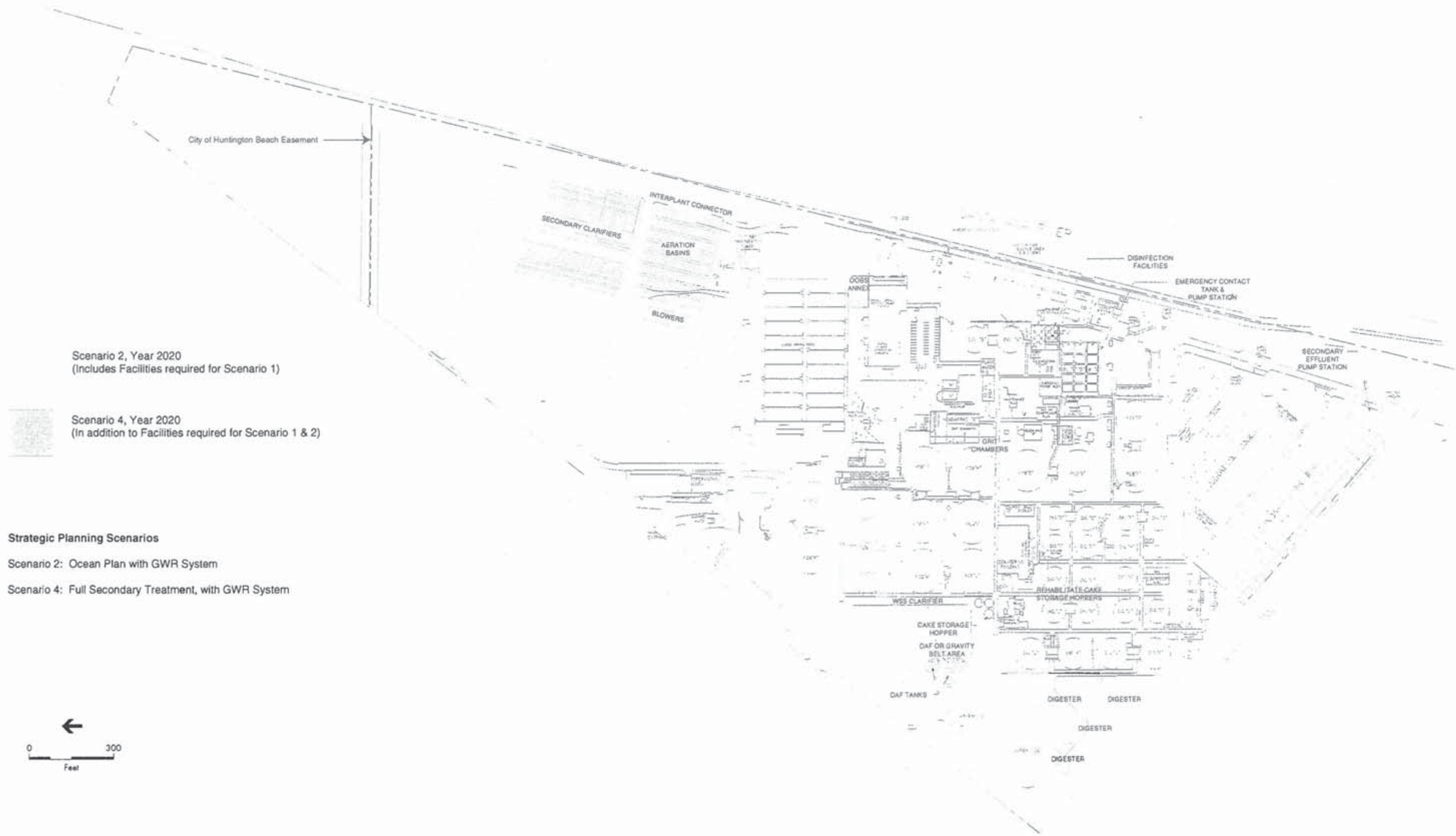
Figure 3-9
Treatment Plant No. 2 Boundary and Vicinity



SOURCE: Camp Dresser Mckee, Environmental Science Associates

OCSD Strategic Plan Program EIR / 960436

Figure 3-10
Treatment Plant No. 2
Future Facilities Site Plan (Scenario 2)



SOURCE: Camp Dresser Mckee, Environmental Science Associates

Figure 3-11
Treatment Plant No. 2 Future Facilities Site Plan
(Scenarios 2 and 4)

SECONDARY TREATMENT

The Strategic Plan proposes additional secondary treatment facilities to be installed at Plant 2 including eight new aeration basins utilizing pure oxygen for Scenarios 3 and 4. No new aeration basins would be required under Scenarios 1 or 2. These new aeration basins would provide 74 mgd of increased capacity. Three new secondary clarifiers are proposed for Scenario 1, increasing capacity by 11 mgd. For the full secondary treatment Scenarios 3 and 4, 17 new clarifiers are proposed, increasing capacity by 60 mgd.

SOLIDS HANDLING AND DEWATERING

The Strategic Plan proposes to rebuild the 15 belt filter press dewatering facilities and refurbish three 80-foot diameter digesters and three holding tanks. Two new 80-foot diameter digesters are proposed for Scenario 1, three for Scenario 2, and four for Scenarios 3 and 4, increasing capacity from the current 100,745 cubic yards (cy) to a maximum of 139,210 cy for Scenario 4. Four new 900-cubic yard cake storage hoppers are proposed for Scenarios 1 and 2 and five for Scenarios 3 and 4, increasing capacity by 3,600 cy for Scenario 1 and 2 and 4,500 cy for Scenarios 3 and 4.

WASTE SIDESTREAM MANAGEMENT

A new five-mgd clarifier for belt filter press underflow is proposed for each Scenario in the Strategic Plan.

UTILITY SYSTEMS

Improvements to the aeration plant instrumentation, the electrical building's ventilation, and PCB-containing transformer replacements are planned by the year 2001. Two air compressors and three centrifugal compressors will be required by the year 2000.

3.7.4 INTERPLANT/JOINT WORKS

A new secondary effluent pump station is proposed to pump water from the secondary treatment facilities at Plant No. 2 through a pipeline back up to Plant No. 1 for delivery to the Orange County Water District and various proposed reclamation projects by 2008. The pumping capacity for this pipeline will increase to 25 mgd by 2015. The new pump station will allow secondary effluent from Treatment Plant No. 2 to contribute to the GWR System's overall needs, alleviating some of the demand on Reclamation Plant No. 1 and reducing the need for new secondary facilities. The pipeline will be installed underground along the 30-foot-wide strip of land adjacent to the Santa Ana River between Reclamation Plant No.1 and Treatment Plant No. 2. The corridor was purchased by the Sanitation Districts in the early 1950s. Presently, this interplant corridor contains six pipe lines carrying either liquids (untreated effluent diverted from Plant No 1 to Plant No. 2 for treatment, Plant No. 1 effluent for ocean disposal), digester gas, and communication lines. The installation of the interplant connector pipeline is discussed in Section 3.9.3.

The District will be evaluating improvements in the management of peak wet weather and storm runoff at each plant site. The run off can be a significant source of influent during heavy rainstorms. The District is planning a project (number J-67, Peak Flow Management) to capture storm runoff at each plant site in holding basins, until flow through the plants is reduced and the collected water can be sent through the treatment system. If the District plans to store influent or effluent in these retention basins, they will be lined. The project will include study and design of enhancements for the existing seven million gallons of on-site storage.

The District plans to modify the Foster Pump Station to allow excess peak wet weather flow out the 78-inch outfall. This project is planned to be completed by the year 2004. In addition, the outfall flow meter will be replaced by the year 2001.

The abandoned chlorine facility building at Plant No.1 will be converted into a belt filter press facility by the year 2000. A new closed loop cooling system will be added to the Central Generation engines, absorption chillers, and digester gas compressors by the year 2000. Several other utilities and O&M projects are provided for in the Strategic Plan to increase plant efficiency and to provide best available technologies. Other planned improvements include plant automation and computerization, safety and security improvements, and updating standard operating procedure specifications. These improvements, many of which would not require CEQA analysis, are planned under each Scenario.

3.7.5 FLOW EQUALIZATION STORAGE CAPACITY

The District has evaluated methods of increasing storage capacity within the existing trunk sewer system and plant facilities as a means of accommodating peak wet-weather flows. The Strategic Plan identifies 6.6 million gallons (MG) of storage space within the trunk sewer collection system (see **Table 3-5**). The Strategic Plan also identifies 6.64 MG of existing in-plant storage capacity. For planning purposes, during the selection process for the Preferred Alternative, the in-plant storage volume capacity was rounded up to 7 MG. This amount of flow equalization storage capacity is the Preferred Alternative and would be similar for each treatment scenario. **Table 3-6** summarizes the in-plant storage capacity.

TABLE 3-5
ESTIMATED IN-SYSTEM STORAGE AVAILABLE IN 2020

Trunk Sewer	Volume (MG)
Coast Trunk	1.76
Bushard	0.49
Knott	0.09
Miller-Holder	0.35
Sunflower	0.37
SARI	3.55
Total	6.61

TABLE 3-6
ESTIMATED IN-PLANT FACILITIES AVAILABLE FOR STORAGE THROUGH YEAR 2020

Plant	Location	MG	Available Until
1	Aeration Basin No. 4	1.35	beyond 2020
1	Secondary Clarifier No. 7	0.43	2020
1	Secondary Clarifiers Nos. 8 and 9	0.86	beyond 2020
2	Flow equalization basins B and C	0.70	indefinitely
2	Aeration Basin No. 2	1.00	beyond 2020
2	Secondary Clarifier Nos. 3 and 4	2.30	beyond 2020
Total		6.64	

SOURCE: OCSD 1999 Strategic Plan, Volume 3 Section 6

3.7.6 CONSTRUCTION METHODS AND SCHEDULE

The treatment facility expansion proposed in the 1999 Strategic Plan will occur in phases over the next 20 years. **Table 3-7** and **3-8** present the proposed implementation schedule for expanded facilities at Plant No. 1 and Plant No. 2 respectively. **Table 3-9** lists proposed interplant projects. Most of the interplant projects are scheduled for the near term (complete before 2005) and may not require CEQA analysis. They have been provided here to give an indication of the District's complete capital improvements program. This EIR addresses at a program-level the overall impacts of construction and operation of the ultimate year 2020 facilities and provides a project-level analysis for the near-term projects to be constructed in the first phase by about the year 2005. As shown in **Table 3-7**, for Scenario 2, the Preferred Alternative, about half of the proposed new facilities would be constructed at Plant No. 1 by about 2005. At Plant No. 2 most of the proposed Scenario 2 facilities would be constructed in the near-term period, with the notable exception of three digesters not scheduled for service until after 2011. **Tables 3-7** and **3 8** also show the additional facilities required for the implementation of Scenario 4. For Plant No. 1, these facilities would be constructed within the timeframe of 20 years. For Plant No. 2, the facilities would be constructed between 2000 and 2005. The facilities phasing at both plants is illustrated in **Figures 3-7, 3-8, 3-10** and **3-11**, above.

Construction of the proposed treatment facilities at the two plants will involve several general types of activities: demolition and removal of some existing facilities, grading currently unimproved property, excavation and soil removal, and constructing process units. Scenarios 1 through 6 share most of these activities. These activities are described further below. In general, the construction will occur in periodic activity peaks, requiring brief periods of significant effort followed by longer periods of reduced activities. **Tables 3-10** and **3-11** summarizes the projected construction characteristics such as the approximate cubic yards of material to be excavated and rough estimates of average and peak truck hauling trips.

TABLE 3-7
FACILITY IMPROVEMENTS SCHEDULE (SCENARIOS 2 AND 4) – PLANT NO. 1

Plant No. 1	2000-2005	2006-2010	2011-2015	2016-2020
Facilities Required for Scenarios 2				
Preliminary Treatment				
Headworks pumping (up to 68 mgd)	X			
Headworks pumping (up to 88 mgd)[1]		X		
Headworks pumping (up to 44 mgd)			X	
Headworks pumping (up to 44 mgd)				X
3 Grit chambers	X			
3 Grit chambers		X		
Primary Treatment				
16 Primary clarifiers[3] (96 mgd)	X			
10 Primary clarifiers[1] (60 mgd)		X		
Secondary Treatment				
Rehabilitate 4 trickling filters	X			
5 Trickling filter clarifiers (20 mgd)	X			
Solid Handling and Dewatering				
Automation of Solids Storage Facility[3]	X			
2 Digesters	X			
4 Digesters[1]		X		
7 Belt filter presses[1]		X		
2 Belt filter presses			X	
5 Cake storage hoppers[1]		X		
1 Cake storage hopper			X	
Miscellaneous				
Chemical facility mods[3]	X			
Odor control enhancements[2]	X		X	
Waste Sidestream Management				
1 Clarifier for existing BFP underflow (3 mgd)	X			
Additional Facilities Required for Scenario 4 – Full Secondary Treatment*				
Secondary Treatment				
3 Trickling Filter Clarifiers (10 mgd)	X			
1 Aeration Basin (12 mgd)	X			
3 Aeration Basins (38 mgd)		X		
3 Aeration Basins (38 mgd)				X
1 Blower		X		
1 Blower				X
16 Secondary Clarifiers (56 mgd)	X			
12 Secondary Clarifiers (42 mgd)		X		
8 Secondary Clarifiers (28 mgd)				X
2 DAF Tanks		X		
1 DAF Tanks				X
Solids Handling and Dewatering				
1 Digester	X			
1 Digester		X		
4 Digesters				X
1 Belt Filter Presses	X			

TABLE 3-7 (Continued)
FACILITY IMPROVEMENTS SCHEDULE (SCENARIOS 2 AND 4) – PLANT NO. 1

Plant No. 1	2000-2005	2006-2010	2011-2015	2016-2020
Solids Handling and Dewatering (cont)				
1 Belt Filter Press		X		
2 Belt Filter Presses				X
1 Cake storage hopper	X			
1 Cake storage hopper		X		
1 Cake storage hopper				X
1 Holding Tank		X		

1 Project design and/or construction begins in the previous time interval.
2 Second phase of project begins before 2010.
3 Project has been contracted and budgeted.

Note: Additional facilities for Scenario 4 are relative to Scenario 2

SOURCE: OCSD 1999 Strategic Plan, Volume 4, Figure 18-13a

TABLE 3-8
FACILITY IMPROVEMENTS SCHEDULE (SCENARIOS 2 AND 4) – PLANT NO. 2

Plant No. 2	2000-2005	2006-2010	2011-2015	2016-2020
Preliminary Treatment				
Headworks improvements[3]	X			
3 Grit chambers	X			
Improvements to influent sampling system[3]	X			
Secondary Treatment				
Secondary plant rehabilitation[3]	X			
Solids Handling and Dewatering				
Dewatering belt press rebuild	X			
Digesters I-0 rehabilitation[3]	X			
Solids storage facility[3]	X			
2 Digesters[1]			X	
1 Digester			X	
2 Cake storage hoppers (rehabilitation)	X			
2 Cake storage hoppers		X		
Utility Systems				
Electrical facility mods. & safety upgrade[3]	X			
High pressure compressed air system[3]	X			
Miscellaneous and Support Projects				
Odor control enhancements[2]	X		X	
Disinfection facilities (25 mgd)[2]			X	
Waste Sidestream Management				
1 Clarifier for BFP underflow (5 mgd)	X			
Additional Facilities Required for Scenario 4 – Full Secondary Treatment*				
Secondary Treatment				
8 Aeration Basins (74 mgd)	X			
3 Blowers	X			
2 DAF Tanks	X			
17 Secondary Clarifier Basins (60 mgd)	X			
Solids Handling and Dewatering				
1 Digester[4]	X			
1 Cake Storage Hopper	X			

1 Project design and/or construction begins in the previous time interval.
2 Second phase of project begins before 2010.
3 Project has been contracted and budgeted.
4 This table indicates that one additional digester will be added under Scenario 4 bringing the total number of new digesters to 4. However, under Scenario 4 all four digesters would be installed by 2003.

Note: Additional facilities for Scenario 4 are relative to Scenario 2

SOURCE: OCSD 1999, Strategic Plan, Volume 4, Figure 18-13b.

TABLE 3-9
FACILITY IMPROVEMENTS SCHEDULE (SCENARIOS 2 AND 4) - INTERPLANT

Interplant-Joint Works	2000-2005	2006-2010	2011-2015	2016-2020
Interplant Facilities				
Secondary effluent pump (50 mgd)		X		
Secondary effluent pump (25 mgd)			X	
Disposal and Outfall Facilities				
Foster Pump Station (78-inch outfall)	X			
Outfall flow meter	X			
120-inch Outfall				
Plant Automation and Computerization	X			
Safety and Security Improvements	X			
Support Facilities	X			
Utility System Improvements	X			
Miscellaneous Projects	X			
Replacement and Refurbishment	X			
Special Projects				
Strategic and Master Planning	X			
Information Management and Computerization	X			
Biosolids Management	X			
Process-Related Special Projects	X			
Miscellaneous	X			
Cooperative Projects	X			

Note: Interplant facilities are planned for each Scenario.

Source: OCSD 1999, Strategic Plan, Volume 4

These construction scenario characteristics have been developed to allow general analysis for construction impacts. For EIR purposes these estimates are used to assess the nature and magnitude of potential construction impacts. The final construction scheduling of specific facility projects will be determined in the future and may vary from that presented here. Similarly, the exact construction characteristics may vary somewhat from those presented here, such as excavation quantities or estimated truck trips. The intent of this information is to provide the correct order of magnitude of activity to allow adequate impact assessment and mitigation development, but it is not an attempt to prescribe the exact construction characteristics for the proposed facility projects.

- Demolition and site clearing. Facilities that will be demolished as part of the improvements to Reclamation Plant No. 1 include the headworks no. 1 facility, the secondary clarifier no. 2 facility, cleaning beds, and the vehicle storage area. The removal of these facilities will accommodate the proposed grit chambers, solids storage hoppers, a truck loading facility, trickling filters, secondary clarifiers, digesters, and aeration basins. For Reclamation Plant No. 2, existing warehouses will be demolished to accommodate proposed digesters.

- Excavation, foundation, and underground construction. For planning purposes soil excavation is not expected to exceed three feet for most structures. However, the proposed digesters will require excavation to 10 feet below grade. Excavated soils are generally either stored on site for a period of time until used in grading, or immediately removed from the site. This analysis will assume that all the soil will be removed from the plant sites immediately after excavation activities.

- Earthmoving and grading. Earthmoving and grading will be required for the construction of new facilities, including stormwater collection basins, aeration basins, secondary clarifiers, digesters, and primary clarifiers.

- Construction of new buildings and other above-ground facilities. Concrete pouring, pile-driving, and steel working activities will occur along with general construction activities during the construction periods for each new facility. The chief building materials to be used include structural steel, concrete, and masonry. Installation of facilities will include electrical, hydraulic, and mechanical systems handling. The proposed digesters will be the tallest structures at the plant sites at approximately 35-40 feet tall.

- Restoration and upgrade of existing facilities. OCSD proposes to upgrade the headworks pumping facility, the odor control facility and rehabilitate the trickling filters at Plant No. 1 and rehabilitate the storage hoppers at Plant No. 2.

- Landscaping. Proposed facilities at Plants No. 1 and 2 will be landscaped following construction consistent with the Urban Design Element (OCSD, Strategic Plan, Vol. 9, 1998). OCSD recognizes the aesthetic impact of its facility on urban elements, and is taking steps through expanded landscaping at the plant perimeter to minimize its impact.

Construction crews may range from 10 to 100 workers depending on the construction schedule and process unit being installed. Facilities construction would be on-going over the next 20 years consisting of intermittent periods of intensive construction activities and longer design periods. It is expected that the existing regional labor force would be adequate to serve the proposed construction activity. Very few trees will be removed since most of the vegetation on the plant property contributes to the urban design program on the periphery of the site and is not within the construction footprint to the year 2020.

Heavy construction equipment for each pipeline construction crew would include:

- Pavement saw
- Jack hammers
- Back hoe
- Front-end loaders
- 10-wheel dump trucks
- Flat-back delivery truck
- Crane
- Compactor
- Water truck
- Trench shields
- Air compressors
- Concrete trucks
- Concrete pumper trucks
- Sweepers
- Welding trucks
- Road grader (for widening at detours along shoulders
- Side boom pipe handler tractor
- Paving equipment: back hoe, asphalt hauling trucks, compactors, paving machine, rollers

TABLE 3-10
ESTIMATED EXCAVATION VOLUME PER PROCESS UNIT

Process Unit	Area (square foot)	Excavation Depth (feet)	Excavated Soil Volume (cubic yards)
Stormwater Retention Basins	43,560	4	6,454
Digester	10,113	10	3,745
Secondary Clarifier Basin	4,950	3	550
Primary Clarifier Basin	8,100	3	900

Assumes one-acre storm retention basins
Assumes 285,000 cubic-foot working-volume digesters
Assumes 6.30 mgd capacity secondary clarifiers
Assumes 12 mgd capacity primary clarifiers
Source: OCSD Strategic Plan Volume 4, Figure 16-6, and Appendix E

TABLE 3-11
ESTIMATED TREATMENT PLANT EXCAVATION SOIL VOLUMES TO THE YEAR 2020 (cubic yards)

	Scen. 1	Scen. 2	Scen. 3	Scen. 4
Plant No. 1				
Stormwater Retention Basin	12,907	12,907	12,907	12,907
Digesters	22,472	22,472	37,454	44,945
Secondary Clarifier Basins	0	0	17,600	19,800
Primary Clarifier Basins	20,700	23,400	20,700	23,400
Total	56,079	58,779	88,661	101,052
Number of trucks *assumes (20 cubic yards) per truck*	2,803	2,939	4,433	5,053
Plant No. 2				
Stormwater Retention Basin	6,454	6,454	6,454	6,454
Digesters	7,491	11,236	14,982	14,982
Secondary Clarifier Basins	1,650	0	9,350	9,350
Primary Clarifier Basins	0	0	0	0
Total	15,595	17,690	30,786	30,786
Number of trucks *assumes (20 cubic yards) per truck*	780	885	1,539	1,539

Table 3-10 provides planning level estimates of excavation volumes for each relevant process unit. **Table 3-11** summarizes construction excavation soil volumes for the four proposed action scenarios along with estimated truck trips to remove excavated material from the site.

3.7.7 OPERATIONAL SCENARIO

The District is anticipating an average dry weather daily influent flow of 352 mgd by the year 2020, which is an increase of approximately 45 percent over current flows. Additional treatment facilities required to process this flow have been outlined above. Issues pertaining to operations include staffing, energy consumption, water usage, and chemical usage.

STAFFING REQUIREMENTS

The District's employee staffing is expected to remain stable or decline slightly by the year 2020. Current full-time total staffing is 515. The full-time staffing anticipated for Scenarios 3 and 4 would increase only slightly (approximately 5 percent) for operations and maintenance personnel.

ENERGY DEMAND AND SUPPLY

No substantial changes are planned for the District's electricity generation and distribution systems. The restructuring of the electric industry in the State of California could impact the District's strategic planning, but at this point the implications for the District are not readily quantifiable.

WATER USAGE

No substantial changes are planned for the District's potable water system. Projected water demand quantities are summarized in **Table 3-12**. These projections assume that the rate of potable water consumed by OCSD during the base case 1997/98 fiscal year will increase each year commensurate with the projected total flow rate.

Potable water consumption for the full secondary Scenarios 3 and 4 is anticipated to be similar to the Scenario 2 projection, since the process functions using potable water are generally primary treatment facilities and administration facilities, and staffing is not projected to increase significantly for full secondary scenarios.

TABLE 3-12
MONTHLY AVERAGE CITY WATER CONSUMPTION (kcu ft)

Fiscal Year	Plant 1	Plant 2
1997-8	459	1,294
Projected for Scenario 2		
2000	490	1,380
2005	545	1,538
2010	590	1,664
2015	612	1,725
2020	634	1,786

CHEMICAL USAGE

Future chemical usage estimates assume an increase commensurate with wastewater flow increases. Chemical usage for Scenario 2 could drop slightly initially due to the initial decrease in secondary treatment volume. Chemical usage for the full secondary Scenarios 3 and 4 is anticipated to increase approximately 30 percent since secondary treatment requires more chemicals (Ooten, 1999). Past and projected Annual Monthly Average Chemical usage at Plant No. 1 and Plant No. 2 are shown in **Tables 3-13** and **3-14**. Truck trips per month are listed in **Table 3-15**. These projections assume that each truck delivery averages 2,500 gallons. These projections are similar for each Scenario. Since Scenario 2 would reduce amounts of secondary treatment from current levels, the number of truck trips would initially decrease.

TABLE 3-13
PAST AND PROJECTED ANNUAL MONTHLY AVERAGE CHEMICAL USAGE AT PLANT NO. 1 (Scenario 2)

Fiscal Year	Hydrogen Peroxide (gallons)	Caustic Soda (gallons)	Ferric Chloride (gallons)	Sodium Hypochlorate (gallons)	Polymer Dewatering (gallons)	Polymer DAF Units (gallons)
1997-8	13,300	2,710	110,000	8,300	40,000	4,170
Projected						
2000	14,187	2,891	117,333	8,853	42,667	4,448
2005	15,804	3,220	160,000	9,862	110,000	11,120
2010	17,107	3,486	171,000	10,676	110,000	11,120
2015	17,733	3,613	176,000	11,067	110,000	11,120
2020	18,359	3,741	182,000	11,457	110,000	11,120

SOURCE: OCSD

TABLE 3-14
PAST AND PROJECTED ANNUAL MONTHLY AVERAGE CHEMICAL USAGE AT PLANT NO. 2 (Scenario 2)

Fiscal Year	Hydrogen Peroxide (gallons)	Caustic Soda (gallons)	Ferric Chloride (gallons)	Sodium Hypochlorate (gallons)	Polymer Dewatering (gallons)
1997-8	22,100	8,000	194,500	15,800	62,800
Projected					
2000	23,573	8,533	161,000	16,853	35,000
2005	26,260	9,506	180,000	18,774	40,000
2010	28,427	10,290	200,000	20,323	45,000
2015	29,467	10,667	200,000	21,067	50,000
2020	30,507	11,043	220,000	21,810	55,000

SOURCE: OCSD

TABLE 3-15
ESTIMATED TRUCK TRIPS PER MONTH FOR CHEMICAL DELIVERIES

	Plant No. 1	Plant No.2	Total
1998	71	121	193
Scenario 2			
2000	76	98	174
2005	124	110	234
2010	129	122	251
2015	132	124	256
2020	135	135	270
Scenario 4			
2000	99	126	225
2005	163	141	304
2010	170	156	327
2015	174	160	333
2020	177	174	352

SOURCE: Environmental Science Associates

Since liquid oxygen is used for secondary treatment, its usage would increase for the full-secondary scenarios. Reclamation Plant No.1 does not use liquid oxygen. In the 1997/98 fiscal year, activated sludge treated 67 mgd or approximately 25 percent of the total influent of 255 mgd. This amount would be expected to double by the year 2020 for the full secondary scenarios to treat an additional 74 mgd, increasing liquid oxygen usage 100 percent. Other chemical quantities would remain as projected for Scenario 2.

3.8 OCEAN DISCHARGE FACILITIES

3.8.1 ALTERNATIVES

The District's existing ocean discharge facilities are described in Section 2.7, above. The District's primary outfall system (the 120-inch diameter, 5-mile-long ocean outfall), which was put into service in 1971, has the rated capacity of 480 mgd. The District has an existing 78-inch, 1-mile-long ocean outfall that was removed from routine service in 1971 with the installation of the 120-inch outfall and has not been used since. The 78-inch outfall is reserved for emergency discharge needs and is included as such in the NPDES permit. Additionally, the District has the capability to discharge to the Santa Ana River through two 50-foot overflow weirs at Plant No. 2. This discharge facility is designated for extreme emergency use only by the District's NPDES permit. The Strategic Plan considered the potential use of the SAR for emergency use but proposes to eliminate the outfall option from the planning scenario. None of the alternatives analyzed in this document include the planned use of the emergency weir to the SAR. The weirs have never been used.

EXISTING 120-INCH OUTFALL

The primary outfall is a 120-inch diameter reinforced concrete pipe approximately 21,400 feet in length. A 6,000-foot long diffuser is attached to the end of the pipe. Effluent is dispersed through the ports at an average depth of 188 feet. The existing 120-inch outfall's rated capacity of 480 mgd has been exceeded on five separate occasions since its installation in 1971, reaching 550 mgd during a storm event in 1995. During each event, the outfall was able to accommodate all the effluent without requiring emergency discharge at either of the alternative two discharge points. Due to increased development and projected population growth within the Service Area, peak wet weather flows are estimated to reach 775 mgd by the year 2020 (see Section 3.4). This amount includes a projected 20% reduction in infiltration inflow and an estimated 13 mgd flow reduction from conservation efforts. To reconcile the discharge capacity deficiencies during peak flow periods, the District has evaluated two alternatives to increase ocean discharge capacity:

- Maintain the existing 78-inch diameter outfall (maximum rated capacity of 245 mgd) for infrequent peak flow discharges in excess of 480 mgd.
- Construct a new 120-inch diameter outfall (maximum rated capacity of 480 mgd) similar to the existing ocean outfall to alleviate future discharge capacity deficiencies.

Sediments have been identified in the bottom of the existing 120-inch outfall. The District may need to clean out these accumulated sediments sometime in the future. Periodic hydraulic testing has been performed to determine if the outfall's performance is affected by the accumulated sediments, and samples have been collected of the material to determine constituents of concern. At this time, it the District may or may not need to clean out the outfall. If needed, the pipeline clean-out would involve additional testing of sediment material and development of a plan for removal of sediments without impacting water quality or benthic communities. This project would require RWQCB approval.

78-INCH OUTFALL

The District's current NPDES permit identifies the 78-inch outfall as an emergency discharge location. This stand-by outfall is maintained and periodically tested to assure its reliability for emergency use. The Strategic Plan projects that flows will exceed the capacity of the 120-inch outfall in the future unless some type of hydraulic relief is provided during peak wet weather periods. The Strategic Plan bases peak flow projections on a 20-year rainfall history through the year 1996 not including the most recent El Niño rainfall events of 1997-98. The District is now updating the hydraulic model with the most recent rainfall data from the last two years including the El Niño rainfall events. This updated modeling is expected to yield similar results in terms of frequency of predicted use of the 78-inch outfall. Any new modeling information available will be included in the Final Program Environmental Impact Report.

Peak wet weather flows of 775 mgd have been predicted by the year 2020. If the combined capacity of the 120-inch outfall and the GWR System (providing up to 100 mgd of flow relief during peak wet weather events) is insufficient to handle peak flows, then the 78-inch outfall would have to be used on an emergency basis. The peak flow projections for the year 2020 indicated that under the Preferred Alternative the emergency use of the 78-inch outfall is expected to occur once every three years in 2020. Without GWR System implementation, use of this outfall is estimated to occur 1.7 times per year. During such an event, flows would be routed through the proposed modified Foster Pump station to the 78-inch outfall. The priorities for routing flow to the 78-inch outfall would be secondary effluent first followed by advanced primary effluent. Under the worst case scenarios, between 12 MG for the Preferred Alternative and 57 MG for alternatives without the GWR System would be discharged out the 78-inch outfall on average once every three years. Based on estimated flow, this would be approximately 75% secondary effluent and the remainder advanced primary effluent during a nine-hour event discharging at a rate of up to 220 mgd based on the hydraulic models. This assumes on-site storage of 7 MG at the treatment plant sites. More storage is being planned to handle on-site stormwater runoff now discharged to the 120-inch outfall during wet weather. Such captured flows would later be released into the treatment plant once the storm flows subside. **Table 3-16** summarizes the projected need for the 78-inch outfall.

The District is considering the use of biological micro-filtration for effluent to be routed to the 78-inch outfall. Micro-filtration improves secondary treatment and has shown high pathogen removal in the range of 4 to 5 logs (<1,000 MPN/100ml). This level of pathogen reduction is much lower than the levels used to analyze public health impacts in Chapter 5, Ocean Discharge. The micro-filtration membranes could be installed in the activated sludge tanks at Treatment Plant No.2. During peak flow conditions, flow through the filters could be increased. The high quality water could also serve Phase 2 and 3 of the GWR System. This technology has been tested with some success by the District but has not yet been approved for full-scale use.

TABLE 3-16
PROJECTED USE OF 78-INCH OUTFALL FOR PEAK WET WEATHER FLOW OCEAN DISCHARGE

	Without GWR System	With GWR System
Frequency of use of 78-inch outfall	1.7/year	0.3/year
Discharge volume	57 MG/year	12 MG/year
Annual duration	16 hours	3 hours
Volume/event		
Average	36MG	38 MG
Median	19 MG	30 MG
Duration event		
Average	10 hours	9 hours
Median	9 hours	9 hours
Storms causing overflow events in 20-year history	29/414 storms	6/414 storms

Source: OCSD Strategic Plan 1999 Volume 3 Section 8

DISINFECTION

On an infrequent basis in the 2020 time frame, there may be a need to discharge effluent during peak wet weather flow periods based on the modeling work that was done for the collection system Strategic Plan. The Preferred Alternative includes a number of provisions to augment the 120-inch outfall capacity and preclude the potential use of the 78-inch outfall. Such provisions include diversion of up to 100 mgd of flow to the GWR System project during peak wet weather, water conservation, a 20% reduction in infiltration and inflow and use of in-plant storage. Additional emergency or stormwater storage is also being planned. However, should the use of the 78-inch outfall occur, it is likely that the local beaches will have to be closed. At the time such events are likely to occur, the Santa Ana River is also likely to be flowing at high flow contributing to local beach contamination from urban runoff. Discussions with the Regional Water Quality Control Board (RWQCB) have indicated that they do not want the District to disinfect using chlorine because of concerns over toxicity and because it is likely that the beaches will have to be closed due to the stormwater discharges anyway. Beneficial uses of the area during wet weather are usually limited except for occasional surfers. Given the short-term duration of such an event and the limited time that water quality is likely to be impacted, closing the beaches and monitoring are deemed to be the most acceptable course of action.

Given that such events are many years into the future and there is much planning that must take place in the future to implement all of these plans, there appears to be no pressing need to change the present course of action. However, it will be up to the various regulatory agencies to direct future planning if there is a need to do something different. The District will soon have the capability to divert secondary effluent to the 78-inch outfall and provide for pathogen reduction through the addition of sodium hypochlorite (bleach).

The District has the facilities to add chlorine as a disinfectant to the effluent via a new bleach station consisting of seven tanks for storing bleach delivered by truck. One tank has a capacity of 6,000 gallons, the remaining six tanks are 12,500 gallons each. There is presently no connection between these tanks and a newly reconstructed surge tower that will link the effluent lines to the 78-inch outfall. Some additional pipeline construction work and bleach diffusers need to be constructed. These facilities have been planned and will be constructed in the next 2-3 years.

At this time, the District is using a temporary tank and a network of pipes to disinfect (as required) effluent at the Ocean Outfall Booster Station (OOBS), Foster Pump Station, and at the emergency outfall to the river. In case of an emergency, the standby line (78-inch line) will be used along with the Foster Pump Station. Bleach could be injected at the Foster discharge line.

In the next few months, District staff are planning to make minor piping modifications to connect the bleach station to the OOBS, Foster and the river outfall. In the past, the District has effectively provided for bacterial reductions to prevent receiving waters from exceeding permit limitations during periodic full-scale testing of the 78-inch outfall under controlled conditions (as required by the RWQCB). In doing this, several weeks of advanced planning occurs including allowance of up to six weeks to order bleach.

In the future, as it becomes apparent that flows are approaching the limits of the 120-inch outfall, a contingency plan for peak wet weather flows will be developed and the preliminary guidance provided by the RWQCB regarding no disinfection during emergencies will be revisited. The District will continue to evaluate options for assuring that public health is protected and respond to any regulatory directives needed to protect water quality.

NEW 120-INCH OUTFALL

The District has evaluated the possibility of constructing a new 120-inch diameter outfall to accommodate future growth and increase discharge capacity. The proposed new outfall would extend into the ocean parallel to the existing outfall, turn north at approximately four miles from the shore, and terminate with a 1,000-foot diffuser extending northward at an approximate average depth of 185 feet. The construction of the new outfall would be conceptually similar to the existing outfall, entering the ocean below-ground and lying on the ocean floor for up to five miles. Implementation of the GWR System would delay the need for the new 120-inch outfall since it provides peak wet weather relief of 100 mgd. Without the implementation of the GWR System, construction of the new outfall would be needed sooner to accommodate projected peak wet weather events.

3.8.2 CONSTRUCTION SCENARIO AND SCHEDULE

The existing 78-inch and 120-inch outfalls are in operational condition. No additional construction is required for ocean discharge through either pipeline. Modification of the Foster Pump Station for use of the 78-inch outfall does not require expansion of the existing pump station facility. Routine maintenance and inspections will be performed as directed by the District's O&M specifications.

The construction of an additional 120-inch outfall would be a significant undertaking. Construction methods would be contingent on specific design criteria. The District has not undertaken studies for a new outfall at this time. Following is a conceptual description of the location and construction methods for this facility.

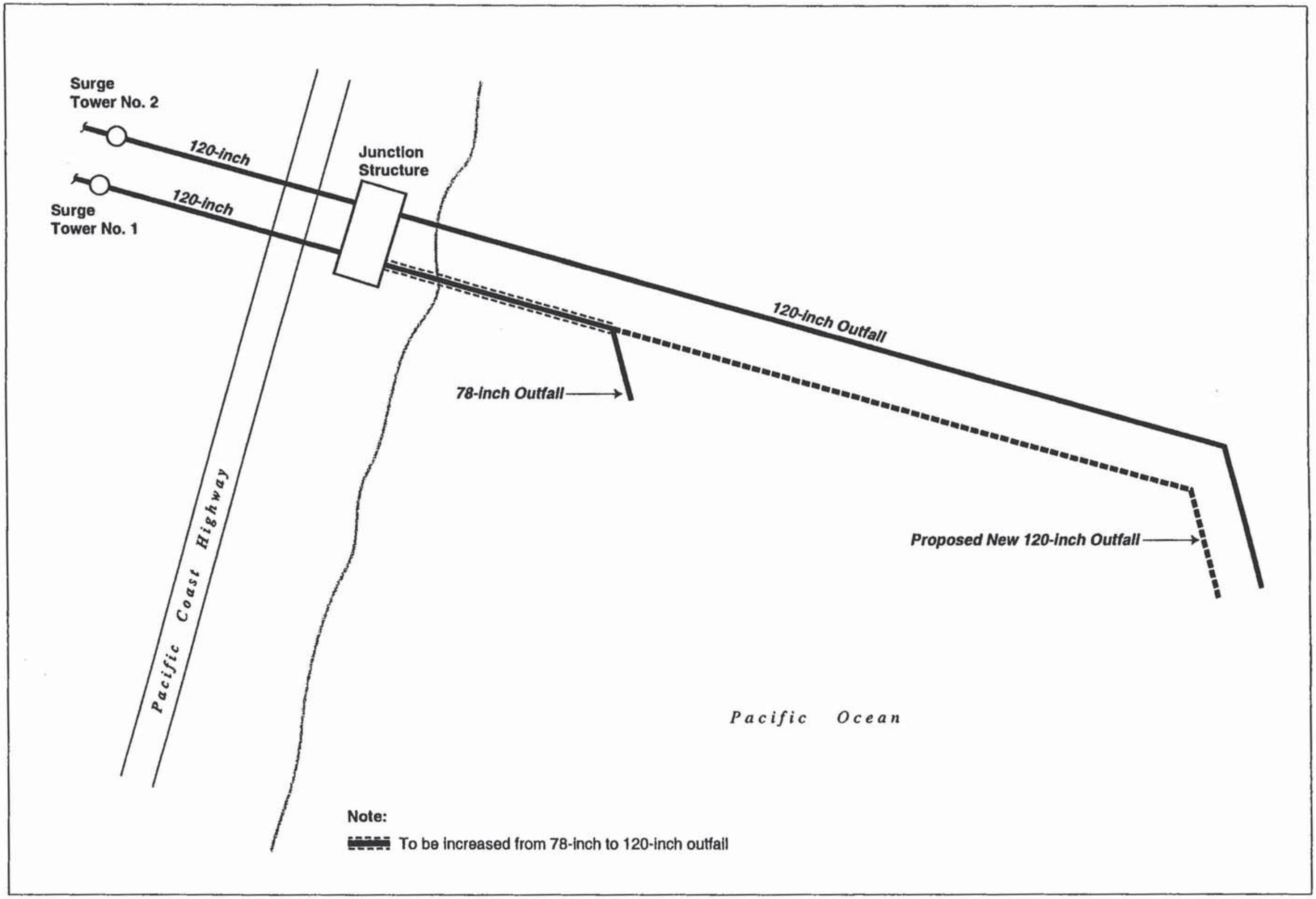
For purposes of this analysis it is assumed that a new 120-inch outfall would be constructed adjacent to and parallel the existing 120-inch outfall extending out to the beginning of the diffuser section. At this point, the new outfall diffuser section would extend north, perpendicular and away from the existing outfall diffuser section. The new diffuser section is assumed to be located in the area of one of the District's existing ocean monitoring stations. This monitoring station provides baseline data for the analysis of this potential ocean discharge location. **Figure 3-12** presents a schematic illustration of the conceptual alignment for a new 120-inch outfall. In the future, if and when the District pursues construction of a second outfall, additional detailed studies will be required to determine the appropriate location for the facility and re-assess the potential discharge impacts. This description allows a program-level impact analysis of a potential new 120-outfall and for comparison of this discharge alternative with the proposed use of the existing 78-inch outfall.

In constructing a new 120-inch outfall, the District will be able to use the previously constructed 120-inch sleeve now leading to the 78-inch outfall, which would reduce or eliminate significant construction activities on the beach and adjoining wetlands.

The completion of a second deep water outfall with a capacity of 240 mgd capacity (average dry weather flow) would be accomplished in several phases. Those phases would include the extension of the 78-inch-diameter outfall to deep water, later followed by replacement of the 78-inch-diameter outfall with a larger pipe. The proposed construction phases are described below.

Phase 1: The beach junction structure would be rebuilt to accommodate a 120-inch-diameter pipe on both the inlet and outlet sides. In addition, the 78-inch-diameter pipe between the beach structure and the surf zone would be replaced with a 120-inch-diameter pipe and "Y" fitting with removable bulkheads to accommodate future outfall construction. This work would be accomplished during the dry season when the 78-inch-diameter outfall capacity is not needed for peak flows.

Phase II: The 78-inch-diameter outfall would be extended to deep water by the construction of a 120-inch-diameter outfall extension and diffuser. The existing 78-inch-diameter outfall contains a "Y" fitting at its connection with the existing 78-inch-diameter diffuser to which the 120-inch-diameter extension could be connected. Therefore, the 78-inch-diameter outfall would not have to be taken out of service during the construction of the extension. The 120-inch-diameter extension would also be constructed with a "Y" fitting near the 78-inch-diameter junction to which the future replacement pipe could be connected. When the 120-inch-diameter extension is completed, the bulkhead in the 78-inch "Y" structure can be removed to open the extended line. The 78-inch diffuser would be plugged at this time.



SOURCE: County Sanitation District of Orange County Master Plan Report.

OCSD Strategic Plan Program EIR / 960436

Figure 3-12
Schematic of Ocean Discharge with New 120-inch Diamter Outfall

Phase III: During Phase III, a new 120-inch-diameter outfall would be constructed parallel to the existing 78-inch-diameter outfall between the "Y" fitting in the surf zone and the new "Y" fitting on the 120-inch-diameter outfall extension. Once the 120-inch-diameter outfall is completed, the bulkheads in the 120-inch-diameter line can be removed and those in the 78-inch-diameter line can be replaced to provide a continuous 120-inch-diameter outfall. The new 120-inch-diameter outfall would have a peak hydraulic capacity of 480 mgd, which, in combination with the existing 120-inch-diameter outfall would provide a total outfall capacity of 960 mgd (peak flow).

During construction activities, trenching may be necessary on the beach, requiring significant shoring and coffer dam structures. The concrete outfall pipeline would be placed on the ocean floor beyond the surf line using barges, hoisting cranes, and marine construction workers. The Strategic Plan identifies construction costs for a new 120-inch, five-mile ocean discharge pipeline to be $150 million, installed by 2015.

3.9 PROPOSED COLLECTION SYSTEM PROJECTS

3.9.1 OVERVIEW

The OCSD utilizes twelve trunk sewer systems to collect and convey wastewater to Plant Nos. 1 and 2. Over 400 miles of trunk sewer systems are currently operated and maintained by the OCSD in addition to interplant connections, and discharge outfalls. The twelve trunk sewer systems yield eleven trunk sewer connections to the headworks at the treatment facilities. Plant No. 1 receives flow from seven trunk sewer systems via six trunk connections, and Plant No. 2 receives flow from five trunk sewer systems via five trunk connections. An Interplant Interceptor provides connection from Plants Nos. 1 and 2. The twelve trunk sewer systems include the following:

Baker-Main
Bushard-Magnolia
Coast
Euclid
Gisler-Redhill
Knott
Miller-Holder
Newhope-Placentia
Newport
SARI/Santa Ana River Trunk
Santa Ana-Dyer Trunk
Sunflower

The Strategic Plan utilizes hydrologic modeling to diagnose the performance of the existing collection system and to predict its performance under projected future average flow conditions. Additional peak flow modeling was conducted using the Storage, Treatment, Overflow, Runoff (STORM) Model to determine impacts of infiltration and inflow to the existing system.

3.9.2 DEFICIENCIES

Based on the modeling results, the Strategic Plan identifies specific pipeline deficiencies by the year 2020 within the system. **Table 3-17** summarizes these deficiencies. Deficiencies are sewer segments lacking the capacity to convey projected flow volumes. The deficiency could be due to the width of the pipeline (constituting a hydraulic deficiency caused by land use changes and flow diversions) or the condition of the pipeline (constituting a structural deficiency caused by deteriorating facilities). Since the deficiencies are based on influent flow projections, they are equally applicable to each treatment alternative.

TABLE 3-17
COLLECTION SYSTEM DEFICIENCIES BY TRUNK SYSTEM IN THE YEAR 2020

Trunk System	Total Length of Deficiencies (ft)
Baker-Main	10,389
Bushard	20,930
Euclid	22,858
Gisler-Redhill	57,627
Knott	20,122
Miller-Holder	1,262
Newhope-Placentia	34,475
SARI	90,038
Sunflower	12,222
Total	269,923

SOURCE: OCSD 1999 Strategic Plan, Volume 3, Section 7

3.9.3 COLLECTION SYSTEM IMPROVEMENTS

The Strategic Plan outlines a project-level capital improvements plan (CIP) for the OCSD collection system which is applicable to each proposed treatment alternative. The collection system CIP is divided into three categories of necessary improvements:

- Pipeline replacements
- Rehabilitation of manholes and pipelines
- Pump station improvements

The Strategic Plan identifies 33 pipeline replacement projects and 19 rehabilitation projects to meet future flow predictions. In addition, eight pump stations are scheduled for improvements, four of which will involve increased pumping capacity. In addition to these proposed projects analyzed throughout this document, the District is planning several collection system projects identified within the CIP. These additional CIP projects include pipeline replacements and new pipeline projects for which additional supplemental CEQA analysis may be necessary.

Appendix C, titled CIP Collection System CEQA List, provides a comprehensive list of collection system improvement projects currently planned, including projects proposed prior to the completion of the 1999 Strategic Plan. **Appendix C** indicates the status of CEQA coverage for each of these proposed projects.

The following sections discuss collection system projects proposed in the Strategic Plan.

PIPELINE REPLACEMENTS

Collection system pipeline replacements involve the replacement of underground sewer lines with new larger pipes. Nearly 47 miles of pipeline replacements are planned almost exclusively within developed city streets. Thirty-three individual projects are planned. The construction process involves digging a trench in the street to expose the pipes, providing appropriate diversions to modify wastewater flow patterns around the affected area, and removing and replacing the sewer pipeline. Since wastewater is conveyed by gravity through much of the collection system, the depth to the sewer line varies from block-to-block depending on localized hydraulics and topography. The District has developed detailed construction specifications, health and safety procedures, and traffic control measures for maintenance work including open trench excavation on trunk sewers. Included in planned pipeline replacement projects is the interplant connector. This pipeline will enable secondary effluent from Treatment Plant No.2 to be pumped back up to Reclamation Plant No. 1 and finally to the GWR System at Factory 21. Construction will involve inserting a liner into an existing 60-inch diameter pipeline that runs underground along the Santa Ana River corridor. The pipeline will be accessed at regular intervals by excavating a short trench, and the liner will be inserted into the pipeline in sections.. **Table 3-18** outlines the proposed schedule for pipeline replacement projects. **Table 3-19** summarizes the proposed pipeline replacements including impacted streets and cities. **Figure 3-13** below and **Maps A1 through A12** in the Map Appendix show the pipeline replacement locations.

REHABILITATION OF MANHOLES AND PIPELINES

Three types of manhole rehabilitation projects are considered in the Strategic Plan:

- Full manhole rehabilitation involves replacing an entire manhole with a new structure including interior corrosion protection and new manhole cover and frame.
- Partial manhole rehabilitation involves replacing only the manhole frame and cover
- Pipe rehabilitation involves inspecting and strengthening pipelines without exposing the entire line by digging a trench

Table 3-20 identifies planned manhole and pipeline rehabilitation projects. The table shows the affected cities, major streets, and the scheduled completion dates.

PUMP STATION IMPROVEMENTS

Pump station improvements involve a range of activities including minor maintenance and safety upgrades to replacing pumps with larger capacity pumps. During pump installations, wastewater flow must be diverted around the project area. **Table 3-21** lists the proposed pump station improvements. Pump station improvements, excluding pump capacity upgrades, are not anticipated to have any impacts nor require CEQA review. However, these improvements are incorporated into this EIR to maintain consistency with the District's CIP. The four pump stations which require capacity upgrades are identified in **Table 3-22**.

TABLE 3-18
COLLECTION SYSTEM PIPELINE IMPROVEMENTS

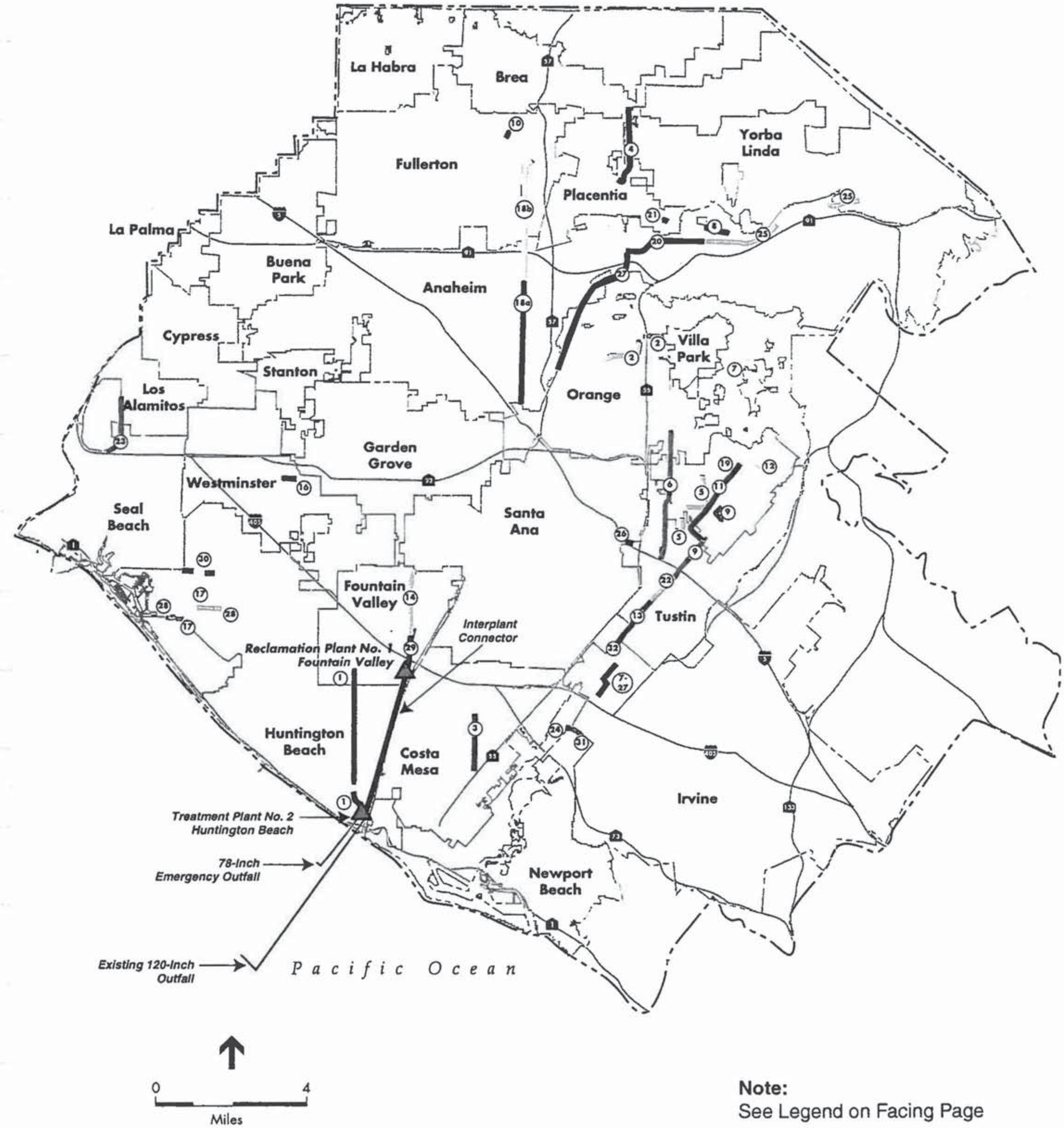
Project No.		2000-2005	2006-2010	2011-2015	2016-2020
	Santa Ana River Trunk Sewer Trunk Line System				
20	Santa Ana River Interceptor Relief – A	X			
25	Santa Ana River Interceptor Relief – B		X		
2	Taft Branch Improvements	X			
4	Carbon Canyon Dam Trunk Improvements	X			
8	Atwood Subtrunk Improvements	X			
21	Atwood Subtrunk Improvements	X			
27	Lower SARI Interceptor Improvements			X	
10	Fullerton Purchase Improvements	X			
14	Euclid Relief Improvements – A	X			
29	Euclid Relief Improvements – B				X
	Newhope-Placentia Trunk Sewer System				
18-A	Newhope-Placentia Trunk Replacement		X		
18-B	Cypress Avenue Trunk Replacement		X		
	Knott Trunk Sewer System				
16	Hoover Feeder Improvements				X
23	West Side Relief Interceptor Improvements		X		
17/28	Warner Avenue Relief Sewer	X		X	
30	Edinger / Bolsa Chica Trunk Improvements				X
	Baker-Main Trunk Sewer System				
31	Campus Drive Subtrunk Improvements		X		
24	Campus Drive Subtrunk Improvements		X		
3	Fairview Relief Sewer	X			
	Gisler-Redhill Trunk Sewer System				
7-27	Armstrong Subtrunk Sewer	X			
6	Gisler-Redhill/North Trunk Improvements	X			
9	Gisler-Redhill System Improvements – A	X			
11	Gisler-Redhill System Improvements – A	X			
22	Gisler-Redhill System Improvements – B	X			
13	Gisler-Redhill System Improvements – B	X			
32	Gisler-Redhill System Improvements – B	X			
12	Tustin Trunk Improvements	X			
19	Tustin Trunk Improvements	X			
11	Tustin Trunk Improvements	X			
5	Orange Trunk Improvements	X			
26	West Trunk Improvements		X		
7	Orange Park Acres Trunk Replacement	X			
	Interplant-Joint Works				
N/A	Bushard Trunk Improvements	X			
N/A	Interplant Connector	X			

SOURCE: OCSD, Strategic Plan 1999, Volume 3, Table 9-14

LEGEND FOR FIGURE 3-13

COLLECTION SYSTEM PROJECTS

Project Number	Project Name
N/A	Bushard Trunk Improvements
2	Taft Branch Improvements
3	Fairview Relief Sewer
4	Carbon Canyon Dam Trunk Improvements
5	Orange Trunk Improvements
6	Gisler-Redhill/North Trunk Improvements
7	Orange Park Acres Trunk Replacement
8	Atwood Subtrunk Improvements
9	Gisler-Redhill System Improvements – A
10	Fullerton Purchase Improvements
11	Gisler-Redhill System Improvements – A
11	Tustin Trunk Improvements
12	Tustin Trunk Improvements
13	Gisler-Redhill System Improvements – B
14	Euclid Relief Improvements – A
16	Hoover Feeder Improvements
17/28	Warner Avenue Relief Sewer
18-A	Newhope-Placentia Trunk Replacement
18-B	Cypress Avenue Trunk Replacement
19	Tustin Trunk Improvements
20	Santa Ana River Interceptor Relief – A
21	Atwood Subtrunk Improvements
22	Gisler-Redhill System Improvements – B
23	West Side Relief Interceptor Improvements
24	Campus Drive Subtrunk Improvements
25	Santa Ana River Interceptor Relief – B
26	West Trunk Improvements
27	Lower SARI Interceptor Improvements
29	Euclid Relief Improvements – B
30	Edinger / Bolsa Chica Trunk Improvements
31	Campus Drive Subtrunk Improvements
32	Gisler-Redhill System Improvements – B
7-27	Armstrong Subtrunk Sewer



Note:
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SOURCE: Camp Dresser Mckee, Environmental Science Associates

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Figure 3-13
Collection Systems and Proposed Replacement Projects

TABLE 3-19
SUMMARY OF PLANNED COLLECTION SYSTEM PIPELINE IMPROVEMENTS

Trunk Sewer System	Project No.	Street	City	Completion Date	Cross Streets		New Diameter (in)	Length (ft)	Capital Cost ($)
					Upstream	Downstream			
SANTA ANA RIVER TRUNK SEWER SYSTEM									
Santa Ana River Interceptor Relief – A	20	La Palma	Anaheim, Placentia	2005	Kellog Dr.	Fee Ana St.	66	4,291	3,548,657
Contract No. 2-31		La Palma	Anaheim	2005	Fee Ana St.	Hawk Cir	72	6,949	6,254,100
		La Palma			Hawk Cir	W/O Tustin Av.	66	230	190,210
		La Palma & Grove St.			W/O Tustin Av.	Grove St.	96	1,437	1,796,000
Santa Ana River Interceptor Relief – B	25	Savi Ranch Parkway	Anaheim / Yorba Linda	2010	W/O Auto Plaza Cir.	W/O Mirage St.	48	4,245	2,343,240
Contract No. 2-31-1		La Palma & Weir Cyn			W/O Mirage St.	W/O Weir Cyn Rd.	60	900	675,000
		La Palma			N/O Tippets Ln.	W/O Agnes Ave.	66	6,030	4,986,810
		La Palma			W/O Agnes Ave.	W/O Chrisden St.	60	1,137	852,750
		La Palma			W/O Chrisden St.	Imperial Hwy.	54	214	139,100
		La Palma			Imperial Hwy.	E/O Brasher St.	60	552	414,000
		La Palma			E/O Brasher St.	Kellog Dr.	66	4,310	3,564,370
Taft Branch Improvements Contract No. 2-49	2	Meats Ave	Orange	2002	Santiago Rd.	W/O 55 Fwy, E/O Tustin St.	15	3,070	546,460
		Taft and Tustin Ave			S/O Meats Av.	E/O Glassel St.	24	6,362	1,762,274
Carbon Canyon Dam Trunk Improvements Contract No. 2-21-1	4	Rose Drive	Brea, Yorba Linda, Placentia	2002	N/O Blake Rd.	Imperial Hwy.	36	3,381	1,524,831
		Rose Drive			Imperial Hwy.	S/O Weyburn Av.	42	1,158	594,054
		Rose Drive			S/O Weyburn Av.	Orange Dr.	30	2,800	994,000
		Rose Drive			Orange Dr.	S/O Yorba Linda Blvd.	36	1,600	721,600
		Rose Drive			S/O Yorba Linda Blvd	Palm Dr.	30	2,800	994,000
		Rose Drive			Palm Dr.	Carbon Creek, E/O Warren	36	400	180,400
Atwood Subtrunk Improvements Contract No. 2-50	8	Orangethorpe Ave	Anaheim, Placentia	2002	Via Breve	Kellog Dr.	24	3,080	853,160
	21	Orangethorpe Ave			Fee Ana St.	Richfield Rd.	30	378	134,190

TABLE 3-19 (Continued)
SUMMARY OF PLANNED COLLECTION SYSTEM PIPELINE IMPROVEMENTS

Trunk Sewer System	Project No.	Street	City	Completion Date	Cross Streets: Upstream	Cross Streets: Downstream	New Diameter (in)	Length (ft)	Capital Cost ($)
SANTA ANA RIVER TRUNK SEWER SYSTEM (CONT.)									
Lower SARI Interceptor Improvements Contract No. 2-51	27	Along Grove St. to SCRRA	Anaheim, Orange, County of Orange	2015	S/O La Palma Ave	South side of SAR, E/O Kraemer Blvd	96	6,532	8,165,000
		Along Santa Ana River (SAR)			Kraemer Blvd.	Taft Av.	72	10,042	9,037,800
		Along SAR			Taft Av.	S/O Yale Av.	78	2,414	2,414,000
EUCLID TRUNK SEWER SYSTEM									
Fullerton Purchase Improvements Contract No. 2-52	10	Maple Ave	Fullerton	2004	Sandalwood Av.	S/O Bastanchury Rd. to Golf Course site	15	1,078	191,884
Euclid Relief Improvements – A	14	Euclid	Fountain Valley	2004	Edinger Av.	Slater Av.	102	9,047	12,213,450
Euclid Relief Improvements – B Contract No. 2-53	29	Euclid	Fountain Valley	2020	Slater Av.	OCSD Plant 1	102	3,859	5,209,650
NEWHOPE-PLACENTIA TRUNK SEWER SYSTEM									
Newhope-Placentia Trunk Replacement, Contract No. 2-46	18-A	State College Blvd	Anaheim	2007	La Palma Av.	Cerritos Av.	42	13,343	6,844,959
		State College Blvd	Anaheim, Orange		Cerritos Av.	Orangewood Av.	48	5,246	2,895,792
Cypress Avenue Trunk Replacement, Contract No. 2-47	18-B	Yorba Linda Blvd	Anaheim	2009	Associated Rd.	Almira Av.	30	285	101,175
		Yorba Linda and State College	Fullerton		Almira Av.	N/O Gymnasium Campus Dr.	24	2,318	642,086
		State College			N/O Gymnasium Campus Dr.	N/O Kimberly Av.	30	7,428	2,636,940
		State College	Fullerton, Anaheim		N/O Kimberly Av.	La Palma Av.	42	5,855	3,003,615

TABLE 3-19 (Continued)
SUMMARY OF PLANNED COLLECTION SYSTEM PIPELINE IMPROVEMENTS

Trunk Sewer System	Project No.	Street	City	Completion Date	Cross Streets: Upstream	Cross Streets: Downstream	New Diameter (in)	Length (ft)	Capital Cost ($)
KNOTT TRUNK SEWER SYSTEM									
Hoover Feeder Improvements Contract No. 3-45	16	Trask Ave.	Westminster	2020	W/O Beach Blvd.	Hoover St.	21	2,251	542,491
West Side Relief Interceptor Improvements Contract No. 3-42	23	Seal Beach Blvd Seal Beach Blvd Old Ranch Pkwy	Los Alamitos Seal Beach Seal Beach	2010	Farquhar Av. N/O Bradbury Rd. S/O Lampson Av.	N/O Bradbury Rd. S/O Lampson Av. S/O Silver Fox Rd.	42 48 60	2,411 6,087 71	1,236,843 3,360,024 53,250
Goldenwest Replacement/ Heil Interceptor Contract No 11-17-3 and 11-20*	N/A	Goldenwest Heil Ave	Huntington Beach	2001	Heil Sprindale Ave.	Ford Goldenwest	39/36 30	4,459 5,214	2,629,000 2,272,000
Warner Avenue Relief Sewer Contract No. 11-22	17, 28	Los Patos Ave/ Warner Ave Warner Ave Warner Ave Warner Ave	Huntington Beach Huntington Beach	2001	Marina View Place Graham St. Kern Dr. W/O Springdale St.	Bolsa Chica St. Kern Dr. W/O Spingdale St. Springdale St.	30 30 36 42	2,633 2,280 850 324	934,715 809,400 383,350 166,212
Edinger/Bolsa Chica Trunk Improvements Contract No. 11-25	30	Edinger Ave. Edinger Ave.	Huntington Beach	2020	E/O Bolsa Chica St. Graham St.	Hummingbird Ln. Clubhouse Ln.	18 24	2,015 1,200	449,345 332,400
BAKER-MAIN TRUNK SEWER SYSTEM									
Campus Drive Subtrunk Improvements Contract No. 7-44	31	Campus Drive	Irvine, Newport Beach	2010	Von Karman	MacArthur	18	2,026	451,790
	24	Campus Drive	Irvine, Newport Beach		MacArthur	W/O MacArthur	24	200	55,400
Abandon Airbase Trunk and Watson Conversion Sewer Contract No. 6-13*	N/A	Watson California - through School	Costa Mesa	2005	Gisler/Watson N/O Gisler, W/O Iowa St.	Dublin/Watson Suburbia	8 30 Abandon	na na	na na

TABLE 3-19 (Continued)
SUMMARY OF PLANNED COLLECTION SYSTEM PIPELINE IMPROVEMENTS

Trunk Sewer System	Project No.	Street	City	Completion Date	Cross Streets: Upstream	Cross Streets: Downstream	New Diameter (in)	Length (ft)	Capital Cost ($)
BAKER-MAIN TRUNK SEWER SYSTEM (CONT.)									
Arlington Parallel and Abandonment Sewer (Abandon Air Base Trunk) Contract No. 6-9 *	N/A	Arlington	Costa Mesa	2003	Monterey	E/O Costa Mesa Jr. High School, along Orange County Fairground	18	na	na
		Monterey			Mission	Arlington	18	na	na
		Parallel Sewer between Fairview and Monterey through Costa Mesa High School			Monterey	Fairview	18	na	na
Fairview Relief Sewer Contract 6-12	3	Fairview Street	Costa Mesa	2000	Village Way	Wilson Street	27	7,813	655,000
College Pump Station Force Parallel Sewer Contract 7-23-1 *	N/A	College	Costa Mesa	2004	College Ave/Gisler Av	College to Watson	27	na	na
					Watson/College	Baker/College	27		
GISLER-REDHILL TRUNK SEWER SYSTEM									
Gisler-Redhill/North Trunk Improvements Contract No. 7-41	6	Prospect Ave.	Tustin, County of Orange	2002	S/O Chapman Av.	Irvine Blvd.	24	14,136	3,915,672
							30	200	71,000
		Prospect Ave.	Tustin		S/O Irvine Blvd.	E. Main St.	30	2,322	875,075
							36	355	95,612
		E. Main St.	Tustin		W/O Prospect	El Camino Real	30	155	55,025
		El Camino Real	Tustin		E. Main St.	El Camino Way	30	930	348,870
		El Camino Real	Tustin		El Camino Real	W/O I-5	36	761	341,858
Armstrong Subtrunk Sewer Contract No. 7-27	N/A	Armstrong	Irvine, Tustin	2002	Barranca	Alton Pkwy	27"	9,646	9,654,400
		Alton Pkwy			Armstrong,	Armstrong, S/O Alton Pkwy			
		Armstrong			Alton Pkwy	MacArthur Blvd			
		MacArthur Blvd			Armstrong	Main St.			

TABLE 3-19 (Continued)
SUMMARY OF PLANNED COLLECTION SYSTEM PIPELINE IMPROVEMENTS

Trunk Sewer System	Project No.	Street	City	Completion Date	Cross Streets: Upstream	Cross Streets: Downstream	New Diameter (in)	Length (ft)	Capital Cost ($)
GISLER-REDHILL TRUNK SEWER SYSTEM (CONT.)									
Gisler-Redhill System Improvements – A Contract No. 7-36	9	Arroyo Ave.	County of Orange	2002	Arroyo Way	S/O Skyline Dr.	15	1,485	264,330
		Skyline	County of Orange		E/O Arroyo Ave	Redhill	15	1,293	230,154
		Redhill	County of Orange		S/O Skyline Dr	Gwen Ave	15	354	264,330
		Redhill	Tustin		Irvine Blvd.	N/O San Juan St.	24	3,528	977,256
		Redhill	Tustin		N/O San Juan St.	Mitchell Av.	30	3,075	1,091,625
Gisler-Redhill System Improvements – B Contract No. 7-37	13, 22, 32	Redhill Blvd	Tustin	2005	Mitchell Av.	Edinger Av.	30	806	286,130
		Redhill Blvd	Tustin		Edinger Av.	N/O Industrial Dr.	24	547	151,519
		Redhill Blvd	Tustin		N/O Industrial Dr.	Valencia Av.	30	3,303	1,172,565
		Redhill Blvd	Tustin, Santa Ana		Warner Av.	Carnegie Av.	36	4,162	1,877,062
		Redhill Blvd	Tustin, Santa Ana, Irvine		Carnegie Av.	Deere Av.	30	4,397	1,560,935
Tustin Trunk Improvements Contract No. 7-38	12, 19, 11	Newport Ave	County of Orange	2004	Crawford Cyn Rd.	Foothill Blvd	12	3,236	540,412
		Newport Ave			N/O La Loma	Castlegate Lane	12	3,219	537,573
		Newport Ave			Castlegate Lane	Skyline Dr.	15	1,709	304,202
		Newport Ave			Skyline Dr.	Old Irvine Bl./Irvine Bl.	12	4,064	678,688
		Newport Ave			Newport Ave	Redhill	12	2,631	439,377
		Cowan Heights Dr.			Shady Ridge Dr.	Skyline Dr.	12	380	63,460
		Cowan Heights Dr.			Skyline Dr.	W/O Newport Blvd	18	155	34,565
		Newport Ave			Crawford Canyon Rd.	Castlegate Ln.	12	6,653	1,111,051
		Newport Ave			Castlegate Ln.	Skyline Dr.	15	1,709	304,202
		Newport Ave			Skyline Dr.	Redhill Av.	12	6,497	1,084,999

TABLE 3-19 (Continued)
SUMMARY OF PLANNED COLLECTION SYSTEM PIPELINE IMPROVEMENTS

Trunk Sewer System	Project No.	Street	City	Completion Date	Cross Streets		New Diameter (in)	Length (ft)	Capital Cost ($)
					Upstream	Downstream			
GISLER-REDHILL TRUNK SEWER SYSTEM (CONT.)									
Orange Trunk Improvements Contract No. 7-39	5	Hewes	County of Orange	2003	S/O Fairhaven Av.	17th St.	12	5,106	852,702
		17th St.	Tustin, County of Orange		Hewes	W/O Esplanade	12	2,839	474,113
		Holt Ave	Tustin, County of Orange		S/O Bigelow Park	Newport Blvd.	15	2,205	392,490
Orange Park Acres Trunk Replacement	7	Santiago Canyon Road	Orange	2000	Randall	Jamestown	24	1,342	237,000
West Trunk Improvements Contract No. 7-40	26	N/A	Santa Ana, Tustin	2010	End of 1st St.	W/O end of 1st St.	15	223	39,694
					W/O end of 1st St.	N/O I-5	18	859	191,557
JOINT/INTERPLANT									
Bushard Trunk Improvement Job No. I-2-4	N/A	Bushard	Fountain Valley Huntington Beach	2000	Ellis Ave Garfield Ave.	Garfield Ave. Brookhurst St.	120	18,715	32,712,000
Interplant Connector	N/A	SAR	Fountain Valley, Huntington Beach		OCSD Plant No.2	OCSD Plant No.1	na	20,000	na

na = information not available
N/A = not applicable

* Projects have been subsequently reviewed in a previous EIR or needs additional environmental review.

SOURCE: OCSD, 1999

TABLE 3-20
SUMMARY OF REHABILITATION PROJECTS

Project Name	Contract /Project Number	Type of Rehab.	City	Affected City Streets	Scheduled Completion Date	Estimated Cost
Santa Ana River Trunk System						
Santa Ana Rehabilitation Contract No. 1-17	N/A	Full	Costa Mesa, Santa Ana	Moore Ave, Alton Ave.	2005	$7,393,000
Greenville Sullivan MH Rehabilitation Contract No. 1-20		Full	Santa Ana	Greenville St., Edinger, Sullivan	2014	$872,850
Raitt Street MH Rehabilitation Contract No. 1-21		Full	Santa Ana	Raitt St.	2014	$753,825
Lower Main-Broadway MH Rehabilitation Contract No. 1-22		Full	Santa Ana	Main St.	2018	$952,200
Euclid Trunk Sewer System						
Euclid Trunk MH Rehabilitation	2-34R	Full	Fountain Valley, Santa Ana, Garden Grove, Anaheim, Fullerton	Euclid, SR 91, I-405	2000	$1,256,000
Newhope Placentia Trunk Sewer System						
Upper Newhope-Placentia MH Rehabilitation	2-54	Full	Garden Grove	9th St.	2009	$1,745,700
Lower Newhope-Placentia MH Rehabilitation	2-55	Full	Fountain Valley, Santa Ana	Newhope St.	2011	$2,221,800
Santa Ana Trunk Sewer System						
South Anaheim MH Rehabilitation	2-57	Full	Garden Grove, Anaheim	Trask Ave., Fairview St., Garden Grove Blvd.	2012	$1,269,600
SARI Manhole MH Rehabilitation	2-56	Partial	Santa Ana, Orange	Santa Ana River	2012	$662,400
Bushard Trunk Sewer System						
Magnolia Trunk Rehabilitation	3-35R	Full	Fullerton, Huntington Beach, Fountain Valley, Westminster, Garden Grove, Stanton, Anaheim	Magnolia St., Edinger, Bushard St., SR 91, 22, I-5, I-405	2001	$7,306,264

TABLE 3-20 (Continued)
SUMMARY OF REHABILITATION PROJECTS

Project Name	Contract /Project Number	Type of Rehab.	City	Affected City Streets	Scheduled Completion Date	Estimated Cost
Seal Beach Interceptor Sewer Rehabilitation	3-11R	Full	Seal Beach	Seal Beach Blvd.	2001	$367,000
Knott Trunk Sewer System						
Knott Interceptor MH Rehabilitation	3-50	Partial	Fountain Valley, Westminister, Garden Grove, Stanton, Cypress, Anaheim, Buena Park	Knott Ave., Golden West St., Bolsa Ave., Newland St., Bushard St., Talbert Ave., Lampson, Hoover St., Slater Ave., Magnolia St.	2012	$1,035,000
West Side Relief Alamitos MH Rehabilitation	3-49	Full	Los Alamitos, Cypress, Seal Beach	Beach Blvd., Cerritos Ave., Bloomfield St., I-405	2012	$662,000
Newport Beach Trunk Sewer System						
Big Canyon Sewer Rehabilitation	5-43	Full	Newport Beach	Big Canyon Drive	2009	$2,182,000
Balboa Trunk Sewer Rehabilitation	5-47	Pipe Rehab.	Newport Beach	Newport Blvd., Balboa Blvd.	2008	3,967,500
Gisler-Redhill Trunk Sewer System						
Lower Gisler-Redhill MH Rehabilitation	7-42	Full	Costa Mesa	Gisler Ave.	2009	$753,825
Upper Gisler-Redhill MH Rehabilitation	7-43	Partial	Tustin, Irvine	Redhill Ave.	2009	$165,600
Baker-Main Trunk Sewer System						
Sunflower Interceptor MH Rehabilitation	7-21	Full	Costa Mesa, Santa Ana	Sunflower Ave.	2000	$356,000
Coast Trunk Sewer System						
Coast Trunk Rehabilitation	11-26	Pipe Rehab.	Huntington Beach	Pacific Coast Highway	2009	$1,984,000

Source: CIP List taken from OCSD's Strategic Plan, Vol. 3 (Collection System), Figure 9-4.

TABLE 3-21
SUMMARY OF PUMP STATION IMPROVEMENTS

Project Name	Contract/ Project Number	City	Scheduled Completion Date	Estimated Cost
Newhope-Placentia Trunk Sewer System				
Abandonment of Yorba Linda PS	2-42	Fullerton	2010	280,000
Miller-Holder Trunk Sewer System				
Edinger PS Improvements	PS11-1	Seal Beach	2010	$1,439,000
Newport Beach Trunk Sewer System				
Relocation of Lido PS	5-41-1	Newport Beach	2000	$331,000
Crystal Cove PS Improvements	PS5-1	Unincorporated Orange County	2002	$424,000
Bitter Point PS Improvements	PS5-2	Newport Beach	2002	$2,428,000
Gisler-Redhill Trunk Sewer System				
Racquet Hill PS Abandonment	7-14-3	Unincorporated Lemon Heights, Orange County	2000	$205,000
Covey Lane PS Abandonment	7-14-4	Unincorporated Lemon Heights, Orange County	2005	$400,000
Baker-Main Trunk Sewer System				
College PS Improvements	PS7-1	Costa Mesa	2004	$1,548,000
Pump Station Improvements	2-37	Throughout Service Area	2000 - 2004	Varies

SOURCE: CIP List taken from OCSD Strategic Plan, Vol. 3 (Collection System), Figure 9-4.

TABLE 3-22
SUMMARY OF PUMP STATION CAPACITY UPGRADES

Pump Station	City	Installed Capacity		Proposed Installed Capacity by 2020		Projected 2020 Flows, mgd		Projected Improvement Cost
		Units	Flows, mgd	Units	Flows, mgd	Avg Dry	Peak Wet	
Crystal Cove	Unincorp.	2	1.73	2	3.26	0.89	1.63	$423,800
Bitter Point	Newport Beach	3	8.64	3	18.68	9.37	12.45	$2,428,400
College Avenue	Costa Mesa	3	8.64	3	11.91	6.52	7.94	$1,548,300
Edinger	Huntington Beach	3	6.05	3	11.07	4.81	7.38	$1,439,100

SOURCE: OCSD Strategic Plan 1999, Volume 3 Section 9

3.9.4 CONSTRUCTION METHODS

PIPELINE CONSTRUCTION METHODS

Construction methods for the replacement and rehabilitation of sewer pipelines will involve open trench methods and potential jack-and-bore methods for sensitive crossings (e.g., busy intersections, railroad spurs, or flood control channels).

Open Trench

Trench width will range from four feet to 16 feet depending on the size of the sewer being replaced. Trench depth will range from 14 to 24 feet. Trenches will be braced using a trench box or speed shoring.[1] The active work area along the open trench will extend about 5 – 10 feet to one side of the trench and 20 – 30 feet to the other side, allowing for access by trucks and loaders.

The minimum construction right-of-way will be 25 feet; the maximum construction easement will be 50 feet wide. On narrower, residential streets, or where deemed necessary, parking restrictions may be imposed during the construction period to facilitate traffic flow around the construction area. Staging areas will occur along the construction routes and construction equipment and other materials will be located in parking lots, vacant lots, or segments of temporarily closed street lanes. Staging areas will be selected in order to minimize hauling distances and long-term disruption. **Figure 3-14** shows a typical open-trench construction technique.

Removed pavement and excavated soil and pipes will be hauled off site for disposal per applicable city and county regulations. Imported backfill will be delivered to stockpiles near the open trench. Once the new pipeline is in place, backfill will be placed in the trench, and the streets will be compacted and paved per city regulations. Soil removed from trenches will be loaded directly into dump trucks and hauled away for disposal per applicable City and County requirements. Imported backfill will be delivered to stockpiles near the open trench. Once the new pipeline is in place, backfill will be placed in the trench, and the streets will be compacted and paved per city and county regulations. **Table 3-23** lists construction method assumptions for pipeline replacement projects. Truck trips include soil removal and backfill delivery using a conservative 15 cubic yards (cy) per truck.

Jacking and Boring

Jacking and boring construction may be used for the crossing of flood control channels and busy intersections. **Figure 3-15** illustrates the jacking and boring technique. The jacking and boring method involves use of a horizontal boring machine or auger to drill a hole and a hydraulic jack to push a casing through the hole. As the boring proceeds, a steel casing pipe is jacked into the hole; the pipeline is then installed in the casing.

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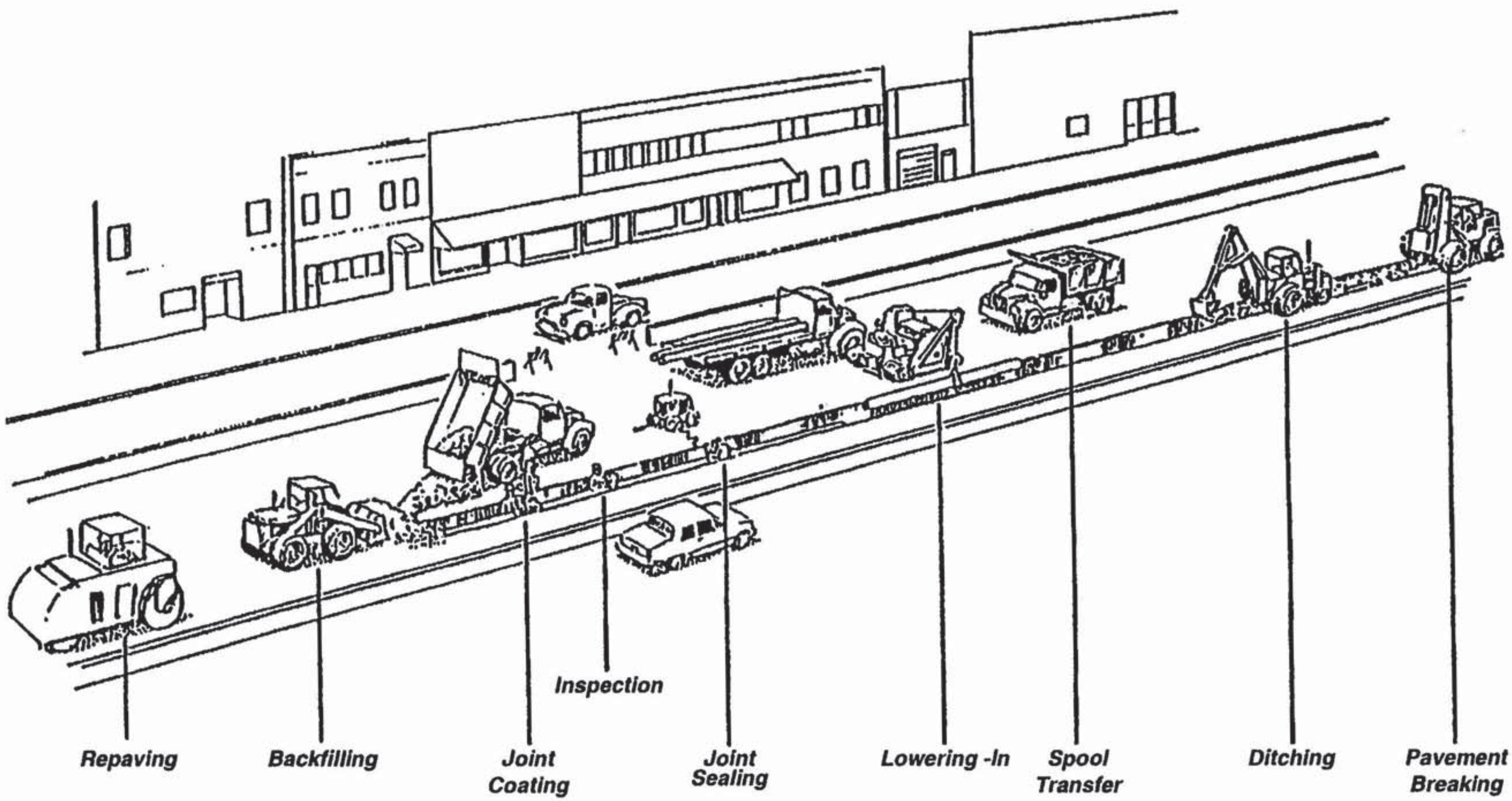
1 Speed shoring is a trench bracing system that utilizes individual shoring units that are manually placed at various intervals along the trench depending on soil type. The units are lowered into the trench and held in place by an operator while the parallel bracing pads are expanded against the trench walls using a hydraulic pumping mechanism.



SOURCE: Environmental Science Associates

OCSD Strategic Plan Program EIR / 960436 ■

Figure 3-14

Typical Open-Trench Construction

The casing is jacked using a large hydraulic jack in a pit located at one end of the crossing. The jacking pit is approximately 50 feet by 20 feet; the temporary pits typically will be excavated to a depth of 50 feet. In some cases this will occur below the water table, requiring the use of sheet-piling and sump pumps. Jack-and bore undercrossings below the water table will require enclosure of the jacking pits with sheet-piling and special bulkheads at the jacking portals. Water from dewatering will be disposed of in accordance with applicable State and local requirements.

TABLE 3-23
ESTIMATED CONSTRUCTION ASSUMPTIONS FOR THE INSTALLATION OF SEWER LINES FROM PRESENT TO THE YEAR 2020

Pipe diameter (inches)	Trench width (ft)	Trench depth (ft)	Length of Installation (ft)	Volume of excavated soil (cy)	Construction right of way (ft)	Estimated truck trips (15 cy/truck)	Speed of const. (ft/day)
12-24	4	14	55,000	114,074	25	7,604	100
24-48	5	14	85,000	220,370	25	14,691	100
48-60	9	20	25,000	166,666	25	11,111	50
72-96	14	22	35,000	399,259	30	26,617	50
120	16	24	45,000	640,000	30	42,666	50
				1,540,370		102,691	

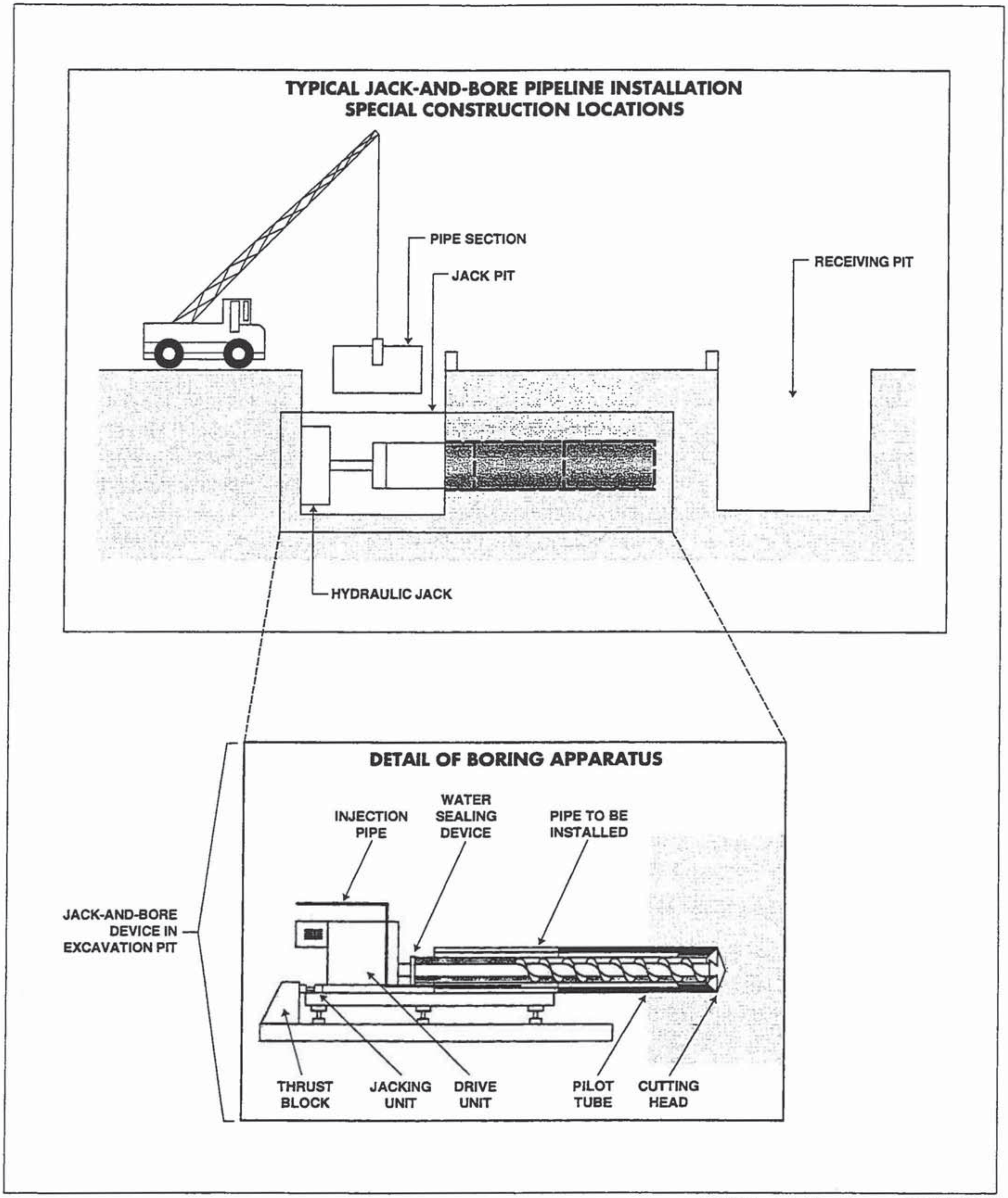
Equipment

Heavy construction equipment for each pipeline construction crew will include:

- Pavement saw
- Jack hammers
- Back hoe
- Front-end loaders
- 10-wheel dump trucks
- Flat-back delivery truck
- Crane
- Compactor
- Water truck
- Trench shields
- Air compressors
- Concrete trucks
- Concrete pumper trucks
- Sweepers
- Welding trucks
- Road grader (for widening at detours along shoulders
- Side boom pipe handler tractor
- Paving equipment: back hoe, asphalt hauling trucks, compactors, paving machine, rollers

PUMPING STATION AND MANHOLE REHABILITATION PROJECTS

Pump station improvements occur within pump buildings or vaults. The construction activities involve delivery and replacement of large-volume pumping equipment.



SOURCE: Existing Sewer Evaluation & Rehabilitation
WEF Manual of Practice FD-6
ASCE Manual and Report on Engineering Practice No. 62.

Figure 3-15
Jack-and-Bore Construction

No trenching occurs during rehabilitation construction projects. The construction area extending over the manhole will be approximately 15 feet wide and 30 feet long accommodating two utility trucks. Manhole rehabilitation will be conducted from within the manhole construction area and will involve internal pipeline re-lining and maintenance. Manhole foundations and covers will be refurbished as necessary. Traffic will be detoured around the construction area and although

some disruption to traffic can occur during the construction activities, the need for road closures is infrequent. On narrower, residential streets, parking restrictions may be imposed during the construction period to facilitate traffic flow around the construction area.

3.9.5 CONSTRUCTION SCHEDULE

For pipeline replacement projects, the pace of work is estimated to average 50 to 100 feet per day per crew (see **Table 3-23**). The impact to an individual property will vary. The length of time that active construction work is immediately in front of a property (assuming, for example, a 100-foot lot line) will likely be three to five days. Construction activity will occur within one block of a given property for about three to four weeks, on average. The duration of individual projects will depend on the length of the sewer being replaced or rehabilitated, the sewer size, and existing depth of the pipe. All construction activities within residential districts will be limited to weekdays during daylight hours, or as specified in encroachment permits with the County, cities, and other responsible agencies. Access to the interplant connection corridor will be made from each plant site, temporarily closing the bike path.

The CIP proposes 40 collection system projects to be initiated and completed by the year 2005. Many of the near-term projects are concentrated on the Gisler-Redhill sewer system located mainly in the City of Tustin and the unincorporated area of Orange County near Lemon Heights. Other near-term projects are spread out throughout the Service Area. **Table 3-18** above lists the schedule for collection system pipeline replacement projects. **Tables 3-19 - 3-21** include scheduled completion dates for proposed improvements.

3.10 PROPOSED RESIDUAL SOLIDS/BIOSOLIDS MANAGEMENT

Residual solids, which include biosolids, grit, and screenings, are byproducts of wastewater treatment. At District Plants 1 and 2, solids settled out of the wastewater in clarifier basins are collected, digested and then sent through a dewatering press called a belt filter press. Digestion reduces pathogens, odors, volatile solids, organic material volume, and the potential for vectors. Digestion also produces methane gas that is used to generate electricity. Dewatering reduces the weight and volume of biosolids that must be transported, thereby reducing transportation costs. The end product is called belt filter press (BFP) cake biosolids.

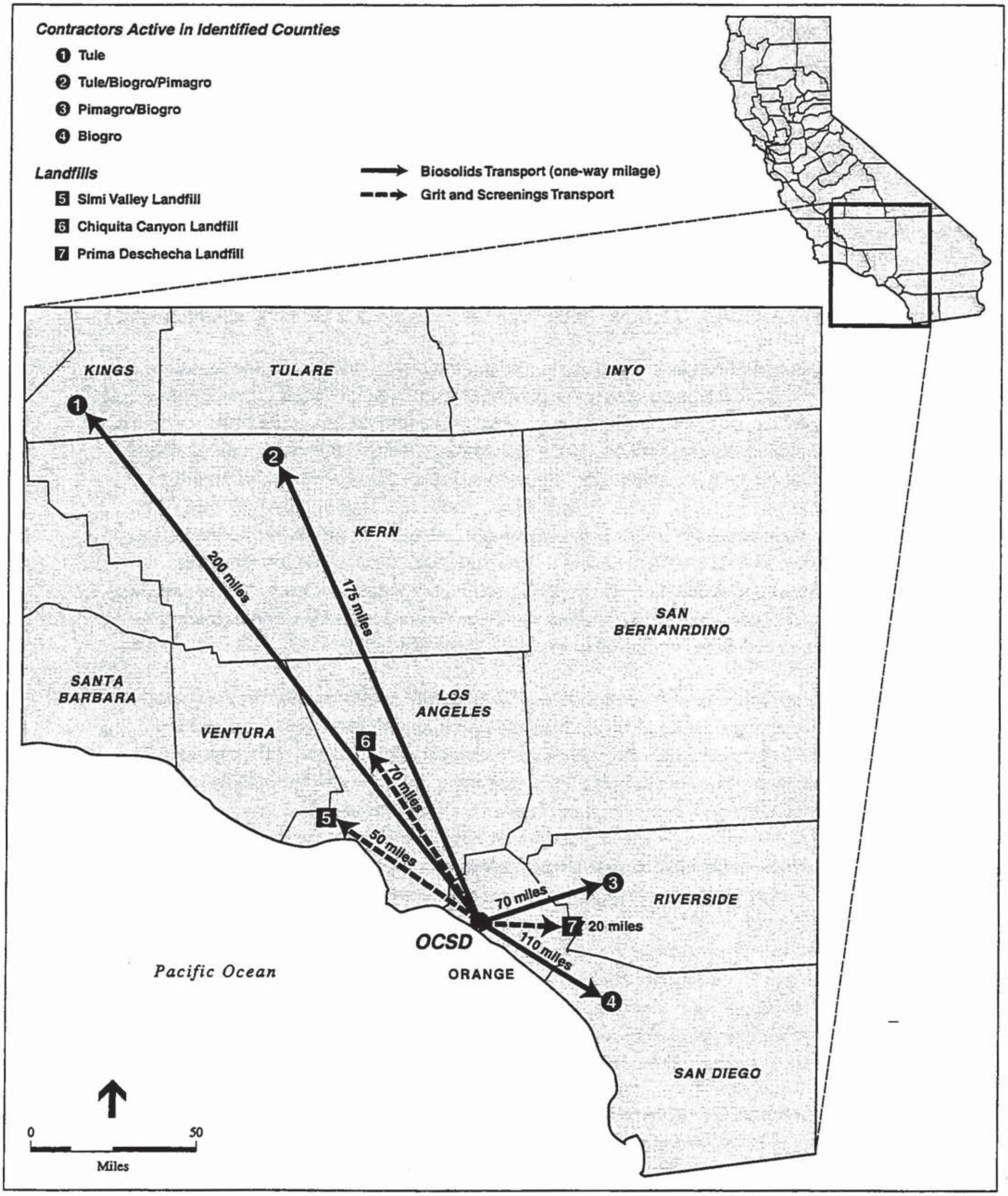
A grading system has been developed to determine biosolids quality on the basis of detectable contaminants and pathogen content. The biosolids classification is used to determine disposal and reuse options. Class A and B biosolids may be used for land application beneficial uses such as certain types of agriculture. Rules governing the reuse of Class B biosolids are more restrictive than those for Class A biosolids. Many counties in California have their own biosolids regulations limiting land application (see Chapter 8.0, Biosolids Management Setting, Impacts, and Mitigations for more detail on the biosolids regulatory environment).

Currently, biosolids generated by District Plants 1 and 2 are classified as Class B biosolids. In 1997, 100 percent of the District's biosolids were used for agricultural land application at sites in Kern County, Kings County, Riverside County, and San Diego County. **Figure 3-16** shows the location, contractors used, and number of miles associated with hauling biosolids to these sites. Some of the trucks used to haul biosolids from the treatment plants to these sites are fueled by compressed natural gas (CNG). CNG filling stations are located at both treatment plants and are also used by on-site vehicles. The CNG filling station at Plant No. 2 is currently non-operational.

The other components of residual solids are the grit and screenings removed in the first step of the treatment process. Bar screens remove large solid objects from the incoming wastewater stream. Rags, plastics, paper and latex goods make up the majority of materials removed by bar screens. Grit chambers remove smaller objects such as sand, rocks, bottle caps, and egg shells. Grit and screenings do not fit the definition of biosolids, but do require disposal in landfills permitted to accept such wastes. In 1997, the District produced a total of 4,200 wet tons of grit and screenings, including 2,400 wet tons of digester grit. A total of 1,800 wet tons were disposed of in the Chiquita Canyon Landfill in Valencia, Los Angeles County, while the remaining tonnages were landfilled in the Prima Deshecha Landfill in southeastern Orange County and the Simi Valley Landfill, also in Los Angeles County. **Figure 3-16** shows the location and number of miles associated with hauling grit and screenings to these landfills.

Residual solids quantities are expected to increase in the future proportionally with projected population growth in the District's Service Area and corresponding increases in wastewater flows. **Table 3-24** compares projected volumes of biosolids and associated truck trips in 2020 under the various treatment scenarios with 1997 conditions. As shown in **Table 3-24**, future biosolids tonnages are greater under treatment Scenarios 3 and 4 relative to other treatment scenarios due to the increase in solids contribution from the use of secondary clarifiers in full secondary treatment. **Table 3-24** also shows the amount of land in acres required for biosolids land application. **Table 3-25** compares projected volumes of grit and screenings and associated truck trips in future years with 1997 conditions. Since secondary treatment will not increase preliminary treatment by-products, grit and screenings quantities are assumed to be similar under each treatment scenario, the District has in place a Biosolids Emergency Response Plan that calls for such actions as filling empty digesters, storing dewatered cake in drying beds, using other higher priced hauling companies and maximizing treatment efficiencies in emergency situations (County Sanitation Districts of Orange County, 1998).

The proposed Strategic Plan recommends that no immediate changes be made to the District's current method of biosolids processing and reuse at Plants 1 and 2. However, a number of factors (e.g., more local regulations and negative public perception) have made the future in land application of biosolids uncertain. In response to these uncertainties, the District has begun to evaluate other biosolids management and processing options for future implementation.



SOURCE: Environmental Science Associates

OCSD Strategic Plan Program EIR / 960436

Figure 3-16
Biosolid Land Application Sites and Disposal Sites Utilized in 1997-1998

Any changes to the District's methods of biosolids management, processing, and reuse would be subject to subsequent future environmental review. The regulatory background surrounding biosolids and future biosolids opportunities being considered by the District are discussed in

Chapter 8.0, Biosolids Management Setting, Impacts, and Mitigation Measures. Chapter 8.0 also evaluates the potential for environmental impacts to occur related to the increase in biosolids volumes and associated truck trips under the various treatment scenarios relative to existing conditions.

TABLE 3-24
1997 AND 2020 BIOSOLIDS VOLUMES BY TREATMENT SCENARIO

	Biosolids (1,000 Wet Tons per Year)			Annual Truck Loads /a/			Land Requirements for Beneficial Use (acres) /b/
	Plant 1	Plant 2	Total	Plant 1	Plant 2	Total	
1996/97	66	114	180	2,640	4,560	7,200	3,600
Projected to 2020							
Scenario 1	131	192	323	5,240	7,680	12,920	6,500
Scenario 2	160	182	342	6,400	7,280	13,680	6,800
Scenario 3	204	193	397	8,160	7,720	15,880	8,000
Scenario 4	205	216	421	8,200	8,640	16,840	8,500

/a/ Truck trips were estimated assuming 25 tons per truck.
/b/ Based on corn oats rotation and 10 dry tons per acre and 20% TSS.

SOURCE: OCSD Strategic Plan, Vol. 8, Sec. 3

TABLE 3-25
PROJECTED VOLUMES OF GRIT AND SCREENINGS

	Grit and Screenings (Wet Tons per Year)			Annual Truck Loads /a/		
	Plant 1	Plant 2	Total	Plant 1	Plant 2	Total
1996/97	760	1,040	1,800	30	42	72
Projections						
2000	820	1,122	1,941	32	44	77
2005	921	1,260	2,181	36	49	86
2010	1,001	1,370	2,372	39	54	93
2015	1,046	1,432	2,478	41	55	96
2020	1,088	1,489	2,576	42	57	99

/a/ Truck trips were estimated assuming 25 tons per truck.
SOURCE: OCSD Strategic Plan, Vol. 8, Sec. 3

3.11 INTENDED USES OF THE EIR/PROJECT APPROVALS

The District has prepared this Draft Program Environmental Impact Report to provide the District's Board of Directors, the public, and Responsible and Trustee agencies reviewing the Strategic Plan projects with information about the potential effects, both beneficial and adverse, on the local and regional environment. The Board and the various agencies with regulatory authority over the projects will use this EIR for the decision-making process in their approval of the Strategic Plan and the permits required to implement the Strategic Plan. The EIR was prepared in compliance with the California Environmental Quality Act (CEQA) of 1970 (as amended) and the State CEQA Guidelines, California Administrative Code, Title 14, Chapter 3.

Agencies that are anticipated to use the EIR in their decision making or from which permits may be required for the project (including the prospect of installing a new 120-inch outfall) and are identified below:

- U.S. Fish and Wildlife Service: Biological Opinion
- U.S. Army Corps of Engineers: Section 404 Permit
- California Coastal Commission: Coastal Development Permit
- California State Land Commission: State lease for outfall
- California Department of Fish and Game: 1601, 1603 streambed alteration agreement
- Caltrans: encroachment permits
- State Water Resources Control Board, and the US Environmental Protection Agency: National Pollution Discharge Elimination (NPDES) Construction Stormwater Permit:
- Regional Water Quality Control Board, Santa Ana Region, and the US Environmental Protection Agency: NPDES Permit:, for ocean discharge
- Regional Water Quality Control Board, Santa Ana Region, and the US Environmental Protection Agency: NPDES Permit, for dewatering
- South Coast Air Quality Management District: Permit to Construct/Operate:
- County of Orange: encroachment permits for parks, unincorporated areas, and flood control; transportation coordination; utilities coordination

- Cities within the Service Area: encroachment permits, local ordinances

Costa Mesa	Anaheim	Garden Grove
Huntington Beach	Fullerton	Stanton
Fountain Valley	La Habra	Cypress
Westminster	Placentia	Buena Park
Seal Beach	Yorba Linda	Brea
Irvine	Santa Ana	Villa Park
Tustin	Los Alamitos	La Palma
Orange	Newport Beach	

The District's proposed projects must comply with local city ordinances and must notify appropriate community organizations within these cities and unincorporated areas of Orange County before commencing construction activities.

3.12 RELATED PROJECTS

OCSD has other projects underway and planned in addition to those proposed as part of the Strategic Plan. The most significant other project that OCSD proposes to implement along with the Strategic Plan is the Groundwater Replenishment System project (GWR System) in conjunction with OCWD. This project is summarized below.

WATER RECLAMATION/GROUNDWATER REPLENISHMENT SYSTEM

The District is participating with Orange County Water District in an ambitious water recycling program by providing secondary effluent for further treatment and distribution by OCWD. Water from the project would be used for groundwater recharge in the Anaheim Forebay and would also supplement existing reclaimed water that originates at the District's Reclamation Plant No. 1 for delivery to OCWD's Water Factory 21 and ultimately injection into the Talbert Sea Water Barrier and landscape irrigation through the Green Acres Project (GAP).

The proposed joint Groundwater Replenishment (GWR) System project would be the largest water reclamation project in the United States. It would allow for the diversion of 100 to 175 mgd of secondary effluent (through Phase 3), flow that would otherwise be discharged through the District's outfall. This volume is greater than 30 percent of the projected potable water needs of the District's Service Area. The Program EIR for the project with the District, OCWD, and the U.S. Bureau of Reclamation as joint lead agencies was certified on March 24, 1999. Implementation of the GWR System would constitute a clear trade-off of resources. The program would provide tertiary treatment for water slated to recharge groundwater basins, while increasing the amount of water receiving only advanced primary treatment for discharge to the ocean.

The GWR System would be implemented in three phases as facility improvements came on line, each phase requiring increased secondary effluent volume from OCSD. The first phase would become operational in 2003 producing up to 50,000 AFY, the second in 2010 producing up to 75,000 AFY, and the third in 2015 producing 100,000 AFY. The GWR System reclamation project would be operating in addition to the GAP project, but would incorporate the sea water intrusion barrier operations and water volume needs.

The District could chose to implement the first phase or first two phases only, and not commit to subsequent phases. However, the analysis in this document assumes that each phase will be completed as scheduled and as currently proposed. Hydraulic flow analysis for peak wet weather events assumes that the GWR System will be capable of accepting 100 mgd of secondary effluent to relieve the ocean outfall system. This is a conservative estimate considering that in the year 2020 the GWR System, if installed to Phase III, may be able to accept 174 mgd.

Seasonal operating scenarios would require a fluctuating demand from OCSD. During the summer season, more effluent would be required than during the winter months in order to maintain both the irrigation demand and the sea water intrusion barrier along with the groundwater basin recharge. However, during peak wet weather flows in the winter, the GWR System would be capable of accepting maximum operational volumes (100 mgd), thereby reducing capacity demands on the ocean outfall system. **Table 3-27** outlines water quantity demands of the GWR System.

TABLE 3-27
SEASONAL OPERATING SCENARIOS OF GWR SYSTEM (MGD)

	Phase I			**Phase II**			**Phase III**		
	Summer	**Winter**	**Peak Wet Weather**	**Summer**	**Winter**	**Peak Wet Weather**	**Summer**	**Winter**	**Peak Wet Weather**
GWR System									
Spreading basins	35	55	85	67	85	100	96	115	133
Irrigation uses	3	0	0	3	0	0	4	0	0
Sea water barrier	30	15	15	30	15	15	30	15	15
MF Backwash to OCSD	2	3	4	4	4	4	5	5	5
RO Brine to outfall	10	9	13	13	14	16	18	18	21
Total GWR System	80	82	117	117	118	135	153	153	174
GAP	10	0	0	10	0	0	12	10	0
OCSD Total Commitment	90	82	117	127	118	135	165	163	174

Assumes a 97% recovery microfiltration.

SOURCE: GWR System Memorandum, 3/22/99, Tama Snow, Tom Dawns.

Table 3-28 summarizes the GWR System's influent quality needs. According to the Strategic Plan's analysis, adequate secondary treatment facilities currently exist to provide the GWR System with Phase I volume and quality needs.

As a by product of the tertiary treatment, some microfiltration backwash would be sent back to Reclamation Plant No. 1 for treatment and disposal. This volume is projected to be no more than 5 mgd for Phase 3 during summer months. (This amount is base on a microfiltration recovery rate of 97%.). The backwash returned to OCSD would be anticipated to have BOD levels below 20 mg/l, totals suspended solids (TSS) levels of 1,667 mg/l, and total dissolved solids (TDS) levels of 995 mg/l.

The byproduct of the reverse osmosis is referred to as brine. This brine would be pumped directly to the ocean outfall, constituting an estimated 18 mgd by Phase 3 during summer months. This brine would be anticipated to have BOD levels below 5 mg/l, TSS levels below 1 mg/l, and TDS levels of 7,957 mg/l.

TABLE 3-28
SECONDARY INFLUENT QUALITY GOALS FOR GWR SYSTEM

Parameter	Quality Goals: Preferred	Quality Goals: Preferred Upper Limit	Maximum
TDS	Best Available	Best Available	Best Available
BOD (mg/l)	5	15	<25
TSS (mg/l)	5	15	<20
TOCs (mg/l)			
Refractory	8	9	<10
Colloidal	2	--	--
Turbidity (NTU)	2-5	6-10	<20

TOC = total organic compounds

SOURCE: GWR System Memorandum, 3/22/99, Tama Snow, Tom Dawns

REFERENCES – PROJECT DESCRIPTION

Orange County Sanitation District (OCSD), *Strategic Plan Volumes 1 through 9*, prepared by Camper Dresser and McKee (CDM), January, 1999a.

OCSD, *Annual Report, Operations and Maintenance* 1998

Beraldi, Lane, personal communication, April 1999.

Lindstrom, Kris, OCSD Consultant, personal communication, March and April 1999.

Snow, Tama and Dawes, Tom, Orange County Water District, Memorandum on GWR System, March 22, 1999

Ooten, Bob, Operations Manager, OCSD, personal communication, May 1999.

CHAPTER 4

REGIONAL SETTING

CHAPTER 4.0
REGIONAL SETTING

This chapter generally describes conditions within the OCSD service area, and serves as the basis for regional evaluation of environmental impacts and growth-inducing impacts of the project.

4.1 TOPOGRAPHIC AND GEOGRAPHIC SETTING

Orange County comprises 500,000 acres, of which 340,000 acres are relatively flat alluvial plains and 160,000 acres are foothill and mountain areas. A regional location map is presented in **Figure 2-1**. The District serves some 226,068 acres of the coastal plain of northwestern Orange County.

The service area lies within the Los Angeles embayment, which includes the coastal plain area, the San Pedro Basin, and the offshore coastal shelf areas. The coastal shelf is the area extending seaward off the coastline. It was formed by alluvial outwash from the Los Angeles, Santa Ana, and San Gabriel Rivers.

4.2 MARINE ENVIRONMENT/PUBLIC HEALTH

Please see Chapter 5 for a discussion of the marine environment.

4.3 LAND USE

The District's service area is primarily urbanized. Only a few unincorporated areas on the urban fringe and natural coastal and hilly areas remain relatively undeveloped. **Map B1** in the Map Appendix presents land use patterns at buildout within the County. This section summarizes land use patterns of the project area to serve as a baseline for assessing the environmental impacts of providing wastewater facilities that will allow continued urban development.

Although the service area contains the majority of Orange County's population, it comprises only slightly more than half of the county's land area and it contains the majority of the county's residential area. Nearly 80 percent of the land in the service area, excluding Districts 13 and 14, is developed. Over one-half of this developed land is in residential uses.

Remaining areas of southern Orange County lie in another drainage basin and are served by other facilities managed or operated by other subregional agencies or individual sewerage districts. The Aliso Water Management Agency has seven member agencies and operates four wastewater treatment plants. The South East Regional Reclamation Authority has six member agencies and manages facilities serving the Dana Point-San Clemente-San Juan Capistrano area.

4.4 TRAFFIC

EXISTING TRANSPORTATION FACILITIES

Automobiles are the primary source of transportation in Orange County. Since much of the transportation network within the service area is already well established and the availability of developable land within the county is rapidly diminishing, future urban growth induced by freeway accessibility is limited.

The freeway system constructed and maintained by the California Department of Transportation, Caltrans, is the backbone circulation system for the County. Interstate 5 travels from the north boundary to the south county line and is considered the County's main highway. Other important freeways include I-405 and State Routes 22, 55, 57, and 91. A network of new toll roads is providing alternative circulation options in the southern and eastern portion of the County. These routes, SR 73, 133, 241, and 261 will become routes that are more important in the future.

The county is crossed by a network of arterial highways, as shown on the Orange County Master Plan of Arterial Highways and general plan circulation elements of the various cities. This highway network defines roadways as major arterials (six-lane divided, 120 foot right of way), primary (4-6 lane divided, 100-foot right of way) and secondary (4 lane divided or undivided, 80 foot right-of-way). A significant circulation feature of the county, Route 55, bisects the county near its midpoint along the former Irvine Ranch boundary. Through streets generally orient north/south north and west of Route 55, while they orient along diagonal alignments southeast of Route 55. This alignment is generally parallel to or perpendicular to the Pacific Coastline.

The rectangular grid of arterials north of Route 55 is nearly perfect, consisting of multilane highways at 2 mile spacing, interrupted only by significant landforms and land preserves. Highway alignments to the south are less regular, with many routes following circuitous alignments because of terrain and landforms.

The freeway and arterial highway system generally carries relatively high traffic volumes, with many routes approaching or exceeding their capacity. This includes most freeways and most arterials that provide access to the freeway system. Most of the arterial highways within the County cannot readily afford to lose through travel lanes for construction purposes without causing congestion, however lanes can be closed for construction purposes during off peak hours at many locations, and intersections between important arterials and lesser streets can occasionally allow longer term closures.

Although the circulation system is nearly complete and consistent with the Master Plan of Highways, there are some exceptions. A few highway facilities have not been constructed along controversial alignments, and roadways in some of the older communities are not built to standards indicted in their general plan circulation elements.

Potential traffic impacts from construction within roadways must generally be analyzed on a case-by case basis, however it is highly likely that any project affecting an arterial highway could result in traffic congestion. In addition, Caltrans does not allow for any closure of the freeway system to facilitate utility construction, requiring jacking or tunneling of replacement facilities using methods that do not affect freeway traffic.

The Orange County Transportation Authority (OCTA) provides bus transit service countywide. In addition, the area ride-sharing program is administered by the OCTA.

Passenger rail service is provided by Amtrak's "San Diegan" route, with stops in Fullerton, Anaheim, Santa Ana, and Irvine, and access north to Los Angeles and Ventura Counties and south to San Diego and Metrolink. Amtrak serves both commuter and regional travel needs. Metrolink serves commuter traffic throughout Orange, Riverside, San Bernardino and Los Angeles Counties.

EXISTING TRAVEL MODES AND CHARACTERISTICS

Although some alternatives exist, the primary means of transportation in the service area is the automobile. Carpool services and park-and-ride lots provide incentives for ride sharing; however, studies of driver behavior patterns in Southern California reveal that 80% of drivers continue to drive alone to work, while 5% use transit. The average travel to work is 16.1 miles and the average travel time to work is 32 minutes.

Orange County Transit Authority provides bus service throughout the County. Rail service is provided by Metrolink and Amtrak.

EXISTING TRAFFIC CONDITIONS

Data for 1995 shows that vehicle miles traveled (VMT) within Orange County is estimated to be 60.6 million per day. The Orange County Master Plan Arterial Highways (MPAH) account for approximately one-half of the daily VMT carried. The MPAH consists of a network of major thoroughfares composed of freeways, transportation corridors, and five main arterial highway classifications: principal, major, primary, secondary, collector and Smart Streets. The Orange County Transportation Authority (OCTA) is responsible for maintaining the integrity of the MPAH through coordination with cities and the County.

It is estimated that there are 531,758 hours of delay per day on Orange County roadways and the average daily speed on area roadways is 31 MPH (*OCTA Long-range Transportation Plan for Orange County*).

FUTURE PLANNED IMPROVEMENTS

Improvements for the various state highway and freeway facilities in Orange County are planned as far as the year 2020. Much of the county improvement projects are the result Measure M. Measure M is a one-half cent sales tax for countywide transportation improvements, approved by Orange County voters in 1990. Plans call for Measure M revenue to create a balanced multi-modal system of freeways, regional and local streets and roads and transit alternatives. Measure M is expected to raise more than $3 billion over the next 20 years.

Additional lanes, in many cases high occupancy vehicle (HOV) lanes, are planned for many of the counties freeways. Metrolink plans to increase train service throughout the county and there are plans for the expansion of the county's toll road system.

Numerous transportation improvements are planned at the local level as part of local general plan circulation elements.

PROJECTED TRAFFIC CONDITIONS

Forecast data for 2020 shows that vehicle miles traveled (VMT) within Orange County is estimated to be 86.4 million, an estimated increase of 43% over 1995 levels. It is estimated that there will be 1,138,564 hours of delay on Orange County roadways and the average daily speed on area roadways will be 28 MPH. (Source: *OCTA Long-range Transportation Plan for Orange County*)

CONGESTION MANAGEMENT PROGRAM

The counties of Orange, Los Angeles, San Bernardino, Riverside, and Ventura and the Southern California Association of Governments, have come together to develop a Congestion Management System (CMS) process for the region (SCAG, 1997). These distinctive entities, known as Congestion Management Agencies (CMAs), are responsible for the preparation and maintenance of Congestion Management Programs (CMPs). The Orange County Transportation Authority (OCTA) is the designated CMA of Orange County and is subject to state CMP requirements.

The key elements of the federal CMS are addressed through the CMP. CMP functions fulfill federal Congestion Management System (CMS) requirements and are listed below.

- Highway Performance: CMA monitors the performance of an identified highway system. This allow the county to track how this system, and its individual components, are performing against established standards, and how performance changes over time.

- Multi-Modal Performance: CMA evaluates the performance of other transportation modes including transit.

- Transportation Demand Management (TDM): Each CMP contains a TDM component geared at reducing travel demand and promoting alternative transportation methods.

- Land Use Programs and Analysis: The CMP incorporates a program for analyzing the impacts of local land use decisions on the regional transportation system.

- Capital Improvement Program (CIP): Using data and performance measures developed through the activities identified above, each CMP develops a CIP. This becomes the first step in developing the County Transportation Improvement Program (TIP). Under state law, projects funded through the Regional TIP must be first contained in the county CMP.

- Deficiency Planning: Unacceptable levels of congestion can develop. When this occurs, the CMP contains provisions for "deficiency plans" to address the problems. Deficiency plans can be developed for specific problem areas or on a system wide basis. In many cases, the deficiency plans capture the benefits of transportation improvements which occur outside the TIP and RTIP such as non-traditional strategies and/or non-regionally significant projects.

4.5 BIOLOGICAL RESOURCES

The District serves the urbanized northwestern section of Orange County (Orange County, 1984). Before this area became intensely developed it consisted of coastal wetlands and flatlands. Today, few of the 750 native plants or wildlife remain in the area.

HABITATS

Within Orange County, eight vegetation communities exist. They are discussed below:

- Grassland: characterized by varied topography and climate. Primary vegetation are bunch grasses and annual grass species such as brome, wild oats, and barley. Low in Wildlife.

- Coastal Sage Scrub: May include up to 30 percent oak coverages with scrub understory in a mixed environment or be limited solely to low growing brush dominated by sagebrush, black and white sage, prickly pear cactus, and various grasses. Limited wildlife.

- Chaparral: May be dominated by a mixture of less than 30 percent oak tree coverage with scrub understory. Characterized by chamise, scrub oak, ceanothus, and manzanita. Many fur-bearing mammals.

- Oak Savannah: Similar to grassland habitat except that a higher percentage is forested.

- Southern Oak Woodland / Forest: Contains oak trees with scrub and/or grass understory. Good foraging area for animal wildlife.

- Riparian Woodland / Forest: Characterized by a dense narrow vegetation band along a stream course. Dominated by Live Oak, Sycamore, Willow and Alder trees.

- Conifer Woodland / Forest: Characterized by Big Cone Spruce, Coulter Pine, and Oak with a brush understory. Good wildlife habitat.

While approximately 50 percent of the county is covered with natural vegetation, the District's service area contains only a few of the remaining representative plant communities. These are found primarily along the upper Santa Ana River, Santiago Creek, and the foothill areas.

Probably the most ecologically important communities within the service area are the coastal salt marshes of Anaheim, Sunset, Bolsa Chica, and Newport Bays. These areas, such as the Bolsa Chica Ecological Reserve, remain in a relatively undisturbed state. They provide important habitats for a variety of birds and rare and endangered plants and animals. **Figure 4-1** shows some of the special biological habitats along the Pacific Coast in Orange County.

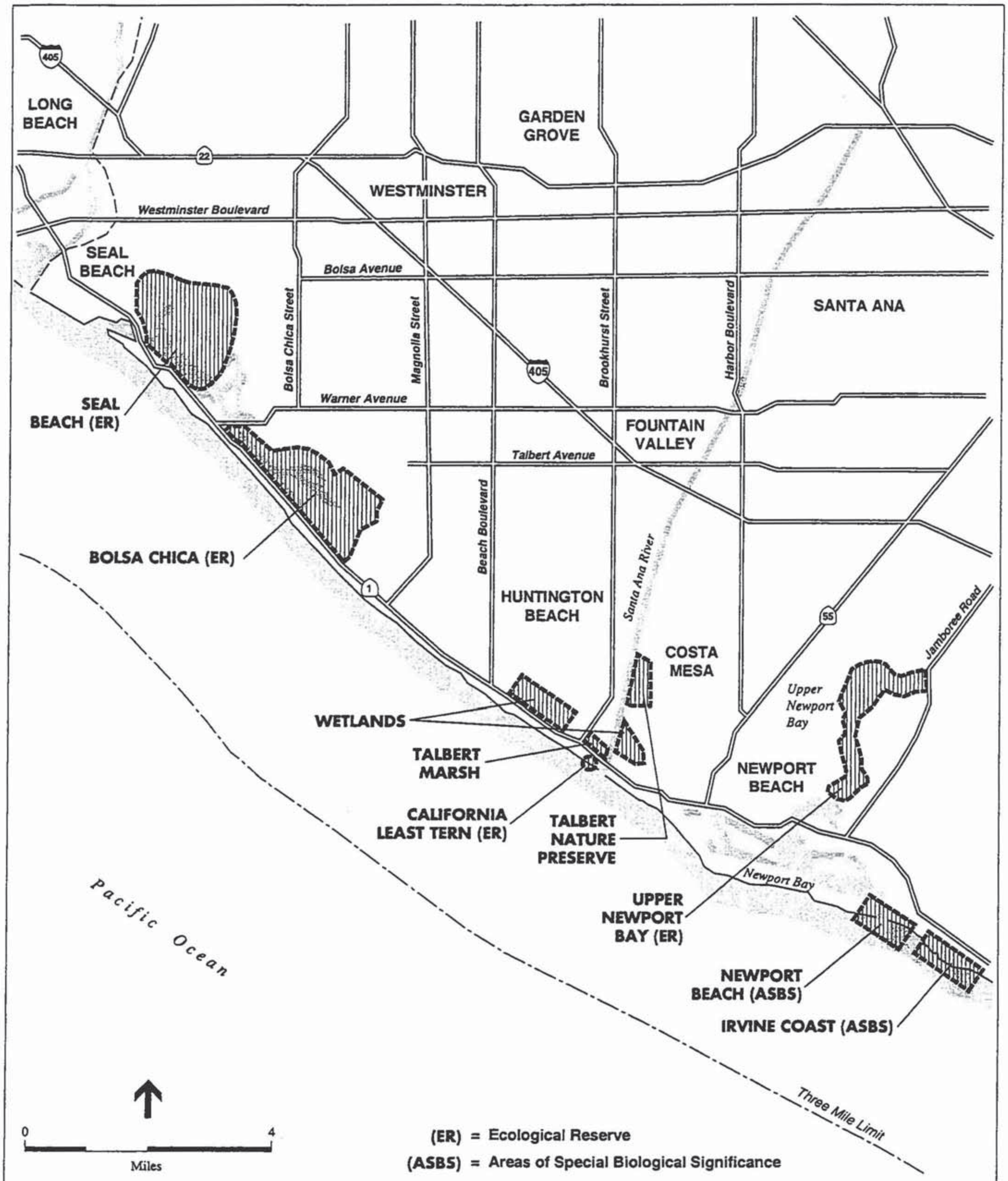
HABITAT PROTECTION EFFORTS

The California Department of Fish and Game (CDFG) protects rare, threatened or endangered species by managing habitat as ecological reserves or wildlife areas (SCAG, 1997). The U.S. Fish and Wildlife Service (USFWS) maintains the National Wildlife Refuge system. Additional tracts of open space supporting valuable wildlife resources are administered by other federal and state agencies, including the U.S. Forest Service, U.S. Park Service, Bureau of Land Management, U.S. Army Corps of Engineers, and California Department of Parks and Recreation. There are other quasi- and non-governmental organizations which oversee the management and protection of critical plant and wildlife communities, including the University of California Natural Reserve System, the Metropolitan Water District of Southern California, the National Audubon Society, and the Nature Conservancy. In Orange County, the acreage of protected areas is 508,408.

Habitat conservation planning efforts have been undertaken in Orange County. These include the Santa Ana River Basin Least Bell's vireo Habitat Conservation Plan (HCP), Central/Coastal NCCP/HCP, Southern NCCP/HCP, Shell HCP, and Chiquita Canyon Conservation Area. Under section 10 of the federal Endangered Species Act, taking of listed species on private lands can be permitted by preparing a HCP, which identifies the anticipated impacts of specific projects, and implementing appropriate conservation measures. Proposed mitigation measures must be clearly identified before the plan can be approved by USFWS.

SPECIAL-STATUS SPECIES

Federal- and state-endangered and threatened plant and animal species reported in Northern Orange County include: Brauton's milk-vetch, salt marsh bird's-beak, Laguna Beach dudleya, Santa Ana River woollystar, crownbeard, San Diego fairy shrimp, Riverside fairy shrimp, Santa Ana sucker, tidewater goby, arroyo toad, coastal cactus wren, western yellow-billed cuckoo, willow flycatcher, California black rail, Belding's savannah sparrow, California gnatcatcher, light-footed clapper rail, California least tern, least bell's vireo, and pacific pocket mouse. A least tern habitat is located on Huntington Beach, west of Plant No. 2 and SR 1.



SOURCE: OCSD Draft Program EIR Master Plan, 1989.

OCSD Strategic Plan Program EIR / 960436

Figure 4-1
Location of Special Biological Habitats in the Vicinity of the Sanitation District Outfalls

The California least tern (on the state and federal endangered species lists) historically nested on coastal beaches adjacent to estuaries from Monterey County south to Baja California (Dawson 1924, Grinnell and Miller 1944). A significant decline was noted in nesting populations by the 1930s, and by 1970 only 300 nesting pairs remained in the state. Because of this dramatic decline in numbers, California least terns were placed on the endangered species lists of both the U. S. Fish and Wildlife Service (USFWS) (50 CFR 17.11) and the California Department of Fish and Game (DFG) (California Administrative Code, Title 14, Section 670.5) in 1969 and 1971, respectively. Although once greatly reduced, the California least tern population has increased.

California least terns are migratory and usually arrive at their breeding areas by mid-April and depart for southern wintering grounds by the end of August (Massey 1974, Erickson 1985). A colony has nested with variable success at Huntington State Beach every year since systematic data were first collected in 1969. This colony is sensitive to disturbance while breeding (OCSD, 1989). Encroachment into nesting colonies can cause the terns to permanently abandon their nesting, foraging, and roosting areas. To protect this colony from disturbance, USFWS and DFG established an approximately 7.5-acre sanctuary in 1964. A chain link fence isolates the nesting colony from the adjacent public beach. Despite this protection, predation by introduced red foxes has occurred.

4.6 NOISE

Environmental noise usually is measured in A-weighted decibels (dBA)[1]. Environmental noise typically fluctuates over time, and different types of noise descriptors are used to account for this variability. Typical noise descriptors include the energy-equivalent noise level (Leq) and the day-night average noise level (Ldn)[2]. The Ldn is commonly used in establishing noise exposure guidelines for specific land uses. Generally, a three-dBA increase in ambient noise levels represents the threshold at which most people can detect a change in the noise environment; an increase of 10 dBA is perceived as a doubling of loudness.

There are two types of noise sources: stationary and mobile. Stationary noise sources are localized and include engine-powered facilities (i.e., wastewater pumping stations). The effect of a stationary noise source diminishes with distance. Mobile noise sources (i.e., automobiles) may affect a larger area and potentially more receptors due to their movement. The major contributor of noise in any urban setting includes transportation vehicles such as automobiles, buses, and airplanes. They impact more receptors due to the loud noise they generate and the prevalence of transportation facilities in Orange County. Construction activities, also common in urban area, can create loud, short-term noise upon its receptors. **Figure 4-2** indicates some representative

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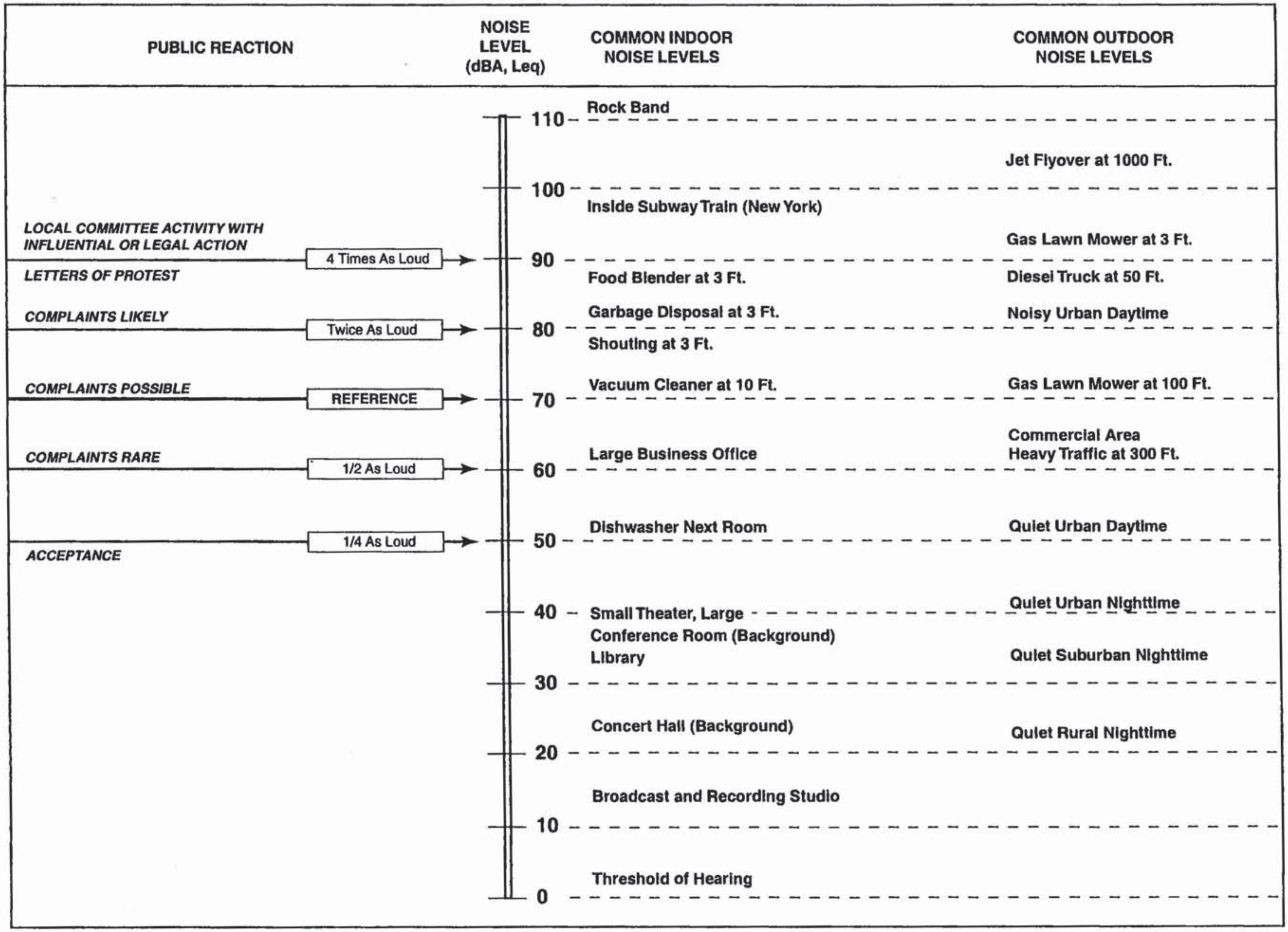
1 A decibel (dB) is a unit of sound energy intensity. Sound waves, traveling outward from a source, exert a sound pressure level (commonly called a "sound level") measured in dB. An A-weighted decibel (dBA) is a decibel corrected for the variation in frequency response of the typical human ear at commonly encountered noise levels.

2 Leq, the energy-equivalent noise level (or "average" noise level), is the equivalent steady-state continuous noise level which, in a stated period of time, contains the same acoustic energy as the time-varying sound level that actually occurs during the same period. Ldn, the day-night average noise level, is a weighted 24-hour noise level. With the Ldn descriptor, noise levels between 10:00 p.m. and 7:00 a.m. are adjusted upward by ten dBA to take into account the greater annoyance of nighttime noise as compared to daytime noise.



SOURCE: Caltrans Transportation Laboratory Noise Manual, 1982; and Modification by Environmental Science Associates

OCSD Strategic Plan Program EIR / 960436 ■

Figure 4-2
Effect of Noise on People

noise sources and their corresponding noise levels (in Leq). The last column of the table compares outdoor noise levels for various environments. Not shown are construction noise levels which may range from 71 to 101 Leq at 50 feet, depending on the type of equipment used.

As with air quality, some land uses are considered more sensitive to noise than others due to the types of population groups or activities involved. Sensitive population groups include children and the elderly. Noise-sensitive receptors in the OCSD service area include, but are not limited to, residential uses, schools, medical facilities, nursing and convalescent homes.

4.7 AIR QUALITY

This section discusses the general climatology and air quality of the basin in which the District is located. It focuses on air quality trends, local air quality contaminant levels in relation to state and federal standards, and the effects of existing air pollutants on health and the environment. The study area lies within the South Coast Air Basin, a coastal plain surrounded by a rim of high mountains.

CLIMATE

The climate of Southern California is primarily influenced by topography and the position of the strength of the East Pacific High Pressure Area. This Pressure Area influences windflow and rainflow patterns as well as ocean currents; rainfall is low in the winter due to this high pressure system. Proximity to the Pacific Ocean combined with varying topography and winds greatly influence temperatures within the County. Winter temperatures average about 52 degrees while summer temperatures average 68 degrees along the coast and for several miles inland. Inland temperatures reach 100 degrees. Orange County is particularly susceptible to fog due to its proximity to the Ocean and the high frequency of temperature inversions which prevent dispersal of fog.

Air quality is affected by both the rate and location of pollutant emissions and by meteorological conditions which influence movement and dispersal of pollutants. Atmospheric conditions such as wind speed, wind direction, and air temperature gradients, along with local topography, provide the link between air pollutant emissions and air quality.

The Orange County Sanitation District (OCSD) service area is within the South Coast Air Basin, which incorporates approximately 12,000 square miles, consisting of four counties -- San Bernardino, Riverside, Los Angeles, and Orange -- including some portions of what used to be the Southeast Desert Air Basin. In May 1996, the boundaries of the South Coast Air Basin were changed by the California Air Resources Board (ARB) to include the Beaumont-Banning area. In addition, the Southeast Desert Air Basin was separated into two areas and renamed as the Mojave Desert Air Basin and the Salton Sea Air Basin. The distinctive climate of the Basin is determined by its terrain and geographic location. The South Coast Air Basin is a coastal plain with connecting broad valleys and low hills, bounded by the Pacific Ocean to the southwest and high mountains around the rest of its perimeter. The general region lies in the semi-permanent high pressure zone of the eastern Pacific, resulting in a mild climate tempered by cool sea breezes with light average wind speeds. The usually mild climatological pattern is interrupted occasionally by periods of extremely hot weather, winter storms, or Santa Ana winds.

The vertical dispersion of air pollutants in the South Coast Air Basin is hampered by the presence of persistent temperature inversions. High-pressure systems, such as the semi-permanent high-pressure zone in which the Basin is located, are characterized by an upper layer of dry air that warms as it descends, restricting the mobility of cooler marine-influenced air near the ground surface, and resulting in the formation of subsidence inversions. Such inversions restrict the vertical dispersion of air pollutants released into the marine layer and, together with strong sunlight, can produce worst-case conditions for the formation of photochemical smog. The basinwide occurrence of inversions at 3,500 feet above sea level or less averages 191 days per year (SCAQMD, 1993).

The atmospheric pollution potential of an area is largely dependent on winds, atmospheric stability, solar radiation, and terrain. The combination of low wind speeds and low inversions produces the greatest concentration of air pollutants. On days without inversions, or on days of winds averaging over 15 mph, smog potential is greatly reduced.

AIR QUALITY REGULATIONS, PLANS AND POLICIES

State and federal agencies have set ambient air quality standards for certain air pollutants. National Ambient Air Quality Standards (NAAQS) have been established for the following criteria pollutants: carbon monoxide (CO), ozone (O_3), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), inhalable particulate matter (PM_{10}), and lead (Pb). The state standards for these criteria pollutants are more stringent than the corresponding federal standards.

Areas are classified under the Federal Clean Air Act as either "attainment" or "non-attainment" areas for each criteria pollutant based on whether the NAAQS have been achieved or not. According to the SCAQMD, the South Coast Air Basin is designated as a non-attainment area for O_3, CO, and PM_{10}; the basin is classified as an attainment area for NO_2, SO_2 and Pb.

The South Coast Air Basin's first Air Quality Management Plan (AQMP), adopted in 1979, established air pollution control strategies intended to attain federal air quality standards by the December 31, 1987 deadline specified by the Clean Air Act Amendments of 1977. Using better data and modeling tools, the 1982 Revision of the AQMP concluded that the Basin could not demonstrate attainment by the 1987 deadline required by the federal Clean Air Act. Therefore, the 1982 Revision of the AQMP proposed a long range strategy that could result in attainment in 20 years. In 1987, a federal court ordered the U.S. Environmental Protection Agency (EPA) to disapprove the 1982 AQMP Revision because it did not demonstrate attainment of the federal standards by the 1987 deadline (SCAQMD and SCAG, 1989).

The 1989 AQMP was adopted locally by the South Coast Air Quality Management District (SCAQMD) in March 1989, and was approved by the California Air Resources Board (ARB) in August 1989.

In July 1991, the SCAQMD and SCAG adopted an AQMP for the Basin which revised the 1989 AQMP. The 1991 AQMP continued an aggressive emission control program using the three-tiered format that was established by the 1989 AQMP. The 1991 AQMP proposed a comprehensive set of control measures that included the use of advanced technologies for stationary and mobile sources.

In 1994, the SCAQMD and SCAG updated the 1991 AQMP. Key new elements of the updated AQMD included improved emissions inventories, emphasis on alternative approaches to emissions control, enhanced photochemical modeling, etc (SCAQMD and SCAG, 1994).

Acting under orders from the federal courts, which required the EPA to promulgate a plan to demonstrate compliance with the Clear Air Act's ozone and carbon monoxide standards, the EPA issued the proposed Federal Implementation Plan (FIP) for Sacramento, Ventura, and the South Coast Air Basin on February 15, 1994. The FIP, intended in part to stimulate state and local efforts to achieve cleaner air for California citizens, was rescinded by the U.S. Congress in April 1995.

In 1997, the SCAQMD and SCAG prepared another update to the AQMP to satisfy the planning requirements of both the Federal Clean Air Act and the California Clean Air Act. The 1997 revision to the AQMP incorporates significant new scientific data, primarily in the form of updated emissions inventories, ambient measurements, and new models.

EXISTING AIR QUALITY

The SCAQMD maintains four air quality monitoring stations in Orange County -- in Anaheim, Costa Mesa, La Habra, and El Toro; with the exception of the latter, all of these monitoring stations are located within the OCSD service area. A five-year summary (1993-1997) of data collected at the three stations within the OCSD service area is shown in **Table 4-1** and compared with the corresponding state ambient air quality standards.

Ozone (O_3). The most pervasive air quality problem in the South Coast Air Basin is high O_3 concentrations. Ozone is not emitted directly, but is a secondary pollutant produced in the atmosphere through a complex series of photochemical reactions involving reactive organic compounds (ROC) and nitrogen oxides (NO_x). Significant O_3 production generally requires about

TABLE 4-1
ORANGE COUNTY AIR QUALITY SUMMARY, 1993-1997[a]

Pollutant (Standard)/ Location	1993 Conc.	1993 Excd.[b]	1994 Conc.	1994 Excd.[b]	1995 Conc.	1995 Excd.[b]	1996 Conc.	1996 Excd.[b]	1997 Conc.	1997 Excd.[b]
Ozone (0.09 ppm – state one-hour average standard)										
Anaheim	0.17	23	0.21	24	0.13	19	0.13	9	0.10	1
Costa Mesa	0.13	10	0.12	3	0.11	3	0.10	1	0.09	0
La Habra	0.19	47	0.25	42	0.16	33	0.15	20	0.13	9
Carbon Monoxide (20 ppm – state one-hour average standard)										
Anaheim	15.0	0	12.0	0	10.0	0	9.0	0	8.0	0
Costa Mesa	10.0	0	10.0	0	8.0	0	9.0	0	7.0	0
La Habra	14.0	0	16.0	0	13.0	0	13.0	0	12.0	0
Carbon Monoxide (9.1 ppm – state eight-hour average standard)										
Anaheim	7.7	0	8.6	0	8.0	0	7.5	0	6.3	0
Costa Mesa	7.3	0	7.9	0	6.7	0	7.3	0	5.8	0
La Habra	6.0	0	8.9	0	6.6	0	6.4	0	6.0	0
Nitrogen Dioxide (0.25 ppm – state one-hour average standard)										
Anaheim	0.20	0	0.19	0	0.18	0	0.14	0	0.13	0
Costa Mesa	0.14	0	0.16	0	0.18	0	0.13	0	0.12	0
La Habra	0.18	0	0.23	0	0.19	0	0.16	0	0.15	0
Sulfur Dioxide (0.045 ppm – state 24-hour average standard)										
Anaheim	--	--	--	--	--	--	--	--	--	--
Costa Mesa	0.009	0	0.009	0	0.009	0	0.003	0	0.016	0
La Habra	0.010	0	0.009	0	0.010	0	--	--	--	--
Particulate Matter – 10 microns (50 μg/m³ – state 24-hour average standard)										
Anaheim	92	13	106	11	172	14	101	6	91	11
Costa Mesa	--	--	--	--	--	--	--	--	--	--
La Habra	--	--	--	--	--	--	--	--	--	--

a. Data are from the SCAQMD monitoring stations located at 1010 S. Harbor Boulevard in the City of Anaheim, 2850 Mesa Verde Drive East in the City of Costa Mesa, and 621 W. Lambert Road in the City of La Habra.
b. Number of days state standard was exceeded.
c. ppm - parts per million; μg/m³ - micrograms per cubic meter.

SOURCE: California Air Resources Board, *Air Quality Data Summaries*, 1993-1997.

three hours in a stable atmosphere with strong sunlight. Ozone is a regional air pollutant because it is transported and diffused by wind concurrent with the photochemical reaction process. Motor vehicles are the major source of ozone precursors in the basin. During late spring, summer, and early fall, light winds, low mixing heights, and abundant sunshine combine to produce conditions favorable for maximum production of O_3. Ozone causes eye and respiratory irritation, reduces resistance to lung infection, and may aggravate pulmonary conditions in persons with lung disease. Ozone is also damaging to vegetation and untreated rubber. The state one-hour ozone standard was exceeded approximately 80 days in 1993 and only 10 days in 1997 at the three monitoring stations (see **Table 4-1**).

Carbon Monoxide (CO). Carbon Monoxide is a non-reactive pollutant emitted primarily by motor vehicles. Ambient CO concentrations generally follow the spatial and temporal distributions of vehicular traffic and are also influenced by meteorological factors such as wind speed and atmospheric mixing. When strong surface inversions formed on winter nights are coupled with near-calm winds, CO from automobile exhaust becomes concentrated. The highest CO levels within the South Coast Air Basin are almost always measured during the winter. Carbon Monoxide interferes with the transfer of oxygen to the blood. It may cause dizziness and fatigue and can impair central nervous system functions. The one-hour and eight-hour average CO standards have not been exceeded at any of the monitoring stations in Orange County in the last five years (see **Table 4.1**).

Nitrogen Dioxide (NO_2). There are two oxides of nitrogen which are important in air pollution: Nitric Oxide (NO) and Nitrogen Dioxide (NO_2). Nitric oxide, along with some NO_2, is emitted from motor vehicle engines, power plants, refineries, industrial boilers, ships, aircraft, and railroads. Nitrogen dioxide is primarily formed when NO reacts with atmospheric oxygen in the presence of Reactive Organic Compounds (ROC) and sunlight; the other product of this reaction is ozone. Nitrogen dioxide is the "whiskey brown" colored gas, more commonly known as smog, readily observed during periods of heavy air pollution. Concentrations of NO_2 are highest during the late fall and winter. Nitrogen dioxide increases damage from respiratory disease and irritation, and may reduce resistance to certain infections. The state standard for NO_2 has not been exceeded in the last five years in Orange County (see **Table 4-1**).

Sulfur Dioxide (SO_2). Sulfur Dioxide is the natural combustion product of sulfur or sulfur-containing fuels. Fuel combustion is a major source, while chemical plants, sulfur recovery plants, and metal processing facilities are minor contributors to SO_2 contamination of the South Coast Air Basin. In humid atmospheres, sulfur oxides can react with water vapor to produce sulfuric acid, a component of acid rain. It can also form sulfate particulates, which reduce visibility. Sulfur dioxide is a lung irritant, and in combination with moisture and oxygen, SO_2 can damage vegetation and man-made materials. Sulfur dioxide levels are generally highest during the winter although no exceedances of ambient SO_2 standards have been recorded in Orange County in the last five years (see **Table 4-1**).

Inhalable Particulate Matter (PM_{10}). PM_{10} refers to particulates less than 10 microns in diameter -- those which can be inhaled and cause health effects. Particulates in the atmosphere result from many kinds of dust- and fume-producing industrial and agricultural operations, combustion, and atmospheric photochemical reactions. Demolition, construction, and vehicular traffic are major sources of particulates in urban areas. Natural sources of particulates include wind-blown dust, and ocean spray. Very small particulates of certain substances can cause direct lung damage, or can contain absorbed gasses that may be injurious. Particulates can also damage materials and reduce visibility. PM_{10} standards have been exceeded 55 times in Anaheim (the only monitoring station for PM10 in the OCSD service area) between 1993 and 1997 (see **Table 4-1**).

EXISTING AIR POLLUTION SOURCES

Air quality in Orange County is affected by emissions from a variety of sources. Those sources include, but are not limited to, industrial uses, agricultural uses, commercial uses, regional motor vehicle emissions, and local motor vehicle traffic on nearby highways and freeways, including Pacific Coast Highway, the San Diego Freeway (Interstate 405), the Santa Ana Freeway (Interstate 5), the San Gabriel Freeway (Interstate 605), the Artesia/ Riverside Freeway (State Route 91), the Orange Freeway (State Route 57), the Costa Mesa Freeway (State Route 55), the Garden Grove Freeway (State Route 22), and the San Joaquin Eastern Corridor Toll Road (State Route 73) and major arterial streets throughout Orange County.

SENSITIVE RECEPTORS

Some land uses are considered more sensitive to air pollution than others due to the types of population groups or activities involved. Sensitive population groups include children, the elderly, the acutely ill and the chronically ill, especially those with cardio-respiratory diseases.

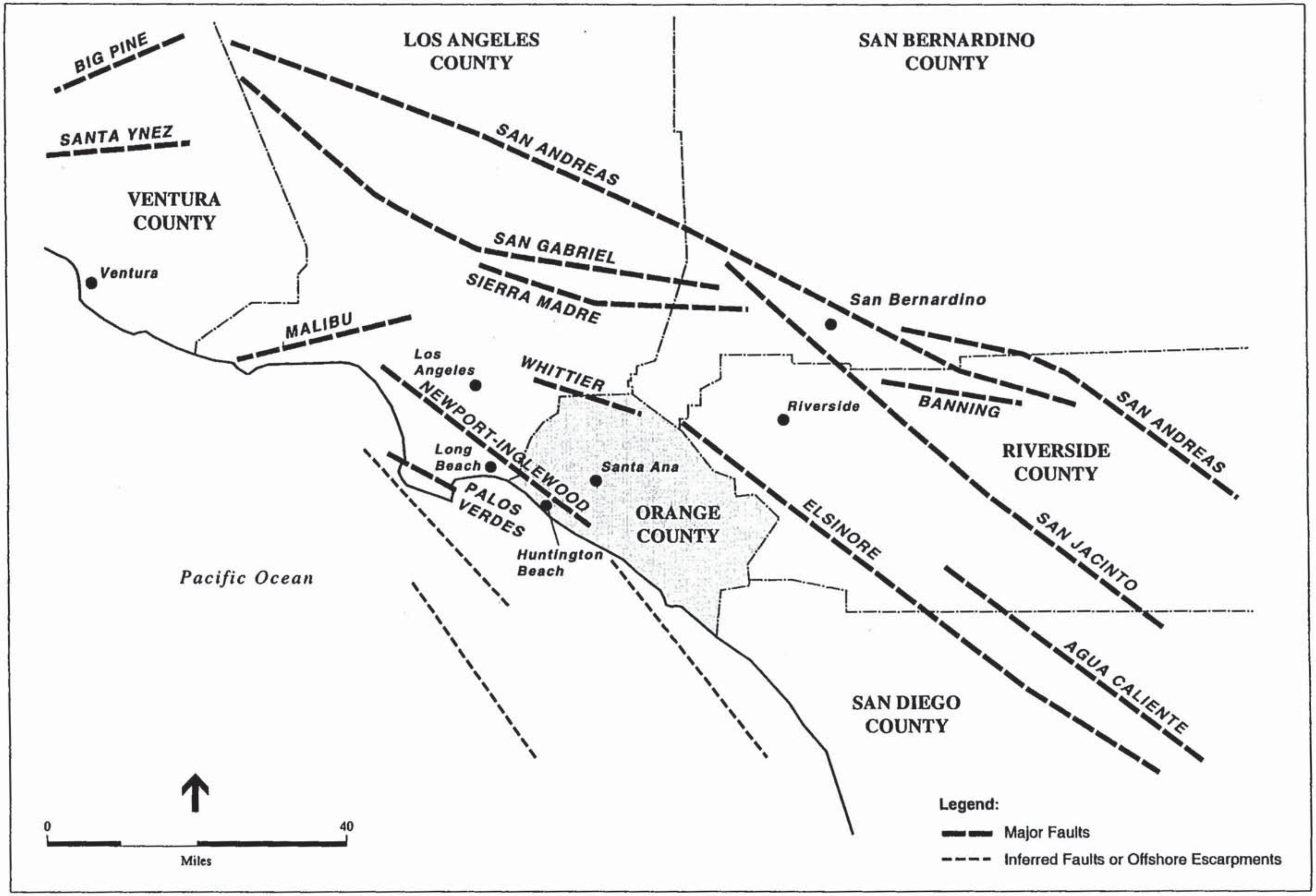
Residential areas are also considered to be sensitive to air pollution because residents (including children and the elderly) tend to be at home for extended periods of time, resulting in sustained exposure to any pollutants present. Recreational land uses are considered moderately sensitive to air pollution. Although exposure periods are generally short, exercise places a high demand on respiratory functions, which can be impaired by air pollution. In addition, noticeable air pollution can detract from the enjoyment of recreation. Industrial and commercial areas are considered the least sensitive to air pollution. Exposure periods are relatively short and intermittent as the majority of the workers tend to stay indoors most of the time. In addition, the working population is generally the healthiest segment of the public.

Air pollution-sensitive receptors in the OCSD service area include, but are not limited to, residential uses, schools, medical facilities, nursing and convalescent homes.

4.8 GEOLOGIC HAZARDS AND SOILS

The Orange County coastal plain is composed of a basin where rocks and alluvium were deposited and where differential subsidence and uplifting have continued to occur since the late Cretaceous period (between 135 million and 65 million years ago). The basin became a low relief surface through a history of differential sinking, uplifting, folding, faulting, erosion, and deposition.

Figure 4-3 shows the fault systems in Orange County. The Newport-Inglewood structural zone is the major structural feature of the coastal area. Folding and faulting along this zone have displaced all rocks older than the alluvial and littoral deposits of the Holocene period (last 11,000



SOURCE: Orange County Emergency Management Division.

OCSD Strategic Plan Program EIR / 960436

Figure 4-3
Regional Fault Zones

years), thereby creating a barrier to groundwater movement. The structural changes and subsequent erosion from the Santa Ana and San Gabriel Rivers have formed a series of coastal mesas.

Notable human changes in the area's geology have resulted largely from groundwater withdrawal, oil extraction, and other human activities. These changes have caused differential subsidence in areas overlying oil fields and seawater intrusion into areas where extraction of fresh groundwater has exceeded natural and artificial recharge.

The geologic substructure under Orange County is subject to considerable tectonic stress. Two active and potentially hazardous fault zones within the study area are the Whittier Fault zone and the Newport-Inglewood Fault zone. Specific geological studies for the Newport-Inglewood fault zone is minimal, but the historical record shows that potentially damaging earthquakes have occurred every few years. The Newport-Inglewood Fault zone is potentially active and has been designated by the California State Geologist as being subject to the Alquist-Priolo Earthquake Fault Zones Act.[3] This act requires that buildings within this hazard zone be designed to withstand earthquake activity and that residential uses not be developed in an active earthquake zone. Despite the lack of recent surface displacements of known faults along the zone and the absence of extensive damage in recent years, the fault zone is a significant potential hazard to the highly developed coastal area. However, benefits associated with the fault zones include anticlinal upwarps, which trap oil and block seawater from infiltrating groundwater aquifers. Risks include structural damages, human injuries, and death.

The U. S. Soil Conservation Service completed a comprehensive soil survey of Orange County that identifies 49 soil types, which are subdivided into 226 individual soil names. A copy of the soil survey report is available from the U. S. Soil Conservation Service office in Tustin, California.

Soils within the study area are characteristic of the Southern California coastal plain. They consist of alluvial fan and floodplain soils, the most important group of agricultural soils in California. These soils are well suited for growing citrus fruits and a variety of other crops.

4.9 HYDROLOGY AND WATER RESOURCES

The hydrologic cycle of the coastal plain has been greatly affected by human activities. Since the late 1940s, rapid urbanization has significantly deteriorated groundwater supplies. This degradation has resulted from the overdrafting of high-quality groundwater and the subsequent infiltration of contaminants (largely salts) into groundwater supplies by seawater intrusion and percolation of salt-laden irrigation water.

3 The purpose of this Act is to prohibit the location of most structures for human occupancy across the traces of active faults and to thereby mitigate the hazard of fault rupture.

SURFACE WATER

The water supply of the coastal plain consists of local water (i.e., groundwater and surface flows) and imported water. Surface flows consist primarily of water flowing through the area in the Santa Ana River and its tributary, Santiago Creek. Because of damming, groundwater pumping, treated waste disposal, and the import and diversion of water for irrigation, the Santa Ana River, which once flowed perennially, now flows year-round only throughout its upper reaches and to the spreading basins used for groundwater recharge near Anaheim.

The Santa Ana River and its tributaries drain the southern portions of the eastern San Gabriel Mountains and the southern parts of the San Bernardino Mountains. Surface water and groundwater in the upper basin flow through Prado Dam, at the head of the Santa Ana River Canyon, and down to the Orange County coastal basin.

Summer flows normally reach the recharge basins downstream of the Imperial Highway bridge and rarely flow beyond the basins to Burris Pit. The flows reaching the recharge basins consist primarily of secondary treated wastewater effluent, irrigation runoff water, imported water used for groundwater recharge, and groundwater forced to the surface by underground barriers. During winter, storm runoff is conveyed in the river, at times creating a flood hazard.

The Santa Ana River and Santiago Creek supply a small percentage of the water used in the northern Orange County. Nevertheless, they are important contributors to the coastal plain's water supply and valuable providers of important wildlife habitat. Other Orange County streams that provide some additional water supply include San Diego Creek, San Juan Creek, and Aliso Creek drainage systems.

GROUNDWATER

A large portion of northern Orange County is underlain within groundwater basin that is primarily supplied by the Santa Ana River watershed (Orange County, 1984). This basin is divided into the Santa Ana Forebay area and the Coastal Plain Pressure Area. Orange County Water District is responsible for the management of the Orange County Groundwater Basin.

Orange County has historically been known for its rich supply of groundwater. Artesian wells once dotted the county's landscape, providing irrigation water for rich farmlands and a bountiful supply of water for domestic uses. But as the population of the county increased, water became a precious commodity. As a consequence of greater river diversions, natural recharge of the groundwater supply decreased. By the late 1800s, the only water percolating into the groundwater supply was precipitation and runoff from winter storms. The short duration typical of southern California storms, however, resulted in an inadequate recharge of the groundwater supply.

In the beginning of the nineteenth century, a groundwater basin management program was initiated to maintain the county's groundwater supply. The program today includes importing water for groundwater replenishment, managing reservoirs to maximize percolation capacity, cooperative conjunction use, and implementing water quality programs.

In spite of water management programs, a significant cumulative loss of freshwater storage occurred due to saline intrusion along the coast until an artificial recharge barrier involving recharge of reclaimed wastewater to prevent saline intrusion was implemented in the early 1970s. In 1998, OCSD and OCWD jointly proposed the GWR System. One component of the Groundwater Replenishment (GWR) System proposes to expand and refurbish the Seawater Intrusion Barrier. The Barrier would inject product water from the GWR System into the ground via new supply pipe and injection wells, thereby protecting the Basin from further degradation due to seawater intrusion.

EXISTING RECLAMATION PRACTICE

In Orange County, reclamation is practiced by OCWD at Water Factory 21 (WF-21, located in Fountain Valley, California, adjacent to the Sanitation District's Plant No. 1) and Irvine Ranch Water District (IRWD). Factory 21 provides advanced treatment to secondary effluent, including coagulation/clarification, recarbonation, multimedia filtration, carbon absorption, reverse osmosis desalination, and chlorination. Product water is injected into the ground to retard saline intrusion into the groundwater basin. This project has a capacity of up to 15 mgd. Currently, WF-21 consists of an advanced wastewater treatment process that includes reverse osmosis and granular activated carbon treatment to yield a product water that meets drinking water standards. Product water is then blended with water from deep wells to provide an adequate volume of injection water.

The Green Acres Project (GAP) has supplied reclaimed water to several Orange County cities[4] for landscape irrigation, industrial applications and toilet flushing. The GAP facilities produce non-potable, tertiary treated, recycled water through a process that includes flocculation, filtration and chlorine disinfection.

Between 1994 and 1997, OCSD provided a daily average of between 7.5 mgd and 8.5 mgd of secondary effluent to OCWD for reclamation (OCSD, 1998). In 1997, OCSD sent approximately 2.4 mgd to WF-21 and about 6.1 mgd to GAP; of this total, around 1 mgd of WF-21 / GAP process waste backwash water was returned to OCSD for treatment and disposal. In 1997, approximately 4.8 GAP water (including blending water) was returned to OCSD for on-site uses at Plant Nos. 1 and 2, while around 0.6 mgd of GAP backwash was returned to Plant No. 1 for treatment and disposal.

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4 The cities of Fountain Valley, Santa Ana, Costa Mesa, Newport Beach and Huntington Beach currently receive GAP water.

IMPORTED WATER AND FUTURE RECLAMATION

To meet growing regional water demands to support seawater intrusion barrier injection systems, groundwater replenishment, irrigation, and other commercial and industrial needs, water importation and future reclamation would be necessary. Currently, more than 50% of the water demand is supplied by water imported from the Colorado River through the Colorado River Aqueduct System, and from the State Water Project (SWP), which transports northern California water south. The Metropolitan Water District (MWD) of Southern California is the master wholesaling water agency for imported water supplies.

To preclude further contamination of the basin groundwater supply by seawater intrusion and to maintain an adequate amount of groundwater to meet increasing demands, OCWD began purchasing surplus Colorado River water in 1949 for groundwater recharge (Orange County Water District 1983).

In the 1950s, it became clear that Colorado River water would not provide an adequate supply of water to Orange County to meet the needs of a growing population. In an attempt to resolve the problem of a decreasing water supply, the California Department of Water Resources designed and built the SWP. The SWP transports surplus water from the Sacramento, San Joaquin, Feather, and other northern California rivers to central and southern California and to the San Francisco Bay Area. The SWP supplies have been delivered to Orange County since 1973.

Future transport of northern California water to southern California is contingent on availability, which decreases as demands in northern California increase. If additional water supplies are not secured and existing facility constraints continue to limit deliveries, SWP contractors in southern California would face increasing risks of water supply deficiencies during dry years. By the year 2020, it is projected that Orange County's population would increase from its current 2.6 million to about 3.5 million people (OCWD and OCSD, 1998); within the OCWD service area population would increase from 2.1 million to about 2.8 million. Even with extensive water conservation efforts, the sheer size of Orange County's population increase is projected to result in a need for more than 150,000 acre-feet per year (AFY) in additional new water supplies.

The GAP and the GWR System would alleviate deficiencies in water supply within the County by enabling OCSD and OCWD to address the issue of groundwater recharge on a regional scale. Within the GWR System, microfiltration and reverse osmosis are the basic processes that would be used to produce the reclaimed water. Using an alignment that generally parallels the Santa Ana River channel, the reclaimed water would be pumped to existing spreading basins at the Anaheim Forebay where the water would recharge underground freshwater aquifers. GWR System water would also integrate the present WF-21 activities into its operations. The GWR System would support the following uses: residential, commercial/industrial, agricultural, recreation, and habitat restoration/enhancement.

FLOODING

Orange County is vulnerable to chronic flooding during the peak rainfall periods. **Figure 4-4** shows flood prone areas as designated by the Federal Emergency Management Agency, Flood Insurance Map for the region. Both treatment plans are located within this flood zone. Also shown on Figure 4-4 is the Standard Project Flood (SPF)[5] area for northern Orange County. The U.S. Army Corps of Engineers has significantly reduced flood risks on the Santa Ana River since 1989. Concrete-lined levees now exist along much of the river and many tributaries. Flood control channels throughout the District's Service Area have been fortified to further minimize flood risk to the greater part of northern Orange County. The magnitude of historic flooding as shown in Figure 4-4 by the SPF area is not anticipated to be repeated due to flood controlling infrastructure efforts. However, flood prone areas remain along the lower Santa Ana River. Flood control effort is divided among three major areas: Tri-County system, regional system, and local drainage programs, briefly described below.

Tri-County System: The Santa Ana River Basin is the largest watershed in Southern California with over 3,200 square miles. The watershed is separated into an upper and a lower basin divided by Prado Dam and Reservoir. Because the Prado Dam was found to be incapable of withstanding a SPF, the U.S. Army Corps of Engineers has recommended the All-River Plan to construction projects to provide SPF protection.

Orange County Flood Control District (OCFCD) is empowered to construct and maintain flood control facilities to prevent or minimize loss of life and property caused by flooding, and for water conservation.

Local Drainage Program: The County's Local Drainage Program provides for construction of storm drain facilities in the unincorporated portions of the County in order to correct localized flooding problems which are not of sufficient magnitude to include in the Flood Control District Program. A similar local drainage program is carried out by each of the 27 cities in the county.

4.10 AESTHETICS

Orange County is characterized by landforms including coastal shorelines, flatlands, hills, mountains, and canyons. Broad sandy beaches extending into shallow offshore waters, coastal bluffs, uplifted marine terraces, and marshes characterize the Pacific shoreline. Besides the shoreline and Newport Bay, the "Saddleback" (the twin-peaked heights of the Santa Ana Mountains, is the signature landmark of Orange County. Major ridgelines occur in the Santa Ana Mountains, Lomas de Santiago and the San Joaquin Hills. Santa Ana Canyon, Capistrano Valley, Laguna, Aliso, Wood, Moro, San Juan, Trabuco Santiago, Modjeska, Silverado, Limestone, and the Black Star Canyons typify the canyons and valleys in Orange County.

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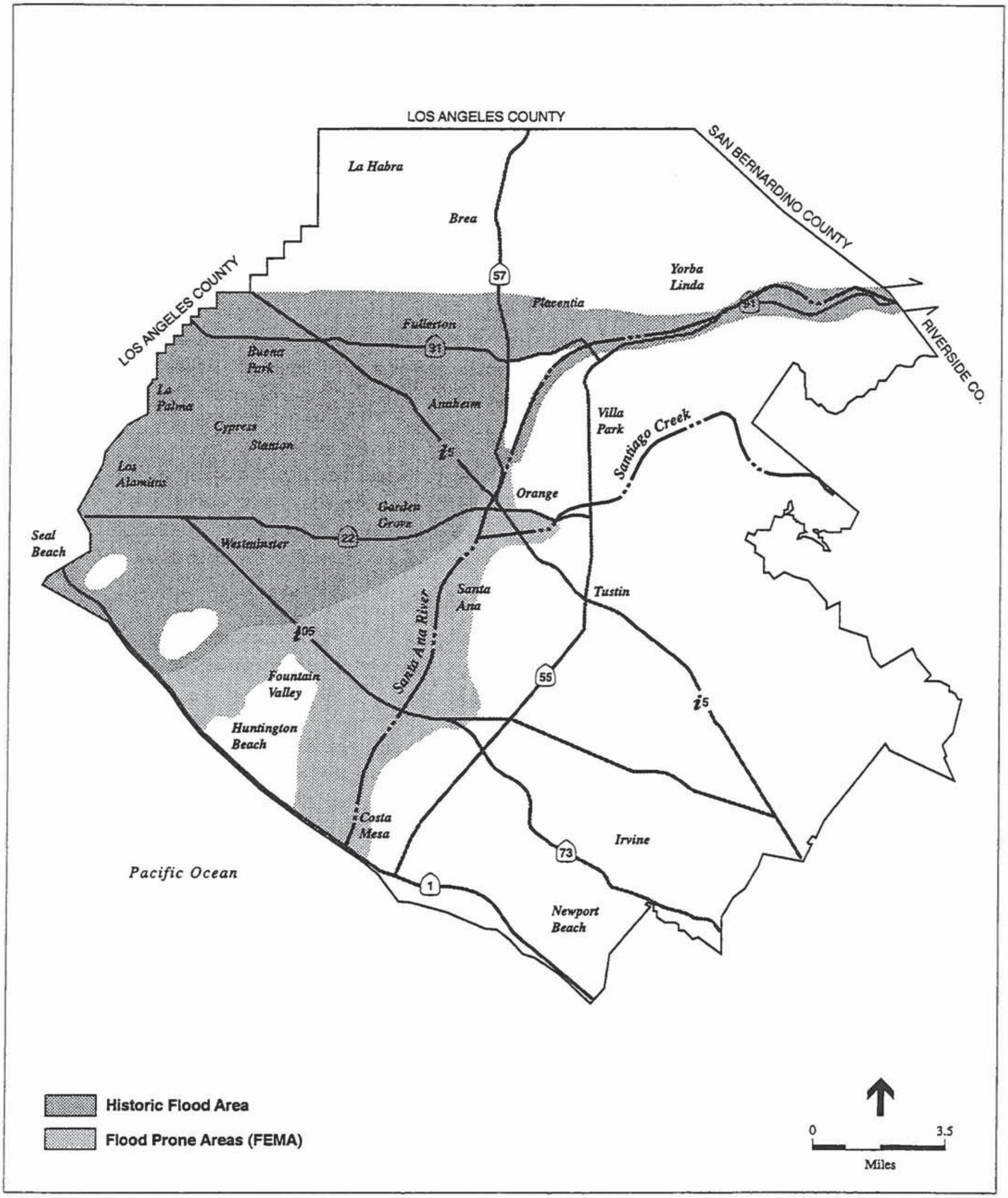
5 Standard Project Flood (SPF) is described as a storm of the most severe meteorological and hydrological conditions on record for a region.



SOURCE: U.S. Army Corps of Engineers, 1980.

OCSD Strategic Plan Program EIR / 960346

Figure 4-4
Santa Ana River Overflow Area

Rock outcroppings as in the Laguna Canyon and geologic formations such as the Sinks and Fremont Canyon are present in Orange County.

More than half of Orange County is urbanized. Approximately one-third of the county's remaining vacant developable land is forecasted for conversion to urban uses. Continued urban development would further diminish the natural amenities that have historically attracted people to this coastal environment. Prime agricultural land, wildlife habitat, open space, and natural drainage areas would continue to be consumed by urban development, and air pollution would be aggravated by the increase in motor vehicle emissions.

In 1972, the Open Space / Conservation Program was formally adopted as an effort to preserve regional open space. The largest single open space feature in the county is the Cleveland National Forest, established in 1908. Other open space areas include the Starr Ranch Audubon Sanctuary, Crystal Cove State Park (located along the Irvine Coast), Chino Hills State Park (adjoining San Bernardino and Riverside Counties). Open space is also provided by County local parks within the suburban and urban setting.

4.11 CULTURAL RESOURCES

Archaeological Resource Management Corporation (ARMC) conducted a cultural resources assessment of project area in which Orange County Sanitation District's (OCSD) proposed pipeline rehabilitation and replacement projects would occur. The purpose of the study was to identify any known cultural resources that could be affected by the proposed improvements.

The cultural resources study was based on a records and literature review of South Central Coastal Information Center (SCCIC) files at the University of California at Los Angeles and ARMC Archives for Orange County. Field studies were not considered to be necessary on the basis that all pipeline and replacement projects would occur within streets or in other previously disturbed areas.

PREHISTORIC RESOURCES

The earliest evidence of prehistoric use of the area north of San Diego is represented by the Millingstone cultural pattern. Such aboriginal populations in southern California were culturally conservative and were basically hunter-gatherers throughout the prehistoric period (Wallace, 1955; Warren, 1968). During this occupation, a littoral (coastal) adaptation can be seen. Small native populations subsisted on plant foods, including seeds, tubers, and berries. Inhabitants also collected shellfish along the coast and bays and hunted small and large game. They made extensive use of grinding stones. Projectile points were few in number, wide, thick, and heavy. They were presumably used as spearpoints based on their weights (Fenenga, 1953). Ceremonial stones known as cogstones, enigmatic ground discs, serve as one of the time markers for this early occupation.

In the ensuing cultural period, the Intermediate Horizon (Campbell) populations expanded their resource base. Hunting and fishing assumed greater importance in the economy, and the mortar and pestle tools, used in processing acorns and other fleshy plant foods, were added to the existing food processing equipment. Projectile points remained relatively large and heavy.

In the final prehistoric period, during the time of the Late Horizon Cultures, there is evidence of a marked expansion of local economies. One can observe an increase in cultural elaboration as well as a proliferation of non-utilitarian items in the cultural inventory of local populations.

The introduction of the sea-going canoe (tomol) in the Santa Barbara and Ventura area ushered in a marine adaptive pattern in vivid contrast to the littoral, or land-locked, pattern of earlier periods. Fishing and hunting of sea mammals assumed greater significance in northern populations, while populations in the central and southern zones continued to rely primarily upon plants, shellfish, and terrestrial game, which they hunted with small, lightweight arrowpoints and a bow.

The trading of steatite and other lithic resources and the introduction of pottery in the southern zone also characterized the Late Horizon Culture in prehistoric southern California. Pestles and portable mortars, especially of the basket-hopper type, were the dominant grinding tools in the northern zone, while the central and southern zone inhabitants continued to rely upon manos and metates, as well as the occasional use of bedrock mortars and grinding slicks.

Personal ornaments of shell, bone, and stone abounded in the late period. Throughout the southern California region, the Late Horizon was a time of cultural flowering and population growth within the overriding influence of the maritime patterns of the Santa Barbara coast and Channel Islands.

ETHNOHISTORY

Ethnographically speaking, the study area falls within the territories of the Juaneño-Luiseño and the Gabrielino people. With respect to these people, the Juaneño are so named by their association with the Mission San Juan Capistrano, the Luiseño with the Mission San Luis Rey, and the Gabrielino with the Mission San Gabriel. Shoshoneans are Takic speakers of the wider Uto-Aztecan family of languages. It is assumed that Uto-Aztecan speakers entered California prior to 2000 B.C. with arrival in the Los Angeles Basin occurring by 1000 B.C. (Moratto, 1984; Kowta, 1969).

Known as hunter-gatherers, these native populations exploited a diverse set of microenvironments from the coast, coastal plain, foothills, Santa Ana Mountains and San Gabriel Mountains, to the interior valleys of southern California. The northern boundary of Juaneño-Luiseño territory is traditionally described as Aliso Creek, although the territory may have actually extended as far north as the mouth of the Santa Ana River (Belardes, 1990). The inland portion of the territory extended to the eastern side of the Elsinore Fault Valley, where it was bordered by the Cahuilla territory. To the south, Luiseño-Juaneño territory extended to east of Palomar Mountain and then westward along Agua Hedionda Creek to the Pacific Ocean (Bean and Shipek, 1978). Gabrielino territory extended from either Aliso Creek or the mouth of the Santa Ana River westward through the Los Angeles Basin to the islands of Santa Catalina, San Clemente, and San Nicolas. The northern boundary of the Gabrielino territory was Topanga Creek, where it continued through the Santa Monica and San Gabriel Mountains to San Bernardino (Bean and Smith, 1978).

With the coming of the Spanish in 1769, the native populations were brought into the mission system and forced to adapt to a new social and economic order with drastic consequences, such as radical reductions in population numbers and elimination of their aboriginal way of life. Remnant populations of the descendants of these native peoples still occupy their ancestral lands.

HISTORIC BACKGROUND

The arrival of the Portolà Expedition in 1769 and establishment of Catholic missions marked the first efforts at extending Spanish control into Alta California. These actions were intended to protect Pacific Coast shipping areas against Russian or English occupation. Beginning in San Diego, the padres surveyed the lands as far north as Monterey Bay and secured them for the Spanish Crown. Mission sites were selected by Fathers Crespi and Gomez (Hallan-Gibson, 1986).

The Portolà party arrived in Orange County on July 22, 1769, at a site in Cristianitos Canyon. The following day the party passed near the future home of Mission San Juan Capistrano. The expedition continued northwestward and stopped at a total of seven campsites (Smith, 1965) in what became Orange County.

The local native inhabitants were brought under the control of the Mission San Juan Capistrano or the San Gabriel Mission. They were converted to Catholicism and provided the mission with a large labor pool. The padres taught them the necessary skills to grow crops, tend cattle, and to make wine, pottery and other crafts. The missions intended to prepare them to look after their own lands that were held in trust for them. Spanish legislators called for the disestablishment of the missions and returning of lands to the natives as early as 1813. However, it was not until the Mexican Period that secularization began.

At the end of the Mexican Revolution, mission lands were seized and turned over to Mexican citizens of the Catholic faith and of good character. The Mission San Juan Capistrano was the first mission to be secularized in 1834. A series of land grants, or grazing rights, were issued by the Spanish Crown. The land between the Santa Ana and San Gabriel Rivers was given to Manuel Nieto in 1784; this was the first land grant in Orange County. The second, called Rancho Santiago de Santa Ana, went to Juan Grijalva and Jose Yorba, his son-in-law. In 1810, the grant was confirmed to Yorba and Grijalva's grandson (Hallan-Gibson, 1986). There followed a period of growth and development as rancheros built adobe homes, ran large herds of cattle and sheep, engaged in foreign trade, and dabbled in politics.

California was drawn into the Mexican-American War in 1846, and Governor Pico fled the oncoming American Army. His son-in-law John Forster, an American sympathizer, tipped off the Union soldiers in a march through Orange County that may have saved their force from defeat by 600 Mexicans (Hallan-Gibson, 1986). After the Treaty of Guadalupe, Hidalgo ended the war in 1848 and California entered the Union. The land claims of the rancheros were scheduled to be upheld, but subsequent laws required the land owners to prove their claims, requiring considerable time and expense. The courts eventually confirmed most of the land claims in Orange County.

In the American Period, life on the ranchos continued much as before, though squatters, rustlers, and mounting debts grew troublesome. Large landholdings were increasingly divided; towns and settlements grew in number. During the 1860s, severe drought, smallpox, and torrential rains alternately took their toll on the large landholders and other settlers in southern California. The cattle market collapsed, land was devalued, and a diversified economy developed. The end of the Civil War brought an impetus to settlement. Land was cheap, and thousands flocked to the Golden West. A real estate boom ensued in the 1880s. The arrival of the Southern Pacific and Sante Fe Railroads provided transportation for people and products into and out of southern California. Sheep ranching became highly profitable due to the scarcity of cotton in the South. Large land grants were partitioned. Development proceeded at a rapid pace through the late nineteenth and early twentieth century. Improvements in transportation and communication contributed to the boom. The citrus industry, and associated beekeeping industry, were among the most successful enterprises in the area during this period.

The County of Orange was approved by the California legislature on June 4, 1889. At that time only three cities in the County had been founded: Anaheim (1878), Santa Ana (1886), and Orange (1888). Fullerton (1904), Seal Beach (1915), Brea (1917), La Habra (1925), Placentia (1926), and Tustin (1927) were added in the early 1900s. An additional 18 cities have been added more recently (Gass, 1988).

LOCATION / SENSITIVITY

Important physical remnants of our cultural heritage are present throughout Orange County. Sub-surface resources such as archaelogical and paleontological sites are abundant in South County, along the coast and in creek areas. General areas of sensitivity for prehistoric and paleontologic resources, and Orange County's Historical Areas are shown in the Orange County General Plan (Orange County, 1984).

According to the *1977 EIS* prepared by the District, there are no cultural resources located at either Plant 1 or Plant 2 (OCSD, 1977). These conclusions were based on a thorough review of archaeological literature and field surveys conducted at the two sites. Moreover, the *1977 EIS* determines that extensive modifications of both sites over the years, both historically by flooding and recently by plant operations (including biosolids drying, borrow pits, and other treatment processes), further reduces the possibility of encountering previously unknown archaeological resources during project construction. For these reasons, a discussion of cultural resources impacts at the plant sites is excluded from the detailed analysis in Chapter 6.0, Treatment System Setting, Impacts and Mitigation.

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CHAPTER 5

OCEAN DISCHARGE SETTING, IMPACTS, AND MITIGATION

CHAPTER 5.0

OCEAN DISCHARGE SETTING, IMPACTS AND MITIGATIONS

5.1 MARINE ENVIRONMENT AND PUBLIC HEALTH SETTING

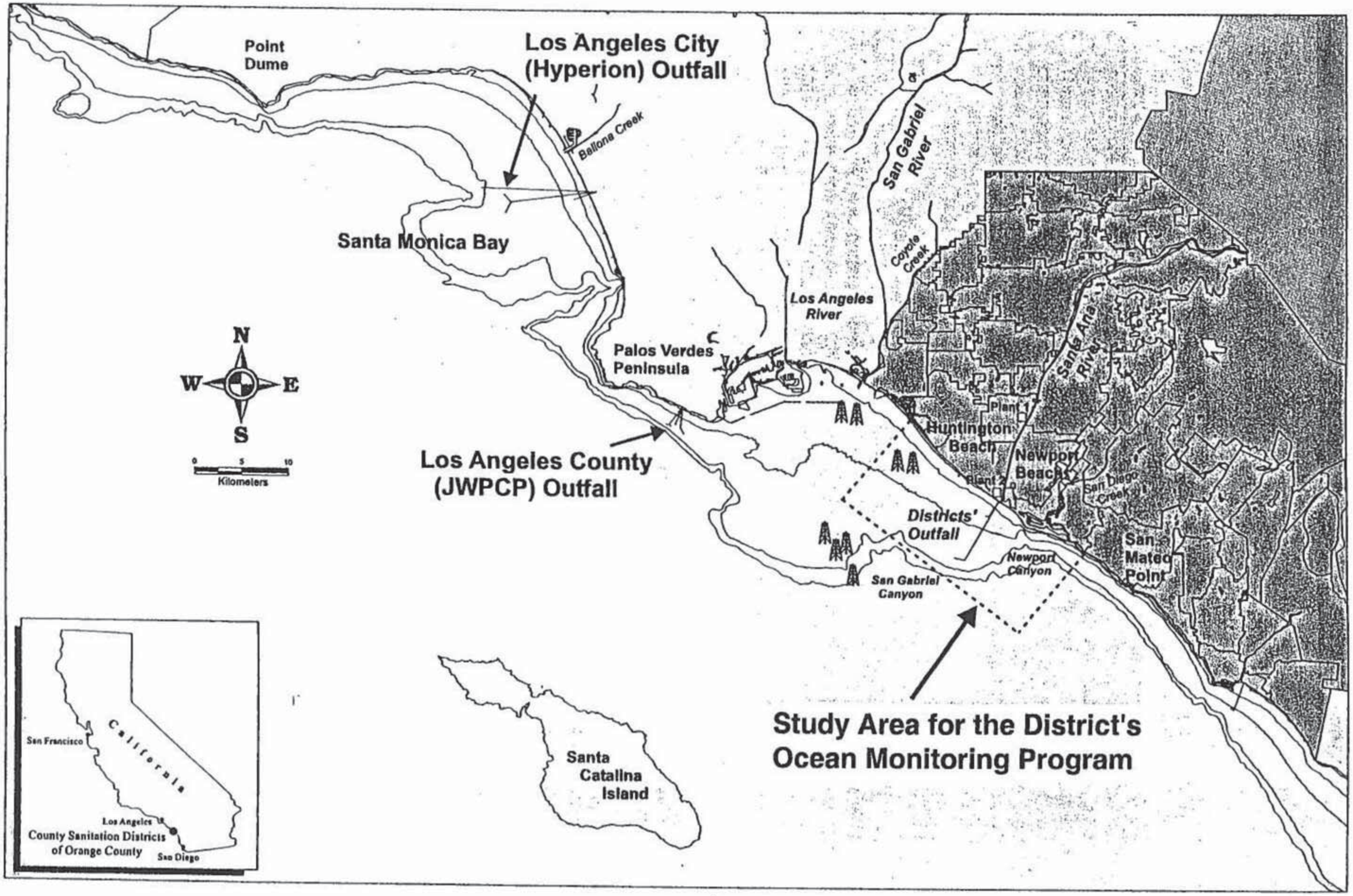
5.1.1 MARINE ENVIRONMENT – OVERVIEW

STUDY AREA

The District discharges treated wastewater effluent to the deep ocean environment, approximately four miles offshore of Huntington Beach and Newport Beach (see **Figure 5-1**). This section of the coast lies in the south-central portion of the Southern California Bight (SCB), a regional area that extends from Point Conception (Santa Barbara County) to a point just south of the United States/Mexico border, which encompassess the coastal watersheds and extends offshore to the California borderlands. The SCB is characterized by both beautiful beaches and rugged shoreline with a complex submarine topography of varying continental shelf widths interrupted by islands, canyons, and basins. The District's outfalls are located on the San Pedro Shelf bounded to the south by Newport Canyon and to the northwest by San Gabriel Canyon. The shelf sediments in this area are primarily sands with silts and clays, inhabited by biological communities typical for these environments.

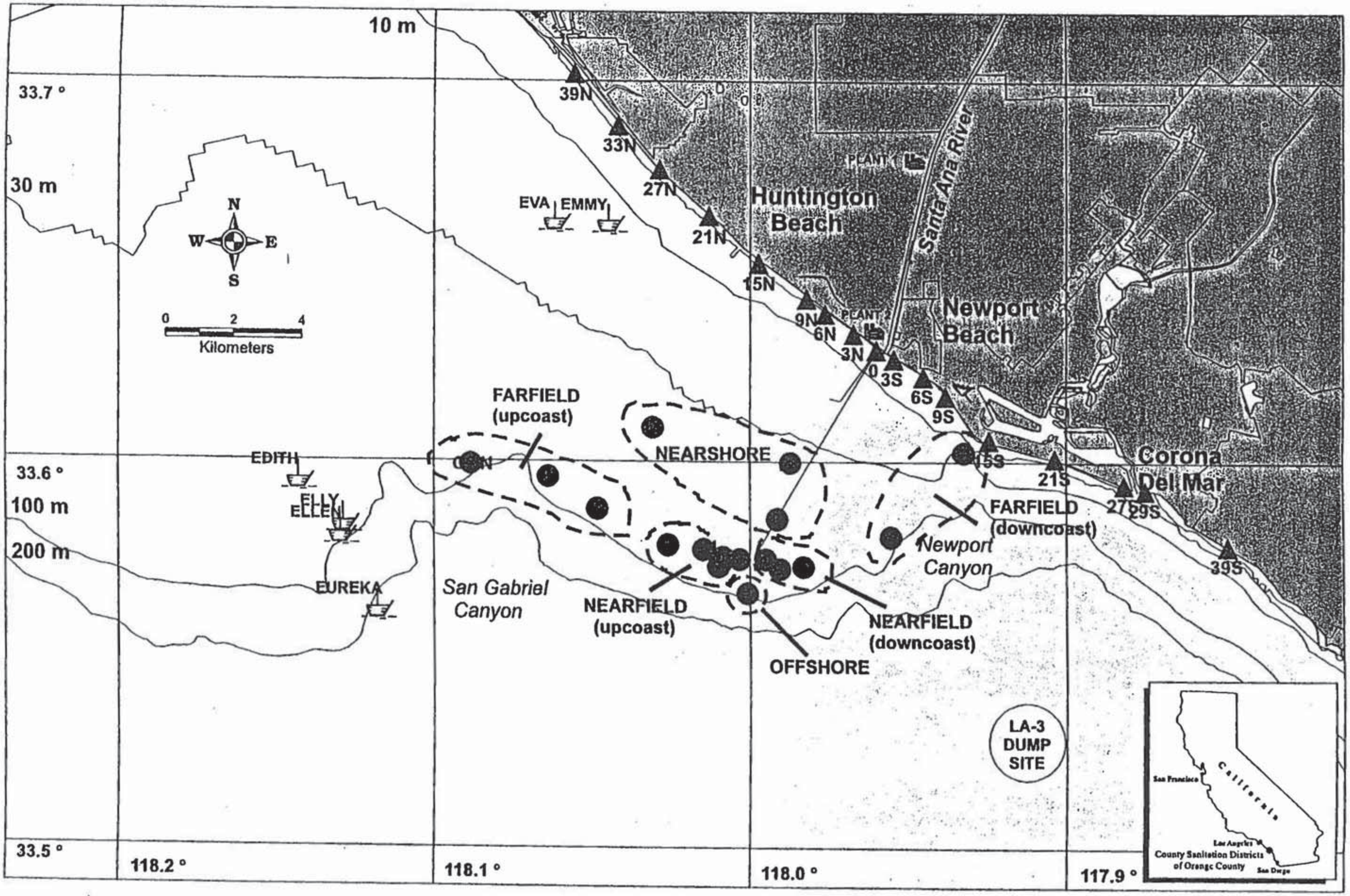
The District has two ocean outfalls located off of Huntington Beach, California - an operational 120-inch diameter outfall and an emergency standby 78-inch diameter outfall (**Figure 5-2**). These two outfalls extend directly off the coast from Plant No. 2, near the mouth of the Santa Ana River. The 78-inch outfall extends 7,200 ft offshore and then turns upcoast, with a 970-foot diffuser section that terminates in a water depth of about 63 ft. The 78-inch outfall was completed in 1954 and was operational until 1971. Currently, the 78-inch outfall is maintained for emergency overflow operations and has not been used, except for periodic testing, in 28 years.

The 120-inch outfall became operational in 1971. The 120-inch outfall extends 4 miles from the shoreline, with an extensive diffuser section extending upcoast for 6,000 ft and terminating in a water depth of 188 ft. Both of these outfalls are buried beneath the surface from onshore out to a water depth of about 27 ft. From this location to the diffuser terminus, the outfall pipes lie upon the seafloor and are heavily ballasted with rock. As such, the District's outfall pipes, diffuser structures, and ballast represent one of the largest artificial reefs in the SCB (CSDOC 1995a, 1996a). These structures are estimated to cover approximately 1.1 million ft^2 of subtidal and mainland shelf soft-bottom habitat.



SOURCE: OCSD, Marine Monitoring Annual Report, 1999

Figure 5-1
District Outfall Location - General and SCB



SOURCE: OCSD, Marine Monitoring Annual Report, 1999

Figure 5-2
District Outfall Locations Plus Monitoring Stations

As part of the Strategic Plan, the District has evaluated, in concept, construction of a new 120-inch diameter outfall in the future. This new outfall structure would serve as an alternative discharge option to handle increasing peak wet weather flows through the year 2020, and/or to handle ultimate average annual flows and peak wet weather flows associated with ultimate buildout of planned land uses within the District's service area beyond 2020. Construction of a new outfall is not the preferred alternative to address peak wet weather flow through the year 2020. Therefore, the Strategic Plan does not identify or develop a specific location for this second outfall. For program-level impact evaluation purposes, the location of the diffuser has been sited approximately 1 mile upcoast from the terminus of the existing 120-inch outfall at a water depth of about 188 ft. This conceptual site location was selected to evaluate the potential impacts and benefits to the marine environment of operating two separate discharge points, rather than one double-barrel discharge location. This proposed conceptual discharge location has been monitored regularly as part of the District's Ocean Monitoring Program (OMP) represented by Station 5 (**Figure 5-2**). Thus, there is extensive information for the environmental setting at this location.

EFFLUENT QUALITY

The District's average annual effluent discharge in 1998 was 255 mgd. Section 2.9, in Chapter 2.0 – Existing Facilities, presents current effluent quality data and summarizes the trends in effluent quality improvement evident over the past several years. [See also Appendix E for data tables and graphs regarding OCSD past and projected effluent quality and trends.] Trends over the past two decades in discharge rates and concentrations for many wastewater constituents reflect changes in the District's treatment processes and source control programs as well as changes in the influent volumes. From 1985 to 1996, metals discharges from the District's wastewater were substantially reduced. Concentrations of organochlorine (e.g., pesticides) or petroleum related compounds are generally undetectable in the District's wastewater effluent.

The engineering design and location of the outfall in a well-mixed coastal environment causes the effluent to immediately achieve a dilution of about 180 parts seawater to 1 part treated effluent (180:1). A high initial dilution (lowest estimate is 148:1) of the wastewater discharge occurs within the immediate mixing area (Zone of Initial Dilution (ZID), within 60 m [198 ft] of the outfall) and greatly reduces these differences. This estimate was based on data available for the original 301(h) permit. However, updated information used recent calculations by Stolzenbach and Hendricks (1997) indicate 300:1. It is notable that the District's new NPDES permit, that will cover 1998-99 for the next reporting period, specifies a 180:1 initial dilution.

OCEAN MONITORING PROGRAM

As described in Section 2.12, above, the District conducts an extensive ocean monitoring program of the coastal environment to assess effects from the wastewater discharges on water quality, bottom conditions, biological organisms, and human health. The program has been a required element of compliance with the District's NPDES permit, first issued in 1985 and renewed in 1998. Shoreline monitoring and offshore water quality, sediment, fish and infaunal communities, and bioaccumulation monitoring are conducted to evaluate compliance with the District's NPDES permit, State water quality standards, and federal 301(h) decision criteria. **Figure 5-2** highlights the key monitoring stations where water quality and benthic sediment and aquatic organisms are sampled routinely, as well as the shoreline monitoring stations. There are additional monitoring stations for water quality and benthic sampling beyond those shown on this figure. **Figure 5-2** indicates how the monitoring stations are grouped and referred to with respected to their location to the 120-inch discharge point. Terms used in this impact analysis including farfield, nearfield, nearshore, and offshore are illustrated on **Figure 5-2**.

The District has now completed 13 years of marine monitoring. Each year the District publishes an annual report to summarize the findings of the marine monitoring program. Much of information present in this EIR chapter is based on the results of this extensive monitoring program. The Marine Monitoring 1998 Annual Report (CSDOC 1999) is hereby incorporated by reference. Copies of this and annual reports for prior years in the monitoring program are available for review at the District's offices, located at Plant No. 1 in Fountain Valley, California.[1]

SUMMARY RESULTS OF OCEAN MONITORING PROGRAM

The following key conclusions are summarized from the District's 1998 Marine Monitoring Annual Report.

- Seasonal warming and cooling of coastal waters, coupled with relatively minor changes in salinity produce layering (stratification) of water by depth. The layer of most rapid temperature and salinity change with depth (referred to as the thermocline or pycnocline) acts as a strong barrier that limits rising and mixing of the wastewater plume. This generally restricts the relatively warm, low salinity plume at depths below 10 m (33 ft) to as much as 40 m (132 ft) during spring through fall. During winter, stronger natural mixing from winds, currents, and surface waves and swells tends to minimize effects from the plume even though stratification is weak or absent. Nevertheless, some plume-related changes, elevated concentrations of fecal coliform bacteria in offshore surface waters in particular, were evident during December 1997-February 1998;

- Historical data (CSDOC 1996a) indicate predominant surface current directions during all seasons are downcoast, and bottom currents are upcoast, generally not towards shore. This also minimizes plume effects, as seen in the 1997-98 data;

- Plume effects are characterized by slight, environmentally insignificant changes in temperature, salinity, dissolved oxygen, pH, transmissivity, and total suspended solids. Most of these changes are in the nearfield (within 2 km [1.2 miles] of the offshore end of the outfall) and restricted below the pycnocline. However, plume-related decreases in salinity occasionally extend into the farfield (as least 7 km [3.5 miles] upcoast);

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1 Orange County Sanitation District, 10844 Ellis Avenue, Foundation Valley, CA. (714) 962-2411.

- Fecal coliform bacteria and ammonium, representing direct indicators of the plume, are commonly detected at nearfield and farfield locations during most months, but almost always below 10-m depths. Exceptions as noted above where in December 1997-February 1998 when a pycnocline was absent at most stations;

- Shoreline data on total coliform bacteria showed continued high compliance with permit standards (about 96% for the median rule and 99.5% for the 10% standard). The few out-of-compliance events were due primarily (if not completely) to river and other runoff sources from land, but not the offshore wastewater discharge;

- The number of beach grease particles was very low (only one). This represented a continued excellent record suggesting no significant effects from the offshore discharge;

- Effects of the wastewater discharges on sediment metal concentrations varied for individual metals. Some metals, such as silver and cadmium, were elevated several-fold in sediments near the outfall, while concentrations of other metals in near-outfall sediments were within a factor of two of the respective concentrations at the reference site;

- Infaunal community measures reflect the environmental complexity of the study area, combined with the influence of the wastewater discharge and reef effects. However, the community is diverse and abundant compared to the regional reference area. Abundance was lower in 1997-98 than most previous years, likely due to natural factors such as the recent El Niño event and not the wastewater discharge;

- Natural features of the study area account for most of the observed variability in species distribution and abundance (Diener et al. 1995; CSDOC 1996a, 1997, 1999). Water depth is the most important determinant of community composition, followed by sediment grain size and canyon effects;

- Infaunal abundance is the community measure that most clearly demonstrates an outfall effect. Increased abundances of tolerant indicator taxa, such as *Capitella 'capitata', Euphilomedes carcharodonta, and Parvilucina tenuisculpta,* indicated an outfall effect, but did not appear to affect community diversity. Historical decreases in infaunal abundance were most evident for the pollution sensitive brittlestar, *Amphiodia urtica*. However, general increases in the abundance of this species near the outfall since 1985 likely reflect lower mass emissions and improving sediment quality due to improved source control and wastewater treatment practices;

- Abundance beyond the Zone of Initial Dilution (ZID) boundary was comparable to regional reference surveys, however, winter abundances were exceptional low due to winter storms and the warmer waters associated with El Niño. Higher abundances near the outfall in summer did not result in a decrease in species richness (number of species) within and beyond the ZID. Thus, the infaunal community exhibited a response to the wastewater discharge that is reflected by gradients in abundance and diversity indices. However, beyond the ZID boundary, these changes did not result in a degraded community. Consequently, the bottom environment is not degraded, and a balanced indigenous population (BIP) occurs in the study region, thus fulfilling compliance objectives;

- Long-term trends in several sediment quality indicators suggest that the magnitudes of excess organic materials (e.g., sulfides) and trace contaminants (e.g., silver and cadmium) are decreasing over time (CSDOC 1999);
- A portion of this change is attributable to changes in the wastewater discharge (i.e., improved quality), as evidenced by relatively greater rates of change for cadmium concentrations in sediments near the outfall (CSDOC 1999);
- Decreasing contaminant concentrations at reference locations suggest regional inputs (e.g., watershed) have also improved and mass loading has decreased;
- Abundances of some sensitive infaunal species (e.g., *Amphiodia urtica*) appear to be increasing; these increases are likely in response to improving sediment quality near the outfall; and
- Other changes, such as increasing numbers of species, are occurring more uniformly over the study area, indicating regional processes and/or improving conditions related to decreasing watershed loadings.

5.1.2 PHYSICAL ENVIRONMENT

The following discussion describes the physical environment for the two existing outfalls and the proposed new outfall location. There would be essentially no difference in the physical environment between the existing 120-inch outfall and the proposed new outfall location. The physical environment for the inshore 78-inch outfall differs substantially by having slower current speeds, a stronger influence by winds, coarser sediments, and more physical disturbance due to swell and storms.

The physical environment of the SCB is strongly influenced by seasonal changes as well as tidal and interannual changes (Emery 1960; Hickey 1993; Jackson 1986). Temperature and salinity determine the pycnocline, a density discontinuity of the water column that serves as a barrier to the vertical movement of the wastewater plume to the surface. The thermocline is a rapid decrease in temperature with increased water depth. Generally, the thermocline and pycnocline occur over the same region of the water column. Thermoclines/pycnoclines tend to develop in spring and are usually well established by April. Strongest layering (stratification) occurs throughout the summer, and stratification begins to break down in fall. By January waters are not stratified, and temperatures and density tend to be little changed throughout the water column. Oceanographic conditions within the District's study can be classified into four seasonal patterns: stratified water column (June/July-October), fall transition (November-December), unstratified to weakly stratified (January-March), and spring transition (April-June). Spring transition usually occurs with upwelling and downwelling periods.

CLIMATE / METEROLOGY

The climate of the SCB is classified as Mediterranean coastal, with long, warm, dry summers and relatively wet, short, and mild winters. Mean annual air temperatures are moderated by the ocean and vary by only a few degrees throughout the SCB, e.g., 17.8°C in Los Angeles, 15°C in Santa Barbara, and 16.7°C in San Diego (Dailey et al. 1993). For the study area the mean air temperatures ranges from 12 to 15°C in January and from 14 to 22°C in August (Kimura 1974).

Annual rainfall in the Orange County watershed has ranged from about 5 to 27 inches since 1985 (CSDOC 1996a). Most precipitation occurs during the months of December through March, but rainfall for any period is highly variable. Episodic storms, drought, and El Niño cycles are natural events, generally correlated with large-scale changes in sea temperatures and weather patterns, that have significant impacts on physical, chemical, and biological processes within the SCB.

Runoff from the major coastal watersheds entering San Pedro Bay near the District's outfalls is collected by the Santa Ana and San Gabriel Rivers, and is an important episodic source of freshwater, sediments, suspended particles, nutrients, and contaminants to the coastal environment (the same is typical for outflow from Newport Bay) (Brownlie and Taylor 1981; Hood 1993). The largest river discharges occur at about 20-to 30-year intervals (Dailey et al. 1993) and are often associated with El Niño events. Intermittent flows from these watersheds are responsible for substantial inputs of contaminants to the SCB (SCCWRP 1992; Schafer and Gossett 1988).

WINDS

Wind patterns and speeds are dominated by pressure centers that generally move easterly through the SCB. Subtropical high-pressure systems centered offshore produce weak southerly and onshore flows (Dorman 1982). Winter offshore winds during the day are typically from the northwest and are generally classified as moderate, averaging about 6 to 9 mph (Dailey et al. 1993; Kimura 1974). After sunset these winds often shift and become westerly. Wind strengths diminish with proximity to the shore and average about half the speeds found offshore. However, stronger winds from winter storms and/or the northward penetration of southern tropical storms may occur. During the spring, northwest winds prevail causing surface waters to be displaced to the south and offshore. The displacement of surface waters causes upwelling of deeper, colder waters to the surface. Within the coastal area, diurnal land breezes are typical during summer when low pressure fronts form over the deserts east of the SCB. These diurnal breezes produce morning coastal fog and low stratus cloud layers. Occasionally, high-pressure systems will form over the Great Basin causing a reversal in surface pressure gradients producing strong, dry, gusty offshore winds. These Santa Ana winds are most common in late summer but can occur during anytime of the year (Dailey et al. 1993).

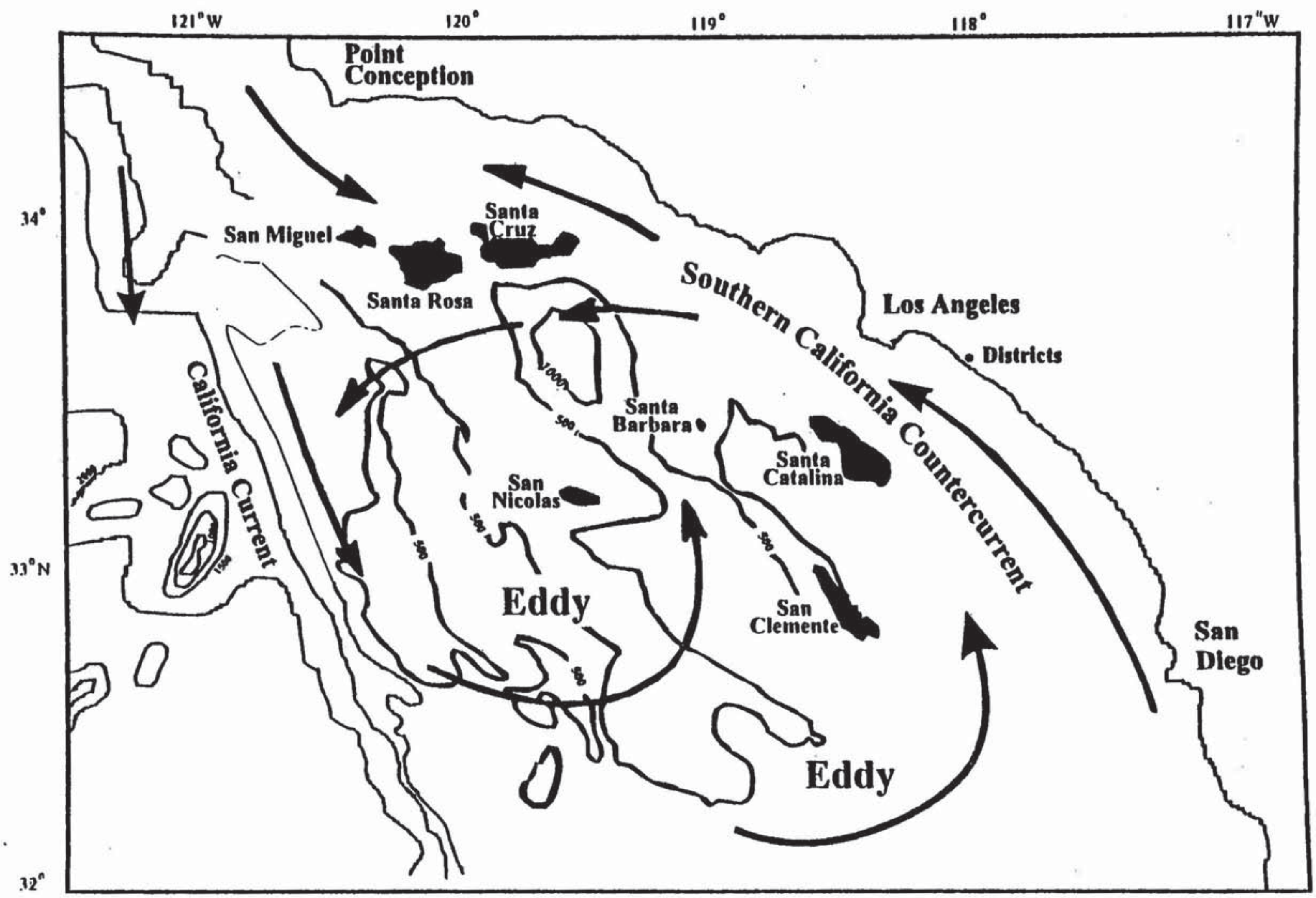
CURRENTS

The dominant hydrographic feature of the California coast is the California Current, which dominates the general water parameters and circulation of the area (Dailey et al. 1993; Hickey 1979; Jones 1971) (see **Figure 5-3**). The California Current originates in colder, northern waters and flows southeastward off the central California coast with a maximum speed of 0.2 to 0.3 mph (Hickey 1979; Pavlova 1966). At Point Conception, where the coastline turns in an easterly direction, the California Current continues its southerly course offshore following the continental borderland, until it swings toward the coast between San Diego, California, and Punta Colnett, Mexico.

This onshore movement of surface waters produces a counterclockwise gyre around the Channel Islands resulting in northerly flows up the central portion of the SCB, forming the Southern California Countercurrent. This northern flow is partially blocked by the northern Channel Islands that divert the bulk of the currents to the west, where they merge with the California Current. The remaining portion of the countercurrent is diverted to the south, where it flows along the coast of the SCB starting near Point Hueneme. This southern inshore flow strongly influences the District's outfall area (Jackson 1986). The remaining portions of the Southern California Countercurrent flow into the Santa Barbara Channel, producing currents of varying strengths with time scales ranging from hours to months (Dailey et al. 1993). Jones (1971) estimated that the water moving around the Channel Islands was replaced three to four times per year. Hickey (1992) has suggested that occasional extreme fluctuations might flush the entire SCB within a few weeks. The surface circulation patterns of the SCB are complex, and the large counterclockwise gyre patterns are typical for most seasons. Peak flows are in summer and fall (Lynn and Simpson 1987) and weaken in winter and spring (Hickey 1992).

In contrast to the complex surface patterns, subsurface waters flowing beneath the California Current and the Southern California Countercurrent at depths greater than 100 ft generally flow northerly. This northerly flow, called the California Undercurrent, has average speeds of 0.2 to 0.5 mph, with maximum speeds occurring over slope areas (Hickey 1992). The undercurrent is variable with net flows occurring over time scales of hours to weeks.

Extensive current measurements were made over a four-year period within the District's study area and near the 120-inch outfall from 1986 to 1988 and from 1993 to 1994 (CSDOC 1996a, b). Two primary current directions are evident near the District's outfall (Gunn 1992): near-surface flows (46 ft) are more upcoast than downcoast (northwest with some reversal southeast), while near-bottom currents (236 ft) are almost exclusively upcoast (northwest) (CSDOC 1996a). These patterns are typical for both summer and winter. However, currents at both depths occasionally flow in the opposite direction and can be quite variable at intermediate depths (Gunn 1992). This is important as it indicates that the transport of wastewater particles is in these directions, and rarely towards shore. Average current speeds for near surface waters are 0 to 0.3 mph, while near-bottom speeds are slightly higher.



SOURCE: OCSD, Marine Monitoring Annual Report, 1996a

Figure 5-3
California Current and Countercurrent

WAVES

Waves (swell) exert a significant influence upon the water column and nearshore bottom habitats (Emery 1958). Significant wave heights and high velocity swell tend to be most prominent during winter and spring and generally result from storms in the northern Pacific. The sheltering effect of the Channel Islands is significant in reducing the magnitude of waves affecting the District's study area (Hickey 1993). Waves produce circular water motions within the water column, and the magnitude of this effect is proportional to the wave height. This effect is attenuated in the water column such that in deep water, the circular motion of the water column does not influence the bottom. However, in shallow water, the circular motion within the water column can induce the resuspension and transport of bottom sediments. Large winter storms and associated swell can re-suspend sediments in water depths over 100 ft in the study area. This resuspension of sediments causes turbidity in the water column and may disrupt the benthic communities.

TIDES

The SCB has mixed semidiurnal tides that move up the coast from the southeast to the northwest. Generally, each day is characterized by two highs and two low tides: high-high tide, low-low tide, high-low tide, and a low-high tide. The daily tidal range is slightly less than 3 to 10 ft.

5.1.3 WATER QUALITY

Thirteen years of monitoring studies have indicated that there are no environmentally significant water quality effects from the District's discharge (CSDOC 1999). Important factors that prevent or minimize effects include (1) the occurrence of natural barriers, caused by water leyring (density differences) that influence mixing and movement of ocean water and restrict effluent discharge related changes to ocean waters below 16 to 33 foot depths during most months; and (2) high natural mixing within this coastal environment. These factors and the high dilution of the wastewater discharge result in relatively small changes in most water quality parameters that are within the typical ranges to which marine organisms are exposed. **Table 5-1** summarizes the changes in various ocean water quality parameters expected with the addition of treated effluent (after initial dilution at 148:1) compared to natural seawater, at approximately 200 foot depth (the depth of the outfall). As shown, only slight changes are expected that generally fall within the range of natural variability, and that consistently comply with the water quality requirements established by the California Ocean Plan.

SOURCES OF OCEAN WATER

Numerous researchers have described the basic water mass characteristics of the SCB (e.g., Jackson 1986; Lynn and Simpson 1987; Reid et al. 1958; Sverdrop and Fleming 1941; Wooster and Jones 1970). The California Current system includes three distinctive water masses (Hickey 1993):

TABLE 5-1
EXPECTED CHANGES (COMPARED TO NATURAL SEAWATER AT APPROXIMATELY 60-M DEPTHS) FROM THE DISTRICT'S WASTEWAER DISCHARGE, FOLLOWING INITAL DILUTION (148:1)

Parameter	Approx. Natural	Expected Change	CA Ocean Plan Objective
Temperature	9-12 C	Increase less than 0.2° C	N/A
Salinity	33.5-34 ppt	Decrease approximately 0.2 ppt	N/A
Dissolved Oxygen	4-6 mg/L	Decrease less than 0.1 mg/L	Less than 10% decrease
pH	7-8.5	Decrease less than 0.1 unit	Less than 0.2 unit change
Total Suspended Solids	<1 mg/L	Increase approximately 0.3-0.4 mg/L	No more than 10% change in ambient light transmittance
Ammonium	<0.02 mg/L	Increase approximately 0.25 mg/L	Less than 4-6 mg/L
Coliform Bacteria	0	Increase up to a most probable number (MPN) of 6,750/100mL	Limits set for body contact recreation and shell fish areas.

SOURCE: County Sanitation Districts of Orange County, California.

- **Pacific Subarctic water,** which enters from the north is characterized by relatively low temperature, low salinity, high dissolved oxygen, and high nutrients.
- **North Pacific Central water**, which enters from the west, is characterized by relatively warm temperature, high salinity, and low dissolved oxygen and nutrients.
- **Pacific Equatorial water**, which enters from the south, is characterized by relatively high temperature, high salinity, low dissolved oxygen, and high nutrients.

As the California Current moves south, the Pacific Subarctic water entrains and mixes with warmer, saltier North Pacific Central water, but retains much of its lower salinity. The warm, saltier, Pacific Equatorial water moves into the study region from the south, generally below the surface mixed layer. The colder waters representing a mixture of Subarctic and Equatorial Pacific waters may extend periodically from deep depths in the study region near the bottom.

These water masses and their movement affect the distribution and characteristics of the water column environment within the study area, including the fate of the wastewater discharge (CSDOC 1996a).

CHANGES IN WATER CONDITIONS

Near the ocean surface, temperature and salinity often change without mixing with other water masses. Warming by the sun is a primary factor that affects surface water temperatures in southern California from June to October (Jackson 1986). Warming of the surface waters causes the development of seasonal thermoclines, which strongly affect the depth distribution of most water quality parameters. During other months, temperature is influenced mostly by movement of water masses into the region. Changes in salinity are controlled primarily by mixing due to waves and winds (Roden 1959). The exception is during winter storms, when freshwater runoff can cause reductions in near-surface salinity up to many kilometers from shore. Oxygen can also change rapidly in near-surface waters as a result of natural biological cycles e.g., primary production (Eganhouse and Venkatesan 1993). Understanding these processes is critical to the interpretation of water quality data and the impact of wastewater discharges upon these measures.

Seasonal upwelling and downwelling have substantial effects upon water quality within the District's study area (Rozengurt and Nguyen 1995). Episodic movement of deeper water masses onto the coastal shelf during spring and early summer typifies upwelling events. Upwelling is initiated when northern winds displace surface waters offshore, resulting in replacement by colder, deeper waters (Hickey 1990). These deeper waters are colder and have lower dissolved oxygen, but they have higher salinity and most importantly are richer in nutrients. Upwelling of nutrient-rich, deeper waters is critical to primary production and the productivity of coastal waters. This seasonal input of nutrient-rich waters is especially important when considered in the context of the decreases in surface water discharges to the coastal environment. Downwelling occurs when southern winds push offshore waters towards the shore, moving the nearshore surface waters down and causing warmer waters and lower salinity than that typical for deeper waters (Mann and Lazier 1991; Rozengurt and Nguyen 1995).

TEMPERATURE

Ten-year ranges of surface and bottom temperatures in the study area are approximately 12 to 24EC and 10 to 13EC, respectively (CSDOC 1996a). These patterns and ranges are similar to the longer-term records (1951-1987) of California Cooperative Fisheries Investigations (CalCOFI) Station 90028, located southeast of the District's study area off Dana Point at a bottom depth of 100 m. Seasonal deviations in surface temperatures are also comparable with even longer-term records (1926-1994) from Scripps Institution of Oceanography pier (CSDOC 1996a). Data show that the natural percent deviation of temperature in the study area is approximately $\pm$ 25%. These differences represent an important basis for evaluating the significance of temperature-related changes that may be caused by the wastewater discharge and demonstrate the dynamic nature of the study area.

While the wastewater discharged from the 120-inch outfall is significantly warmer than the receiving waters, it is only a small and localized effect because of the intense mixing and initial dilution (180:1) within the ZID. Initial dilution calculations predict temperature changes to the receiving waters beyond the ZID to be less than 0.2EC (CSDOC 1996a). Most notable are plume-related temperature changes that are primarily due to secondary entrainment of colder, deeper water in the outfall vicinity. These patterns are observed mostly during late spring through early fall, when a pycnocline is present. During winter, changes are less evident as temperatures tend to be more uniform throughout the water column, and there is greater mixing potential due to a weak or absent pycnocline. Analysis of long-term (10-year) mean data (temperature profiles by depth and month, and deviations at near bottom depths) show no important differences between nearfield and farfield stations that are relatable to the discharge of wastewater (CSDOC 1996a, b).

SALINITY

Salinity values are not highly variable in the SCB. Typically, salinity increases less than 1 part per thousand (ppt) from surface to bottom. Ten-year ranges of surface (excluding surface rainfall runoff) and bottom (<330 ft) salinity from the District's OMP are approximately 33 to 34 ppt and 33.2 to 34 ppt, respectively. Seasonal changes are evident but small. The most significant change in salinity is associated with surface waters during freshwater runoff during rainstorms. These can reduce salinity between the surface and 33-ft depths by as much as 4 to 5 ppt. Because changes in salinity are typically small and not observed below 50 ft, it is temperature that is the primary determinant of water column stratification.

Wastewater discharge effects on salinity are small and most notable during water column stratification. Decreases in salinity are approximately 0.1 to 0.2 ppt within the wastewater plume, based upon 10 years of monitoring (e.g., CSDOC 1995a, 1996a, b), and are consistent with expected initial dilutions of 130 to 200:1. Evaluation of long-term mean data (salinity profiles by depth and month, and deviations near-bottom depths) indicates only one month when direct wastewater plume changes were evident (CSDOC 1996b).

DISSOLVED OXYGEN

Seasonal patterns in dissolved oxygen are generally characterized by higher concentrations in surface and subsurface layers due to atmospheric mixing, with concentrations decreasing with depth as a result of biological activity and oxygen-consuming chemical reactions (CSDOC 1996a). These patterns closely mirror the vertical distribution of temperature. Ten-year ranges for surface and near-bottom (297 ft) depths are approximately 6 to 11 mg/L and 3 to 7 mg/L, respectively (CSDOC 1996a, b).

Natural deviations of dissolved oxygen are large, ranging at least ± 25%, and result from a combination of factors including intrusions of water masses, primary production (phytoplankton blooms), and upwelling/downwelling events (CSDOC 1996a, b). These natural deviations greatly exceed any influence of the wastewater plume beyond the ZID. This is important because compliance criteria of the California Ocean Plan require a decrease of less than 10% in dissolved oxygen compared to reference areas (CSDOC 1996c; State Water Resources Control Board 1997). Changes in the receiving waters due to the wastewater discharge are primarily related to secondary entrainment effects of bottom waters as noted above for temperature. Changes in dissolved oxygen within the wastewater plume are typically less than 0.5 mg/L due to both entrainment effects and plume oxygen-consuming materials. This is consistent with indirect plume effects since initial dilutions within the ZID should result in direct decreases that are one order of magnitude lower (CSDOC 1996a). Thus, direct changes due to the wastewater plume are obscured by the greater differences from indirect effects.

HYDROGEN ION CONCENTRATIONS

The waters of the SCB are well buffered and thus, pH values show only small variations similar in pattern to that of DO. Changes in pH with depth result from the chemical relationship between carbon dioxide (CO_2) and the atmosphere (lower CO_2 and higher pH near the surface), balanced by biological activities at deeper depths (CO_2 increases due to respiration and decomposition, thus decreasing pH) (Harvey 1963). Ten-year ranges for surface and bottom depths (198 ft) are approximately 7.7 to 8.7 and 7.5 to 8.4, respectively (CSDOC 1996a, b). Thus, natural deviations (at least ∀ 6%) (CSDOC 1996a) can be several times greater than the California Ocean Plan criterion that permits a 0.2-pH-unit difference from reference conditions (State Water Resources Control Board 1997). Seasonal decreases in pH near the bottom are associated with upwelling events, which can be localized in the study area.

The pH of the wastewater effluent typically ranges between 7.1 and 7.6. Direct effects (if any) to receiving waters attributable to the wastewater plume have not been distinguishable from indirect effects (CSDOC 1996a). This is consistent with initial dilution calculations that predict decreases of pH of less than 0.1 units. Wastewater discharge changes to the receiving waters are similar to the patterns observed for dissolved oxygen but are less pronounced and relate mainly to the entrainment of bottom waters.

WATER CLARITY / TURBIDITY (TRANSMISSIVITY AND TOTAL SUSPENDED SOLIDS)

Natural changes to water clarity in the study area are caused mostly by surface runoff, river discharges, and sediment loading from winter rainfall; plankton and suspended particles near the pycnocline during spring and summer; and sediment resuspension by wave action, particularly at shallow, nearshore locations. All of these act in concert to reduce clarity. Knowledge of these causes and natural patterns is important in distinguishing effects from the wastewater plume, since TSS in the final effluent can be 20 to 40 times higher than in the receiving waters at the discharge depth (CSDOC 1991).

The District's OMP has measured ambient TSS concentrations from near zero (below detection limits) to approximately 30 to 40 mg/L, but most overall mean values were less than 2 to 5 mg/L (CSDOC 1996a, b). TSS concentrations in the receiving waters are dependent upon the initial dilution of the effluent, which ranges from 130 to 200:1, depending upon current speeds and stratification and averages about 180:1. Based upon the average dilution of 180:1, the expected change in TSS concentration above ambient concentrations in the receiving waters is calculated to be 0.28 mg/L and ranges between 0.25 and 0.38 mg/L. Concentrations will tend to be higher in summer than winter due water column stratification that tends to reduce the initial dilution. Thus, the effluent discharge results in a change that is less than 10% of ambient conditions and significantly less than the range of natural variability.

The California Ocean Plan and the District's NPDES permit require that the wastewater discharge shall not cause aesthetically undesirable discoloration of the ocean surface and natural light levels shall not be significantly reduced beyond the ZID. Water color and surface clarity from 1985 to 1995 were fully in compliance (100%) even during winter when any negative effects from plume discharge should be most evident due to the absence of the pycnocline (CSDOC 1996c). Over the same ten-year period, transmissivity values showed very high compliance (94-100%) compliance. Generally, transmissivity ranged between 80 to 90% transmittance, but included some very low values from 5 to 30%. These low values where typically associated with nearshore stations (higher turbidity due to wave resuspension), upwelling and plankton blooms near canyons and the pycnocline, and plumes from rivers and harbors (CSDOC 1996a). Therefore, these potentially out of compliance values are not considered significant or caused by the wastewater discharge. Furthermore, ranges of natural light levels often exceeded ± 35%, far exceeding the California Ocean Plan criteria (CSDOC 1996a,c).

Some observations of significantly lower light levels near the outfall are attributable to natural cause, while about 5 to 6% of the observations during summer appear to be associated with discharge. During summer when the themocline is well developed and current speeds tend to be slower, there is less initial dilution and the plume can be detected beyond the ZID. While these lower light levels exceed permit limitations, they are clearly less than the range of natural deviations in water transmissivity and are therefore not considered biologically significant.

OIL AND GREASE

Oil and grease concentrations in seawater range from <0.001 to 0.02 mg/L in the waters of the SCB (EPA 1988). Oil and grease in the wastewater effluent are derived from both natural sources (e.g., oil seeps and natural compounds from plants) and contaminants derived from numerous sources including automotive lubricants, cooking oils and fats, and other household and industrial lubricants.

Oil and grease effluent concentrations tend to be highly variable, but monthly averages indicate temporal trends. From 1977 to 1982 monthly averages decreased from around 45 mg/L (65,000 lbs/day) to about 15 mg/L (28,000 lbs/day). Since 1983, average monthly oil and grease concentrations have been relatively constant, remaining between 10 and 20 mg/L. However, because flow rates have continued to increase, the mass emission of oil and grease have increased to about 35,000 lbs/day. The District's OMP found that most water samples were below detection limits and those samples with measurable quantities of oil and grease were typically less than 0.5 mg/L (CSDOC 1996a). While there was no consistent pattern relative to the outfall, highest values often were collected near the wastewater outfall.

NUTRIENTS

Life in the sea is dependent upon the production of organic matter in the lighted surface layers (euphotic zone). Thus, the availability of nutrients in the water column is crucial to this process. Coastal waters are particularly important in terms of primary production due to nutrient inputs from coastal runoff, atmospheric fallout, nutrient recycling via upwelling, wastewater discharges, and an abundance of sunlight in these shallow waters. Major nutrients are compounds of phosphorus, nitrogen, and silica that are required for the growth of the primary producers — algae and phytoplankton. While any one nutrient can be a limiting factor for primary production, nitrogen is typically the limiting element. Nitrogen is available in many forms including nitrates, nitrates, urea, and ammonia.

Natural ammonium values in Southern California coastal waters vary from approximately 0.005 to 0.5 mg/L (Eppley et al. 1979). Little information exists on the effects of ammonium on fish and invertebrates in the coastal environment. Data from the District's Ocean Monitoring Program suggest that while ammonium is an important source of nitrogen for primary production, other factors and nutrient sources are more significant in governing phytoplankton biomass. Excess ammonium, as long as it is below some toxic threshold, has no observable effects on phytoplankton biomass (e.g., Cullen and Eppley 1981).

Ammonium is the only nutrient regularly monitored in the effluent and receiving waters by the District. Concentrations of ammonium-nitrogen in the effluent have remained relatively constant since 1982 at about 24 to 26 mg/L, representing a discharge of about 50,000 lbs/day. The District's NPDES permit states that the discharge of nutrients shall not cause objectionable aquatic growths or degrade indigenous biota. Permit limitations state that the effluent ammonium as nitrogen concentration shall not exceed 30 mg/L (6-month median) or 56,800 lbs/day. Maximum values of ammonium-nitrogen in the receiving waters after initial dilution due to the wastewater discharge are low, 0.01 to 0.5 mg/L, based upon analysis of 13,754 samples over a ten-year period (CSDOC 1996a). This range is 5 to 12 times lower than California Ocean Plan receiving water objectives for chronic (4 mg/L) and acute (6 mg/L) ammonium toxicity, respectively (State Water Resources Control Board 1997).

Ammonium is one of the principal indicators of the wastewater plume. Values of ammonium indicate that the plume is predominately restricted below 33 to 66 feet, during most months. This is important evidence that the plume is mostly excluded from surface waters. However, on rare occasions, upwelling can cause surfacing of ammonium. Elevated ammonium concentrations beyond the ZID are frequent; however, these concentrations are low, typically 0.2 to 0.4 mg/L, and compare favorably with expected concentrations following initial dilution. Evaluation of long-term data (ammonium profiles by depth and month) do not indicate any significant differences in mean concentrations between nearfield and farfield stations (CSDOC 1996b). In contrast, the range of values shows greater influence at the nearfield stations, even though the overall concentrations are low (as above) (CSDOC 1996a). This suggest that mixing and dilution of the plume are occurring with increasing distance from the outfall, although this is mainly along the plume edge, while the core portion of the plume seems to persist longer and further from the outfall.

5.1.4 SEDIMENT QUALITY

The sedimentary environment of the SCB consists of a mixture of inorganic and biogenic sediments. Terrestrial runoff, river discharges, and erosion of the continental shelf are sources of inorganic sediments. In the study area, the Santa Ana and San Gabriel Rivers, as well as inputs from Newport Harbor, deliver the majority of sediments to the study area during episodic storms. Larger particles, sands and gravels, are sorted by wave actions at the coast and redistributed to the intertidal and nearshore areas. During times of strong storm wave events, coarser sediments may be resuspended and moved further offshore into deeper waters. Finer sediments, silts and clays, are transported as suspended load following the water circulation during their slow fall through the water column. Sediment inputs are generally low except during runoff and flooding, thus, during much of the year and during droughts, the predominant suspension particulates are of biological origin (biogenic). Biogenic particulates undergo extensive recycling and alteration before they reach the bottom and again upon settling. Biogenic particulates contribute about 20% of the total borderland SCB sediment, which also includes carbonate, opaline silica, and other organic matter (Dailey et al. 1993).

GRAIN SIZE

Sediments on the San Pedro Shelf within the District's study area are predominately sand (70 to 80%), with smaller percentages of silts plus clays (particle diameters <62 microns; 20-30%). Exceptions are sediments in the canyons, which are predominately silts and clays. Median grain sizes range from approximately 15 to 150 microns. Grain size on the San Pedro Shelf varies with depth and bottom topography. Generally, sediments become finer with increasing water depth; however, there are exceptions to this general pattern within the study area. Nearshore sediments (99-165 ft water depths) are finer downcoast than upcoast, apparently because of discharges from the Santa Ana River. Near the 120-inch outfall and downcoast at the outfall depth, sediments are coarser than usual due to erosion and exposure of coarse, relic sediments and the reef effect of mostly dead, mollusc shells that have fallen off the outfall structure onto the adjacent sediments. Newport and San Gabriel Canyons are depositional areas, as indicated by the relatively small median diameters (<20 microns) and higher percentages of silts and clays (CSDOC 1996a). Within Newport Canyon, grain size does not change significantly with depth (Maurer et al. 1994).

ORGANIC MATTER

The concentration of organic matter in sediments depends upon the its rate of supply, its preservation before and after deposition, and the overall sedimentation rate (Tissot and Welte 1984). In the SCB organic matter content of sediments comprises 1% or less (dry weight) on the mainland shelf (Emery 1960). Concentrations in canyons and basins range from 5 to 10%. Many studies have noted the inverse correlation between organic matter content and grain size (CSDOC 1996a, Diener and Fuller 1995; Emery 1960; Gorsline 1992; Thompson et al. 1987). Higher concentrations of organic materials occur with finer-grained sediments in depositional areas, and lower concentrations occur in erosional areas with coarser grained sediments where organic-rich, fine sediments do not accumulate (CSDOC 1996a).

Based upon data (248 sites between 33 and 656 ft deep) from the Southern California Bight Pilot Project (SCBPP), TOC concentrations ranged from 0.04 to 5.12%. In general, sediments from the San Pedro Shelf had lower concentrations of TOC than sediments from most other areas (CSDOC 1996a; Schiff and Gossett 1997). TOC near the District's 120-inch outfall along the 188-ft depth contour ranged from 0.4 to 0.6 %, which is comparable to the mean concentration of sediments (0.57 ±0.24 %) from reference areas of the SCB. Similarly, while TOC concentrations near major Public Owned Treatment Works (POTW) outfalls were higher than those in SCB reference areas, these increased values were not statistically significant (Schiff and Gossett 1997). Thus, in the SCB organic enrichment of sediments from wastewater discharges is of less critical concern than it has been in the past.

METALS

The concentration of metals in sediments is related to their abundance in source minerals, contaminant sources, and subsequent mixing and dilution with sediments from other geological sources. Because most metals have a strong attraction for fine-grained particles, the distribution and fates of metals are largely controlled by particle transport and depositional processes. Thus, spatial patterns in metal concentrations tend to follow grain size patterns, and depositional areas such as canyons represent sites of accumulation for particle associated metals and organic compounds (Maurer et al. 1994).

Average concentrations of metals in sediments collected in 1994 during the SCBPP are summarized in (**Table 5-2**). These data indicate that absolute metal concentrations in sediments from the San Pedro Shelf, including areas adjacent to the District's outfall, are generally comparable to those in other areas of the SCB (CSDOC 1996a). Similarly, average metal concentrations measured during the District's OMP are comparable to reference areas of the SCB (**Table 5-3**).

Within the study area, concentrations of the metals beryllium, chromium, lead, nickel, thallium, and zinc, which have strong affinities for fine-grained sediments, exhibit clear depth related increases. Concentrations of these metals indicate no appreciable effects from the District's wastewater discharge. Patterns for cadmium, silver, and, to a lesser extent, copper and mercury are not clearly related to depth or grain size distributions. Instead, spatial patterns in these metals, particularly silver and cadmium, indicate gradients relative to the outfall location and appear to be related to the wastewater discharge (CSDOC 1996a, 1998).

Sediment concentrations for most metals have shown significant decreases since 1985 (**Table 5-4**). Decreases for some metals (e.g., lead) are related to increased public awareness and changes in environmental laws, which have banned or reduced lead additives in gasoline and paints. Metals related to the District's wastewater have decreased dramatically through an extensive and effective source control program. For example, average reductions in sediment metal concentrations at the 120-inch outfall depth (188 ft) ranged from 14% for nickel to 51% for cadmium. The magnitude of change in sediment cadmium, chromium, copper, lead, nickel, and zinc was greatest near the outfall, particularly at Stations within the ZID at the diffuser terminus

TABLE 5-2
MEDIAN AND RANGES OF SEDIMENT METAL CONCENTRATIONS (µg/g) DURING THE SOUTHERN CALIFORNIA BIGHT PILOT PROJECT (July/August 1994)

	San Pedro Shelf (n=21)	Santa Monica Bay (n=19)	Santa Barbara Channel (n=32)
Aluminum	4,680 (1,730-9,360)	5,050 (1,540-6,940)	4,060 (1,300-6,150)
Silver	0.05 (0.05-0.28)	0.34 (0.05-0.98)	0.05 (0.05-0.11)
Arsenic	1.6 (1.0-5.0)	5.5 (1.8-6.7)	2.4 (1.3-8.2)
Cadmium	0.10 (0.05-0.28)	0.28 (0.07-1.07)	0.16 (0.07-0.4)
Chromium	12 (5.3-18)	21 (5.9-80)	12 (4.7-18)
Copper	6.0 (2.0-14)	9.0 (2.0-49)	5.0 (2.0-11)
Iron	8,930 (4,150-13,500)	11,300 (3,810-20,800)	11,150 (3,550-39,400)
Mercury	0.03 (0.02-0.11)	0.10 (0.04-1.17)	0.03 (0.02-0.09)
Nickel	6.0 (3.0-9.0)	12 (5.0-19)	10 (4.0-18)
Lead	4.0 (0.9-7.9)	9.0 (4.3-18.8)	4.0 (1.6-7.1)
Zinc	25 (12-39)	33 (12-54)	28 (9.0-53)

SOURCE: County Sanitation Districts of Orange County, California.

(Stations 0 and ZB2) (CSDOC 1998). Decreases in effluent metal concentrations correlated with decreasing sediment metal concentrations, especially those elevated near the discharge, and accounted for 35 to 74% of the variance in the sediment concentrations (Phillips and Hershelman 1996). Relatively smaller but statistical significant decreases occurred at the reference station (Station Control) and other 188-ft stations (CSDOC 1996a). In contrast, no significant changes occurred in the shallow Newport Canyon Stations C1 and C2 for most metals except for decreased silver and increased cadmium. Results from correlations of effluent and sediment metal concentrations imply that, at least for chromium, nickel, lead, and zinc, additional reductions in the District's effluent metal and /or particulate mass emission rates would not necessarily produce further substantial decreases near the 120-inch outfall. Some metal concentrations, such as nickel and chromium, have reached or are approaching the nominal background concentrations for the Shelf. Thus, further reductions in concentrations of these metals in the effluent would not necessarily produce continuing declines in sediment metal concentrations (Phillips and Hershelman 1996).

SEDIMENT TRACE ORGANICS

Several classes of trace organic compounds occur naturally in marine sediments. These compound classes include: polycyclic aromatic hydrocarbons (PAHs) from natural oil seeps and erosion of tertiary shales (Simoneit and Kaplan 1980; Venkatesan et al. 1980); sterols from marine animal feces (Venkatesan and Santiago 1989); saturated hydrocarbons from marine

TABLE 5-3
MEAN METAL CONCENTRATIONS (μg/g) IN SEDIMENTS BY DEPTH DURING 1985-1995, WITH COMPARISONS TO REFERENCE VALUES FROM THE 1990 SCCWRP REFERENCE SURVEY
(Bold numbers represent comparable data)

Depth	N	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
30 m	**66**	**4.2**	**0.22**	**0.17**	**15.3**	**8.1**	**7.6**	**0.04**	**7.0**	**0.28**	**0.12**	**0.23**	**34.0**
40 m	72	4.0	0.26	0.25	17.6	11.2	9.1	0.05	7.5	0.25	0.31	0.22	38.4
50 m	9	3.8	0.26	0.56	20.1	16.3	9.0	0.06	8.1	0.26	0.50	0.24	45.0
60 m	**1,447**	**3.1**	**0.26**	**0.42**	**19.1**	**13.8**	**7.7**	**0.04**	**8.0**	**0.26**	**0.41**	**0.18**	**43.2**
90 m	27	3.2	0.31	0.25	19.3	12.6	7.9	0.04	9.0	0.30	0.26	0.19	44.8
100 m	**45**	**3.8**	**0.32**	**0.45**	**21.8**	**14.5**	**8.7**	**0.06**	**9.9**	**0.28**	**0.32**	**0.23**	**49.1**
200 m	**38**	**4.4**	**0.44**	**0.42**	**27.0**	**20.6**	**11.9**	**0.07**	**13.0**	**0.50**	**0.32**	**0.28**	**58.0**
300 m	36	5.0	0.49	0.35	30.8	20.1	12.2	0.07	14.0	0.68	0.25	0.27	64.0
Canyon[1]	164	9.1	0.66	0.60	32.0	26.3	24.5	0.10	18.8	0.64	0.30	0.35	100
SCCWRP 1990 Reference Site Survey[2]													
30 m	6	nm	nm	0.26	17.0	5.3	4.4	nm	8.0	nm	0.10	nm	29.1
60 m	7	nm	nm	0.24	25.6	9.2	6.9	nm	11.4	nm	0.25	nm	45.1
150 m	7	nm	nm	0.37	31.0	13.9	8.2	nm	13.9	nm	0.50	nm	55.1

SOURCE: County Sanitation Districts of Orange County, California.

nm = not measured

1 depths range from approximately 30-300 m.
2 Source: SCCWRP (1992)

TABLE 5-4
MEAN ANNUAL SEDIMENT METAL CONCENTRATIONS AT THE DISTRICT'S 60-m STATIONS

	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97
Arsenic	9.1	4.4	4.6	4.1	3.4	3.2	3.4	3.6	3.0	3.3	3.2	2.9
Beryllium	0.31	0.30	0.29	0.26	0.29	0.33	0.29	0.34	0.29	0.29	0.28	0.11
Cadmium	0.91	0.74	0.61	0.56	0.53	0.56	0.45	0.41	0.75	0.53	0.67	0.32
Chromium	23	21	21	20	20	20	19	19	21	20	21	18
Copper	21	19	18	16	15	16	14	14	16	15	17	14
Lead	12.4	10.9	10.9	10.1	10.1	9.1	8.4	9.0	7.9	9.2	8.3	6.8
Mercury	0.07	0.07	0.07	0.06	0.06	0.05	0.05	0.05	0.04	0.07	0.05	0.04
Nickel	10.5	8.9	8.3	8.4	8.6	8.4	8.6	8.9	10.0	10.7	9.9	8.0
Silver	0.51	0.46	0.47	0.47	0.42	0.42	0.33	0.38	0.60	0.33	0.27	0.23
Zinc	59	53	51	49	49	46	45	43	51	50	51	42

Number of samples analyzed per year = 156 except 1994-95, where n=133. All concentrations in mg/kg dry wt.

SOURCE: County Sanitation Districts of Orange County, California

plankton and terrestrial plant waxes (Crisp et al. 1979); and saturated terpanes and steranes from oil seeps and biogenic materials (Simoneit and Kaplan 1980). Similar to metals, these organic compounds typically have strong affinities for the smaller-sized sediment particles. Thus, the distribution in marine sediments also follows sediment grain size. Organic contaminants of sediment include synthetic organic compounds (e.g., pesticides such as DDT and polychlorinated biphenyls) as a result of historic waste disposal activities and their persistence in the marine environment (e.g., Brown et al. 1986; Horn 1974). Because of their widespread usage and dispersal throughout all habitats, these types of compounds are generally above detection limits in sediments even in areas considered as reference sites.

Between 1985 and 1996 the District's OMP analyzed sediments for presence of all volatile and semivolatile organics on the EPA priority pollutant list (CSDOC 1996a). The majority of these compounds (approximately 80%), especially the volatile organics, are consistently nondetectable in sediments. Although some volatile organic compounds are present in the final effluent, they are relatively soluble in seawater and are not expected to accumulate in sediments. Volatile organic compounds may still be important as potential toxicants in water and/or at the sea surface in localized areas with large inputs (Mearns et al. 1991).

Reported concentrations of sediment organics are dependent upon the methods used for extraction and analyses. Thus, organic compound concentrations from other studies are not necessarily comparable to those from the District's OMP. From 1985 to 1996, the District's OMP utilized EPA 301(h) methods for sediment organics. However, special studies conducted in 1993 and 1994 utilized more sensitive NOAA Status and Trends methods. Most of the following discussion focuses on studies that utilized NOAA Status and Trends methods for sediment organic compounds. Depth-averaged concentrations of total DDT and total polychlorinated biphenyls generally increased with depth between 66 and 990 ft, and then decreased at depths increasing from 990 to 1,650 ft (**Table 5-5**) (CSDOC 1996a). The overall ranges for total DDT and total polychlorinated biphenyls were 3.1 to 60.8 ng/g and 5.2 to 40.2 ng/g, respectively. For comparison, concentrations from 5.4 to 15.0 ng/g of total DDT and 7.1 to 12.3 ng/g total polychlorinated biphenyls have been reported for 98-, 197-, and 492-ft reference sites throughout the SCB (SCCWRP 1992). A special study conducted in 1993 by the District within its study area measured the concentration of all chlorinated pesticides at the 120-inch outfall and at reference stations of comparable depth (**Table 5-6**). Concentrations of total DDT at outfall and reference stations were approximately 5 ng/g, and total chlordanes, gamma-hexachlorocyclohexane, dieldrin, and hexachlorobenzene were approximately 1 mg/g or less. Total polychlorinated biphenyls near the outfall (22.3-88.7 ng/g) were approximately one order of magnitude higher than values at the reference area (2.5-6.2 ng/g) (CSDOC 1996a). These results indicated that wastewater discharges contributed slightly to elevated polychlorinated biphenyls near the outfall and did not significantly contribute to DDT concentrations near the outfall compared to regional input sources. Temporal trends for these contaminants are depicted in **Figure 5-4**.

PAH compounds show depth patterns similar to those for chlorinated compounds, with concentrations 3 to 8 times higher near the 120-inch outfall compared to reference areas (**Table 5-7**). PAH compounds are derived from numerous sources including petroleum, combustion, and natural sources. Specific PAHs have variable toxicity, and ratios of specific compounds provide some indication of source. Sediments near outfalls contain compounds indicative of combustion and petroleum products, and increased concentrations near outfalls reflect wastewater discharges (Eganhouse and Gossett 1991). However, the District's OMP indicates large, temporal variability (e.g., runoff events) in the type of and concentrations of organic compounds in sediments near the 120-inch outfall. This suggests that discharge-related effects are episodic, and that most organic contaminants do not accumulate in sediments near the outfall (CSDOC 1996a).

TOXICITY

Toxicity of wastewater effluents must be measured on a periodic basis to determine the biological response of test organisms to the final effluent under various conditions ranging from undiluted to highly diluted effluent. Testing in the past was performed for a 96-hour period to determine acute toxicity (measured in Toxic Units Acute or TUa units). The TUa is derived from the test concentration (percent wastewater) giving 50% survival of test organisms divided into 100 as defined in the California Ocean Plan (State Water Resources Control Board 1997). More recently, testing has been done to determine chronic toxicity, expressed in TUc or Toxic Units Chronic, which are derived from dividing 100 by the NOEC (No Observable Effects Concentration). The NOEC is the maximum percent effluent or receiving water that causes no observerable effect on a test organism using a critical life stage toxicity test on one or more of the approved test species.

TABLE 5-5
DEPTH-AVERAGED ORGANIC CONCENTRATIONS IN BOTTOM SEDIMENTS DURING AUGUST 1994

Depth (m)	n	OC	C/N	ΣPCB	ΣDDT	ΣChlord	ΣALK	ΣPAH	ΣLAB	ΣSterol
SAR	3	0.44	9.0	9.5	5.6	1.3	5,036	1,699	10.3	8,865
Newport Bay	3	0.96	11.4	21.7	39.8	2.8	2,404	1,366	17.8	14,859
20	3	0.29	10.8	7.2	4.0	0.72	479	129	10.2	3,803
40	4	0.44	12.3	9.9	6.6	0.64	479	167	55.0	4,024
60	5	0.52	11.0	8.9	7.3	1.8	623	282	73.9	4,974
200	5	1.12	11.3	24.6	21.7	2.0	1,902	690	87.5	10,039
300	4	1.74	10.8	25.0	30.1	1.2	2,521	919	168	7,822
400	4	1.82	11.0	24.6	21.3	1.4	3,274	794	128	6,584
500	1	1.78	11.5	14.3	28.2	0.84	1,549	325	48.1	4,168
Outfall	1	1.18	15.6	17.6	8.6	0.89	1,552	851	585	20,070

OC = organic carbon (%)
C/N = total carbon/total nitrogen
ΣPCB = summed concentrations (ng/g dw) of individual congeners
ΣDDT = summed concentrations (ng/g dw) o,p- and p,p- isomers of DDT, DDE, and DDD
ΣChlord = summed concentrations (ng/g dw) of alpha chlordane and trans-nonachlor
ΣALK = summed concentrations (ng/g dw) of normal alkanes (nC_{12} - nC_{34})
ΣPAH = summed concentrations (ng/g dw) of parent and alkyl-substituted homologs
ΣLAB = summed concentrations (ng/g dw) of linear alkyl benzenes
ΣSterol = summed concentrations (ng/g dw) of sterols
SAR = Santa Ana River
Newport = Newport Bay

SOURCE: County Sanitation Districts of Orange County, California

The testing protocols are constantly being evaluated to determine those that are the best measures of toxicity and useful for compliance purposes.

One of the problems experienced in toxicity testing is the variability of results and the difficulty in differentiating the effects of ammonia toxicity from those of other toxic compounds that may be present. Ammonia toxicity after initial dilution has been shown not to be a concern, but is often found in the test concentrations where dilutions are not as great as those achieved in the marine environment and where the pH is likely to be much higher than in seawater.

Another complicating factor in toxicity is the variability of the effluent. Wastewater effluents are constantly changing and given the sensitivity of certain organisms to trace amounts of toxic compounds (particularly pesticides), it has been shown that even small amounts of pesticide can provide a toxic response signal in bioassay tests. For some dischargers, even those with secondary treatment and little industrial waste, toxicity has been measured in excess of allowable

TABLE 5-6
CONCENTRATIONS (ng/g dry weight) OF ORGANOCHLORINES, PAHs, AND STEROLS IN SEDIMENTS DURING 1993 AND 1994

Station		TOC	ΣDDT	ΣPCB	ΣChlord.	Dieldrin	ΣPAHs	ΣSterol
0	1993	0.73	5.5 ± 0.5	46 ± 30	1.3 ± 0.1	0.29 ± 0.2	529 ± 280	2,552
	1994	1.18	8.6	17.6	0.89	0.30	851	20,067
Control	1993	0.34	5.3 ± 1.6	4.9 ± 1.7	0.19 ± 0.03	0.02 ± 0.005	90 ± 21	787
	1994	0.52	8.6	6.8	0.40	0.52	147	3,736
5	1993	0.38	4.6 ± 0.5	13 ± 8.1	0.31 ± 0.1	0.03 ± 0.0	209 ± 133	1,167
	1994	0.38	4.2	10.2	0.84	0.11	307	2,488
C2	1993	1.66	26 ± 11	17 ± 5.6	3.6 ± 1.5	0.40 ± 0.2	595 ± 139	2,157
	1994	nm	nm	nm	nm	nm	nm	nm

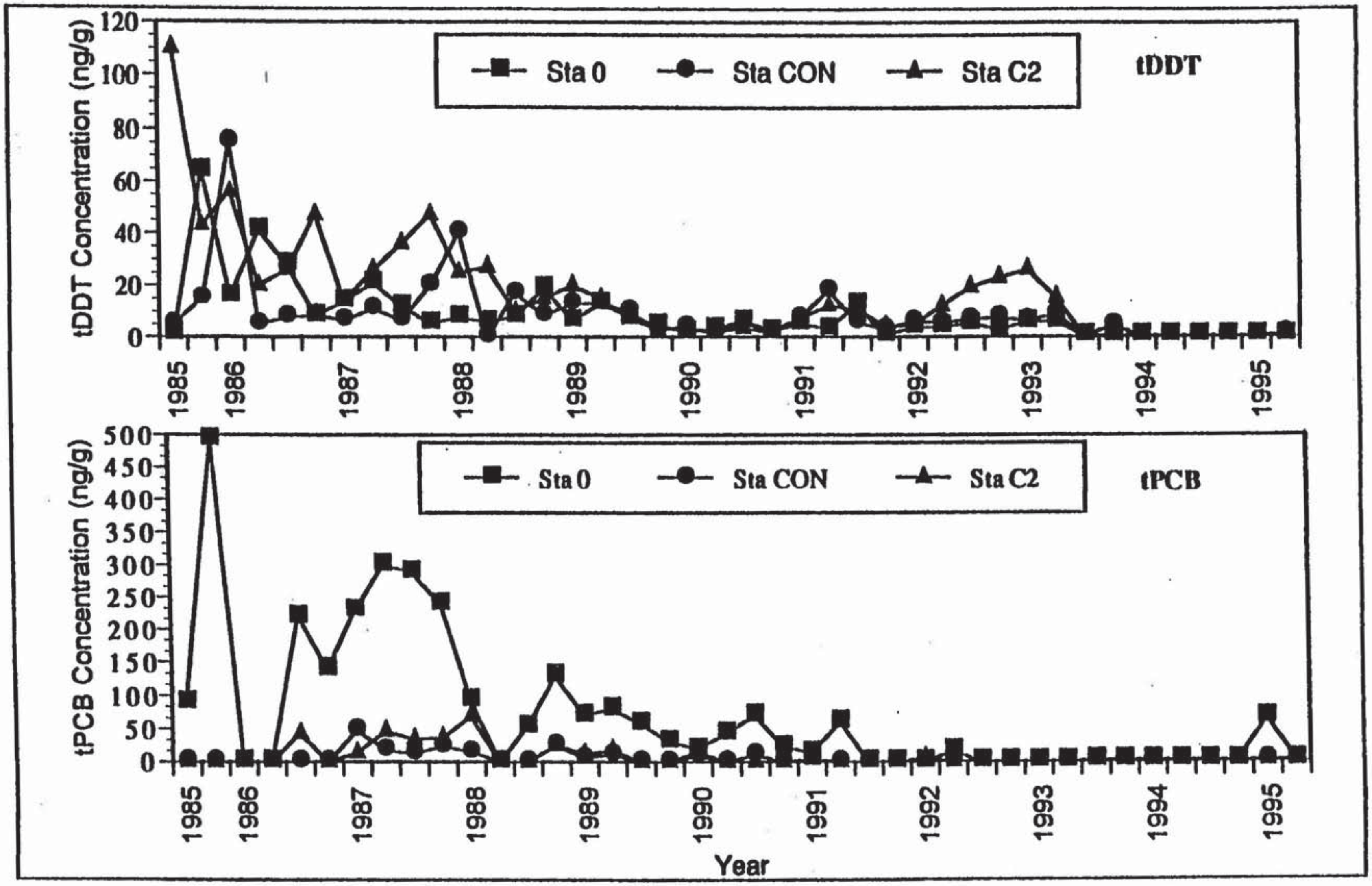
TOC = Total Organic Carbon (% dw)
ΣDDT = summed concentrations (ng/g dw) of o,p- and p,p-isomers of DDT, DDE, and DDD
ΣPCB = summed concentrations (ng/g dw) of individual congeners
ΣChlord. = summed concentrations (ng/g dw) of alpha chlordane and trans-nonachlor
ΣPAHs = summed concentrations (ng/g dw) of parent and alkyl-substituted homologs
ΣSterol = summed concentrations (ng/g dw) of sterol compounds
nm = not measured

SOURCE: County Sanitation Districts of Orange County, California

limits as a result of indiscriminate dumping of common household garden pesticides down the drain. Thus, it is important for the public to be educated about the proper disposal of pesticides and to maintain household hazardous waste collection programs that promote keeping such compounds from being released to the environment in ways other than they were intended. In the past, the District has sponsored such programs, which the County of Orange now has in place.

Figure 5-5 shows the average monthly toxicity test results for the period July 1990 through May 1998, which measured acute toxicity. There have been two occasions on which toxicity measures have exceeded the California Ocean Plan limitations of greater than 1.5 Tu. In both occasions, the observed toxicity levels were probably the result of artificial ammonia toxicity due to drift in pH during the tests (CSDOC 1995b).

Additional test protocols have been developed for measuring the toxicity from marine sediments on sensitive organisms. While these tests are not used for compliance, they are of interest for assessing the impacts of the discharge over time. To date, the test work that has been done have shown that sediments near the outfall diffuser are not toxic (T. Gerlinger, personal communication 1999).



SOURCE: OCSD, Marine Monitoring Annual Report, 1996a

Figure 5-4
Graph - DDT and PCB Concentrations

TABLE 5-7
CONCENTRATIONS OF POLYCYCLIC AROMATIC HYDROCARBONS AND COMPONENT RATIOS FOR SEDIMENTS DURING 1993 AND 1994

Station		ΣPAHs	ΣPAH/ Perylene	ΣN	ΣP	ΣF	N/P	N/ Perylene	MP/P	Fl/Py
0	1993	529 - 280	51.2	98 - 25	88 - 17	30 - 3.7	1.14	12.9	1.12	1.04
	1994	851	72.5	177	164	82.3	1.08	15.1	1.22	1.06
Control	1993	90 - 21	32.9	13 - 2.5	27 - 6.9	5.0 - 2.4	0.53	4.9	1.18	0.85
	1994	147	14.5	nd	39.5	11.4	--	--	6.53	0.73
5	1993	209 - 133	46.0	27 - 1.4	54 - 30	12 - 2.5	0.64	8.1	0.65	1.22
	1994	307	22.9	13.2	86.2	5.3	0.15	0.99	--	0.86

ΣPAHs = summed concentrations of parent and alkyl-substituted homologs
ΣN = summed concentrations of parent plus C1 through C4-substituted naphthalenes
ΣP = summed concentrations of parent plus C1 through C4-substituted pheranthrenes
ΣF = summed concentrations of parent plus C1 through C3-substituted fluorenes
MP/P = methyl phenanthrene/phenanthrene
Fl/Py = fluoranthene/pyrene

SOURCE: County Sanitation Districts of Orange County, California

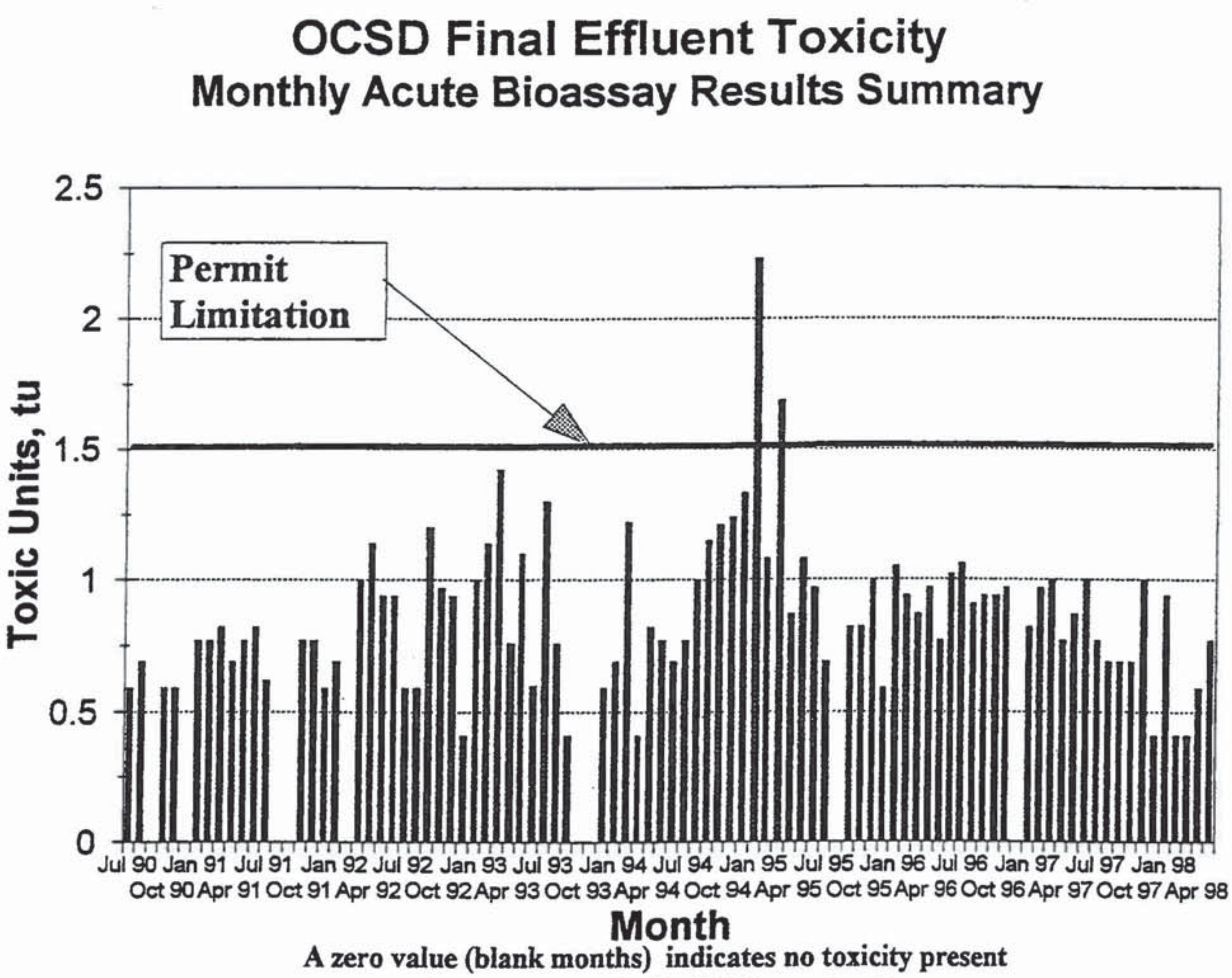
5.1.5 BIOTA

Appendix F presents a more detailed description of the biological resources in the marine environment within the study area and broader SCB area. That information is summarized here to support the impact analysis.

PLANKTON

"Plankton" is a term describing plants (phytoplankton) and animals (zooplankton) that drift passively in the oceanic currents. Plankton includes fish and invertebrate larvae. Planktonic organisms are typically small, but even larger organisms can be planktonic if they are unable to actively move significant distances against ocean currents.

Hardy (1993) provides a good review of the current state of knowledge for phytoplankton within the SCB. However, there are few phytoplankton studies of Southern California coastal waters because of the difficulties and expense involved in their characterization. There have been over 280 phytoplankton species recorded from California coastal waters (Riznyk 1977). A list of the most common species of phytoplankton identified from the San Pedro Shelf is included in **Table 5-8**.



SOURCE: Lindstrom, 1999

Figure 5-5
Graph of Toxicity (KPL)

TABLE 5-8
COMMON PHYTOPLANKTON SPECIES IN THE SOUTHERN CALIFORNIA BIGHT

DIATOMS
Asterionella japonica
Biddulphia longicruris
Chaetoceros compressus
C. debilis
C. didymus
C. socialis
Ditylum brightwellii
Eucampia zoodiacus
Nitzchia spp.
Rhizosolenia spp.
Skeletonema costatum
Thalassionema nitzschioides

DINOFLAGELLATES
Ceratium fusus
C. tripos
C. furca

DINOFLAGELLATES (cont.)
Dinophysis acuminata
Gonyaulax polyedra
Gymnodinium splendens
Noctiluca scintillans
Peridinium spp.
Prorocentrum micans

COCCOLITHOPHORES
Coccolithus huxleyi

SILICOFLAGELLATES
Dictycha fibula
Distepharius speculum

SOURCE: Riznyk 1974.

Phytoplankton, tiny plants, are the base of the marine food chain, essential primary producers that photosynthesize and exhibit a high rate of productivity. They are responsible for oxygen production in the sea. Phytoplankton support grazing zooplankton. The success of zooplankton, which in turn drives fish production, depends upon both the quality and quantity of the phytoplankton supply. The spatial and temporal patterns of phytoplankton are quite variable and important to fisheries, particularly larval stages. The most abundant and important components of the phytoplankton are generally the diatoms and dinoflagellates, which range in size from a few to a few hundred micrometers.

Standing crop and primary production vary seasonally and annually. Data collected within the study area and south to San Diego found that standing crop ranged from 1.9 g per ft^2 in late fall to 8.4 g per ft^2 in late summer (EPA 1988). Productivity follows a similar trend, ranging from 0.03 to 0.13 g per ft^2 per day or about five tons per acre per year (tay) of dry organic matter. This level is 10 times higher than open ocean areas but lower than other terrestrial or marine ecosystems such as estuaries (25 tay) or kelp beds (40 tay), which rank among the most productive ecosystems in the world.

Regional nearshore zooplankton include small to microscopic animals, protozoans (radiolarians, ciliates, foraminifera) and larval forms of benthic invertebrates. Larger zooplankton (>1.4 inch) that serve as a major food source for fish include a broad diversity of copepod and mysid crustaceans. Euphausiid crustaceans tend to replace mysids in offshore areas. Other important plankton include arrow worms, ctenophores, salps, and cladocerans. **Table 5-9** lists some of the

TABLE 5-9
MAJOR ZOOPLANKTON SPECIES IN THE SOUTHERN CALIFORNIA BIGHT

Major Taxa	Species
CNIDARIA	*Syncoryne eximia*
	Phialiadium gregarium
CTENOPHORA	*Pleurobrachia bachei*
	Beroe spp.
CHAETOGNATHA	*Sagitta euneritica*
	S. bierei
	S. enflata
	S. minima
POLYCHAETA	*Tomopteris eiegans*
MOLLUSCA	
Pteropoda	*Limacina helicina*
Heteropoda	*Atlanta peron*
	Atlanta spp.
	Carinaria japonica
Cephalopoda	*Abraliopsis felis*
	Gonatus onyx
CRUSTACEA	
Copepoda	*Labadocera trispinosa*
	Acartia tonsa
	A. clausi
	Calanus helgolandicus
	C. pacificus
	Rhinocalanus nasutus
	Oithona similis
	O. occulata
Amphipoda	*Vibilia armata*
Cladocera	*Penilla avirostris*
	Evadne nordmanni
	Podon polyphemoides
	Evadne spinifera
	E. tergestina
Euphausiacea	*Euphausia pacifica*
	Nematoscelis difficilis
	Nyctiphanes simplex
	Stylocheiron longicorne
	Thysanoessa gregaria
	T. spinifera
Decapoda	*Sergestes similis*
	Pandalus jordani
	Crangon spp.
CHORDATA	*Doliolum denticulatum*

SOURCE: Bureau of Land Management 1978.

common zooplankton of the SCB (BLM 1978). Based upon time-averaged results of cross-shelf transects sampled over a two-year period in northern San Diego County (Barnett & Sertic 1979a), the invertebrate zooplankton community was characterized by the following patterns:

1. Inshore. Organisms whose concentrations were consistently higher between 0 and 2 miles from shore. This group includes the copepods *Acartia clausi* and *Oithona occulata*, the cladoceran, *Podon polyphemoides*, the cypris larvae of barnacles, the larvae of bivalves and polychaetes, and the nauplii of the copepods, *Acartia* spp. and *Labidocera* spp.

2. Offshore. Organisms whose concentrations were consistently higher between 2.5 and 4 miles from shore. In this group are the copepods *Coryceaus anglicus*, *Paracalanus parvus*, and *Oithona plumifera*, the cladocerans, *Evadne nordmanni* and *Penilia avirostris*, and the arrow worm *Sagitta euneritica*.

3. Variable. Organisms whose pattern on any one date is non-uniform but whose peaks of abundance was less than half a mile from shore. The copepods *Acartia tonsa* and *Labidocera trispinosa*, the cladoceran *Evadne spinifera*, cyphonautes larvae of ectoprocts, gastropod veligers, and fish eggs make up this group.

The patterns for fish larvae (ichthyoplankton) were reported by Barnett and Sertic (1979b) as follows:

1. Inshore. Larvae that had persistently higher concentrations within 1 mile of shore included the cheekspot goby (*Ilypnus gilberti*), giant kelpfish (*Heterostichus rostratus*), unidentified clinid type A (probably *Paraclinus*), silverside larvae, Bay goby (*Lepidogobius lepidus*) and Blennies.

2. Nearshore. The northern anchovy (*Engraulis mordax*) had persistently higher concentrations between 1 and 2.5 miles from shore.

3. Seasonally shifting. The larvae of queenfish (*Seriphus politus*) and white croaker (*Genyonemus lineatus*) had seasonally shifting patterns of concentration. They had peaks from 1 to 2.5 miles offshore from February - mid-April and an inshore peak from mid-April through July.

4. Offshore. Larvae with persistently higher concentrations further than 2.5 miles from shore included the northern lampfish (*Stenobrachius leucopsaus*), Pacific hake (*Merluccius productus*), and rockfish (*Sebastes* spp.) larvae.

Table 5-10 lists some of the common taxa of invertebrate and fish larvae found in nearshore waters of the SCB (BLM 1978). The outfall area can be expected to have similar patterns and characteristic taxonomic grounds, although no local studies have been done for the offshore waters.

The above descriptions provide a general guide to macrozooplankton and ichthyoplankton in nearshore and offshore waters. However, site specific factors such as slope, topography, and depth may induce cross-shelf shifts in these patterns; thus, the patterns are only broadly defined. Cross-shelf shifts also occur in response to natural phenomena such as internal wave patterns. Vertical distribution patterns also determine probability of contact with the wastewater plumes.

TABLE 5-10
COMMON FISH AND INVERTEBRATE LARVAE
OF THE SOUTHERN CALIFORNIA BIGHT

Scientific Name	Common Name
FISH LARVAE	
Engraulis mordax	Northern anchovy
Merluccius productus	Pacific hake
Citharichthys spp.	Sanddab
Bathylagidae	Deepsea smelt
Myctophidae	Lantern fish
Gonostomatidae	Lightfish
Sardinops caerulea	Pacific sardine
Trachurus symmetricus	Jack mackerel
Parophrys vetulus	English sole
INVERTEBRATE LARVAE	
Mollusca	
Mytilus spp.	Mussel
Polychaeta	
Vanadis formosa	
Torrea candida	
Travesiopsis lobifera	
Cirripeda	
Balanus spp.	Barnacle
Decopoda	
Cancer magister	Dungeness crab
Pugettia producta	Kelp crab

SOURCE: Bureau of Land Management

The depth of the outfall and the trapping of the plume well below the surface at deeper depths make comparisons with past studies problematic.

As summarized by Barnett & Sertic (1979a), the vertical patterns of the macrozooplankton formed four groups:

1. Those with higher concentrations near the surface: *Evadne nordmani, E. spinifera, Penilla avirostris,* and fish eggs.
2. Those with higher concentrations mid-depth to near bottom: *Oithona plumifera* and *Sagitta euneritica.*
3. Those with higher concentrations near the bottom: *Oithona occulata* and cypris larvae.
4. Those with a uniform pattern in the water column: *Coryceaus anglicus, Acartia tonsa, Paracalanus parvus, Labidocera tripinosa,* and cyphonautes larvae.

The inshore-offshore and vertical patterns generally were maintained in the longshore dimension (Kinnetic Laboratories, Inc. 1990).

KELP BEDS

Kelp beds dominated by the large brown alga, *Macrocystis pyrifera,* grow in scattered areas throughout the SCB upon hard substrate and in waters generally less than 65 ft deep. While kelp beds are unique habitats characterized by very high productivity, there are no kelp beds located in the vicinity of the District's outfalls. Some algae and kelp may grow on the pipe outfall structure and associated ballast, but the nearest kelp beds are located on rocky substrate about 6.6 miles south of Newport Harbor and 18 miles north near the mouth of the Los Angeles/Long Beach Harbor (CDF&G 1980).

INTERTIDAL COMMUNITIES

The intertidal area where the proposed new outfall would be buried is a sandy beach located west (upcoast) of the existing outfall pipes. Sandy beaches represent the predominant intertidal habitat in the SCB and are characteristically high-energy environments with unstable substrates (Daily et al. 1993). Species composition on a sandy beach largely depends on the beach slope and sand size and texture, which are strongly influenced by the degree of exposure to wave shock (County of Santa Barbara 1992).

Due to the unstable nature of beaches, organisms living in the sand tend to be either highly mobile and migrate with changes in the water level or sedentary with deep burrowing capability. Despite their mobility, vertical zonation of invertebrates occurs on sandy beaches with certain species occupying predictable levels of a beach (Daily et al. 1993). The high intertidal zone tends to be inhabited by several species of beach hoppers (amphipods in the genus *Orchestoidea*), the predatory isopod *Excirolana chiltoni*, and the more sedentary bloodworm *Euzonus mucronata.* The sand crabs *Emerita analoga* and *Lepidopa californica* dominate the middle intertidal and often comprise the majority of individuals on a given beach. The lower intertidal zone, where beach slope is shallower and the sand is finer, is occupied by a broader range of wave tolerant organisms including crustaceans (e.g., mysids, cumaceans, and amphipods), polychaetes, molluscs (e.g., *Olivella* and *Donax),* and possibly sand dollars.

BENTHOS

The benthos is a general term referring to those organisms that live in (infauna), on (epibenthic), or near (demersal) the seafloor. This organisms include invertebrate and fish species. **Table 5-11** summarizes the key species identified in the study area based on frequency of occurrence, while **Table 5-12** summarizes the key species sampled in the study area based on abundance.

Soft-Bottom Communities

The infauna and epibenthic biotas of soft-bottom habitats have been well characterized throughout the SCB and are well known in the study area by over 15 years of monitoring. The

TABLE 5-11
TOP SPECIES BY FREQUENCY OF OCCURRENCE FROM 1985-1998

Species	Major Group	Farfield	Nearfield	Station 5	Within ZID	Shallow	Newport Bay
Tubulanus polymorphus/pellucidus	Nemertea	49	73	76	69	12	6
Chloeia pinnata	Polychaeta	16	3	3	12	.	.
Glycera nana	Polychaeta	7	20	16	15	44	7
Glycera americana	Polychaeta	93	139	102	38	51	8
Lumbrineris californiensis	Polychaeta	40	24	23	9	95	121
Aricidea (Acmira) *catherinae*	Polychaeta	13	14	7	4	20	65
Prionospio lighti	Polychaeta	29	65	58	28	21	3
Prionospio sp. A (SCAMIT1991)	Polychaeta	2	2	2	2	11	17
Spiophanes missionensis	Polychaeta	5	9	1	21	1	78
Paraprionospio pinnata	Polychaeta	10	15	15	22	5	4
Aphelochaeta sp. C (Dorsey1984)	Polychaeta	133	87	131	67	89	2
Cossura candida	Polychaeta	494	295	.	197	37	1
Capitella "capitata"	Polychaeta	167	40	65	7	156	43
Heteromastus filobranchus	Polychaeta	.	.	.	.	.	5
Mediomastus spp.	Polychaeta	4	6	6	3	4	10
Euclymeninae sp. A (SCAMIT1987)	Polychaeta	9	11	21	18	27	135
Pectinaria californiensis	Polychaeta	3	4	4	6	30	9
Melinna oculata	Polychaeta	69	68	87	204	10	.
Parvilucina tenuisculpta	Mollusca, Bivalvia	26	10	8	11	6	16
Tellina carpenteri	Mollusca, Bivalvia	6	5	9	5	15	24
Euphilomedes carcharodonta	Crustacea, Ostracoda	17	1	5	1	16	59
Ampelisca brevisimulata	Crustacea, Amphipoda	14	8	12	10	8	.
Amphideutopus oculatus	Crustacea, Amphipoda	44	52	28	83	2	.
Photis californica	Crustacea, Amphipoda	62	49	105	8	145	.
Phoronida	Phoronida	8	7	11	25	9	.
Glottidia albida	Brachiopoda	60	182	344	123	3	.
Amphiodia urtica	Echinodermata, Ophiuroidea	1	62	10	194	7	44

Example: *Amphiodia urtica* is the most frequently occurring species in the farfield area.)
SOURCE: MEC Analytical Systems, 1999

TABLE 5-12
TOP SPECIES BY ABUNDANCE FROM 1985-1998

Species	Major Group	Farfield	Nearfield	Station 5	Within ZID	Shallow	Newport Bay
Chloeia pinnata	Polychaeta	7	4	3	7	.	.
Exogone dwisula (SCAMIT1996)	Polychaeta	117	16	12	9	193	.
Levinsenia gracilis	Polychaeta	178	238	216	340	122	8
Levinsenia multibranchiata	Polychaeta	.	.	.	.	.	9
Aricidea (Acmira) *catherinae*	Polychaeta	12	10	7	8	10	37
Prionospio lighti	Polychaeta	32	67	51	23	22	5
Prionospio sp. A (SCAMIT1991)	Polychaeta	3	2	2	3	19	28
Spiophanes missionensis	Polychaeta	2	3	1	16	2	88
Paraprionospio pinnata	Polychaeta	22	23	22	30	12	10
Monticellina dorsobranchialis	Polychaeta	48	58	42	212	4	16
Aphelochaeta sp. C (Dorsey1984)	Polychaeta	137	101	129	65	79	1
Cossura candida	Polychaeta	494	293	.	225	7	6
Capitella "capitata"	Polychaeta	196	45	70	1	165	7
Mediomastus spp.	Polychaeta	11	9	6	4	8	4
Myriochele sp. M (SCAMIT1985)	Polychaeta	6	5	11	20	17	72
Pectinaria californiensis	Polychaeta	4	7	4	12	9	2
Nassarius perpinguis	Mollusca, Gastropoda	325	280	177	168	43	3
Parvilucina tenuisculpta	Mollusca, Bivalvia	14	6	9	5	20	24
Tellina carpenteri	Mollusca, Bivalvia	10	8	10	10	27	26
Euphilomedes carcharodonta	Crustacea, Ostracoda	20	1	5	2	21	67
Euphilomedes producta	Crustacea, Ostracoda	46	11	8	19	448	154
Amphideutopus oculatus	Crustacea, Amphipoda	28	68	59	86	5	.
Photis californica	Crustacea, Amphipoda	31	25	36	6	128	.
Rhepoxynius bicuspidatus	Crustacea, Amphipoda	9	34	19	79	68	.
Phoronida	Phoronida	5	12	15	28	3	.
Glottidia albida	Brachiopoda	68	197	344	150	6	.
Amphiodia sp	Echinodermata, Ophiuroidea	8	70	30	176	13	30
Amphiodia urtica	Echinodermata, Ophiuroidea	1	33	13	219	1	25

(Example: *Amphiodia urtica* is the most abundance species in the farfield.)
SOURCE: MEC Analytical Systems, 1999

OMP has regularly collected samples from stations ranging in water depths from 60 to over 1,000 ft. Between August 1985 and January 1998, the OMP has collected and identified over two million infaunal organisms representing 1,229 taxa; over 143,000 epibenthic macroinvertebrates representing 140 taxa; and over 125,000 fish representing 112 species (CSDOC 1998).

Studies of benthic communities and infauna in particular are important because most species are relatively sedentary, living in and on the sediments, and some are directly exposed to wastewater particulates that settle or move across the bottom. Furthermore, infaunal organisms exhibit a range of sensitivities to environmental stressors (e.g., contaminants, organic matter) which, in turn, may alter community measures (e.g., number of species, abundance, biomass, and diversity indices). By analyzing the response of the infaunal community to stressors, the magnitude and spatial extent of wastewater discharge impacts can be evaluated. Similarly, the effectiveness of wastewater treatment strategies can be evaluated from temporal trends and/or changes in community measures.

The major biological features and infaunal patterns have been extensively studied by the District's OMP. These studies documented the environmental complexity of the study area and the effects of the District's outfall and wastewater discharge. Natural features of the study area accounted for over 81% of the variability in the species distribution and their abundance (CSDOC 1996a; Diener et al. 1995). This variability was caused by depth effects, the uniqueness of Newport and San Gabriel Canyons, sediment patterns, and seasonal, annual, and long-term (multi-year) cycles. Outfall effects accounted for only 6.3% of the infaunal distribution. This low percentage is surprising since 7.5% of the sampling locations are located within 198 ft of the discharge, where both reef and discharge effects are most significant.

The District's OMP of the 120-inch outfall and wastewater discharge has found two types of impacts on the receiving water environment. First, there are discharge effects, which are related to the discharge of over 240 mgd of treated effluent. Secondly, there are reef effects from the outfall pipe structure and associated rock ballast since the outfall represents one of the largest, subtidal, artificial reefs in the SCB. These two effects produce different types of impacts to soft-bottom communities and have different spatial scales that overlap near the outfall diffuser.

The discharge of over 240 mgd of treated wastewater has the potential to impact benthic organisms. While increases in sediment contaminant concentrations have been shown near the present 120-inch outfall, there is no evidence of sediment toxicity, based upon bioassay and sediment toxicity test results (CSDOC 1995a). Thus, observed distribution of organisms appears to be related primarily to organic matter inputs (organic carbon and nitrogen as food or nutrients), predation, and/or other physical and biological processes, and not to sediment contamination. Infauna and epibenthic macroinvertebrates and fish show only minor, localized effects from the District's discharge. The infaunal community is a more sensitive indicator of discharge effects, and the spatial patterns show responses beyond areas where elevated sediment TOC concentrations can be measured.

The most significant effect of the wastewater discharge is enhanced abundance of a few opportunistic species and lower abundance of a few pollution-tolerant species near the outfall.

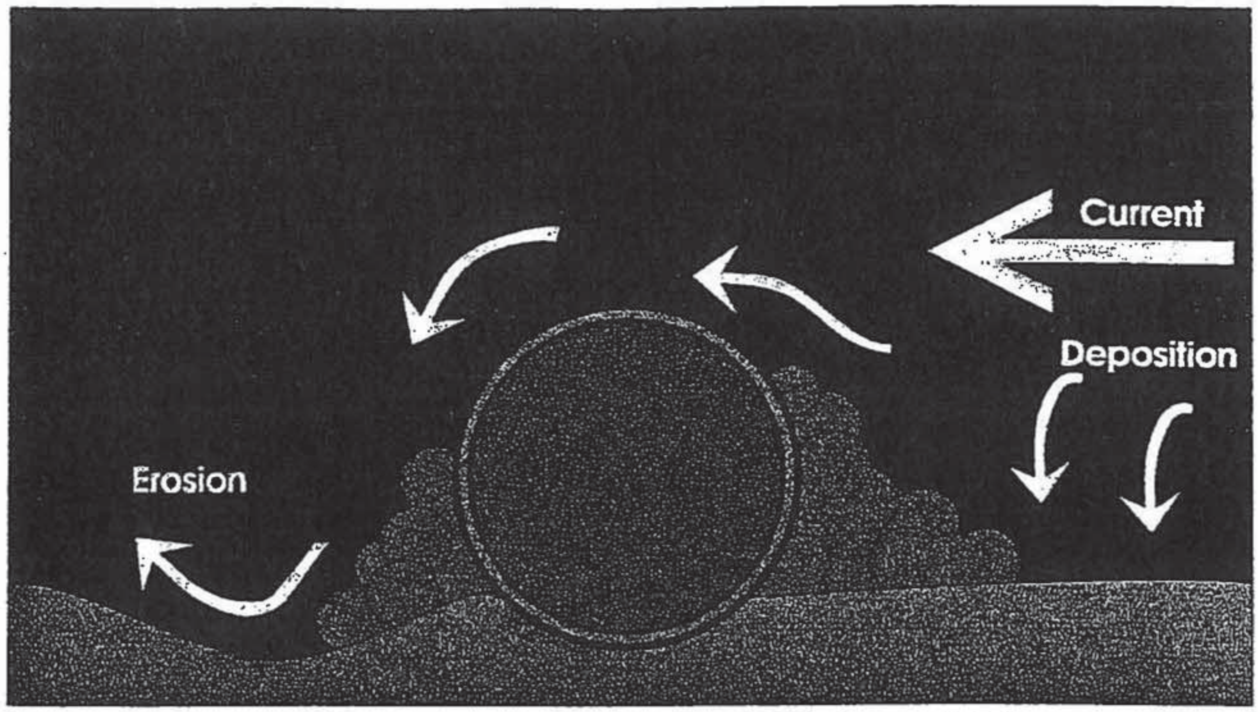
Species richness shows little evidence of an outfall effect. Based upon models of infauna response to stressors (e.g., Pearson and Rosenberg 1978- response to organic carbon; Gray 1989- response to generalized stressors), increased abundance without significant loss of species richness represents a normal community response to a mild gradient of organic material, and does not indicate a highly stressed or degraded community. These findings are supported by Infaunal Trophic Index (ITI) and Trophic Motility Size (TMS) analyses, which indicate an infaunal gradient near the outfall but no large change in community function. Multivariate cluster analysis was also used to graphical portray the spatial extent of outfall effects that show only limited outfall effects. Cluster analysis indicated that the outfall affected few species and, while some species have lower abundance near the outfall, no species appear to be excluded near the outfall (CSDOC 1996a). These results support the conclusion that a balanced indigenous population exists near the outfall.

Ten-year trends indicate that some pollution-tolerant indicator species have been decreasing, while sensitive species (e.g., the brittlestar) have been increasing in abundance nearer the discharge point. The brittlestar *Amphioida* has shown a significant recovery at locations near the outfall correlated with improving quality of the effluent and lower mass emissions. However, full recovery of this species may not occur in areas nearest the outfall because of reef effects, i.e., predation on this species by reef residents. These trends indicate improving environmental quality near the discharge correlated with improving effluent quality related to effective source control programs and changes in treatment technology and practices.

Hard-Bottom Communities and Artificial Reefs

The District's outfall pipe and diffuser structures represent one of the largest artificial reefs in the SCB. Artificial reefs have a profound influence on the adjacent soft-bottom community, altering the physical environment and abundance patterns of organisms up to hundreds of yards from the structure (Ambrose and Anderson 1990; Davis et al. 1982; Diener et al. 1997). The District's 120-inch outfall pipe and associated rock ballast cover approximately 1.1 million ft^2 (about 25 acres). Because the outfall structure is well supported with rock ballast, this structure resembles many artificial reefs built in the SCB (Lewis and McKee 1989). Because hard-bottom substrate is not natural to the area of the 120-inch outfall, its presence and the habitat it provides enhances biological diversity and possibly increased productivity and greater fish stocks. It is for these reasons that artificial reefs are viewed as beneficial to the environment and millions of dollars have been spent constructing artificial reefs in the SCB. However, artificial reefs do impact the surrounding benthic environment by predators attracted to the reef, reef resident predators, as well as physical alteration of sediment particle size by currents interacting with the reef structure (**Figure 5-6**). A summary and extensive discussion of the value of artificial reefs, biomass production of reefs, and the effects of reefs on benthic communities was presented in CSDOC (1995a, 1996a).

Infaunal communities near reefs may be altered in two ways: predation by reef associated organisms (Ambrose and Anderson 1990; Davis et al. 1982; Posey and Ambrose 1994) and redistribution of sediment characteristics due to the reef structure (Baynes and Szmant 1989; Fricke et al. 1986). Reef effects caused an increase in organic carbon content and finer sediments



"Reef Effects" - Physical Disturbance to Soft-bottom Habitat

"Reef Effects" - Predation on Soft-bottom Habitat

SOURCE: OCSD, Marine Monitoring Annual Report, 1995

Figure 5-6
Reef Effect Impacts

within 660 ft of the pipe structure (CSDOC 1995a). Infaunal abundance patterns were altered as far away as 1,320 ft from the pipe structure with some organisms being enhanced, while others had depressed abundances. Of special importance was the brittlestar *Amphiodia urtica,* a sensitive indicator species that had depressed abundances near the pipe (reef) extending between 656 and 1,312 ft. Thus, depressed abundances of this species were not due to wastewater discharge effects, but appeared to result from predation by species living on the reef or attracted to the reef edge.

EPIBENTHIC MACROINVERTEBRATES AND FISH

Demersal species are those species generally found living on or just above the bottom. Studies of demersal species are important because these species live and feed either on or in close association with the bottom, and are potentially directly exposed to wastewater particulates from the wastewater discharge. Many of these organisms are good indicators of environmental quality and show external manifestations of stress and disease that may be related to wastewater discharges (e.g., fin lesions and lip tumors). Furthermore, the District studies these communities to document that the outfall area is not a disease epicenter nor is degraded.

Nearshore, soft-bottom areas of the SCB support high abundances of species such as flatfish, surfperch, and croakers. Generally, schooling fish are abundant just beyond the surfzone, while flatfish increase in abundance as depth increases (Allen 1982; Cross and Allen 1993; Love et al. 1986). **Table 5-13** summarizes the key fish species in the study area based on frequency of occurrence, while **Table 5-14** summarizes key fish species observed in the study area based on abundance. In nearshore waters, Love et al. (1986) found that queenfish (*Seriphus politus*), white croaker, and northern anchovy dominated depths less than 20 ft, while flatfish, including speckled sanddabs (*Citharichthys stigmaeus*), hornyhead turbot (*Pleuronichthys verticalis*), and fantail sole (*Xystreurys liolepis*), were more common at depths between 20 and 59 ft.

These patterns are similar to those observed during the District's OMP. Other flatfish common in the SCB include Dover sole (*Microstomus pacificus*), English sole (*Pleuronectes vetulus*), and slender sole (*Eopsetta exilis*). Of these species, Dover sole and English sole are commonly collected during the OMP and are caught commercially.

The most abundant species near the 78-inch outfall include white croaker, queenfish, longfin sanddabs (*Citharichthys xanthostigma*), California lizardfish (*Synodus lucioceps*), northern anchovy, yellowchin sculpin (*Icelinus quadriseriatus*), and tonguefish (*Symphurus atricauda*). The most abundant species at the 119 ft and outfall depth stations (188 ft) were yellowchin sculpin, Pacific sanddabs (*Citharichthys sordidus*), speckled and longfin sanddabs, and tonguefish. Thompson et al. (1987) found that the most abundant species at 98-, 197-, and 492-ft depths in the SCB were Pacific sanddabs, bigmouth sole (*Hippoglossina stomata*), and plainfin midshipman (*Porichthys notatus*), respectively. These same species were abundant during the 1994 SCBPP (Allen et al. 1998) and are commonly found in the top ten for the District's OMP studies (Maurer et al. 1998).

TABLE 5-13
TOP FISH SPECIES RANKED BY FREQUENCY OF OCCURRENCE BY DEPTH OR AREA FROM 1985-1998

Species	Common Name	18 meters	36 meters	Farfield	Nearfield
Engraulis mordax	Northern anchovy	4	20	18	38
Synodus lucioceps	California lizardfish	3	6	6	12
Porichthys notatus	Plainfin midshipman	26	17	9	15
Zaniolepis latipinnis	Longspine combfish	.	27	8	6
Icelinus quadriseriatus	Yellowchin sculpin	27	3	2	5
Chitonotus pugetensis	Roughback sculpin	.	10	12	8
Genyonemus lineatus	White croaker	1	9	19	41
Seriphus politus	Queenfish	7	18	28	.
Lepidogobius lepidus	Bay goby	23	5	10	10
Citharichthys sordidus	Pacific sanddab	16	11	1	1
Citharichthys stigmaeus	Speckled sanddab	2	1	15	4
Citharichthys xanthostigma	Longfin sanddab	10	2	3	2
Hippoglossina stomata	Bigmouth sole	12	7	4	9
Xystreurys liolepis	Fantail sole	6	12	37	24
Microstomus pacificus	Dover sole	42	.	7	14
Pleuronectes vetulus	English sole	13	19	13	7
Pleuronichthys ritteri	Spotted turbot	8	39	52	.
Pleuronichthys verticalis	Hornyhead turbot	5	8	11	11
Symphurus atricauda	California tonguefish	9	4	5	3

(Example: white croaker is most frequently occurring species at 18-m depth.)
SOURCE: MEC Analytical Systems, 1999

Fish communities nearest the outfall (OMP Station T1) were generally not significantly different from reference stations, although more fish and larger fish are sampled nearest the outfall area, indicating some positive influence of the wastewater discharge upon fish community measures. Longer-term trends of declining fish abundance are consistent with trends throughout the SCB and are indicative of regional effects and not suggestive of discharge effects. Fish caught on the outfall structure are typical of those from artificial and natural reefs in the SCB. Thus, the biological community on the outfall structure appears to be representative of a balanced indigenous population, and the outfall area is not representative of a degraded habitat. Changes in species composition over the past 24 years appear to be due to several factors including large-scale climatic and possibly watershed changes, over fishing, and loss of nearshore habitats, but not due to discharge effects.

As found for other communities, depth effects were the most important in determining the composition and abundance macroinvertebrates. **Table 5-15** summarizes the key

TABLE 5-14
TOP FISH SPECIES RANKED BY ABUNDANCE BY DEPTH OR AREA FROM 1985-1998

Species	Common Name	18 meters	36 meters	Farfield	Nearfield
Engraulis mordax	Northern anchovy	3	20	20	38
Synodus lucioceps	California lizardfish	4	3	4	6
Zaniolepis latipinnis	Longspine combfish	.	27	5	8
Icelinus quadriseriatus	Yellowchin sculpin	27	2	1	1
Chitonotus pugetensis	Roughback sculpin	.	10	8	7
Genyonemus lineatus	White croaker	1	7	10	41
Seriphus politus	Queenfish	7	18	31	.
Lepidogobius lepidus	Bay goby	23	6	9	11
Citharichthys sordidus	Pacific sanddab	16	13	2	2
Citharichthys stigmaeus	Speckled sanddab	2	1	11	5
Citharichthys xanthostigma	Longfin sanddab	10	4	3	4
Hippoglossina stomata	Bigmouth sole	12	8	6	9
Xystreurys liolepis	Fantail sole	6	12	37	28
Pleuronectes vetulus	English sole	14	19	18	10
Pleuronichthys ritteri	Spotted turbot	8	39	52	.
Pleuronichthys verticalis	Hornyhead turbot	5	9	15	12
Symphurus atricauda	California tonguefish	9	5	7	3

(Example: white croaker is the most abundant species at 18-m depth.)
SOURCE: MEC Analytical Systems, 1999

macroinvertebrate species observed based on frequency of occurrence and **Table 5-16** summarizes the key species based on abundance. The dominant invertebrates for the inshore area, 60 to 120 ft, and representative of the 78-inch outfall area, included the shortspined starfish *(Pisaster brevispinus)*, the mantis shrimp (*Hemisquilla ensigera*), swimming crab (*Portunus xantusii*), blue spotted shrimp and Alaskan crangon shrimp (*Crangon nigromaculata* and *C. alaskensis*), and the sandstar (*Astropecten verrilli*). At the outfall depths the most common invertebrates included the white sea urchin (*Lytechinus pictus*), sea cucumber (*Parastichopus californicus*), ridgeback prawn (*Sicyonia ingentis*), and sandstars. These species are similar to those found by others as typical for these depths (Allen et al. 1998; Thompson et al. 1987).

Macroinvertebrate community measures show some minor changes near the outfall, but it cannot be determined if these are related to reef effects or wastewater discharge effects. Outfall station T1 tended to have intermediate number of macroinvertebrate species and abundances compared to the two local reference areas. This supports the contention that the wastewater discharge has minor impacts on these communities. Trends in fish and macroinvertebrate community measures show a generally decline since 1985. However, these trends were consistent within the study area and were similar to other regional studies that appear to be independent from discharge effects.

TABLE 5-15
TOP MACROINVERTEBRATE SPECIES RANKED BY FREQUENCY OF OCCURRENCE BY DEPTH OR AREA FROM 1985-1998

Species	Common Name	18 meters	36 meters	Farfield	Nearfield
Thesea sp. B (colonial)	Gorgonian seafan	5	3	5	4
Heterogorgia tortuosa (colonial)	Gorgonian seafan	17	9	22	12
Renilla kollikeri	Sea pansy	8	.	.	.
Acanthoptilum scalpellifolium	Sea pen	23	29	18	9
Acanthodoris brunnea	(Dorid) Nudibranch	28	18	10	10
Hamatoscalpellum californicum	Barnacle	10	8	7	7
Sicyonia ingentis	Ridgeback prawn	.	2	3	2
Crangon alaskensis	Caridean shrimp	13	33	11	8
Crangon nigromaculata	Blue spotted shrimp	3	26	.	36
Pagurus spilocarpus	Hermit crab	4	10	31	28
Pyromaia tuberculata	Spider crab	6	7	36	25
Heterocrypta occidentalis	Elbow crab	9	4	23	15
Luidia foliolata	Sandstar	12	5	6	6
Astropecten verrilli	Sandstar	2	1	4	1
Astropecten armatus	Sandstar	7	70	.	.
Pisaster brevispinus	Shortspined starfish	1	20	.	53
Ophiura luetkeni	Brittlestar	43	31	9	13
Ophiothrix spiculata	Brittlestar	.	21	8	14
Lytechinus pictus	White sea urchin	14	6	1	3
Parastichopus californicus	Sea cucumber	.	15	2	5

(Example: *Pisaster brevispinus* is the most frequently occurring species at 18-m depth.)
SOURCE: MEC Analytical Systems, 1999

BIRDS

Table 5-17 lists the bird species common to the mainland beach habitats in the region. **Table 5-18** summarizes the birds of ecological importance occurring within the study region. The seabird community in the SCB is composed of approximately 80 species (Bender et al. 1974, Briggs et al. 1981), however, only 25 to 30 of these species are common or abundant; the remaining species comprise less than 5% of the total. Of this total, some 17 species have been recorded as nesting within the Bight. Three species, the Least Tern, Caspian Tern, and Elegant Tern nest only on mainland beaches. The Least Tern nests in Orange County in several areas within the District's coastal service area including near Plant No. 2 at the mouth of the Santa Ana River. There are seven year-round resident species and three summer visitors known to regularly nesting among

TABLE 5-16
TOP MACROINVERTEBRATE SPECIES RANKED BY ABUNDANCE BY DEPTH OR AREA FROM 1985-1998

Species	Common Name	18 meters	36 meters	Farfield	Nearfield
Thesea sp. B (colonial)	Gorgonian seafan	10	8	13	12
Acanthoptilum scalpellifolium	Sea pen	22	24	16	3
Pleurobranchaea californica	Opistobranch sea slug	.	9	11	37
Acanthodoris brunnea	Nudibranch	28	19	12	8
Hamatoscalpellum californicum	Barnacle	7	4	3	6
Sicyonia ingentis	Ridgeback prawn	.	5	4	4
Crangon alaskensis	Caridean shrimp	1	34	8	10
Crangon nigromaculata	Blue spotted shrimp	5	28	.	38
Pagurus spilocarpus	Hermit crab	8	11	42	23
Pyromaia tuberculata	Spider crab	9	7	40	33
Heterocrypta occidentalis	Elbow crab	4	2	28	19
Luidia foliolata	Sandstar	15	6	9	7
Luidia armata	Sandstar	41	10	31	21
Luidia asthenosoma/ludwigi	Sandstar	.	12	10	52
Astropecten verrilli	Sandstar	2	3	5	2
Pisaster brevispinus	Shortspined starfish	3	29	.	53
Ophiura luetkeni	Brittlestar	43	23	6	9
Ophiothrix spiculata	Brittlestar	.	15	7	11
Lytechinus pictus	White sea urchin	6	1	1	1
Parastichopus californicus	Sea cucumber	.	21	2	5

(Example: *Crangon alaskensis* is the most abundant species at 18-m depth.)
SOURCE: MEC Analytical Systems, 1999

the Channel Islands or Coronado Islands, including the California Brown Pelican. Reproductive success is strongly linked to food availability, and to the predictability of seasonal foraging areas. During periods of reduced food availability, fecundity declines as noted for the California Brown Pelican population and the relationship to Northern Anchovy abundance.

Other species are year–round visitors that do not breed in Southern California but can be expected somewhere within the Bight at any time of the year. Among these are two gull species and one tern. The Black–footed Albatross may be expected in open–ocean waters at any season. Six species may be listed as summer visitors including the Sooty Shearwater, generally regarded as the most abundant and perhaps the most energetically important seabird of the California Current region. Nearly half the seabird species recorded for Southern California waters are winter visitors from October through April. Included in this group are several species of loons, grebes, and sea ducks, a large variety of jaegers, gulls, and terns, and several abundant species of the family

TABLE 5-17
BIRD SPECIES COMPOSITION AND GROUPS COMMON TO THE MAINLAND BEACH HABITATS

Bird Group	Peak Abundance
Loons/Grebes	
Common Loon (*Gavia immer*)	November–May
Pacific Loon (*Gavia pacifica*)	
Red–throated Loon (*Gavia stellata*)	
Horned Grebe (*Podiceps auritus*)	
Eared Grebe (*Podiceps nigricollis*)	
Western Grebe (*Aechmophorus occidentalis*)	
Pelicans/Cormorants	
Brown Pelican (*Pelecanus occidentalis californicus*)*	August–October, April–July
Double–crested Cormorant (*Phalacrocorax auritus*)	
Brandt's Cormorant (*Phalacrocorax penicillantus*)	
Gulls/Terns	
Western Gull (*Larus occidentalis*)*	October-May
Herring Gull (*Larus argentatus*)	
California Gull (*Larus californicus*)*	
Ring–billed Gull (*Larus delewarensis*)*	
Mew Gull (*Larus canus*)	
Heermann's Gull (*Larus heermanni*)*	
Bonaparte's Gull (*Larus philadelphia*)*	
Common Tern (*Sterna hirundo*)*	
Caspian Tern (*Sterna caspia*)*	
Elegant Tern (*Sterna elegans*)*	
Forster's Tern (*Sterna forsteri*)*	
California Least Tern (*Sterna antillarum browni*)*	
Arctic Tern (*Sterna paradisaea*)*	
Geese/Scoters/Mergansers	
Brant (*Branta bernicla*)	
Surf Scoter (*Melanitta perspicillata*)	December–February
White–winged Scoter (*Melanitta fusca*)	
Red–breasted Merganser (*Mergus serrator*)	
Phalaropes	
Red–necked Phalarope (*Phalaropus lobatus*)*	August
Red Phalarope (*Phalaropus fulicaria*)*	
Shorebirds	
Western Sandpiper (*Calidris mauri*)	October–April
Sanderling (*Calidris alba*)	
Ruddy Turnstone (*Arenaria interpres*)	
Willet (*Catoptrophorus semipalmatus*)	
Marbled Godwit (*Limosa fedoa*)	
Semipalmated Plover (*Charadrius semipalmatus*)	

* Birds observed off Orange County during ocean monitoring
SOURCE: Briggs et al. 1981, Unitt 1984

TABLE 5-18
AQUATIC BIRD RESOURCES OF ECOLOGICAL IMPORTANCE OCCURRING WITHIN THE STUDY REGION

	Coastal Marshes/Shoreline Santa Ana River Mouth	Nearshore (78 in. outfall)	Offshore Area (120 inch outfall)
Shorebirds			
Shorebirds	+	+	
Jaegers		+	
Gulls	+	+	
Black Oystercatcher	+	+	
Snowy Plover			+
California Least Tern		+	+
Wading Birds			
Herons		+	
Egrets		+	
Rails			
Light–footed Clapper Rail	+		+
California Black Rail			+
Great Blue Heron		+	
Waterfowl			
Loons	+	+	
Grebes	+	+	
Geese	+	+	
Dabbling Ducks			+
Diving Ducks	+	+	
Sea Ducks	+	+	
Mergansers		+	
Seabirds			
California Brown Pelican		+	+
Brandt's Cormorant		+	

SOURCE: Beccassio et al. 1981

Alcidae — the murres, auklets, and puffins. Pure transients include nine species that pass through Southern California waters while migrating between their wintering and breeding grounds.

Due to their coastal distribution, types of prey (mainly fish), depth of foraging, season of abundance, or historical data on accumulation of chemical contaminants, the following seabirds are candidate species of concern for potential injury from the bioaccumulation of contaminants that may be derived from wastewater in general (notably chlorinated hydrocarbons).

- California Brown Pelican (Federal and State listed as endangered)
- Surf Scoter (common)
- Heerman's Gull (common)
- California Gull (common off Orange County)

- Brandt's Cormorant (common off Orange County)
- Double-crested Cormorant (common off Orange County)
- Pelagic Cormorant (occassionally seen off Orange County)

The relative abundance and marked seasonality of seabirds is highly noticeable to observers. These observations indicated that some 50–95% of the seabirds were associated with the "open water" habitat, 5–10% with the "mainland shore" habitat, and 1–4% with the "island beach" habitat. The mainland beach seabird fauna is comprised of the following groups: jaegers/gulls, terns (50–97%), geese/scoters/mergansers, pelicans/cormorants (24%), and loons/grebes whose abundances differ dramatically with season. Large changes in abundances are due to incursions of Loons/Grebes (November – June), and pelicans/cormorants (August – October, April – July).

MAMMALS

The SCB contains one of the most abundant and diverse populations of marine mammals in the world (Bonnell and Dailey 1993). There have been 31 species of cetaceans and 6 pinnipeds observed in the SCB of which some fourteen have been observed in recent years (**Table 5-19**). This listing includes year-round residents, seasonal migrants, occasional visitors, or as rare occurrences. They may migrate over extensive distances, forage over large areas, and consume substantial quantities of food (averaging 1,000 tons/day).

The U.S. Navy conducted a three year (1986-1988) aerial census of marine mammals in the southern half of the SCB, as part of a study on migration of the Gray whale. The results showed that 96% of the observed abundance was represented by five species, i.e., Gray whale, Risso's dolphin, Common dolphin, California sea lion, and Pacific white-sided dolphin (Schulberg, et. al, 1989).

Six species of pinnipeds are present in the SCB, three of which are commonly observed off Orange County. Unlike most of the cetaceans, all the pinnipeds, with the exception of the Guadalupe fur seal, are year-round residents and breed locally. The Guadalupe fur seal is an occasional visitor during the winter and breeds well to the south on Isla de Guadalupe in Mexico. Pinnipeds are major predators within the SCB, consuming large quantities of fish and invertebrates. For example, California sea lions consume an average of 38% of all the food consumed, most of which is comprised of fish, cephalopods, and crustaceans (Bonnell and Dailey 1993).

Locally, three species of pinnipeds are commonly observed. The nearest hauling grounds for California sea lions and Harbor seals are the Newport Harbor breakwater areas and rocky areas to the south along Corona Del Mar and Laguna Beaches. They are also use offshore buoys. Northern elephant seals are sighted commonly off Orange County, especially near Laguna Beach, where they may be hauling out.

In the area of the discharge in the deeper offshore waters, the only species that are routinely observed are Gray whales, White-sided dolphins, common dolphins, Bottlenose dolphins (rarely), California sea lions, and, in the nearshore area, harbor seals.

TABLE 5-19
MARINE MAMMALS OF THE ORANGE COUNTY COAST AND THEIR STATUS

Common Name	Scientific Name	Population Size[a] (Orange County Coast)	Status off Orange County
Cetaceans			
Bottlenose dolphin	*Tursiops truncatus*		Resident - Coastal
Common dolphin	*Delphinus delphis*		Resident - Offshore
Rissos dolphin	*Grampus griseus*		Year-round resident
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*		Year-round resident
Gray whale[E] (formerly lists?)	*Eschrichtius robustus*		Seasonal migrant
Minke whale	*Balaenoptera acutorcstrata*		Seasonal migrant
Northern right-whale dolphin	*Lissodelphis borealis*	C[(e)]	Year-round resident
Short-finned pilot whale	*Globicephala macrorhynchus;* also called *G. scammonii*	C	Year-round resident
Killer whale	*Orcinus orca*	C	Occasional visitor
Sperm whale	*Physeter macrocephalus*	C[(e)]	Occasional visitor
Rough-toothed dolphin	*Steno bredanensis*	C	Possible visitor
Pinnipeds			
California sea lion	*Zalophus californianus*	157,000	Year-round resident
Pacific harbor seal	*Phoca vitulina*	312,000	Year-round resident
Northern elephant seal	*Mirounga angustriostris*	>100,000[(e)]	Year-round resident

Note: Dash (C) indicates that population estimate cannot be made from existing data.
[E]Formerly designated as endangered under the Endangered Species Act of 1973 (ESA).
[T]Designated as threatened under the Endangered Species Act of 1973.
[(a)]U.S. Department of Commerce 1987; other sources as cited.
[(b)]Braham 1984a.
[(c)]Ohsumi and Wada 1974.
[(d)]Ohsumi and Fukuda 1975.
[(e)]World population limited to North Pacific area.
[(f)]Breiwick et al. 1988.
[(g)]Braham and Rice 1984.
[(h)]Estimate includes only eastern North Pacific stock.
[(i)]Jones et al. 1987.
[(j)]Estes 1980; Calkins and Schneider 1985; Roterdam and SimonBJackson 1988.

SOURCE: Modified from Kelly, 1990 and Bonnell and Dailey 1993

THREATENED AND ENDANGERED SPECIES

Table 5-20 lists the state and federal listed threatened and endangered species in the project area. All marine mammal species are protected under the federal Marine Mammal Protection Act of

TABLE 5-20
SPECIAL STATUS SPECIES

Common Name	Scientific Name	Federal Status	State Status	Habitat	Use of Habitat
California Brown Pelican	*Pelecanus occidentalis californicus*	Endangered	Endangered	ocean waters, estuary/salt marsh	Occasional visitor, feeding
California Least Tern	*Sterna antillarum browni*	Endangered	Endangered	ocean waters, estuary/salt marsh	feeding and nesting. Nest near mouth of Santa Ana River, over area of OCSD's buried outfall
Light Footed Clapper Rail	*Rallus longirostris levipes*	Endangered	Endangered	estuary/salt marsh	Adult concentration, feeding, nesting
Belding's Savannah Sparrow	*Passerculus sandwichensis beldingi*		Endangered	estuary/salt marsh	Adult concentration, feeding, nesting. Occurs in wetlands near Plant No. 2
Guadalupe Fur Seal	*Arctocephalus townsendi*	Threatened	Threatened	Ocean waters	Migratory area, occasional visitor
Stellar Sea Lion	*Eumetopias jubatus*	Threatened		Ocean waters	Migratory area, occasional visitor
Humpback Whale	*Megaptera novaeangliae*	Endangered		Ocean waters	occasional visitor
Blue Whale	*Balaenoptera musculus*	Endangered		Ocean waters	Migratory area, feeds in area
Sei Whale	*Balaenoptera borealis*	Endangered		Ocean waters	occasional visitor
Finback Whale	*Balaenoptera physalus*	Endangered		Ocean waters	Migratory area, feeds in area
Northern Right Whale	*Eubalaena glacialis*	Endangered		Ocean waters	occasional visitor
Sperm Whale	*Physter mactocephalus*	Endangered		Ocean waters	occasional visitor
Western Snowy Plover	*Charadrius alexandrinus nivosus*	Threatened	None	estuary/salt marsh	feeding and nesting

1972. There are a few marine species that have been designated as threatened, rare or endangered under various Federal and State statutes that protect wildlife. Previous inquiries and reviews by the National Marine Fisheries Service and the U. S. Fish and Wildlife Service have indicated that there are twelve listed rare and endangered species potentially present in the coastal area of Orange County. These bird and mammal species and their preferred habitats and use of the local area are described in **Table 5-20**.

Only a couple of these species are likely to have any possibility of being impacted (either directly or indirectly) from the operation of the OCSD wastewater treatment facilities and the discharge of less-than-secondary treated wastewater. These are the California Brown Pelican and California Least tern, both fish-eating birds that have been observed feeding near offshore OMP stations. The remaining bird species are found at beaches in Orange County or the wetlands and beaches of Anaheim or Newport Bays or other local bays and estuarine areas. Most of the listed pinnepeds and whale species are rarely sighted in the area and are unlikely to be anything but an occasional visitor to the region. In inland areas of the OCSD service area, there are other protected species that must be considered when constructing or maintaining the sewer collection facilities.

5.1.6 PUBLIC HEALTH

Public health concerns in the area of discharge include levels of coliforms and viruses in the water and concentrations of pollutants in the tissues of fish and shellfish consumed by humans. Water-contact recreation is heavy within 300 yards of the shore off Newport and Huntington Beaches (MEC 1997). Areas further offshore are used occasionally for water-contact activities. Shellfish and fish are taken from these waters and used for human consumption. Certain contaminants can be transferred from the effluent to these organisms through the food web.

PATHOGENS

Based on calculations of present flow rates and percent removal of microorganisms from the influent, the expected concentration of indicator bacteria in the effluent is 1.3 x 10^7 MPN/100 ml for total coliforms, 4 x 10^6 MPN/100 ml for fecal coliforms, and 0.6 PFU/10 ml for enteric viruses (Lindstrom 1999). For samples collected in offshore receiving waters for the period 1985 to 1995 of the existing outfall, the expected concentration of fecal coliforms was calculated to be a mean of approximately 6,750 MPN/100ml (CSDOC 1996a). Actual field-collected data are described below.

Fecal coliform monitoring data collected by the OMP in offshore receiving waters of the existing 120-inch outfall from 1987 to 1998 are shown in **Table 5-21**. Most values are <20 MPN/100ml. Fecal coliform levels are greater in waters below the pycnocline compared to waters above and within the pycnocline except in shallow water samples. Values are >1,000 MPN/100ml in 7.2% of farfield samples, 15.7% of nearfield samples, 0.5% of shallow samples, and 19.5% of within ZID samples.

TABLE 5-21
FECAL COLIFORMS (MPN/100 ML) IN THE VICINITY OF THE EXISTING CSDOC OUTFALL FOR THE PERIOD JULY 1987 TO MAY 1998
(Values are Percent Occurrence)

Area	Relation to Pycnocline	Number of Samples	<20	21-100	101-1000	1001-10,000	>10,000
Farfield	Above	852	81.3	13.1	3.9	1.5	0.1
Farfield	Within	836	69.6	14.8	10.2	4.9	0.5
Farfield	Below	1426	49.0	14.2	22.2	13.1	1.5
Nearfield	Above	910	77.9	11.5	4.9	4.6	1.0
Nearfield	Within	870	63.6	15.2	9.4	9.9	2.0
Nearfield	Below	1365	41.7	13.1	15.5	21.0	8.7
Shallow	Above	63	68.3	27.0	4.8	0	0
Shallow	Within	71	59.2	40.8	0	0	0
Shallow	Below	63	63.5	31.7	3.2	1.6	0
Within ZID	Above	58	65.5	31.0	3.4	0	0
Within ZID	Within	60	43.3	28.3	8.3	15.0	5.0
Within ZID	Below	73	34.2	16.4	11.0	32.9	5.5

SOURCE: MEC Analytical Systems, 1999

Total coliform surfzone monitoring data collected by the Districts along Newport Beach from Bolsa Chica to Crystal Cove from January 1997 to January 1999 are shown in **Table 5-22**. Coliform values are higher at the mouth of the Santa Ana River (Station 0) and just upcoast of the mouth and are lower south of Newport Bay. Most total coliform values in the surfzone are <20 MPN/100 mL. Total coliforms are >1,000 MPN/100 mL in 6.2% of the samples. High values are often associated with rain events, likely caused by contamination from runoff and onshore sources (CSDOC 1996c). While there have been beach closures along Newport Beach due to landside breaks in pipelines or pump station malfunctions related to the District's operations, there have been no incidences of beach closure due to contamination from the wastewater discharged from the 120-inch outfall (Mazur, personal communication 1999).

Data on coliforms in waters near the 78-inch outfall diffuser are available for fall 1996 (**Table 5-23**). Fecal coliform counts were all <20 MPN/100 ml in surface waters, <20 to > 6,000 in midwaters, and <20 to 9,000 in bottom waters. Most samples were <20 MPN/100 ml. Coliform levels at the proposed diffuser site for the new ocean outfall are summarized in **Table 5.24**. One hundred percent of the fecal coliform concentrations in these waters are <100 MPN/100 ml in waters above and within the pycnocline; values >1,000 MPN/100 ml are found in 16.7% of the samples taken from waters below the pycnocline.

TISSUE BURDENS

Contaminants in fish and shellfish tissues of animals used for human consumption have been measured by the District's OMP. Compliance criteria state that "the natural taste, odor, and color

TABLE 5-22
TOTAL COLIFORMS (MPN/100 mL) IN THE SURFZONE FROM BOLSA CHICA TO CRYSTAL COVE FOR THE PERIOD JANUARY 1997 TO JANUARY 1999 (Values are Percent Occurrence) STATIONS ARE FROM THE OMP

Station	Number of Samples	<20	21-100	101-1000	1001-10,000	>10,000
39N	471	57.1	21.2	16.8	4.2	0.6
33N	471	52.9	22.5	18.9	4.9	0.8
27N	471	60.7	18.9	16.3	3.4	0.6
21N	471	60.3	19.1	16.3	3.2	0.6
15N	471	50.5	25.1	20.2	3.6	0.6
9N	471	37.2	25.7	29.7	6.4	1.1
6N	471	38.9	26.5	28.2	5.5	0.8
3N	471	33.5	26.3	32.3	6.4	1.5
0	471	35.7	21.9	30.1	9.1	3.2
3S	469	49.9	15.6	19.6	8.5	6.4
6S	469	57.1	17.3	16.4	5.8	3.4
9S	471	56.3	19.1	15.3	7.9	1.5
15S	471	54.8	17.6	21.2	6.2	0.2
21S	471	61.4	18.3	15.7	4.7	0
27S	471	71.3	14.2	11.5	3.0	0
29S	308	66.6	20.5	12.3	0.6	0
39S	307	88.9	8.8	2.3	0	0

SOURCE: MEC Analytical Systems, 1999

TABLE 5-23
FECAL COLIFORMS (MPN/100 mL) NEAR THE 78-INCH OUTFALL DIFFUSER LOCATION FOR THE PERIOD SEPTEMBER THROUGH NOVEMBER 1996 (Values are Percent Occurrence)

Depth	Number of Samples	<20	21-100	101-1000	1001-10,000	>10,000
Surface	10	100	0	0	0	0
Mid-Water	10	60	10	20	0	10
Bottom	10	50	10	20	20	0

SOURCE: MEC Analytical Systems, 1999

TABLE 5-24
FECAL COLIFORMS (MPN/100 mL) NEAR THE PROPOSED NEW OUTFALL LOCATION FOR THE PERIOD JULY 1987 TO MAY 1998
(Values are Percent Occurrence)

Relation to Pycnocline	Number of Samples	<20	21-100	101-1000	1001-10,000	>10,000
Above	28	71.4	28.6	0	0	0
Within	28	64.3	35.7	0	0	0
Below	42	38.1	26.2	19.0	14.3	2.4

SOURCE: MEC Analytical Systems, 1999

of fish, shellfish, or other marine resources used for human consumption shall not be altered" (CSDOC 1996c; State Resources Control Board 1997). No numerical or objective criteria for assessing taste, odor, and color of tissues have been established; however, examination of organisms collected by the Districts over a ten-year period showed no abnormal color or odor (CSDOC 1996c).

Concentrations of metals in the muscle tissues were measured in barred sand bass (*Paralabrax nebulifer*), Pacific mackerel (*Scomber japonicus*), white croaker (*Genyonemus lineatus*), and California scorpionfish (*Scorpaena guttata*) collected near the existing 120-inch outfall. Differences among species are seen, such as higher levels of arsenic in California scorpionfish and higher concentrations of mercury in barred sand bass (CSDOC 1996a). Measured concentrations of metals are similar to values reported for these species from other areas of the SCB (CSDOC 1994, 1996a; Mearns et al. 1991). Concentrations of mercury in muscle tissues of barred sand bass collected within the ZID exceed California Department of Health Services advisory levels (0.5 mg/kg). A special study (Phillips et al. 1997a) indicated that mercury concentrations in this species increase with age, and when data on mercury concentrations are age-corrected, concentrations are not significantly higher at the outfall compared to reference areas.

Concentrations of volatile organic and base/neutral/acid compounds in fish tissues are non-detectable. Levels of total DDT and polychlorinated biphenyls in the muscle tissues of the four fish species were elevated in 1987 to 1989 but have been <100 ng/g wet weight since 1992. The total DDT and total polychlorinated biphenyls concentrations are below the corresponding Food and Drug Administration Action Limits (5 and 2 mg/kg, respectively) (CSDOC 1996a).

Concentrations of metals in crab muscle tissue at the outfall are <1 mg/kg for all priority pollutant metals except arsenic, copper, and zinc (CSDOC 1996a). Concentrations of chlorinated pesticides and polychlorinated biphenyls are low and at or below detection limits. DDE is the only compound present in measurable amounts (<0.1 to 2.6 ng/g). All other chlorinated pesticides and polychlorinated biphenyls are nondetectable.

5.1.7 BENEFICIAL USES

The beneficial uses of the marine environment, as defined in the NPDES permit, include water contact recreation, noncontact water recreation, ocean commercial and non-freshwater sport fishing, wildlife habitat, preservation of rare and endangered species, marine habitat, industrial service supply, navigation, and shellfish harvesting. Three distinct areas are considered: Santa Ana River Tidal Prism, Pacific Ocean Near Shore, and Pacific Ocean Offshore. The beneficial uses of each area are summarized in **Table 5-25.**

WATER CONTACT RECREATION

Of the 68 km (40 miles) of coastline in Orange County, there are 5.5 km (3 miles) of rocky shores and almost 63 km (39 miles) of beaches. Huntington Beach extends 14.5 km (9 miles) from Huntington Harbor and Sunset Beach to the Santa Ana River, and includes Huntington Beach State Park and Bolsa Chica State Park. Newport and Balboa Beaches are to the south of Santa Ana River. In 1987, Huntington Beach attracted over 9 million visitors (Lindstrom personal communication 1999). Swimming and surfing are the most popular water sports. Surfers, protected by wet suits, spend many hours in the water beyond the surf line. Water contact recreation is unlikely 8 km (5 miles) offshore in the area of the outfall.

NON-CONTACT WATER RECREATION

Non-contact water recreation in the region includes boating, beach activities, and bicycling along the Huntington State Beach, Bolsa Chica Beach, and the Newport Beach Bikeway. Currently there are three harbors in the area with moorage for about 5,000 private vessels. Boating offshore enhances the aesthetic enjoyment of the marine environment, particularly during whale migration. Many land-based visitors enjoy the wildlife refuges (Seal Beach National Wildlife Refuge, Bolsa Chica Ecological Reserve and Marsh Wildlife Area, Upper Newport Bay Ecological Reserve, and Newport Beach and Irvine Coast Marine Life Refuges). Birding and studying the intertidal life are informal activities for many visitors as well as the focus of scientific and educational field trips.

OCEAN COMMERCIAL AND SPORT FISHING

Newport Harbor provides moorage for at least 2,220 commercial fishing vessels, which include trollers, trawlers, seiners, gill netters, trappers, and divers. Commercial fishing in the vicinity of the outfall (Block 738) is predominately for California barracuda, California halibut, and white seabass. The total fish harvest was 39,000 kg (43 tons) in 1987. The major commercial fisheries in the vicinity of the outfall include: small gillnet fisheries for white croaker, thresher shark, and California barracuda; purse seine fisheries for Pacific bonito and jack mackerel; and the squid fishery. The squid fishery took 5,178,700 kg (5,709 tons) of squid from the Los Angeles

TABLE 5-25
DESIGNATED BENEFICIAL USES LISTED IN OCSD 1998 NPDES PERMIT

Beneficial Use	Santa Ana River Tidal Prism	Pacific Ocean Nearshore Zone	Pacific Ocean Offshore Zone
Water contact recreation	X	X	X
Non-contact water recreation	X	X	X
Ocean commercial and sport fishing	X	X	X
Wildlife habitat	X		X
Preservation of rare and endangered species	X		
Marine habitat	X	X	X
Industrial service Supply		X	X
Navigation		X	X
Shellfish harvesting		X	
Preservation of biological habitats of special significance			X
Spawning, reproduction and development		X	X

NOTE: The nearshore zone extends from the shoreline to the 30-foot depth contour, and the offshore zone extends from the 30-foot depth contour to the limit of state waters (3-mile limit) and beyond to federal waters. Surface waters of the Offshore Zone, to a depth of 10 feet, are used for water contact recreation (added in 1998).

area in 1987. Crab and lobster are also trapped commercially and recreationally, with 467,300 kg (515 tons) caught in 1987. The trawl fishery for the spiny sea cucumber (*Parastichopus californicus*), most of which is sold abroad in Asian markets, is another major fishing occurring near the outfall area.

Recreational fishing from the beach, piers, and party boats is common. The catch includes predominately Pacific bonito, Pacific mackerel, California barracuda, rockfish, and kelp and barred sand bass (Oliphant personal communication 1999). Queenfish, white croaker, surf perch, Pacific bonito, California barracuda, top and jack smelt, and shiner and black perch are commonly taken from the piers and jetties (Lindstrom personal communication 1999).

SHELLFISH HARVESTING

Shellfish beds occurred along Huntington Beach near Huntington Harbor, Bolsa Chica, Huntington Beach State Park, and Balboa Beach through the early 1980s (California Department of Fish and Game 1980). Pismo, bean, and jackknife clams were common in these areas. Recreational clamming along these beaches historically was very popular, particularly in Pismo clam beds. A one-day survey conducted on January 17, 1976, found 1,574 people digging for clams between Seal and Newport Beaches (CSDOC 1977). A major storm in 1983 destroyed the beds, and population recovery has been limited (Mazur pers. comm.). It is possible that recreational clamming may resume if the clam beds reestablish themselves in the next few years. Mussel harvesting, although less popular than clamming, is continuing (Mazur personal communication 1999).

INDUSTRY AND COMMERCE

The Southern California Outer Continental Shelf contains reserves of oil and gas, estimated at 860 million barrels of oil (a 54-day supply for California) and 1.73 trillion cubic feet of gas (Mineral Management Service 1983). Two oil platforms are located about 10 km (6 miles) north of the outfall within 2.5 km (1.5 miles) of shore and are regulated by the California Department of Mining and Geology. Three oil platforms are 14 km (9 miles) offshore, regulated by MMS. A submerged pipeline delivers oil to shore in Los Angeles County. In 1987 6,650,000 barrels of oil were delivered (Lawrence personal communication 1999).

Long Beach and Los Angeles Harbors account for more than 30 million tons of freight annually carried in over 8,000 vessels in 1980 (EPA 1988). This tonnage is expected to increase by 167 percent over 1980 levels by the year 2020 (EPA 1988). A major shipping lane passes through the Gulf of Santa Catalina 16 km (10 miles) offshore.

5.2 IMPACTS AND MITIGATION

5.2.1 SIGNIFICANCE CRITERIA

Impacts to the marine environment are considered significant if they result in non-compliance with the District's NPDES permit (No. CA 0110604, Order No. 98-5), the California Ocean Plan, federal 301(h) decision criteria, or CEQA Guidelines. The District's permit is revised on a five-year cycle, and the California Ocean Plan is also revised on a regular basis. For the purposes of this document, the current regulatory requirements are used to determine future compliance, with the understanding that these permits/plans may be revised in the future, altering the assessment of compliance.

According to CEQA, an impact is significant or potentially significant when the project has the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, or reduce the number or restrict the range of a rare or endangered plant or animal (*CEQA Guidelines,* section 15065).

The significance of the above-mentioned impacts is evaluated in light of (1) alteration in fractions and absolute numbers of impacted populations; (2) duration of impact; and (3) the commercial, recreational, or ecological, significance of the resource. Impacts are considered significant if they (1) cause a long-term, widespread measurable change in species composition; (2) reduce the population of an endangered species; (3) cause or contribute to a measurable change in function of areas of special biological significance; or (4) cause a measurable change in a population of any (non-endangered) species of recognized commercial, recreational, or ecological concern.

5.2.2 PROJECTED FUTURE EFFLUENT QUALITY AND KEY ASSUMPTIONS

The following key assumptions and information are used in the impact analysis to evaluate effluent discharge to the ocean under the six treatment scenarios and the two discharge options. The six treatment options, as described in Chapter 3.0, are:

- Scenario 1 - NPDES Permit, No GWR System
- Scenario 2 - NPDES Permit, With GWR System (Preferred Project)
- Scenario 3 - Full Secondary, No GWR System
- Scenario 4 - Full Secondary, With GWR System
- Scenario 5 - 50:50 Blend, No GWR System
- Scenario 6 - 50:50 Blend, With GWR System

The two ocean disposal options are:

1) Use existing 120-inch Outfall plus infrequent use of the 78-inch outfall for peak wet weather flow discharge.

2) Construct a new, second 120-inch outfall and use both it and the existing 120-inch outfall full time (50:50 flow split).

120-INCH OUTFALL DISCHARGE

Table 5-26 summarizes the projected future effluent quality in terms of constituent concentration for each of the six treatment scenarios. **Table 5-27** presents the projected future mass loadings for each scenario. These projections are based on average annual conditions, recognizing that there will be seasonal variations in quality and loading. These projections are for the year 2020, and thus are worst-case, maximum effluent volume under the proposed Strategic Plan.

Figure 5-7 graphs the breakdown of treatment process proposed of the effluent under each of one six scenarios. **Figure 5-8** summarizes the percent of advance primary effluent and secondary effluent that will make up the effluent blend discharge on an average annual basis. As shown, Scenario 2, the preferred alternative, represents a blend of advanced primary (~80-65%) and secondary effluent (~20-35%). Scenario 3 and 4 represent discharge of 100% secondary effluent. Scenarios 5 and 6 represent the District's currently adopted treatment policy of discharging a blend of 50% advanced primary and 50% secondary effluent.

Under the preferred discharge option, all effluent would be discharged through the existing 120-inch outfall, except on rare occasions during exceptionally high peak wet weather events where the District would also need employ its 78-inch outfall to discharge excess effluent.

A second discharge option would be to construct a new 120-inch, five-mile long outfall. For impact analysis it is assumed that the existing 120-inch and the new 120-inch outfalls would be in operation year round and would each receive 50% of the average annual effluent flow. The projected effluent water quality presented in **Table 5-26** would apply to both outfalls. For mass load, presented in **Table 5-27**, under this option each outfall would receive 50% of the average annual loadings shown.

78-INCH OUTFALL DISCHARGE

Under the preferred discharge option, the District would use the existing 78-inch outfall very infrequently to discharge peak wet weather flows. **Table 3-16** in Chapter 3.0 indicates the projected frequency of use for the 78-inch outfall. Full secondary treated effluent would be discharged at this location when enough is available. Hydraulic modeling has predicted that once in approximately every 10 years, up to 25% primary effluent may be discharged out the 78-inch outfall. Based on preliminary guidance from the RWQCB, the effluent would not be disinfected. **Table 5-28** shows the projected effluent quality (constituent concentrations) and **Table 5-29** shows the projected annual mass loadings. The loadings projections are based on a worst case assumption that a total of 57 MG is discharged through the 78-inch outfall in one year, and that it all occurs during one, 10-hour discharge event.

TABLE 5-26
PROJECTED EFFLUENT QUALITY
OCSD STRATEGIC PLAN 2020 EIR ALTERNATIVES
120-INCH OUTFALL QUALITY ANNUAL AVERAGE CONDITIONS

Effluent Parameter mg/l unless otherwise indicated	Scenario 1 Current NPDES conditions w/o GWR	Scenario 2 (Preferred) Current NPDES conditions w/ GWR (includes brine from GWR)	Scenario 3 Full Secondary w/o GWR	Scenario 4 Full Secondary w/GWR. (includes brine from GWR)	Scenario 5 (No Project) 50:50 Blend w/o GWR	Scenario 6 (No Project) 50:50 Blend w/ GWR. (includes brine from GWR)
Annual Average Flow discharge to 120 inch outfall, MGD	324.1	243.6 16.0 brine 259.6	324.1	243.6 16.0 brine 259.6	324.1	243.6 16.0 brine 259.6
BOD	76	111	21	21	76	75
TSS	45	57	23	24	44	43
Ammonia- Nitrogen	21	26	19	23	20	23
COD	161	233	50	50	160	161
Oil & Grease	18	24	7	7	17	18
Toxicity	tbd	tbd	tbd	tbd	tbd	tbd
pH, units	7.6	7.56	7.63	7.65	7.60	7.58
Metals, ug/l						
Cadmium	1.4	2.1	0.5	0.7	1.4	1.3
Chromium	5	7	3	4	4.5	4.4
Copper	33.5	49	16.5	23.1	32.9	37.1
Lead	2.4	3.6	1.9	2.7	2.3	3.2
Nickel	21	32	21	30	20.6	30.8
Silver	2.2	3.3	1.3	1.9	2.2	2.7
Zinc	47	78	39	57	47	69
Pesticides (total all combined) Total Identiable Chlorinated HCs , ug/l	0.02	0.02	0.01	0.01	0.02	0.02
PCBs,ug/l	<dl	<dl	<dl	<dl	<dl	<dl
PAHs, ug/l	<1 ug/l	<1 ug/l	<1 ug/l	<1 ug/l	<1 ug/l	<1 ug/l
Other Organic compounds (ug/l) benzoic acid (81) phthalates (<10) 4-methylphenol (10)	100 ug/l	100 ug/l	100 ug/l	100 ug/l	100 ug/l	100 ug/l

TABLE 5-26 (Continued)
PROJECTED EFFLUENT QUALITY
OCSD STRATEGIC PLAN 2020 EIR ALTERNATIVES
120-INCH OUTFALL QUALITY ANNUAL AVERAGE CONDITIONS

Effluent Parameter mg/l unless otherwise indicated	Scenario 1 Current NPDES conditions w/o GWR	Scenario 2 (Preferred) Current NPDES conditions w/ GWR (includes brine from GWR)	Scenario 3 Full Secondary w/o GWR	Scenario 4 Full Secondary w/GWR. (includes brine from GWR)	Scenario 5 (No Project) 50:50 Blend w/o GWR	Scenario 6 (No Project) 50:50 Blend w/ GWR. (includes brine from GWR)
DO (%suppression at trapping depth after 24 hours 180/100:1 dilutions	1.4/2.5	2.6/4.6	0.5/0.9	0.5/0.9	1.4/2.5	1.4/2.5
Salinity, ppt TDS, mg/l	1.2 1200	1.7 1728	1.2 1200	1.7 1728	1.2 1200	1.7 1728
Viruses and indicator bacteria						
Total coliform MPN/100 ml	1.3E+07	1.8E+07	3.5E+06	4.2E+06	1.3E+07	1.1E+07
Fecal coliform MPN/100 ml	4.0E+07	6.4E+07	1.4E+06	1.5E+06	3.9E+07	3.9E+07
Virus, PFU/10 ml	0.16	0.23	0.03	0.03	0.16	0.15
Particle size	n/a	n/a	n/a	n/a	n/a	n/a
Organic Carbon	n/a	n/a	n/a	n/a	n/a	n/a
Nutrients						
Nitrogen (total)	30	35	30	34	30	34
Phosphates	n/a	n/a	n/a	n/a	n/a	n/a

Abbreviations
MGD – millions of gallons per day
mg/l – milligrams per liter (parts per million)
ug/l – micrograms per liter (parts per billion)
GWR – Groundwater Replenishment (System)
NPDES – National Pollution Discharge Elimination System permit
BOD – 5-day biochemical oxygen demand
TSS – total suspended solids

COD –chemical oxygen demand
DO – dissolved oxygen
PCB – polychlorinated biphenyls
PAH – polyaromatic hydrocarbons
HC - hydrocarbons
MPN – most probable number
PFU – plaque forming units (a measure of numerical abundance used in microbiology lab analysis for viruses)

tbd – to be determined
n/a – not available

SOURCE: K.P. Lindstrom, Inc., 1999

TABLE 5-27
PROJECTED EFFLUENT LOADS
OCSD STRATEGIC PLAN 2020 EIR ALTERNATIVES
120-INCH OUTFALL LOADINGS ANNUAL AVERAGE CONDITIONS

Effluent Parameter Pounds per day unless otherwise indicated	Scenario 1 Current NPDES conditions w/o GWR	Scenario 2 (Preferred) Current NPDES conditions w/ GWR (includes brine from GWR)	Scenario 3 Full Secondary w/o GWR	Scenario 4 Full Secondary w/ GWR (includes brine from GWR)	Scenario 5 (No Project) 50:50 Blend w/o GWR	Scenario 6 (No Project) 50:50 Blend w/ GWR (includes brine from GWR)
Annual Average Flow out outfall, MGD	324.1	243.6 16.0 brine 259.6	324.1	243.6 16.0 brine 259.6	324.1	243.6 16.0 brine 259.6
BOD,lb/day Metric tons/yr	206,471 34,255	225,347 37,387	56,684 9,404	43,307 7,185	204,445 33,919	151,855 25,194
TSS, lb/day Metric tons/yr	120,500 19,992	116,481 19,325	63,449 10,527	48,228 8,002	119,772 19,871	86,664 14,375
Ammonia-N	56,434	55,513	52,609	50,799	54,631	50,315
COD	436,424	472,394	135,700	101,581	431,653	326,528
Oil & Grease	47,679	49,617	18,974	14,221	47,224	35,694
Toxicity	tbd	tbd	tbd	tbd	tbd	tbd
pH, units	7.6	7.56	7.63	7.65	7.60	7.58
Metals, lb/day						
Cadmium	3.84	4.64	1.31	1.56	3.84	3.52
Chromium	12.47	14.88	8.22	9.29	12.24	12.26
Copper	90.48	106.06	44.51	49.93	88.89	80.40
Lead	6.4	7.8	5.2	5.9	6.2	6.9
Nickel	57	70	57.6	65.7	55.8	66.6
Silver	6.0	7.2	3.5	4.0	5.8	5.7
Zinc	127.3	112.0	106.2	124.3	128.2	149.9
Total	**303.4**	**379.1**	**226.5**	**260.7**	**301.0**	**325.6**
Pesticides (total all combined) Total Identifiable Chlorinated HCs ,	negligible	negligible	negligible	negligible	negligible	negligible
PCBs,	negligible	negligible	negligible	negligible	negligible	negligible
PAHs	< 2.7	<2.2	<2.7	<2.2	<2.7	<2.2

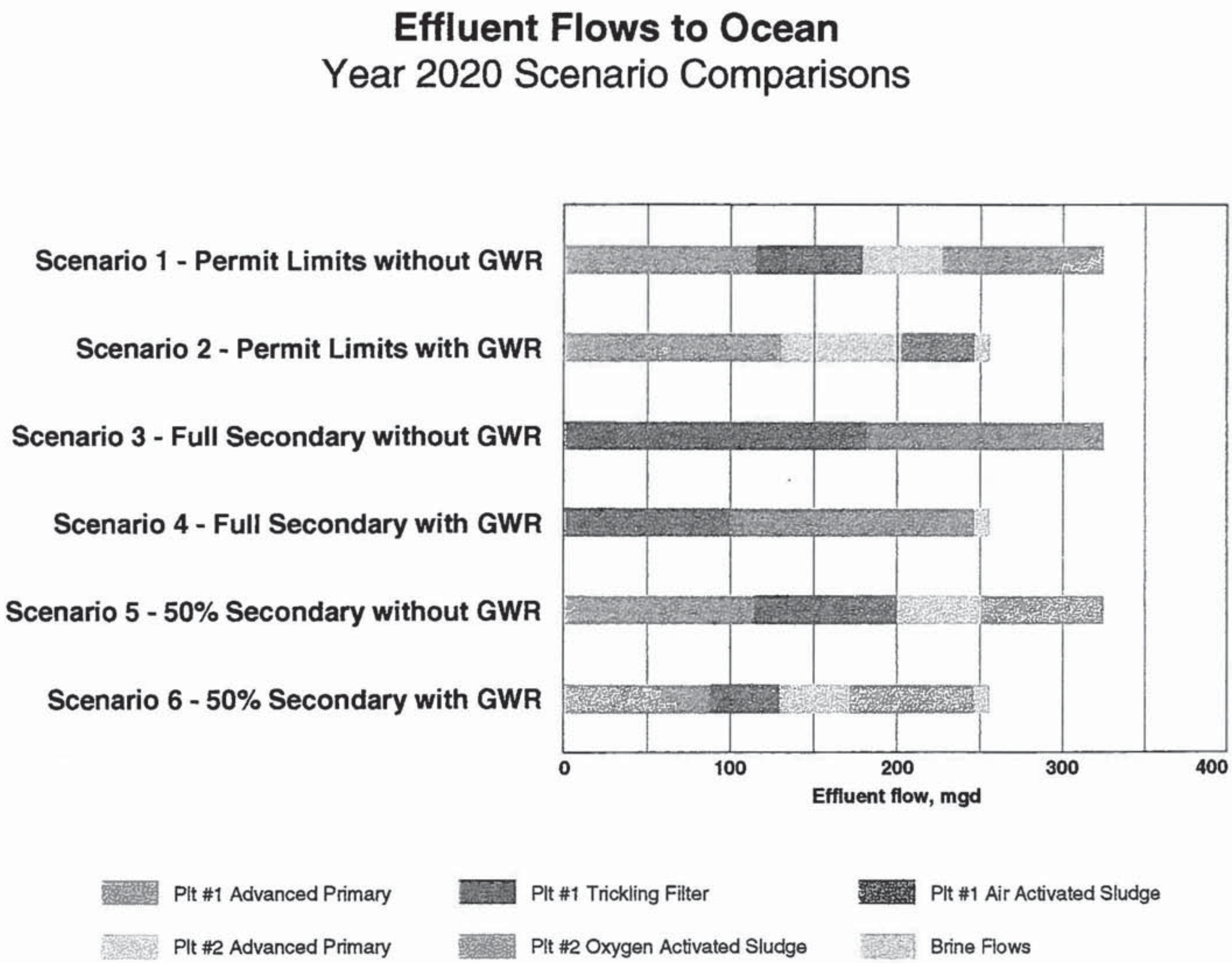
TABLE 5-27 (Continued)
PROJECTED EFFLUENT LOADS
OCSD STRATEGIC PLAN 2020 EIR ALTERNATIVES
120-INCH OUTFALL LOADINGS ANNUAL AVERAGE CONDITIONS

Effluent Parameter Pounds per day unless otherwise indicated	Scenario 1 Current NPDES conditions w/o GWR	Scenario 2 (Preferred) Current NPDES conditions w/ GWR (includes brine from GWR)	Scenario 3 Full Secondary w/o GWR	Scenario 4 Full Secondary w/ GWR (includes brine from GWR)	Scenario 5 (No Project) 50:50 Blend w/o GWR	Scenario 6 (No Project) 50:50 Blend w/ GWR (includes brine from GWR)
Other Organic compounds	270	216	270	216	270	216
DO (%suppression at trapping depth after 24 hours 180/100:1 dilutions	2.6/4.6	1.4/2.5	0.5/0.9	0.5/0.9	1.4/2.5	1.4/2.5
Salt TDS	3.2E+06	3.5E+06	3.2+E06	3.5E+06	3.2+E06	3.5E+06
Viruses and indicator bacteria						
Total coliform MPN/100 ml	1.3E+07	1.8E+07	3.5E+06	4.2E+06	1.3E+07	1.1E+07
Fecal coliform MPN/100 ml	4.0E+06	6.4E+06	1.4E+06	1.5E+06	3.9E+06	3.9E+06
Virus, PFU/10 ml	0.16	0.23	0.03	0.03	0.16	0.15
Particle size	n/a	n/a	n/a	n/a	n/a	n/a
Organic Carbon	n/a	n/a	n/a	n/a	n/a	n/a
Nutrients						
Nitrogen (total)	81,716	75,174	80,141	74,012	81,694	73,932
Phosphates	n/a	n/a	n/a	n/a	n/a	n/a

Abbreviations
MGD – millions of gallons per day
mg/l – milligrams per liter (parts per million)
ug/l – micrograms per liter (parts per billion)
GWR – Groundwater Replentishment (System)
NPDES – National Pollution Discharge Elimination System permit
BOD – 5-day biochemical oxygen demand
TSS – total suspended solids
COD –chemical oxygen demand
DO – dissolved oxygen
PCB – polychlorinated biphenyls
PAH – polyaromatic hydrocarbons
HC - hydrocarbons
MPN – most probable number
PFU – plaque forming units (a measure of numerical abundance used in microbiology lab analysis for viruses)

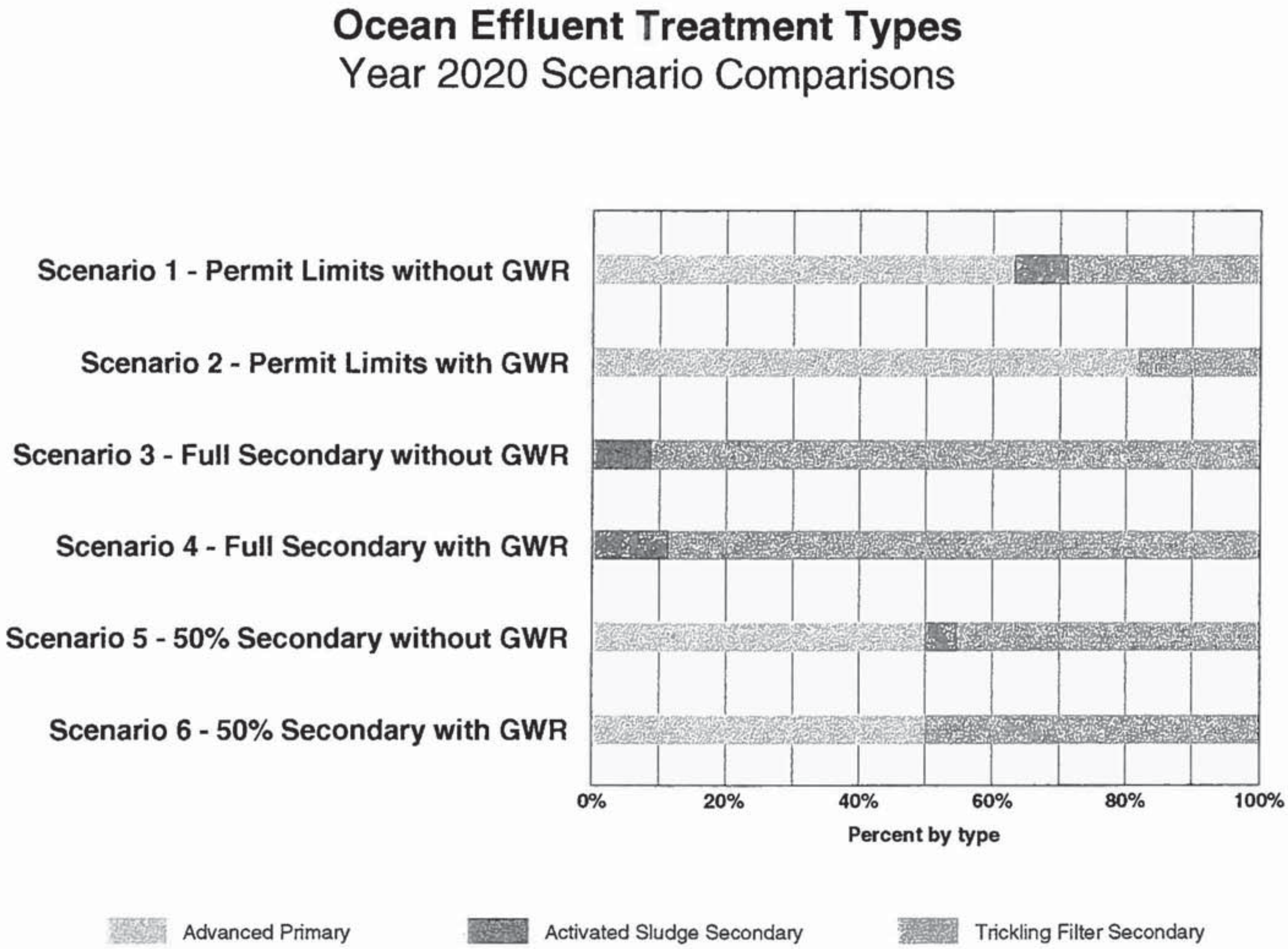
tbd – to be determined
n/a – not available

SOURCE: K.P. Lindstrom, Inc., 1999



SOURCE: Lindstrom, 1999

Figure 5-7
Breakdown of Primary and Secondary Treatment Process for Each Scenario



SOURCE: Lindstrom, 1999

Figure 5-8
Summary of Percent Secondary and Advanced Primary in Effluent Blend for Ocean Discharge

TABLE 5-28
PROJECTED EFFLUENT QUALITY
OCSD STRATEGIC PLAN 2020 EIR ALTERNATIVES
78-INCH OUTFALL QUALITY ANNUAL ONE-DAY WORST CASE CONDITIONS

Effluent Parameter mg/l unless otherwise indicated	Scenario 1 Current NPDES conditions w/o GWR	Scenario 2 (Preferred) Current NPDES conditions w/ GWR (includes brine from GWR)	Scenario 3 Full Secondary w/o GWR	Scenario 4 Full Secondary w/ GWR (includes brine from GWR)	Scenario 5 (No Project) 50:50 Blend w/o GWR	Scenario 6 (No Project) 50:50 Blend w/ GWR (includes brine from GWR)
Annual Flow discharge to 78-inch outfall, MGD	57 MG 5.7 mgd (rate over10 hours)	12 MG 1.2 mgd (rate over10 hours)	57 MG 5.7 mgd (rate over10 hours)	12 MG 1.2 mgd (rate over 10 hours	57 MG 5.7 mgd (rate over10 hours)	12 MG 1.2 mgd (rate over 10 hours)
BOD	75	75	20	20	75	75
TSS	44	44	20	20	44	44
Ammonia- Nitrogen	20	20	20	20	20	20
COD	160	160	50	50	160	160
Oil & Grease	18	18	7	7	18	18
Toxicity	tbd	tbd	tbd	tbd	tbd	tbd
pH, units	7.6	7.6	7.6	7.6	7.6	7.6
Metals, ug/l						
Cadmium	0.3	0.3	0.1	0.1	0.1	0.1
Chromium	4.4	4.4	2.5	2.5	4.4	4.4
Copper	32	32	12.5	12.5	32	32
Lead	2.3	2.3	1.7	1.7	2.3	2.3
Nickel	21	21	18	18	21	21
Silver	2.2	2.2	1.1	1.1	2.2	2.2
Zinc	44	44	24	24	44	44
Pesticides (total all combined) Total Identiable Chlorinated HCs , ug/l	0.02	0.02	0.01	0.01	0.02	0.02
PCBs,ug/l	<dl	<dl	<dl	<dl	<dl	<dl
PAHs, ug/l	<1 ug/l	<1 ug/l	<1 ug/l	<1 ug/l	<1 ug/l	<1 ug/l
Other Organic compounds (ug/l) benzoic acid (81) phthalates (<10) 4-methylphenol (10)	100 ug/l	100 ug/l	100 ug/l	100 ug/l	100 ug/l	100 ug/l

TABLE 5-28 (Continued)
PROJECTED EFFLUENT QUALITY
OCSD STRATEGIC PLAN 2020 EIR ALTERNATIVES
78-INCH OUTFALL QUALITY ANNUAL ONE-DAY WORST CASE CONDITIONS

Effluent Parameter mg/l unless otherwise indicated	Scenario 1 Current NPDES conditions w/o GWR	Scenario 2 (Preferred) Current NPDES conditions w/ GWR (includes brine from GWR)	Scenario 3 Full Secondary w/o GWR	Scenario 4 Full Secondary w/ GWR (includes brine from GWR)	Scenario 5 (No Project) 50:50 Blend w/o GWR	Scenario 6 (No Project) 50:50 Blend w/ GWR (includes brine from GWR)
DO (%suppression at trapping depth after 24 hours 100:1 dilutions	<5	<5	1-2	1-2	<5	<5
Salinity, ppt TDS, mg/l	1.2 1200	1.2 1200	1.2 1200	1.2 1200	1.2 1200	1.2 1200
Viruses and indicator bacteria						
Total coliform MPN/100 ml	4.5E+07	4.5E+07	1.4E+06	1.4E+06	4.5E+07	4.5E+07
Fecal coliform MPN/100 ml	6.4E+06	6.4E+06	1.1E+06	1.1+06	6.4E+06	6.4E+06
Virus, PFU/10 ml	>550	>550	58	58	>550	>550
Particle size	n/a	n/a	n/a	n/a	n/a	n/a
Organic Carbon	n/a	n/a	n/a	n/a	n/a	n/a
Nutrients						
Nitrogen (total)	30	30	30	30	30	30
Phosphates	n/a	n/a	n/a	n/a	n/a	n/a

Abbreviations
MGD – millions of gallons per day
mg/l – milligrams per liter (parts per million)
ug/l – micrograms per liter (parts per billion)
GWR – Groundwater Replentishment (System)
NPDES – National Pollution Discharge Elimination System permit
BOD – 5-day biochemical oxygen demand
TSS – total suspended solids

COD –chemical oxygen demand
DO – dissolved oxygen
PCB – polychlorinated biphenyls
PAH – polyaromatic hydrocarbons
HC - hydrocarbons
MPN – most probable number
PFU – plaque forming units (a measure of numerical abundance used in microbiology lab analysis for viruses)

tbd – to be determined
n/a – not available

SOURCE: K.P. Lindstrom, Inc., 1999

TABLE 5-29
PROJECTED EFFLUENT LOADS
OCSD STRATEGIC PLAN 2020 EIR ALTERNATIVES
78-INCH OUTFALL LOADINGS ANNUAL WORST CASE DAY CONDITIONS

Effluent Parameter Pounds per day unless otherwise indicated	Scenario 1 Current NPDES conditions w/o GWR	Scenario 2 (Preferred) Current NPDES conditions w/ GWR (includes brine from GWR)	Scenario 3 Full Secondary w/o GWR	Scenario 4 Full Secondary w/ GWR. (includes brine from GWR)	Scenario 5 (No Project) 50:50 Blend w/o GWR	Scenario 6 (No Project) 50:50 Blend w/ GWR (includes brine from GWR)
Annual Worst Case Flow out outfall, MGD	57 MG	12 MG	57 MG	12 MG	57 MG	12 MG
BOD,lb/day	35,654	7,506	9,519	2,004	35,654	7,506
TSS, lb/day	20,207	9,519	9,519	2,004	20,207	9,519
Ammonia-N	9,491	1,998	3,306	1,800	9,491	1,998
COD						
Oil & Grease	8,322	1,752	696	1,752	8,322	1,752
Toxicity	tbd	tbd	tbd	tbd	tbd	tbd
pH, units	7.6	7.6	7.6	7.6	7.6	7.6
Metals, lb/day						
Cadmium	0.143	0.03	0.048	0.10	0.143	0.03
Chromium	2.1	0.6	1.2	0.3	2.1	0.6
Copper	14.9	3.8	5.9	1.3	14.9	3.8
Lead	1.1	0.3	0.8	0.2	1.1	0.3
Nickel	9.7	3.0	8.9	1.9	9.7	3.0
Silver	1.0	0.3	0.5	0.1	1.0	0.3
Zinc	20.2	5.5	11.5	2.4	20.2	5.5
Total	**49**	**13.4**	**29**	**6.1**	49	**13.4**
Pesticides (total all combined) Total Identifiable Chlorinated HCs ,	negligible	Negligible	negligible	negligible	negligible	negligible
PCBs,	negligible	Negligible	negligible	negligible	negligible	negligible
PAHs	negligible	Negligible	negligible	negligible	negligible	negligible
Other Organic compounds	negligible	Negligible	negligible	negligible	negligible	negligible

TABLE 5-29 (Continued)
PROJECTED EFFLUENT LOADS
OCSD STRATEGIC PLAN 2020 EIR ALTERNATIVES
78-INCH OUTFALL LOADINGS ANNUAL WORST CASE DAY CONDITIONS

Effluent Parameter Pounds per day unless otherwise indicated	Scenario 1 Current NPDES conditions w/o GWR	Scenario 2 (Preferred) Current NPDES conditions w/ GWR (includes brine from GWR)	Scenario 3 Full Secondary w/o GWR	Scenario 4 Full Secondary w/ GWR. (includes brine from GWR)	Scenario 5 (No Project) 50:50 Blend w/o GWR	Scenario 6 (No Project) 50:50 Blend w/ GWR (includes brine from GWR)
DO (%suppression at trapping depth after 24 hours 180/100:1 dilutions	See table 3	See table 3	See table 3	See table 3	See table 3	See table 3
Salt TDS	negligible	negligible	negligible	negligible	negligible	negligible
Viruses and indicator bacteria						
Total coliform MPN/100 ml	4.5E+07	4.5E+07	1.4E+06	1.4E+06	4.5E+07	4.5E+07
Fecal coliform MPN/100 ml	6.4E+06	6.4E+06	1.1E+06	1.1+06	6.4E+06	6.4E+06
Virus, PFU/gal	>550	>550	58	58	>550	>550
Particle size	n/a	n/a	n/a	n/a	n/a	n/a
Organic Carbon	n/a	n/a	n/a	n/a	n/a	n/a
Nutrients						
Nitrogen (total)	14,507	3,054	13,794	2,904	14,507	3,054
Phosphates	n/a	n/a	n/a	n/a	n/a	n/a

Abbreviations
MGD – millions of gallons per day
mg/l – milligrams per liter (parts per million)
ug/l – micrograms per liter (parts per billion)
GWR – Groundwater Replentishment (System)
NPDES – National Pollution Discharge Elimination System permit
BOD – 5-day biochemical oxygen demand
TSS – total suspended solids

COD –chemical oxygen demand
DO – dissolved oxygen
PCB – polychlorinated biphenyls
PAH – polyaromatic hydrocarbons
HC - hydrocarbons
MPN – most probable number
PFU – plaque forming units (a measure of numerical abundance used in microbiology lab analysis for viruses)

tbd – to be determined
n/a – not available

SOURCE: K.P. Lindstrom, Inc., 1999

5.2.3 IMPACT SUMMARY

This section provides a brief summary of the impact analysis that follows.

WATER QUALITY

Table 5-30 summarizes the water quality effects of increased effluent discharged under the six treatment scenarios. A slight reduction in dissolved oxygen and pH would occur at the ZID for all treatments. This effect would be negligible in the receiving waters. A low number of out-of-compliance events is expected, as occurs for the present-day discharge. Effects are similar with and without the GWR System.

Changes in TSS differ for the three discharges. Current NPDES conditions would result in a 10 to 13% increase in mass loading and a slight increase in out-of-compliance events for transmissivity. Full secondary would result in a 40-55% decrease in mass loading and an expected decrease in out-of-compliance events in the receiving waters. The 50:50 blend is affected by the GWR System. Without the GWR System, a 13% increase in mass loading is expected, with a slight increase in out-of-compliance events. With GWR System, the 50:50 blend would result in a 18% reduction in mass loading and an expected decrease in out-of-compliance events compared to present-day conditions.

Water clarity would be reduced slightly given current NPDES conditions and increased through the use of full secondary treated wastewater. The 50:50 blend would affect water clarity slightly, with a slight reduction in clarity without GWR System and a slight increase in clarity with GWR System.

Effects of treatment to ammonium would be minor. No excess algal growth is expected for any treatment type. The effect of GWR System is minor also.

Change in oil and grease in surface waters is affected by treatment type. Current conditions would result in a 37 to 42% increase in mass loading and a 10 to 46% increase in concentration, although mass loading and concentration would be in compliance. The increase in oil and grease, however, may result in observation of floatables, which would be a significant impact. Full secondary would result in a decrease in mass loading and concentration. The use of the 50:50 blend is affected by GWR System. With GWR System, there would be a slight increase in mass loading, but conditions in the receiving waters are expected to be the same as present-day conditions. Without GWR System, the 50:50 blend would result in a 35% increase in mass loading and a potential increase in observed floatables in surface waters, which, if observed, would be a significant impact.

SEDIMENT QUALITY

Sediment quality effects projected to 2020 for current discharge conditions, full secondary, and 50:50 blend are summarized in **Table 5-30**. While the TSS loading changes for the three

TABLE 5-30
SUMMARY OF EFFECTS TO WATER QUALITY, SEDIMENT QUALITY, AND BIOTA FROM PROPOSED EFFLUENT DISCHARGE

Effects	Current NPDES Conditions (Scenarios 1 and 2)	Full Secondary (Scenarios 3 and 4)	50:50 Blend (Scenarios 5 and 6)
Dissolved oxygen depression	1.4 to 2.6% at ZID; low numbers (similar to present day) of out-of-compliance events expected in receiving waters	0.5% at ZID; low numbers of out-of-compliance events expected in receiving waters (similar to present day)	1.4% at ZID; low numbers of out-of-compliance events expected in receiving waters (similar to present day)
Decrease in pH	0.05-0.09 at ZID; low numbers of out-of-compliance events expected in receiving waters (similar to present day)	0-0.02 at ZID; low numbers of out-of-compliance events expected in receiving waters (similar to present day)	0.05-0.07 at ZID; low numbers of out-of-compliance events expected in receiving waters (similar to present day)
Change in total suspended solids	10-13% increase in mass loading; slight increase in out-of-compliance events expected in receiving waters	40-55% decrease in mass loading; decrease in out-of-compliance events expected in receiving waters	13% increase in mass loading and slight increase in out-of-compliance events expected in receiving waters without GWR; 18% decrease in mass loading and slight decrease in out-of-compliance events expected in receiving waters with GWR
Change in water clarity and light penetration	Slight reduction	Increase	Slight reduction without GWR; slight increase with GWR
Change in floating particulates (oil and grease) in surface waters	37-42% increase in mass loading; exceedance of permit limit (significant impact); potential increase observed floatables	46-59% decrease in mass loading and concentration	With GWR-2% increase in mass loading; Without GWR-35% increase in mass loading; exceedance of permit limit (significant impact); potential increase in observed floatables.
Change in nutrients	9-11% increase in mass loading of ammonium, no excess algal growth	0-3% increase in mass loading of ammonium; no excess algal growth	7% increase in mass loading of ammonium without GWR; 1% decrease in mass loading of ammonium with GWR; no excess algal growth with or without GWR

TABLE 5-30
SUMMARY OF EFFECTS TO WATER QUALITY, SEDIMENT QUALITY, AND BIOTA FROM PROPOSED EFFLUENT DISCHARGE- Continued

Effects	Current NPDES Conditions (Scenarios 1 and 2)	Full Secondary (Scenarios 3 and 4)	50:50 Blend (Scenarios 5 and 6)
Grain size	n/a	n/a	n/a
Organic matter loading	20-22 g/ft^2/yr; below threshold	9-10 g/ft^2/yr; below threshold	16-20 g/ft^2/yr; below threshold
Metal loading	303-379 lbs/day (32-66% increase); no resultant degradation of benthic organisms or the indigenous population	227-261 lbs/day (0-14% increase); no resultant degradation of benthic organisms or the indigenous population	301-326 lbs/day (31-42% increase); no resultant degradation of benthic organisms or the indigenous population
Pesticides	Negligible	Negligible	Negligible
PCBs	Negligible	Negligible	Negligible
PAHs	2.2-2.7 lbs/day	2.2-2.7 lbs/day	2.2-2.7 lbs/day
Other organic compounds	216-270 lbs/day	216-270 lbs/day	216-270 lbs/day
Change in light levels and primary production of phytoplankton	Slight decrease in light; negligible effect on photosynthesis and primary production	Decrease in turbidity and increase in light; negligible effect on photosynthesis and primary production	Without GWR, slight decrease in light; with GWR, slight increase in light; negligible effect on photosynthesis and primary production
Change in nutrient levels and growth of phytoplankton	9-11% increase in mass loading of ammonium; no excess algal growth	0-3% increase in mass loading of ammonium; no excess algal growth	7% increase in mass loading of ammonium without GWR; 1% decrease in mass loading of ammonium with GWR; no excess algal growth with or without GWR
Toxicity of the effluent to plankton	Unknown but unlikely to be significant	Unknown but unlikely to be significant	Unknown but unlikely to be significant
Impact to soft-bottom biota	No change in community function or presence of a BIP beyond the ZID; no degradation of biota	No change in community function or presence of a BIP beyond the ZID; no degradation of biota	No change in community function or presence of a BIP beyond the ZID; no degradation of biota
Impact to demersal fish and epibenthic macroinvertebrat es	No degradation of biota, no fish disease	No degradation of biota, no fish disease	No degradation of biota, no fish disease

treatment types (some increase and others decrease) the change will not impact sediment characteristics, such as grain size, if SS loading is not changed.

Organic loading levels would be highest for current NPDES conditions (Scenarios 1 and 2), intermediate for the 50:50 blend (Scenarios 5 and 6), and lowest for full secondary (scenarios 3 and 4). All loadings, however, are below critical threshold levels for organic matter of approximately 28 to 46 g/ft^2/yr. Levels also are below those for present-day conditions, for which there is no indication of degradation to the benthic community. Organic loading is directly dependent upon the percentage of organic matter in the TSS and the proportion of the particles to settle on aggregate within about six hours of being discharged. The effects of GWR on these parameters are unknown and cannot be predicted until further studies are conducted.

Projected metal loading would be highest for Scenarios 1 and 2 (current NPDES permit conditions) (303-379 lbs/day) and lowest for full secondary (Scenarios 3 and 4) (227-261 lbs/day). At the present level, 229 lbs/day, there is no indication of effects to biota or sediment toxicity. No resultant degradation of benthic organisms or the indigenous population would occur for any of the three treatment types. The GWR would increase metal loading, but these increases are small and believed to be not significant. The effect of GWR on the proportion of dissolved metals and effluent toxicity requires additional study.

Effects of pesticides, PCBs, PAHs, and other organics would be the same for the three treatment types. GWR, on the other hand, would remove more of the organic constituents from the wastewater discharge, which would lower potential effects.

BIOTA

Effects to biota from each Scenario to the year 2020 are summarized in **Table 5-30**. Overall, moved from conclusions none of the treatment Scenarios would be expected to significantly impact biota in the receiving waters of the any of the proposed discharge locations. The projections to 2020 show minor differences between treatment Scenarios to primary productivity of the marine environment. Current NPDES conditions may result in slight decreases in light for photosynthesis due to increased TSS loading, while full secondary would result in increased light due to decreased TSS loading. The 50:50 blend with GWR would have slightly lowered light levels; without GWR, the 50:50 blend would result in an increase in available light for photosynthesis of phytoplankton. The change in turbidity is mostly below the pycnocline, and only small changes are expected in the surface waters. Thus, effects in changes of light levels on primary production are negligible for the three treatment types. Nutrient levels would increase 0-3% for full secondary and 9-11% for current NPDES conditions. The 50:50 blend shows a 7% increase without GWR and a 1% decrease with GWR. No over stimulation of algae is expected for any of the three treatment types. Toxicity of the effluent to plankton is unknown but unlikely to be significant for any of the three treatment types. The effects of GWR on effluent toxicity require additional study.

Effects on soft-bottom benthic organisms are measured in terms of degradation of the community or BIP resulting from a change in community function or, possibly, by a substantial increase in opportunistic species. For the present effluent, abundance of benthic organisms is enhanced in the summer due to increased SS and, in turn, increased food supply. However, there is no associated change in species richness beyond the ZID and no change in community function or BIP presence, and, thus, no indication of degradation. The effect of treatment type on SS is unknown; however, differences among the treatment types are expected to result in potential differences in the degree of enhancement and are not expected to be at the level of affected community function or BIP. No future degradation or significant impacts are expected for any of the three treatment types. GWR may influence benthic communities because of its effect on flow rate. With GWR, flow rates are projected to be 259.6 mgd; without GWR, flow rates are projected to be 324.1 mgd. As SS is expected to increase with flow rate, the absence of the GWR may result in increased SS loading and enhanced abundances of benthic organisms. This increase would also increase the organic matter loading to the sediments, but this increase would be below the assimilation capacity of the benthic community, and significant shifts in community function would not be predicted. Additional studies are necessary to acquire information on the relationship of TSS and SS, the effects of GWR in SS, and the organic content of SS in order to fully understand the differences among the treatment scenarios and the inclusion of GWR.

Differences among the three treatment types are not expected to result in any differences in impacts to demersal fish or epibenthic macroinvertebrates. GWR would affect flow rate. Increased flow rate may result in increased impacts to biota; however, impacts are expected to be not significant for any treatment type, with or without GWR.

PUBLIC HEALTH

Public health effects projected to 2020 for current discharge conditions, full secondary, and 50:50 blend are summarized in **Table 5-31**. In Year 2020, current NPDES conditions would result in increased concentrations of total and fecal coliforms in offshore receiving waters, while full secondary would result in decreased concentrations, and 50:50 blend would result in slightly decreased concentrations of coliforms. For all three treatment types, water-contact and shellfish-harvesting waters generally would be in compliance with NPDES permit criteria. Effects would be the same with and without GWR.

Emergency discharge of peak wet-weather flows through the 78-inch outfall could result in a significant impact to public health. This outfall is within the nearshore zone, and contamination of shallow nearshore and surfzone waters due to the wastewater discharge is likely. It is expected that bacterial samples collected from the surfzone shortly after the emergency discharge through the 78-inch outfall would be out-of-compliance with the District's NPDES criteria, resulting in the need for beach closures. Although this discharge would only occur during peak winter wet weather events, when beach attendance is low, this area receives year round use thus the discharge could expose people to elevated bacteria levels. This would be a significant impact for all scenarios.

Effects to levels of contaminants in tissues of fish or shellfish for human consumption would be the same for the three treatment types and with and without GWR.

Table 5-31
Summary of Public Health Effects in the Marine Environment for Current Discharge Conditions, Full Secondary, and 50:50 Blend

Effects	Current NPDES Conditions (Scenarios 1 and 2)	Full Secondary (Scenarios 3 and 4)	50:50 Blend (Scenarios 5 and 6)
Microbiological effects	Same or increased concentration of total and fecal coliforms in offshore receiving waters; water-contact and shellfish-harvesting waters generally in compliance	Decreased concentration of total and fecal coliforms in offshore receiving waters; water-contact and shellfish-harvesting waters generally in compliance	Same or slightly decreased concentration of total and fecal coliforms in offshore receiving waters; water-contact and shellfish-harvesting waters generally in compliance
Contaminant levels in fish and shellfish tissues	Negligible	Negligible	Negligible

5.2.4 MARINE ENVIRONMENT

PHYSICAL ENVIRONMENT

Impact 5-1. Effluent discharge under any of the six treatment scenarios, for the two discharge location options, and with the emergency use of the 78-inch outfall would result in less than significant impacts to temperature and salinity. Less than significant. No mitigation is required.

Temperature

There are no California Ocean Plan or District's NPDES permit standards for temperature in the receiving waters. The wastewater effluent discharged to the ocean is generally warmer than the receiving waters. The main effect of this warmer water is that it tends to be less dense and more buoyant upon being discharged. Initial dilution calculations predict temperature changes to the receiving waters beyond the Zone of Initial Dilution (ZID) to be less than 0.2°C (CSDOC 1996a) (see **Table 5-1**, above). Natural variability in the receiving waters greatly exceeds this value, and the effects of small increases in water temperature due to the wastewater discharge are not significant. More notable are decreases in temperature of the wastewater plume that are due primarily to secondary entrainment of colder, deeper water in the outfall vicinity. These patterns are observed mostly during late spring through early fall, when a pycnocline is present. During winter, changes are less evident as temperatures tend to be more uniform throughout the water column, and there is greater mixing potential due to a weak or absent pycnocline. Analysis of long-term (10-year) mean data (temperature profiles by depth and month, and deviations at near-bottom depths) shows no differences between nearfield and farfield stations that are relatable to the temperature of the wastewater discharge (CSDOC 1996a, b). Because there is no measurable difference between areas near the discharge compared to reference areas, these small changes in temperature would not result in a significant impact.

The temperature of the wastewater effluent at the present time is assumed to be representative of future effluent discharged under any of the six alternative treatment scenarios. Because there are no numerical standards for temperature in the receiving waters, there will be no significant impact associated with implementation the Preferred Scenario, Scenarios 1, 3, 4, 5, or 6, or the proposed alternative discharge locations. Use of the 78-inch outfall would not impact temperature of the receiving waters.

Salinity

There are no California Ocean Plan or District's NPDES permit standards for salinity in the receiving waters. The wastewater effluent discharged to the ocean is essentially freshwater, with a salinity of about 1 parts per thousand (ppt), which is about 3% as salty as seawater. Because of this lower salinity, the wastewater field is less dense and more buoyant than the receiving waters and tends to rise in the water column as it mixes. Initial dilution calculations predict salinity changes to the receiving waters beyond the ZID to be less than 0.2 ppt (CSDOC 1996a). These predictions are supported by field measurements made during the Ocean Monitoring Program (OMP) that find salinity changes associated with the wastewater discharge in the range of 0.1 to 0.2 ppt. Changes in salinity associated with secondary entrainment of bottom waters have not been observed. Analysis of long-term (10-year) mean data (salinity profiles by depth and month, and deviations at near-bottom depths) shows no important differences between nearfield and farfield stations that are relatable to the salinity of the wastewater discharge (CSDOC 1996a, b). Because there is no measurable difference between areas near the discharge compared to reference areas, these small changes in salinity would not result in a significant impact.

The salinity of the effluent for the Preferred Scenario is calculated to be 1.7 ppt (**Table 5-26**). This is more saline than the present discharge and can be expected to decrease the potential to observe differences in salinity of the wastewater plume compared to ambient waters. The increase in salinity for the Preferred Scenario is due to the GWR System, which will discharge brine into the effluent stream and increase effluent salinity. The increase in salinity will reduce the buoyancy of the wastewater plume and may decrease initial dilution by a small factor. Changes to initial dilution from an increase of 0.5 ppt in salinity are essentially negligible. The actual increase in effluent salinity resulting from the GWR system needs to be determined to assess its effect on initial dilution. This increase in salinity will not produce significant impacts to receiving waters and may well reduce the potential to measure salinity difference within the plume.

Alternative Scenarios

Treatment Scenarios 4 and 6 also have an effluent salinity of 1.7 ppt because of the brine from GWR System and other desalting projects added to the effluent. The other scenarios (1, 3, and 5) will have a lower salinity (1.2 ppt) because these scenarios have no GWR System component. Since there are no numerical standards for salinity in the receiving waters and because these values are greater than those for the present discharge, any potential impacts to salinity from the discharge will be less than for the present discharge. Therefore, no significant impacts are expected from any of these scenarios.

Optional Discharge Locations

Because the proposed scenarios all will discharge more saline waters than present conditions and because there are no standards for salinity in the receiving waters, there will be no significant impacts regardless of the discharge location. Use of the 78-inch outfall would not impact salinity of the receiving waters.

Mitigation

No mitigation required.

WATER QUALITY

Impact 5-2. Effluent discharge under the six alternative treatment scenarios and two discharge location options would result in less than significant impacts to dissolved oxygen, pH, total suspended solids, surface water color, or ammonium. Less than significant. No mitigation is required.

Dissolved Oxygen

California Ocean Plan, as well as the District's NPDES permit, criteria require that the dissolved oxygen concentration in the receiving waters as a result of the discharge be no more than 10% reduced compared to that which occurs naturally. Naturally occurring dissolved oxygen concentrations are approximately 6 to 11 mg/L in surface waters and 3 to 7 mg/L in bottom waters. A 10% reduction would be approximately 0.6 to 1.1 mg/L lower dissolved oxygen in surface and 0.3 to 0.7 mg/L lower dissolved oxygen in bottom receiving waters compared to the mean for the corresponding stratum at a reference station.

The Preferred Scenario would result in a 2.6% suppression at the trapping depth after 24 hours at the 180:1 dilution in the permit or a 4.6% suppression given worst case (100:1) dilution (**Tables 5-26 and 5-27**). Ranges for dissolved oxygen at bottom depths are 3 to 7 mg/L, thus the depression would be less than 0.3 mg/L at the trapping depth. Dissolved oxygen depression after initial dilution would be negligible. Thus, these estimates of dissolved oxygen concentration for the Preferred Scenario would meet California Ocean Plan criteria and would not result in a significant impact.

Natural variations in dissolved oxygen are on the order of ±25%. Concentrations of dissolved oxygen in the receiving waters have been monitored by the OMP. Results of compliance testing for the 1997-1998 OMP indicated eleven out-of-compliance events out of 384 tested (2.9%) for individual stations and six out of 222 tested for station groups (2.7%) (CSDOC 1998). All out-of-compliance events occurred in the nearshore and nearfield. Plume-related changes are due mostly to entrainment of deeper water with lower concentrations of dissolved oxygen, particularly in the summer. Changes in dissolved oxygen within the plume are generally less than

0.5 mg/L due to entrainment and plume oxygen-consuming materials. Changes associated with the Preferred Scenario are expected to be at the same level of magnitude.

Alternative Scenarios

The other scenarios are expected to result in the following dissolved oxygen depressions at the plume trapping depth after 24 hours given a 180:1 dilution of the effluent in the ZID: Scenario 1- 1.4% depression; Scenario 3- 0.5%; Scenario 4- 0.5%; Scenario 5- 1.4%; and Scenario 6- 1.4% (**Tables 5-26 and 5-27**). California Ocean Plan criteria require that the dissolved oxygen concentration in the receiving waters as a result of the discharge be no more than 10% reduced compared to that which occurs naturally. Thus, these estimates of dissolved oxygen concentration for Scenarios 1, 3, 4, 5, and 6 would meet California Ocean Plan criteria and would not result in a significant impact. Plume-related changes due to entrainment are anticipated at a level similar to those for the Preferred Scenario, although reduction in dissolved oxygen in the receiving waters may be slightly lower. Out-of-compliance events are expected to occur in low numbers.

Optional Discharge Locations

The 50:50 split of the effluent between the 120-inch outfall and the new outfall would not affect dissolved oxygen depression in the receiving waters. Impacts would be the same as for use of the 120-inch outfall. This would not result in a significant impact.

78-inch Outfall

For all scenarios, use of the 78-inch outfall would result in a suppression of <5% at the trapping depth after 24 hours at a 100:1 dilution (**Tables 5-28 and 5-29**). Dissolved oxygen depression after initial dilution would be negligible. Thus, these estimates of dissolved oxygen concentration would meet California Ocean Plan criteria and would not result in a significant impact.

pH

The California Ocean Plan requires that the pH of the receiving waters shall not be changed by the wastewater discharge at any time more than 0.2 units from that which occurs naturally. According to the District's NPDES permit, the pH of the discharge shall not exceed 9.0 nor be less than 6.0. Ten-year ranges for pH at the 60-m depth contour are approximately 7.7 to 8.7 for surface and 7.5 to 8.4 for bottom waters. Natural variations are ± 5% due to surface water interface with the atmosphere, biological activities in deeper waters, and seasonal decreases near the bottom associated with upwelling. To test compliance with the California Ocean Plan criterion, values for pH at OMP stations are compared to values at the reference station by stratum each month. Results of compliance testing for the 1997-1998 OMP indicated seven out-of-compliance events out of 384 tested (1.8%) for individual stations and three out of 222 tested for station groups (1.4%) (CSDOC 1998). All out-of-compliance events occurred nearshore and upcoast nearfield in spring and summer. These plume-associated changes were caused by entrainment of deeper, lower pH water near the outfall.

The pH of the present-day effluent is 7.65. For the Preferred Scenario, the pH of the effluent is projected to be 7.56 (**Tables 5-26 and 5-27**). The maximum change in receiving water pH following initial dilution of 180:1 of effluent with pH range 6 to 9 was calculated to be 0.02 units by Tetra Tech (1995). Therefore, the anticipated change in pH of the receiving waters for the Preferred Scenario is expected to be within the California Ocean Plan criterion of 0.2 units. Out-of-compliance events are likely to occur in low numbers, similar to those for the present-day effluent and would be within the range of natural variability and typical conditions to which marine organisms are exposed (CSDOC 1996a, 1997). This would not result in a significant impact.

Alternative Scenarios

Projected effluent pH units for Scenarios 1, 3, 4, 5, and 6 are 7.6, 7.63, 7.65, 7.60, and 7.58 mg/L, respectively (**Tables 5-26 and 5-27**) (**Figure 5-9**). These concentrations are all with in the range of 6 to 9; therefore, the anticipated change in pH in the receiving waters is expected to be within the California Ocean Plan criterion of 0.2 units. Impacts of these scenarios would the same as for the Preferred Scenario. Out-of-compliance events are likely to occur in low numbers, similar to those for the present-day effluent and would be within the range of natural variability and typical conditions to which marine organisms are exposed. These scenarios would not result in a significant impact.

Optional Discharge Locations

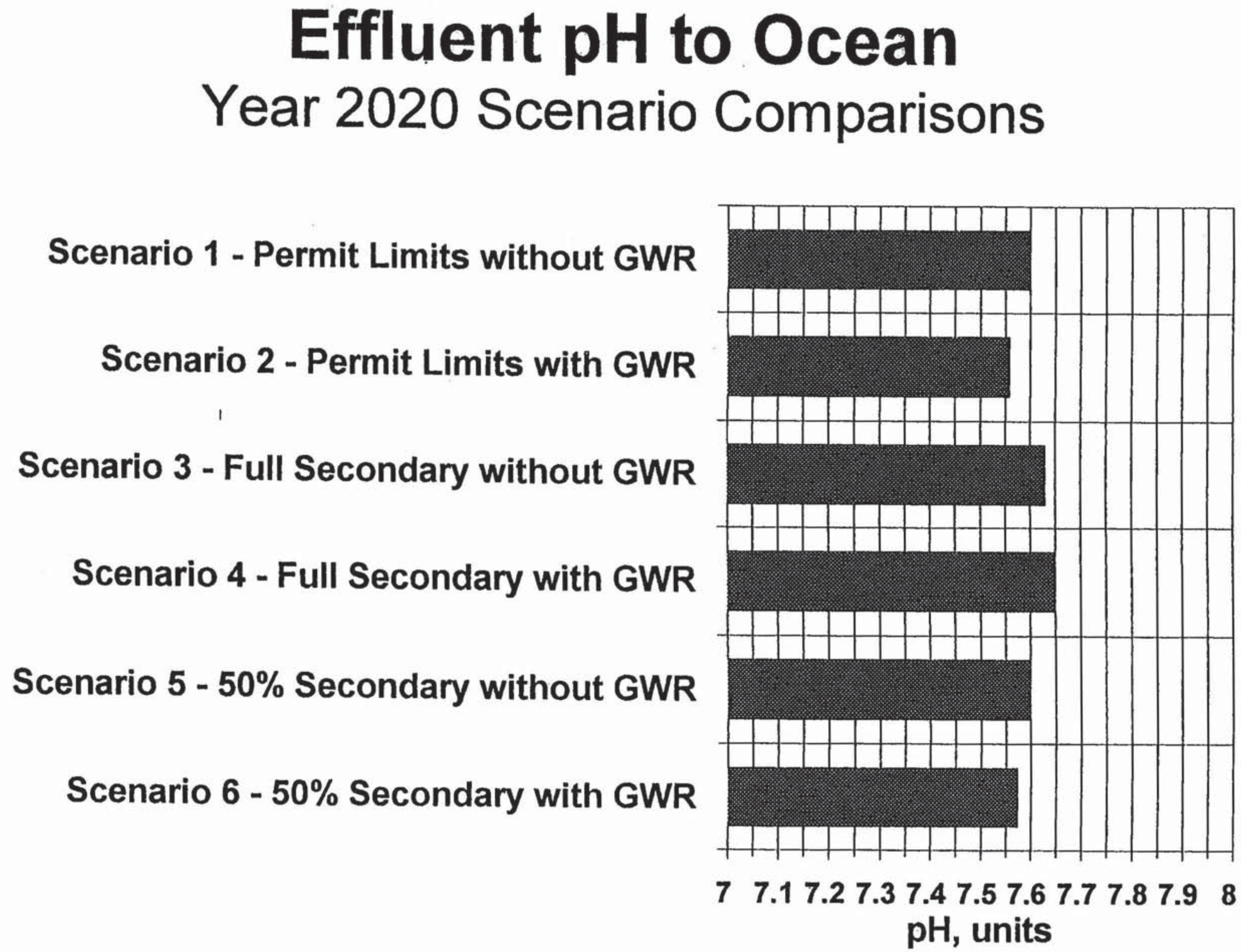
pH would not be affected by the 50:50 split of the effluent between the 120-inch outfall and the new outfall. Use of the two outfalls would not result in a significant impact.

78-inch Outfall

Effluent discharges from the 78-inch outfall would have a pH of 7.6 for all treatment scenarios (**Tables 5-28 and 5-29**). The anticipated change in pH of the receiving waters would be within the California Ocean Plan criterion of 0.2 units. Thus, these estimates of pH would meet California Ocean Plan criteria and would not result in a significant impact.

Water Clarity/Turbidity (Transmissivity/Total Suspended Solids)

The California Ocean Plan and the District's NPDES permit require 75% removal of suspended solids from the influent as a 30-day average. Furthermore, the permit requires an effluent limitation of 60 mg/L and a 30-day average daily discharge rate of less than 121,000 lbs/day. The permit also requires that the wastewater discharge "shall not cause aesthetically undesirable discoloration of the ocean surface" and "natural light shall not be significantly reduced at any point outside the ZID." The concern is that visual impacts might reduce beneficial uses, and reduction in light levels could significantly affect the photosynthetic ability of marine organisms. Additionally, there are concerns about the settlement of wastewater particulates from the discharge plume onto the ocean bottom and potential adverse effects to benthic communities.



SOURCE: Lindstrom, 1999.

Figure 5-9
Effluent pH to Ocean
Year 2020 Scenario Comparisons

Total Suspended Solids

The only numerical standards for suspended solids in the receiving waters are that the mass loading should not exceed 121,000 lbs/day (20,000 mt/yr). Light transmittance is routinely used as a surrogate standard for water clarity because of the relationship between suspended solids and light transmittance. Generally, light levels are decreased proportionally with number of suspended particles. Therefore, the relative effect of suspended solids in the wastewater discharge on light levels can be evaluated by measuring light transmittance (and secchi disk readings for surface waters). Natural changes to water clarity in the study area are caused mostly by surface runoff, river discharges, and sediment loading from winter rainfall; plankton and suspended particles near the pycnocline during spring and summer; and sediment re-suspension by wave action, particularly at shallow, nearshore locations. All of these act in concert to reduce clarity (lower transmissivity and secchi disk values and increase Total Suspended Solids [TSS]). The changes in transmissivity associated with phytoplankton complicate the relationship between particles and transmissivity, but this effect can be estimated by measuring chlorophyll, which is routinely used as a surrogate for phytoplankton concentration.

Since 1985, average effluent TSS concentrations have remained relatively constant between 40 and 55 mg/L (average 50 mg/L), well below the current permit limit of 60 mg/L and about 83% of the allowable 30-day average concentration. Presently, the mass loading of TSS to the receiving waters is 106,250 lbs/day (17,596 mt/yr) or about 88% of the of the 30-day average mass emission limit. TSS concentrations in the receiving waters are dependent upon the initial dilution of the effluent, which ranges from 130 to 200:1, depending upon current speeds and stratification. Based upon an average dilution of 180:1, the expected change in TSS concentration above ambient concentrations in the receiving waters is calculated to be 0.28 mg/L and range between 0.25 and 0.38 mg/L. Concentrations tend to be higher in summer than winter due water column stratification that tends to reduce the initial dilution. Ambient TSS concentrations in the receiving water, as measured during the District's OMP, range from below detection limits to approximately 30 mg/L, but most overall mean values are between 2 and 5 mg/L (CSDOC 1996a, b). Thus, expected increases in TSS concentrations in the receiving waters due to the wastewater discharge are about one order of magnitude less than ambient conditions and well within the range of natural variability.

The measurement of transmissivity in the receiving waters is a regular part of the OMP. Compliance testing with the permit standards is based upon visual observations of the surface water color near the outfall and comparison of mean transmissivity values for each stratum within the water column to values at reference areas. Values below the 95% confidence limit of the reference station are considered potential out-of-compliance events. Many out-of-range occurrences are found either at inshore stations or near Newport Canyon and, therefore, are related to natural events (e.g., plankton blooms, resuspension of bottom sediments, river runoff, upwelling) and not to the discharge. About 5 to 6% of the tests are out-of-range occurrences found for stations near the discharge area and may be attributable to discharge effects. However, these lower light levels are significantly less than the range of decreased light transmittance caused by natural variability, which would suggest that these statistically lower values may not be biologically significant.

The Preferred Scenario will increase the average effluent TSS concentration to 57 mg/L (**Table 5-26**), representing a mass loading of 116, 481 lbs/day (19,325 mt/yr) (**Tables 5-27**). This represents an increase of 14% for effluent concentration and a 10% increase in the mass loading compared to present levels. These values are in compliance with present permit limitations, although historically the District has not operated that close to the limit. Based upon the range of initial dilutions (130-200:1), these values would increase the TSS concentration in the receiving waters from 0.29 to 0.44 mg/L above ambient levels. This range is still about an order of magnitude less than average ambient conditions and well within the range of natural variability. Additional mixing with ambient waters beyond the ZID dilutes these concentrations further. This increase in TSS related to the Preferred Scenario might be expected to increase the percentage of potentially out-of-compliance observations in the nearfield by about 1% over the present levels. This increase is believed to be not significant.

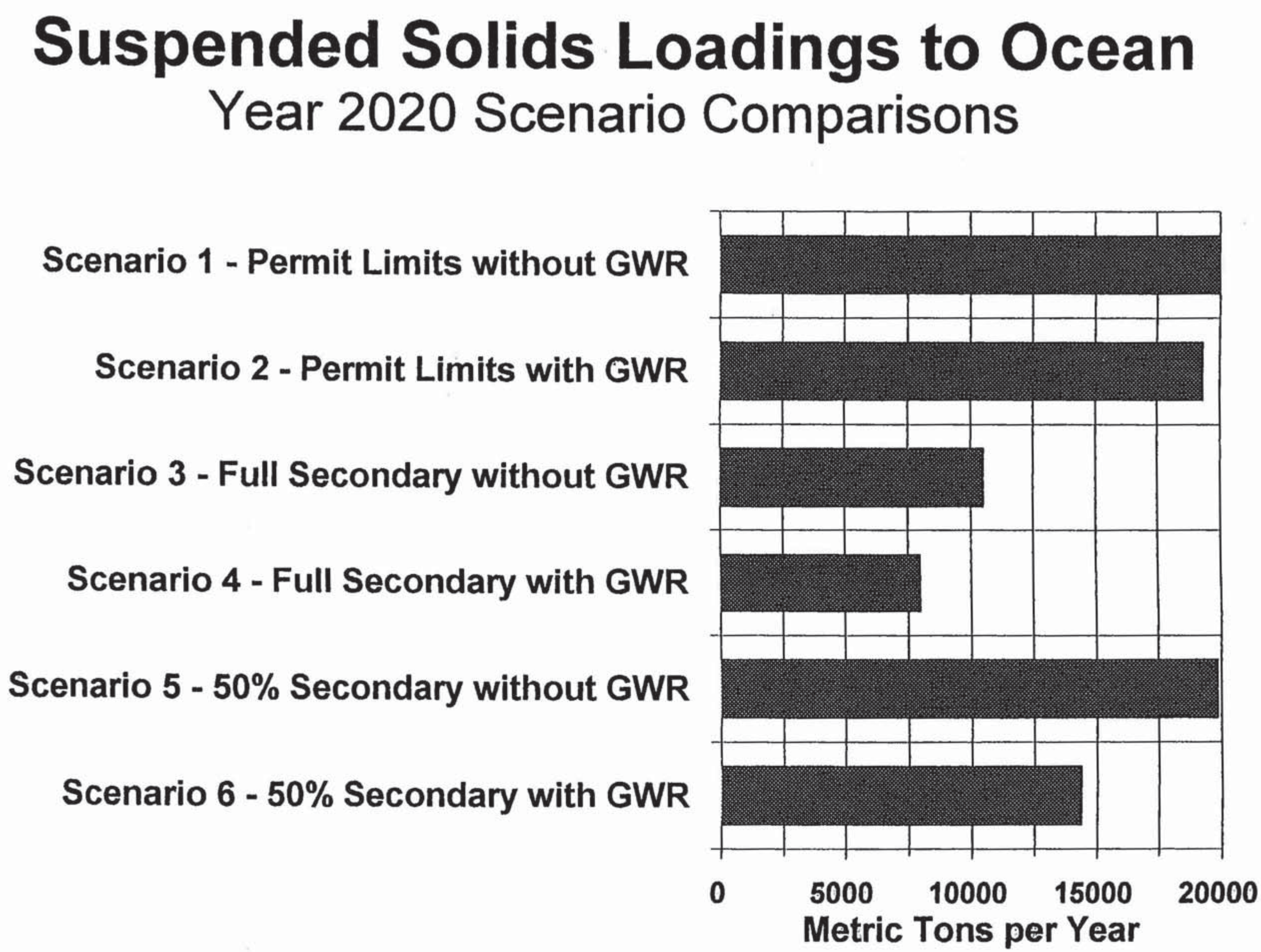
Several studies have been undertaken to determine if wastewater outfalls affect water clarity (e.g., Conversi et al. 1990; Conversi and McGowan 1992, 1994). These studies found that large-scale regional phenomena associated with seasonal oceanographic changes, distance from the coast, and longer-term oceanographic trends were primarily responsible for regional changes in water clarity, while changes due to wastewater outfalls could not be detected.

Surface Water Color

The second part of compliance for water clarity/turbidity is the color of surface waters. Water color is a subjective evaluation and is related to aesthetics and not to quantifiable impacts. Based upon the District's OMP, surface water color has not been affected by the discharge, and, therefore, the District has been in compliance. The lack of visual impact to surface waters is a result of the wastewater plume being constrained below the thermocline/pycnocline for most of the year, so surface waters are unaffected during those periods. Non-stratified water conditions (winter) and upwelling events (usually spring) represent times when the plume has the greatest probability of affecting surface waters. However, these are also the times when the initial dilution is highest, which minimizes the potential for discoloration of surface waters. Winter is also the period when surface waters are often discolored by river discharges and surface runoff. Turbidity plumes from river discharges significantly change the water color and have been observed to extend several miles offshore and may persist for days to weeks. Upwelling events are localized phenomena and are generally restricted to the Canyon areas in the District's study area. These natural discolorations of surface waters far exceed any possible slight and localized surface discoloration that could be attributable to the wastewater discharge. Therefore, the increases in TSS concentrations associated with the Preferred Scenario would not result in a significant effect to surface water color.

Alternative Scenarios

Comparison of suspended solids loading for the six discharge scenarios is illustrated in **Figure 5-10**. Treatment Scenarios 3 and 4 would produce the lowest TSS concentrations of 23 and 24 mg/L, respectively (**Table 5-26**). These values are less than half the concentration of the Preferred Scenario 2 and could be expected to reduce the number of potentially out-of-



SOURCE: Lindstrom, 1999.

Figure 5-10
Suspended Solids Loadings to Ocean
Year 2020 Scenario Comparisons

compliance observations accordingly. Scenarios 1, 4, and 5 would have intermediate concentrations of about 44 mg/L. The proposed TSS concentrations are all within permit limits.

Mass loading of TSS to receiving waters would be highest for Scenarios 1 (120,500 lbs/day or 19,992 mt/yr) and 5 (119,772 lbs/day or 19,871 mt/yr) (**Table 5-27**); these are just below the 20,000 mt/yr permit limit. Scenarios 4 (48,228 lbs/day or 8,002 mt/yr) and 3 (63,449 lbs/day or 10,527 mt/yr) would have the lowest mass emissions, with Scenario 6 (86,664 lbs/day or 14,375 mt/yr) having an intermediate value. These changes in mass loading are not expected to affect water clarity. The impact of the other treatment scenarios to water color would be the same as for the Preferred Scenario. Neither TSS nor water color would be significantly affected by any treatment scenario.

Optional Discharge Locations

Given a 50:50 split of the final effluent between the existing 120-inch outfall and the new outfall, TSS concentrations to the receiving waters would remain unchanged for the six discharge scenarios. Thus, there would be no significant change in the number of potential out-of-compliance observations for reduced light levels near the discharge.

The mass loading for each of the discharge scenarios would not be affected by outfall location; however, the dispersal of the solids would occur over a greater area, therefore reducing the potential for impacts from particle settlement onto the benthos. If the new outfall were located in an area where there was no overlapping affect from the existing 120-inch outfall, then the suspended solids would be distributed over an area twice as great as the area of the present discharge, thereby reducing any potential effects by 50%. However, because the selected location does experience some overlapping effects, a reduction of less than 50% would be expected. The addition of a second outfall would not significantly reduce the potential for any adverse effects to light levels, and some out-of-compliance observations would still be expected during stratification periods. This would not result in a significant impact.

Impacts to surface water color would be the same for the 50:50 split as for the 120-inch outfall. No significant impacts would occur.

Nutrients

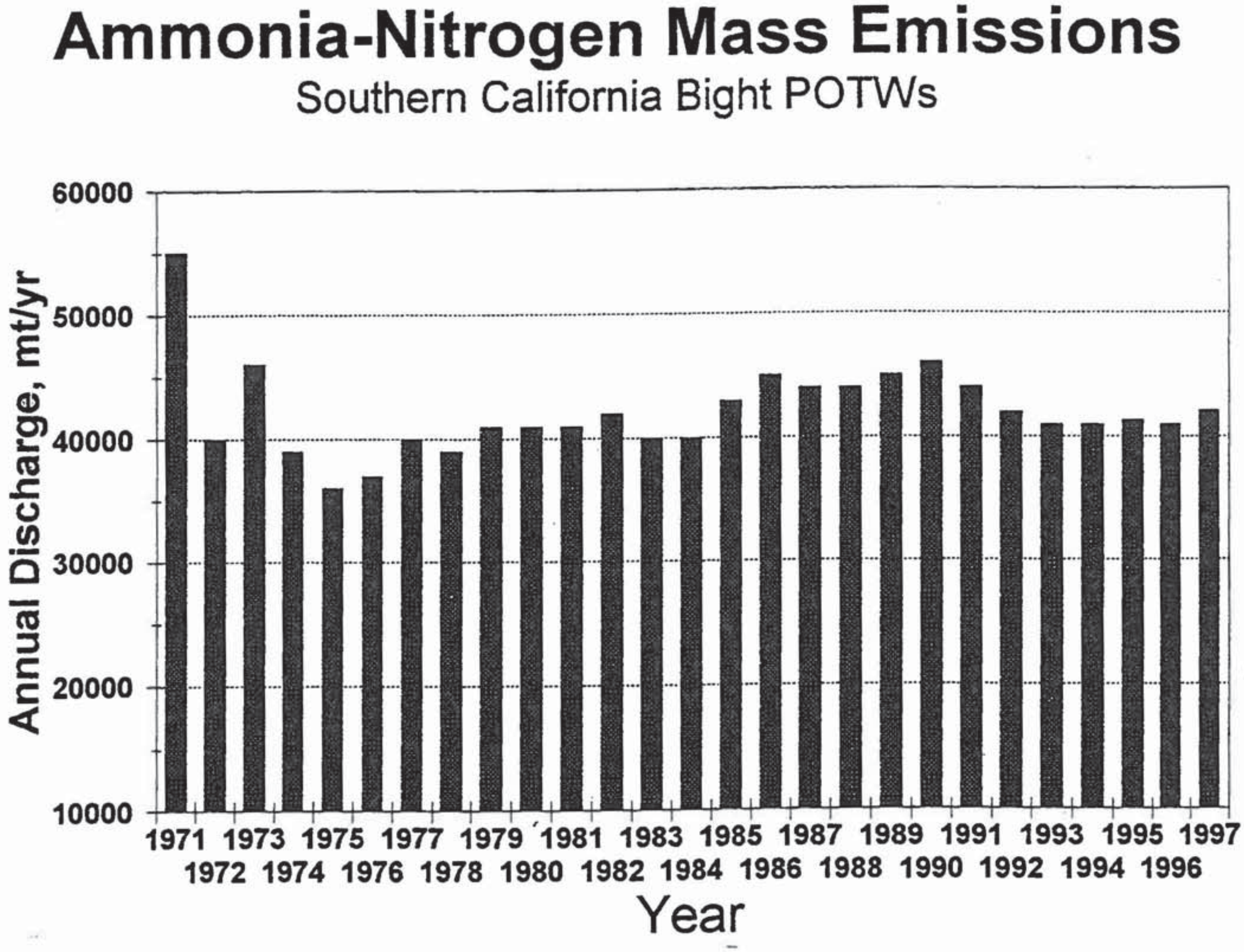
The District's NPDES permit limits ammonium concentrations in the effluent to a maximum of 30 mg/L (6-month median concentration) and/or a mass loading limit of 56,800 lbs/day. The California Ocean Plan requires that "nutrient materials shall not cause objectionable aquatic growths or degrade indigenous biota." There has been no evidence of excessive stimulation of algal bloom conditions that is attributable to the wastewater plume evident from data collected by the OMP in recent years. California Ocean Plan water quality objectives for ammonium as nitrogen in the receiving waters are 0.6 mg/L (6-month median) ammonium, 2.4 mg/L daily maximum, and 6.0 mg/L for instantaneous maximum. The OMP has measured maximum concentrations of ammonium in the receiving waters due to the wastewater discharge from 0.01 to 0.5 mg/L. Plume-related elevations of ammonium are generally below 33 to 66 feet. Natural levels of ammonium in Southern California waters are approximately 0.005 to 0.5 mg/L. Thus, due to the high initial dilution of the effluent upon discharge, concentrations in the receiving waters are below the 6-month median average and from 5 to 12 times lower than the daily and instantaneous maximum objectives, respectively.

The wastewater discharge contains compounds of carbon, nitrogen, phosphorus, and silicon that, in low concentrations, are essential nutrients for the survival and growth of biota, especially plankton. However, elevated concentrations of these same nutrients can be detrimental to organisms and their survival. Ammonium as nitrogen is the only nutrient regularly monitored by the District in its effluent and in the receiving waters. Ammonium occurs naturally in the marine environment within concentration ranges that typify present-day concentrations in the wastewater plume after initial dilution. These natural concentrations of ammonium in the receiving waters appear to be a limiting factor for plankton productivity; therefore, added inputs of ammonia have the potential to stimulate productivity. Conversely, high concentrations of ammonium may have toxic effects.

Mass emissions of ammonium from the largest Public Owned Treatment Works in the SCB have been relatively constant since 1972 at about 41,000 mt/yr (**Figure 5-11**). Since 1985, the District's ammonium effluent concentrations (annual average) have been maintained between 23 to 25 mg/L (mean 24 mg/L) (CSDOC 1998) with no apparent seasonal pattern (Lindstrom 1999, Attachment N-1). Since 1991, the daily mass loading from the District's outfall has been gradually increasing to about 51,000 lbs/day (8,446 mt/yr) as a result of increasing flow rates (**Figure 5-12**). Maximum values in the receiving waters due to the wastewater discharge range from 0.01 to 0.5 mg/L; elevated concentrations (0.2 to 0.4 mg/L) beyond the ZID are frequent.

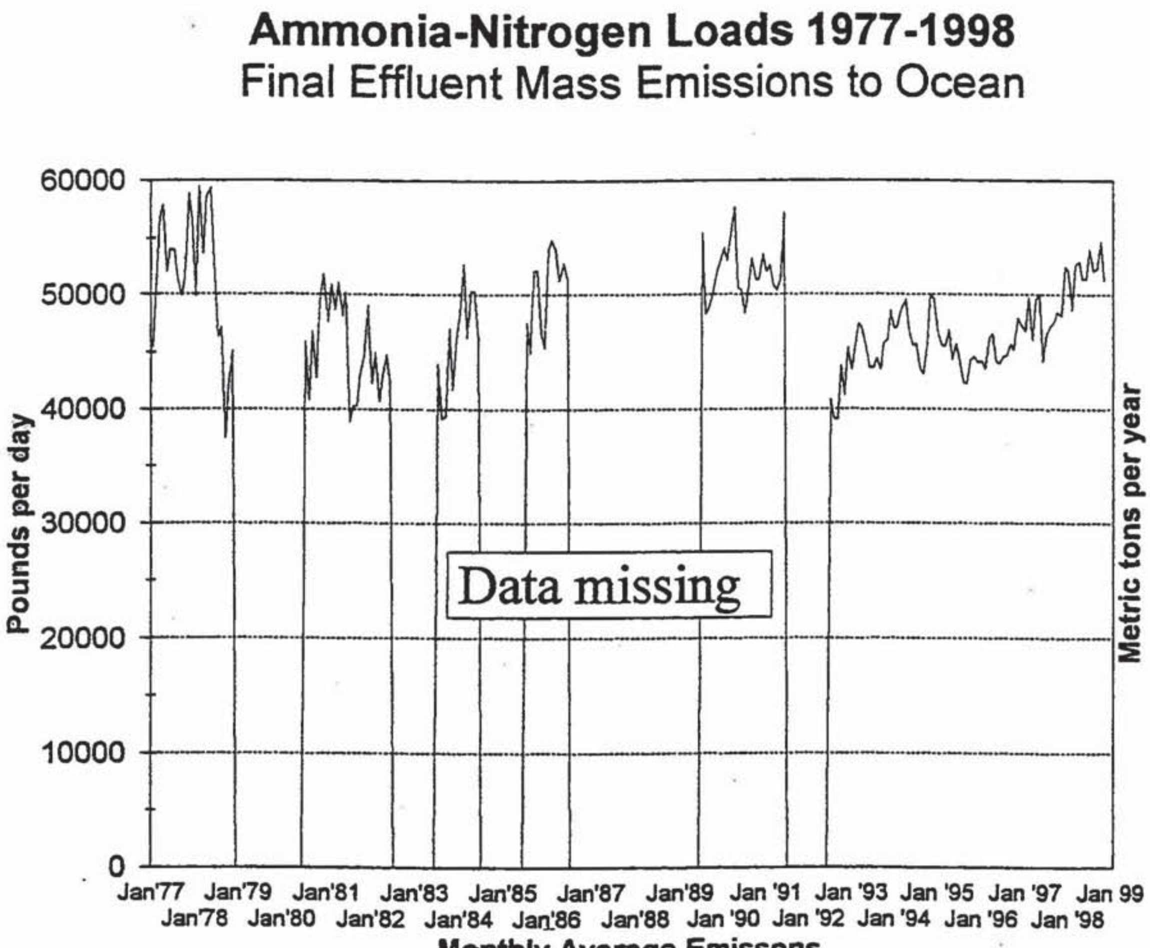
For the Preferred Scenario, ammonium concentrations are expected to be 26 mg/L or an increase of approximately 8% over the existing conditions (**Table 5-26**). After initial dilution, the calculated increase in ammonium beyond the ZID would average about 0.14 mg/L and would range from 0.20 to 0.13 mg/L, depending upon the dilution factor. These values are well below the California Ocean Plan criteria and within the range of natural variability. Mass loading at an average concentration of 26 mg/L will result in an average annual mass loading of 55,513 lbs/day (9,193 mt/yr) or an increase of 8.8% above present levels (**Table 5-27**). This mass loading would comply with permit criteria, and the small increase could increase phytoplankton biomass; however, this increase would be small and is expected to be not significant. That is, the increase in ammonium concentrations generally would be below the pycnocline, whereas the phytoplankton are more concentrated above the pycnocline; therefore, the effect is expected to be minor. -

Given the Preferred Scenario, the CSDOC outfall would contribute 9,193 mt/yr, or an increase of 747 mt/yr over the present discharge level. Approximately 179,673 mt/yr of nitrogen as ammonium are introduced into the coastal euphotic zone by upwelling (Lindstrom 1999; SCCWRP 1973). Surface runoff and drainage add 4,369 mt/yr, and municipal and industrial discharges contribute approximately 26,999 mt/yr (Lindstrom 1999; NOAA 1987). While ammonium from wastewater is an important source of nitrogen for primary production, other nutrient sources are more significant. The small increase in annual mass loading for the Preferred



SOURCE: Lindstrom, 1999

Figure 5-11
Ammonia-Nitrogen Mass Emissions
Southern California Bight POTWs



SOURCE: Lindstrom, 1999

Figure 5-12
OCSD Ammonia-Nitrogen Loads 1977-1998

Scenario is insignificant compared to the natural loading and, therefore, is not considered significant.

Alternative Scenarios

The projected effluent concentration for Scenarios 4 and 6 is 23 mg/L, which is slightly lower than that expected for the Preferred Scenario (26 mg/L) (**Table 5-26**). Given that the rate of flow is the same (259.6 mgd), mass loading effects of Scenarios 4 and 6 would be lower than those for the Preferred Scenario. Levels in receiving waters would be in compliance with California Ocean Plan objectives, and no excessive or objectionable algal growth is expected. This would not result in a significant impact.

Effluent concentrations for Scenarios 1, 3, and 5 are 21, 19, and 20, respectively, at a flow rate of 324.1 mgd (**Table 5-26**). Average annual mass loading is 56,434 lbs/day for Scenario 1, 52, 609 for Scenario 3, and 54, 631 lbs/day for Scenario 5, compared to 55, 513 lbs/day for the Preferred Scenario (**Table 5-27**) (**Figure 5-13**). Mass loading for Scenario 1 represents an increase of 10.7% above present levels. Since the increase in ammonium levels above the pycnocline is small, the effect is expected to be minor and similar to that for the Preferred Scenario. No excessive or objectionable algal growth is expected. For Scenario 1, concentration of ammonium in the ZID would be approximately 0.21 mg/L, which is on the same order of magnitude as the Preferred Scenario and well below the California Ocean Plan objectives for toxicity (4 mg/L ammonium for chronic and 6 mg/L ammonium for acute toxicity). These concentrations would not result in a significant impact.

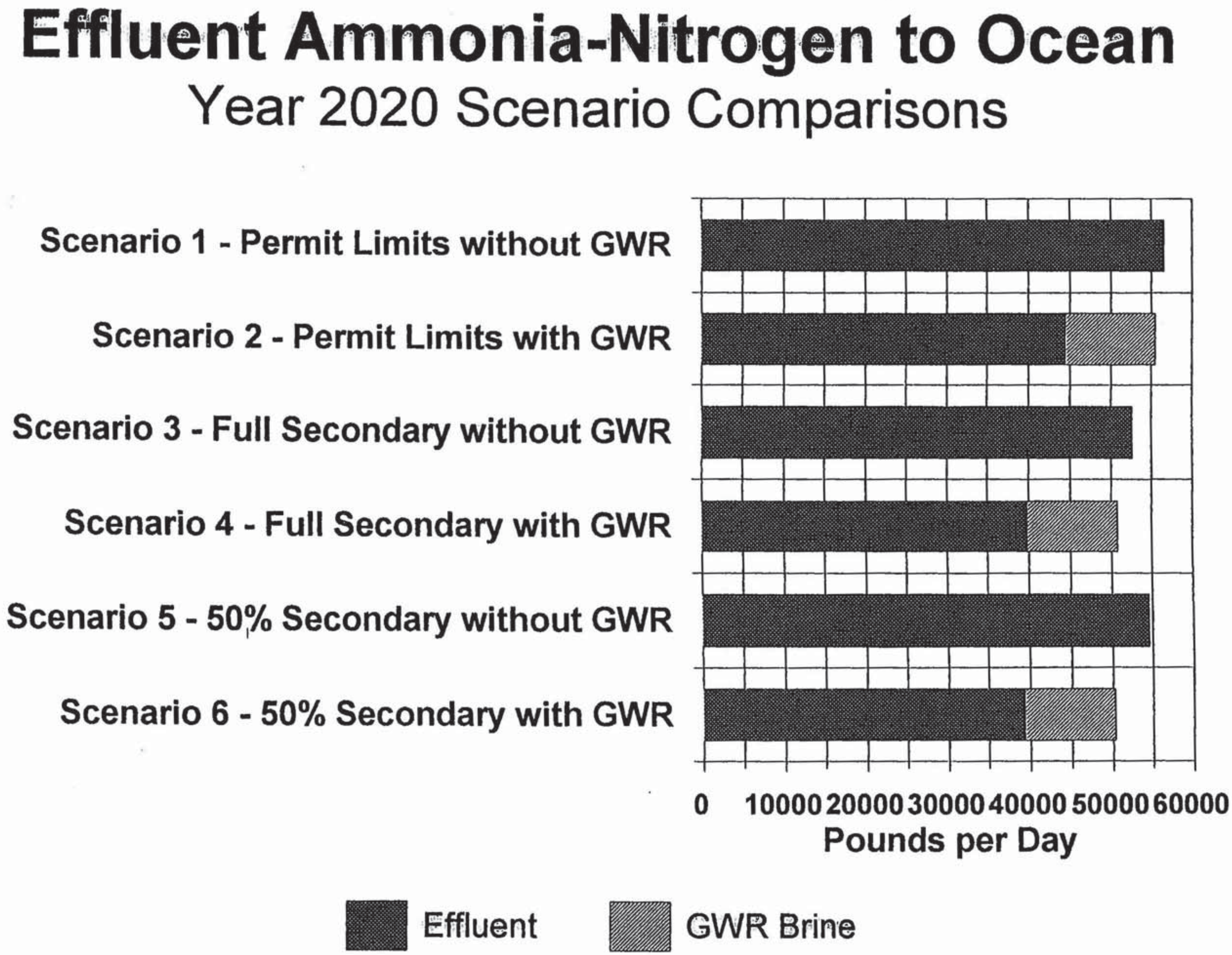
Mass loading for Scenarios 3 and 5 would be less than that for the Preferred Scenario; thus, impacts would be the same or lower than those for the Preferred Scenario. Levels in receiving waters would be in compliance with California Ocean Plan objectives, and no excessive or objectionable algal growth is expected. This would not result in a significant impact.

Optional Discharge Locations

Given a 50:50 split of the final effluent to the existing 120-inch outfall and the new outfall (identical initial dilutions to 120-inch outfall), ammonium concentrations to the receiving waters would remain unchanged. While the mass loading would also remain unchanged, the area over which the mass is distributed would increase because of the new outfall location. Therefore, the potential to stimulate excessive biomass production might be reduced. This would not result in a significant impact.

78-inch Outfall

California Ocean Plan water quality objectives for receiving waters are 4 mg/L ammonium for chronic and 6 mg/L for acute toxicity. Effluent discharges from the 78-inch outfall would have an ammonium concentration of 20 mg/L for all treatment scenarios (**Table 5-28**). Dividing this expected concentration by the initial dilution of 100 approximates the ammonium concentrations within the ZID. This calculation yields a ZID concentration of 0.20 mg/L, which is well below the California Ocean Plan objectives.



SOURCE: Lindstrom, 1999.

Figure 5-13
Effluent Ammonia-Nitrogen to Ocean
Year 2020 Scenario Comparisons

The California Ocean Plan also requires that nutrient materials shall not cause objectionable aquatic growths or degrade indigenous biota. Mass loading of ammonium varies from 1,800 to 9,491 pounds for the six treatment scenarios (**Table 5-29**). Given that this is a one-day occurrence, impacts to aquatic biota would be negligible. Thus, these estimates of ammonium would meet California Ocean Plan criteria and would not result in significant impacts.

Mitigation

No mitigation is required.

Impact 5-3. Oil and Grease effluent levels would comply with numeric permit limits under Scenarios 1, 2, and 5 but would potentially create observable floating particles which would be a permit violation. Less than significant with mitigation. Discharge for Scenarios 3, 4, and 6 would not result in a significant impact to floating particulates and oil and grease. Less than significant.

Oil and Grease

The District's NPDES permit and the California Ocean Plan state that the 30-day limit for oil and grease is 25 mg/L or 61,500 lbs/day and "floating particulates and oil and grease" (that is of potential sewage origin) "shall not be visible." Oil and grease are generally attributable to human-related activities, although natural oil and gas seeps contribute substantially to hydrocarbon loading in the Southern California Bight (SCB) (Anderson et al. 1993). Results of the District's shoreline monitoring indicate that beach grease is due primarily to runoff from sources on land. This is supported by the fact that there is no evidence that the wastewater discharge ever reaches the shoreline. Offshore oil and grease or floatables are derived from numerous sources, including runoff from land, boat traffic, minor fuel spills and leakage, and potentially wastewater discharge (CSDOC 1996a, 1997). The OMP has occasionally observed surface oil films and particulates; however, these observations have indicated very little, if any, relationship with the wastewater discharge location.

Mass loading of oil and grease discharged to receiving waters has increased from 24,000 lbs/day in 1985 to 34,900 lbs/day in 1998. This increase has been due to increasing flow rates and modifications of treatment strategies. Average annual concentrations of oil and grease in 1998 were 16.4 mg/L, well below permit limits. At the present level of discharge, there has been no indication of any effects to floatable loads, and, thus, the discharge meets all compliance objectives. However, because certain organic contaminants and pathogens partition to oil and grease particles, increasing oil and grease mass loading could increase these components in the receiving waters. This could be significant if it increases pathogen counts in surface waters, which could be blown onshore or in areas of body contact.

The Preferred Scenario would increase oil and grease concentration in the effluent to 24 mg/L, an increase of 46% (**Table 5-26**). The effluent concentration would be just below the permit limit

(25 mg/L) and, thus, in compliance. Mass loading would increase to 49,617 lbs/day or an increase of 42% (**Table 5-27**). While there is no model useful for predicting whether these increases in concentration and mass loading would cause increases in floatables, this represents a substantial increase in oil and grease to the receiving waters and the potential for floatables to be observed, which would be a significant impact. Because it is not possible to predict whether or not floatables would be observed, monitoring is recommended.

Alternative Scenarios

Scenarios 3 and 4 would have the lowest oil and grease effluent concentration (7 mg/L) (**Table 5-26**). Scenarios 5, 6, and 1 would have concentrations of 17, 18, and 18 mg/L, respectively. These concentrations would meet the present permit criteria and are less than or close to the present discharge concentrations. Therefore, any of these scenarios would have similar or less impact than the present discharge and, thus, would be in compliance. Mass loading would be lowest for Scenario 4 at 14,221 lbs/day and Scenario 3 at 18,974 lbs/day (**Table 5-27**) (**Figure 5-14**). Scenario 4 would have the lowest concentration and mass loading of all scenarios.

Scenario 6 would have an intermediate mass loading (35,694 lbs/day). Scenario 6 is similar to present mass loading values, which have not caused compliance problems. Concentrations for Scenarios 1 and 5 would be 18 and 17 mg/L, respectively. Scenarios 1 (47,679 lbs/day) and 5 (47,224 lbs/day) would have mass loading values close to the Preferred Scenario. The increases associated with Scenarios 1 and 5 could lead to observing floatables. These impacts would be significant.

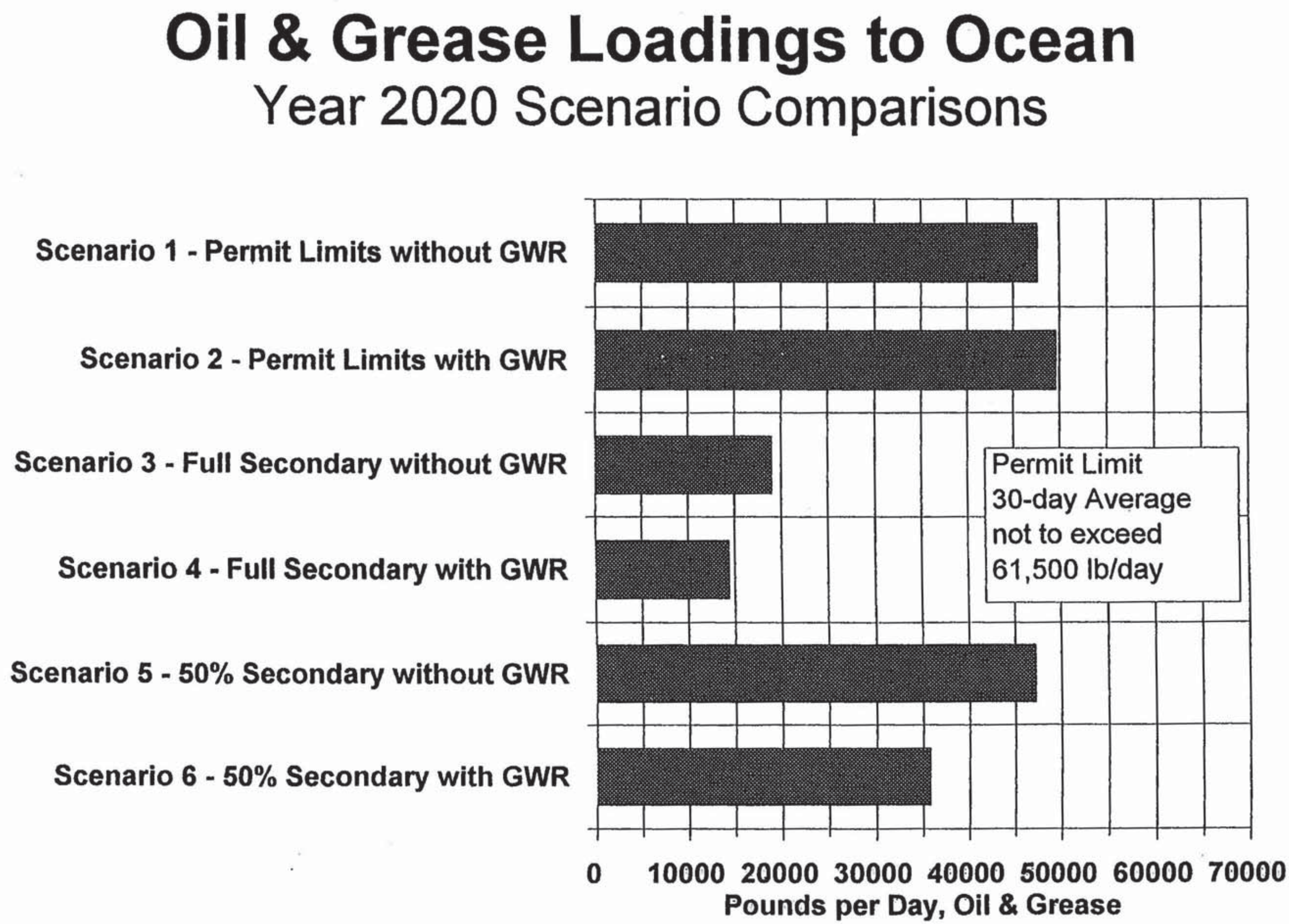
Optional Discharge Locations

Given a 50:50 split of the final effluent between the existing 120-inch outfall and the new outfall, oil and grease concentrations and mass loadings would remain unchanged. The Preferred Scenario and Scenarios 1 and 5 could lead to observable floatables. These impacts would be significant.

EIR-Identified Mitigation

Measure 5-3: Monitor receiving waters in accordance with the current permit monitoring requirement and, if floating particulates from the discharge are observed in surface receiving waters, modify treatment to reduce oil and grease in the effluent.

Impact 5-4. Emergency use of the 78-inch outfall for wet weather effluent discharge would not result in significant impacts to surface water color, oil and grease dissolved oxygen, pH, total suspended solids, or ammonium. Less than significant.



SOURCE: Lindstrom, 1999.

Figure 5-14
Oil & Grease Loadings to Ocean
Year 2020 Scenario Comparisons

Transmissivity and Color

A 10-hour emergency discharge to the inshore 78-inch outfall has the potential to impact water transmissivity and color, depending upon the timing of such an event. For the Preferred Scenario and Scenarios 1, 5, and 6, the TSS concentration is calculated to be 44 mg/L, and for Scenarios 3 and 4, TSS is calculated to be 20 mg/L (**Table 5-28**). All these concentrations are well below permit limits. Mass loadings would be relatively low, ranging from about 2,004 (Scenario 4) to 20,207 pounds for Scenarios 1 and 5 (**Table 5-29**). The Preferred Scenario and Scenarios 3 and 6 are intermediate at 9,519 pounds. The 100:1 dilution factor for the 78-inch outfall would result in an increase of 0.20 to 0.44 mg/L in suspended solids above ambient concentrations beyond the ZID. These concentrations are small and, under most circumstances, would not significantly decrease ambient light levels.

The most likely use of the 78-inch outfall would be during winter rainfall when storm flows exceeded the capacity of the 120-inch outfall. During these conditions the nearshore area would most likely be experiencing turbid, low-salinity flows from the Santa Ana River and other non-point sources. Waves would also cause resuspension of nearshore sediments, and rip currents would add to the nearshore turbidity. Under these conditions, the emergency use of the 78-inch outfall would most likely not be detectable, and decreased transmissivity levels would not be distinguished from storm flow influences.

Oil and grease concentrations for emergency use of the 78-inch outfall are calculated to be 18 mg/L for the Preferred Scenario; 18 mg/L for Scenarios 1, 5, and 6; and 7 mg/L for Scenarios 3 and 4 (**Table 5-28**). These concentrations are all well below permit limits. Mass loadings would range from 696 lbs (Scenario 3) to 8,322 lbs (Scenarios 1 and 5) (**Table 5-29**). The Preferred Scenario, as well as Scenarios 4 and 6 are intermediate, with a mass loading of 1,752 lbs.

Mitigation Measures

No mitigation required.

Impact 5-5. Increased discharge of brine under any scenario but particularly under Scenarios 2, 4, and 6 with the GWR System would reduce initial dilution and increase metals concentrations. This could result in potentially significant toxicity impacts, but additional study is needed before GWR begins to determine this. Potentially significant but less than significant with mitigation.

Toxicity

Effluent toxicity testing by the District was modified in June 1998 to include both acute and chronic toxicity. Before this time, the District conducted monthly acute testing using adult fathead minnows. **Figure 5-5**, in the Setting Section, graphs monthly acute bioassay results from July 1990 through May 1998 and indicates that only twice has the effluent exceeded the toxicity threshold of 1.5 TUa. For these two exceedances, toxicity was determined to be artificial, due to a rise in pH and corresponding increase in toxic, un-ionized ammonia during the testing period. Additional episodes of high toxicity were not observed after modification of the test procedure to aerate test chambers containing high concentrations of effluent with pure oxygen rather than air, and, thus, control pH levels.

The new permit requires a 3-month screening period to determine the more sensitive of two species — fathead minnow and water flea. The more sensitive species is used in acute toxicity testing for the rest of the year. Chronic testing is conducted on either purple sea urchin or red abalone to measure sublethal effects. Recent toxicity testing is in compliance with the new and more sensitive permit standards.

Projecting the potential toxicity of effluents is very difficult since they are subject to change as the wastewater composition changes. The factors of importance that might be used to distinguish the various treatment and discharge scenarios include the concentrations of ammonia present in the effluent, the presence of brine from the GWR System project, and other desalting residuals that contain higher concentrations of potential toxicants and can influence the physiology of the test organisms. With higher levels of biological treatment, survival rates of test organisms are expected to be higher. This is because secondary treatment achieves higher removals of potential toxicants including ammonia. However, secondary treatment may contain higher concentrations of dissolved metals, which may be more biologically available to test organisms in a chronic test. The presence of reverse osmosis reject water in the form of brine from the GWR System project will increase the concentration of metals in the final effluent and, hence, is likely to increase toxicity. Analytical testing will be needed to determine the actual composition of the brine, and bioassay testing will be needed to determine toxicity. The increase in metals and ammonia in the effluent would most likely not cause an effluent toxicity exceedance for marine chronic toxicity since the District has a chronic mixing zone dilution factor. Because of this, the District is held to show no effect at 0.56% effluent, and the highest test concentration is 3.2% effluent. However, the District is also held to a freshwater acute standard that does not allow for a mixing zone and, thus, testing of 100% effluent is required. (However, the State Water Resources Control Board has proposed amending the California Ocean Plan to allow for an acute mixing zone.) It is likely that toxicity testing methods will change over time as more is known about the biological responses of various organisms to wastewater effluents.

Based on the estimated concentration of trace metals and ammonia in the final effluents generated by the various scenarios, a ranking of scenarios for potential toxicity indicates the following order of relative toxicity: Preferred Scenario 2 (highest potential toxicity based on metals concentration in final effluent), Scenario 6, Scenario 4, Scenario 1, Scenario 5, and Scenario 3 (lowest potential based on metals concentration in final effluent).

The above rankings are relative. Compliance monitoring will determine if NPDES permit conditions are met. There is nothing about the projected compositions that indicates that the effluent from any of the scenarios will exceed California Ocean Plan or NPDES permit limitations (based on existing regulatory requirements). Increased salinity may be a problem in the freshwater acute tests as salt is a reference toxicant for freshwater species. In the future, as regulatory requirements change and influent and effluent compositions change, actual toxicity measurements will dictate the types of actions that may be needed to reduce any toxicity that exceeds regulatory limits. Additional work is needed to determine if projected concentrations of ammonia, metals, and salt in the effluent will result in toxicity, especially with regard to increased brine from the GWR system.

EIR-Identified Mitigation

Measure 5-5: Study and monitor the effect of brine disposal on initial dilution and toxicity. If non-compliance occurs, and/or adverse marine life impacts are observed, the District will implement measures to achieve and maintain NPDES compliance including:

- Brine dilution
- Brine treatment
- Alternative brine disposal (e.g., drying and landfill disposal)

SEDIMENT QUALITY

Impact 5-6. Effluent discharge under the six proposed treatment scenarios and two discharge location options and with use of the 78-inch outfall at a rate of once every three years would not result in significant impacts to sediment quality in terms of organic matter, metals, or trace organics. Less than Significant. No mitigation is required.

Total Suspended Solids

It is the physical and chemical composition of the discharged final effluent and the composition of the receiving environment that determine the impacts to marine sediments and biota. Therefore, knowing both the chemical and physical composition of the final effluent and understanding the processes that led to wastewater particulates settling (mass, settling velocity, aggregation, flocculation) to the bottom are crucial for evaluating discharge effects. These relationships provide the key to predicting environmental effects from different treatment scenarios. These relationships also provide an important management tool for coordinating the treatment process to comply with permit criteria, minimizing environmental impacts while protecting beneficial uses, and preserving the public trust in the use of receiving waters.

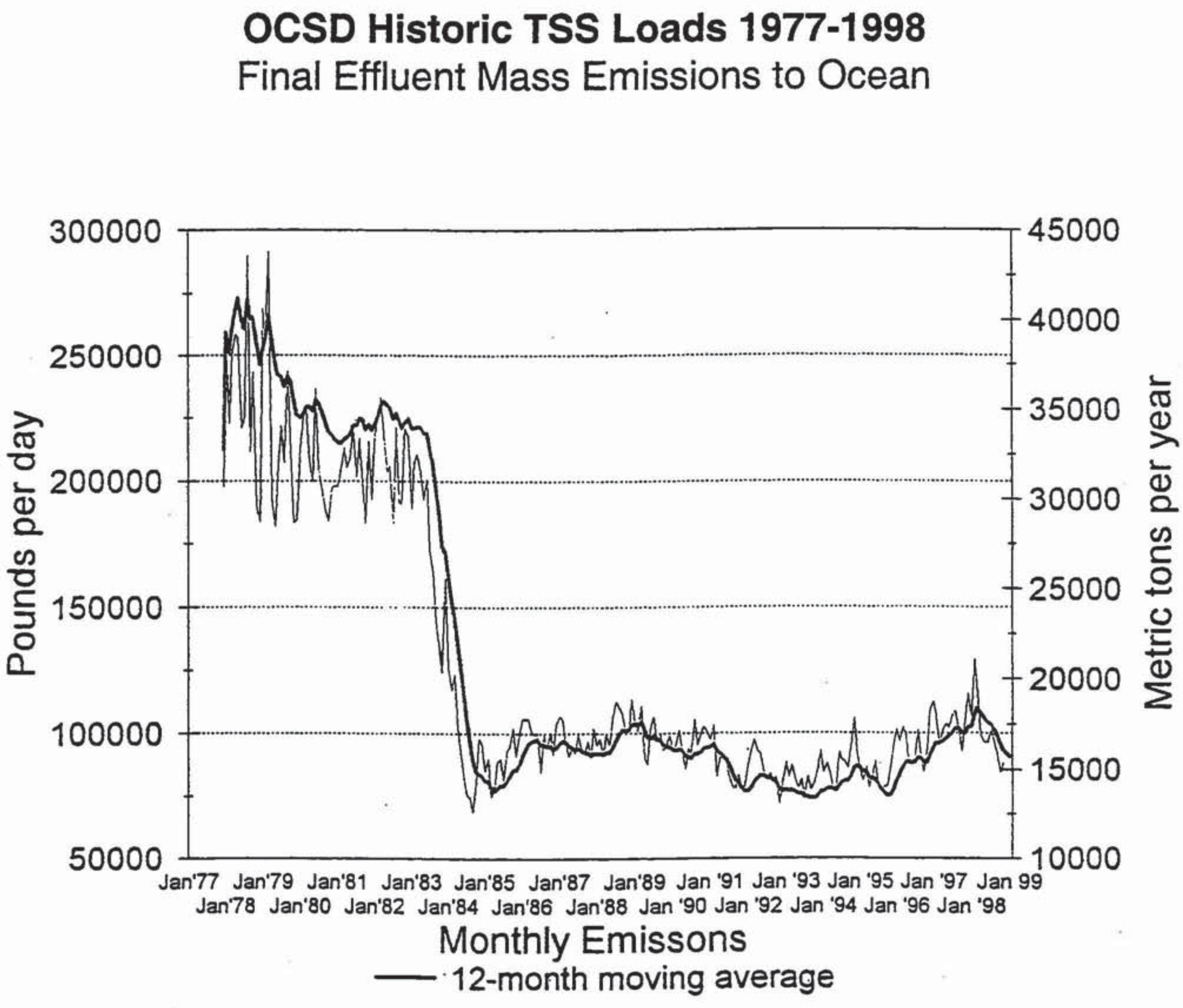
The California Ocean Plan and the District's NPDES permit require that the wastewater discharge of inert solids, toxic materials, and organic materials shall not change the inert characteristics of the sediments or degrade benthic communities and/or the indigenous biota. This introductory section describes the relationship between the wastewater discharge and impacts to the sediment quality. The resultant impacts to the biota will be discussed in greater detail subsequently. Following this overview of the relationship of treatment, effluent, and effects to the benthos, further detail is provided to evaluate the impacts of the proposed scenarios for the constituents of concern.

TSS concentration in the effluent is discussed in Impact 5-2. Effluent TSS concentrations have remained relatively constant between 40 and 55 mg/L, with an average of 50 mg/L, since 1985 (**Figure 5-15**). These concentrations are well below the current permit limit of 60 mg/L and represent about 83% of the allowable 30-day average concentration. While average TSS concentration has remained relatively constant over this period, the physical and chemical compositions of the effluent have changed significantly. This is indicated by the continued decrease in concentrations of contaminants in the effluent (also most likely decreased toxicity) and the resultant decrease in concentrations of contaminants in the sediments near the discharge. These decreases are due to effective source control and changes in treatment that have affected the physical composition of the effluent.

Physical changes relate to greater removal of larger particles as indicated by decreases in settleable solids (SS) in the effluent (**Figure 5-16**) and the smaller spatial distribution of modified sediments near the outfall. Understanding the various factors that affect wastewater particles in the receiving waters and those that contribute to particles settling to the bottom is complex. Particle size and mass, as well as the potential to aggregate (usually a function of particle concentration and shear forces), are important as these properties largely determine whether a wastewater particle will reach the bottom and, to some extent, what happens to it once it reaches the bottom. If the discharged effluent contained only small particles with low mass that did not aggregate or settle, then direct impacts to sediments and benthic biota would not occur. There might be secondary impacts associated with changes in water quality that might then affect the benthos, but the deposition and accumulation of organics and contaminants in the sediments and their effects on the biota would not be a concern. Thus, the focus for understanding impacts from the wastewater discharge on the benthos, assuming no aggregation, is directly proportional to the composition of particulates in the effluent that (have the appropriate mass to) settle near the outfall.

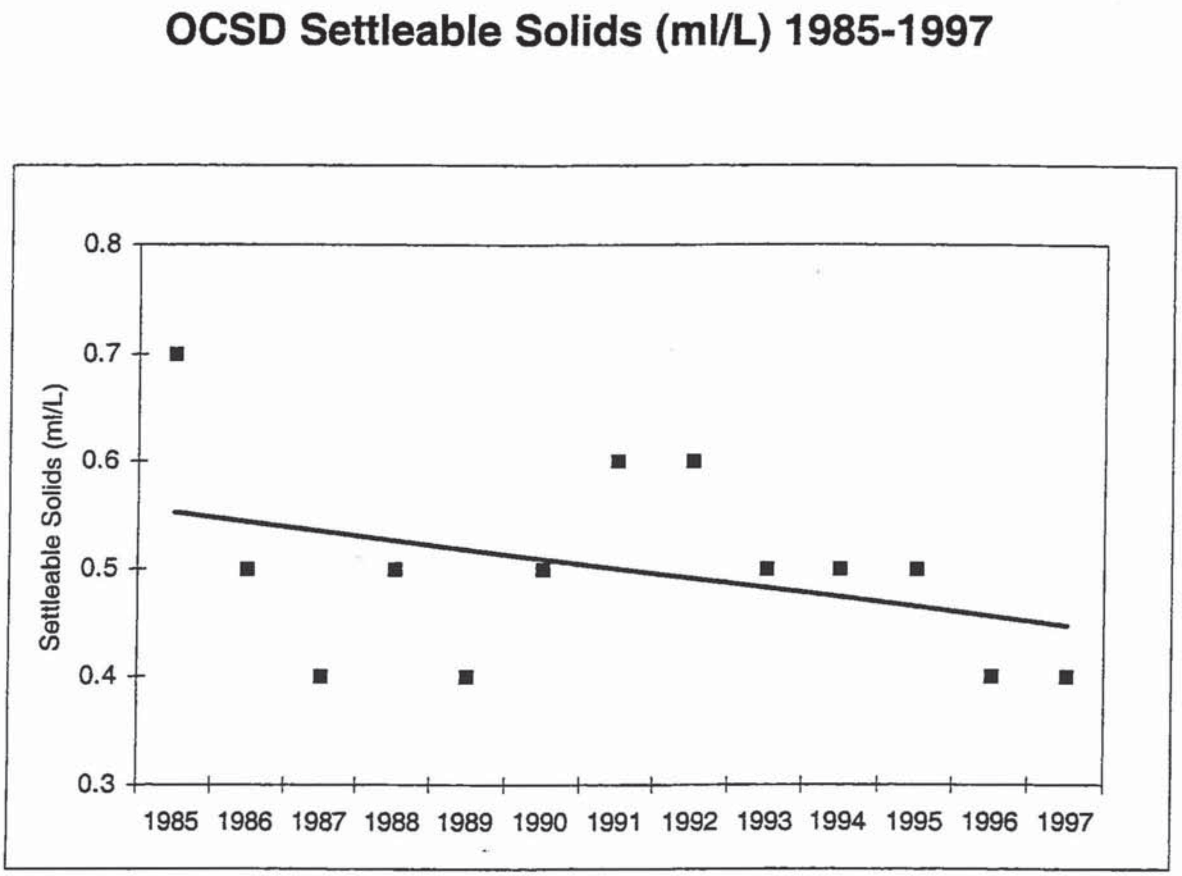
At the present time, the constituents of the final effluent and their environmental effects are poorly correlated, in part, because of information gaps in the composition of the effluent. While the District's final effluent sampling and analyses fulfill their discharge permit requirements, additional analyses are needed. The District has recently initiated a special study to characterize the effluent in greater detail to provide necessary information on particle size and contaminant relationships. Until these data are available, TSS will be used to estimate particle loading, and quantity of SS will be used as a surrogate for wastewater particle size.

For this assessment, the modeling studies conducted by Tetra Tech (1995) for the technical review of the District's reapplication for a 301(h) waiver were reanalyzed using a more appropriate value for percent organic matter in the District's effluent. While EPA guidance suggests using 80% of the TSS as an estimate for quantity of organic matter, an empirical measurement of the District's effluent found the amount of organic matter was 38.2% TSS (Hendricks and Eganhouse 1992). Almost without exception, the modeling efforts over-predict organic mass loading to the sediments sometimes by one to two orders of magnitude when



SOURCE: Lindstrom, 1999

Figure 5-15
OCSD Historic TSS Loads and
Final Effluent Mass Emissions to Ocean 1977-1998



SOURCE: MEC Analytical Systems, 1999

Figure 5-16
OCSD Anual Average Settleable Solids (ml/L) 1985-1997

compared to field measurements (e.g. CSDOC 1989; Hendricks and Eganhouse 1992). Thus, while modeling efforts provide generalized guidance, they are not accurate when compared to empirical observations and, therefore, should not be the sole basis for predicting future impacts associated with different treatment and discharge scenarios. With additional information concerning the specific composition of the effluent, this situation may improve significantly.

The OMP measures a suite of sediment parameters, including concentrations of contaminants, particle size, and distribution of the receiving sediments. Sediment contaminants derived from the wastewater discharge are clearly indicated by a concentration gradient centered on the discharge area. Phillips and Hershelman (1996) provide a detailed analysis of the relationships between effluent metal concentrations and sediment metal concentrations near the District's outfall. The data from the OMP and from Phillips and Hershelman's analysis delineate the spatial extent of elevated metal concentrations above reference levels, which defines the measurable extent of wastewater effects. This is a measured value and could be the basis for ground-truthing model predictions. The spatial scale of affected area is contaminant- dependent, which suggests that contaminants may be partitioning to different-sized particles with different settling rates and re-suspension potential.

These contaminants, therefore, will be distributed over different spatial scales. Again, this points to the need for additional information concerning particle sizes in the effluent and the partitioning of contaminants.

While it is known that the wastewater plume can be detected many miles from the discharge, sediment contaminants show a range of spatial scales from no effect beyond the ZID to elevated concentrations that extend a few miles beyond the ZID. Particles settling after six hours do not accumulate at a rate that is measurable as a gradient from the discharge point. Particles settling after six hours may accumulate in depositional areas such as canyons, but these areas are also depositional areas for non-point source particulates. These generalizations suggest that for suspended solids in the final effluent to directly affect the sediments and biota, the final effluent composition must contain particles in the size/mass range (and/or aggregating potential) that will fall to the bottom within six hours (assumes no resuspension). Therefore, if the final effluent were managed to minimize particles of these sizes and if the initial dilution were great enough to minimize aggregation and flocculation, then there would be no measurable deposition effect near the outfall. Hendricks and Eganhouse (1992) recognized this when they noted that effluent characteristics and/or treatment may be important factors in controlling the rate of particle deposition.

Since effluent particle size, mass, and extent of aggregation are unknown, modelers must make assumptions about these values to model sediment organic loading from effluent particles. For example, Tetra Tech (1995) in evaluating the District's 301 (h) waiver reapplication, assumed 20% of the effluent solids would settle out within 4.3 nautical miles upcoast and downcoast of the outfall. In another calculation using DECAL, Tetra Tech (1987) assumed 34% of the solids would settle out within 11 nautical miles, assuming a mass loading of 215,849 lbs/day (36,200 mts/yr). A suite of settling velocities based upon Hendricks (1982) and Hendricks and Eganhouse (1992) was used in the District's reapplication. These authors utilized assumptions including those restricted to particle aggregation as well as those pertaining to particle sizes and mass. These assumptions have lead to differing results for estimates of the loading of carbon and solids from the District's outfall to the bottom. What is most important is that without knowing the particle mass, particle sizes, aggregation/flocculation factors, there is no predictable relationship between TSS in the effluent and the number of particles that settle to the bottom. That is, it is possible to have a final effluent with 50 mg/L TSS where no particles settle in six hours (all small particles) or one where all particles settle within six hours (all large, massive particles).

Because contaminant gradients have been measured relative to the District's outfall, some proportion of the final effluent TSS must be settling to the bottom. A recent laboratory study found that for primary-treated effluent without chemical addition from a large metropolitan area, only about 22% of the particles settle out of the water column, and of these, 80 to 100% of the particles settle within six hours (Baker et al. 1995). It is reasonable to expect that for more advanced treatment, which would remove more of the larger particles, less than 22% of the TSS would settle within six hours. Typical treatment practices find TSS removal rates for primary treatment at 30 to 50%, while the District's chemically-assisted, advanced primary treatment removes 73 to 77% of the TSS. Full secondary treatment strives to remove over 85% of the TSS. Thus, a more reasonable estimate of the proportion of particles from the District's effluent that would settle near the outfall is less than 10%. Additionally, with the continued reduction in SS, about 18% since 1985 (**Figure 5-16**), a more reasonable estimate for the proportion of settleable particles would be 5 to 10 %. However, for Scenarios 2, 4, and 6, which include GWR, the discharge of essentially advanced primary-treated effluent mixed with GWR brine in summer would be expected to increase to the proportion of settleable particles to a range of 10 to 15% SS. Consequently, the proportion of solids reaching the bottom would be proportional to the SS concentration and not related to TSS concentration. It is reasonable to expect some seasonal variation in SS, which will vary with treatment and influent flows. The scenarios with GWR will affect the SS concentrations because the diversion will reduce the proportion of secondary treatment in the final effluent. During summer, essentially advanced primary treatment and brine from GWR will characterize the final effluent.

Grain Size

As stated above, the District's NPDES permit requires that the wastewater discharge, i.e., inert solids, shall not change the characteristics of the receiving sediments so as to degrade the indigenous benthic communities. Since there are no existing data on the physical composition of the SS in the effluent, compliance evaluations rely on comparison of grain size of the sediments near the outfall with that at reference areas and a determination as to whether gradients in particle size are centered on the outfall. As described in the Setting, there are significant, natural gradients in the sizes of particles within the study area that are related to water depth, river inputs, and canyons (**Figure 5-16**). Changes in median grain size near the outfall are not apparent. However, a more detailed analysis of grain sizes near the outfall indicates that there is a greater proportion of larger particle sizes and fewer fines near the outfall and downcoast compared to upcoast. This gradient relates to a combination of natural, coarse, relic sediments eroding and becoming exposed along the 180- to 350-ft water depth contours. Some of these sediments were exposed during the construction of the outfall; others have been created by outfall reef effects. The presence of the outfall structure affects surrounding sediments by adding fallen shell material and possibly by changing the bottom current flows to enhance erosion of fine sediments near the outfall structure. The outfall acts as a large, artificial reef colonized by many organisms including bivalve molluscs (clams), which thrive on the structure, then die and fall near the outfall, thus contributing to the proportion of the large-particle-size fragment of the sediments. This effect is localized and does not extend beyond the ZID.

The Preferred Scenario will result in a 9.9% increase of the amount of TSS discharge over 1997/98 levels. The effect of this increase cannot be predicted because the particle sizes of the effluent are unknown. However, changes are expected to be small because the magnitude of change is relatively small, and the receiving environment is dynamic and not conducive to particle settlement as indicated by no detectable change in grain size over the past 14 years. No significant impact is expected to the characteristics of the sediments from the wastewater discharge.

Alternative Scenarios

The other five treatment scenarios will not affect the sediment characteristics if the SS loading does not change significantly from concentrations representative of those since 1985. No significant impact is expected to the characteristics of the sediments from the wastewater discharge.

Optional Discharge Locations

Within the expected range of effluent SS loading, discharges to a new outfall location will not cause significant effects to the characteristics of the sediments. However, the construction of a new outfall will add considerably to the size of the artificial reef represented by the outfalls. The new, hard-bottom substrate will provide a habitat for molluscs and add dead mollusc shells to the sediments. This effect, while large, is not a result of the discharge of inert particles nor will it be detectable beyond the ZID. Use of the alternative discharge location is not significant.

78-inch Outfall

Regardless of the treatment scenario, emergency use of the 78-inch outfall will not affect the characteristic of the sediments in the vicinity of the outfall. No significant effects will result from the temporary and short-term use of the 78-inch outfall.

Organic Matter

The District's permit requires that the concentration of toxic and organic materials discharged to the receiving waters shall not be increased to levels that would degrade marine life and indigenous biota. The concern about organic loading is that excessive amounts of organic matter can overwhelm the biota, and the oxygen demand of the organic material can drive the sediments anaerobic. The organisms that make up benthic communities naturally process large amounts of organic matter (food) including that derived from natural sources as well as from human-produced inputs. Degrading and recycling of organic matter occur at rates that minimize long-term accumulation. However, if the input rate exceeds a critical loading level (assimilative capacity), accumulation that changes the benthos from a nutrient processing and recycling system to an organic storage (accumulation) system can occur. The critical threshold or the assimilative capacity of the system is defined as the loading rate above which sediment quality and biota are significantly altered or degraded. Degraded, in this context, refers to the inability of the benthic biota to aerobically metabolize (process) and recycle most of the organic matter. Organic loading rates that are greater than the assimilative capacity dramatically change the function of the benthic community and its biota, and the sediments become depleted of oxygen.

Extensive literature exists on both organic loading rates and processing of organic carbon by benthic communities (e.g., Hargrave 1973; Maughan and Oviatt 1993; Pearson and Rosenberg 1978; Rhoads and Boyer 1982; Rice and Rhoads 1989; Ritz et al. 1989). Natural benthic communities are composed of many trophic groups that partition the habitat and resources. As organic loading exceeds the assimilative capacity, organic accumulation begins and oxygen levels drop due to the oxygen demand of the organic material. Accumulation buries organisms, and oxygen demand lowers oxygen concentrations, which, in turn, begins to kill or displace the deep, active borrowers and feeders. The loss of these community members reduces the movement of water and materials into the sediments via worm tubes and holes, which accelerates the lowering of the oxygen concentrations within the sediments. As the deep, active borrowers and feeders die, they tend to be replaced by small, near-surface-feeding species. Dense tube mats produced by these opportunistic species trap more organic material, which contributes to an increased oxygen demand and drives sediments towards becoming anaerobic. Lower oxygen levels restrict survival and colonization to only opportunistic species tolerant of low oxygen. Thus, the number of species in the community decreases, which is one of the first signs of a stressed community. Abundances may continue to be high, as these opportunistic species can multiply quickly. However, if organic loading drives the sediments anaerobic, only a few species may survive. At extreme organic loadings, the sediments may become abiotic (no infaunal organisms). The change in the sediments and benthic community provides a strong signal when the assimilative capacity is exceeded.

Threshold critical organic loading rates to benthic communities appear somewhere in the range of 28 to 46 $g/ft^2/yr$ (SAIC 1998). **Table 5-32** summarizes the results of modeling evaluations of organic loading rates for the District's ocean discharge and the projected organic loading rates for each of the six treatment scenarios. Tetrà Tech conducted modeling of the District's discharge on behalf of the EPA as part of the technical review for renewal of the District's NPDES permit. The District found that the results of this modeling effort yielded estimated organic loading rates that are more than twice the measured values. This was due to use of very conservative assumptions about the organic content of the Total Suspended Solids (TSS) in the effluent (80 percent), which exceed measured values by over a factor of two, among other factors. The Tetra Tech model also assumed an impact area of 0.10 square mile, which is less than the area encompassed by the District's ZID. Thus, all estimates of loading and accumulation beyond the ZID would be lower than these values.

TABLE 5-32
CALCULATED AND MEASURED MAXIMUM ORGANIC MATTER DEPOSITION AND ACCUMULATION FOR ANNUAL STEADY STATE AND 90-DAY CRITICAL PERIODS.

Effluent TSS (mg/L)	Mass Load TSS lbs/day (mt/yr)	Steady State Maximum Organic Deposition $g/ft^2/yr$ ($g/m^2/yr$)	Steady State Maximum Organic Accumulation $g/ft^2/yr$ ($g/m^2/yr$)	Critical 90-day Maximum Organic Deposition $g/ft^2/90$-day ($g/m^2/90$-day)	Critical 90-day Maximum Organic Accumulation $g/ft^2/90$-day ($g/m^2/90$-day)	Organic Matter in Effluent (%)	Affected Area (square miles)
48[1]	105,756 (17,514)	39 (424)	11 (116)	17 (186)	12 (128)	80	0.10
48[1]	124,143 (20,559)	44 (471)	12 (130)	19 (208)	13 (143)	80	0.10
72[1]	186,217 (30,839)	66 (707)	18 (194)	36 (390)	20 (214)	80	0.10
49[2]	105,671 (17,500)	11 (117)	--	--	--	38.2	Sediment trap
Scenario 1 - 45	120,500 (19,992)	20 (215)	6 (60)	9 (95)	6 (66)	38.2	0.10
Preferred Scenario – 57	225,347 (19,325)	22 (234)	6 (66)	10 (103)	7 (72)	38.2	0.10
Scenario 3 – 23	63,449 (10,527)	10 (108)	3 (29)	4 (47)	3 (36)	38.2	0.10
Scenario 4 - 24	48,228 (8,002)	9 (98)	3 (27)	4 (41)	3 (33)	38.2	0.10
Scenario 5 – 44	119,772 (19,871)	20 (220)	6 (62)	9 (97)	6 (67)	38.2	0.10
Scenario 6 – 43	86,664 (14,375)	16 (176)	4 (48)	7 (74)	5 (58)	38.2	0.10

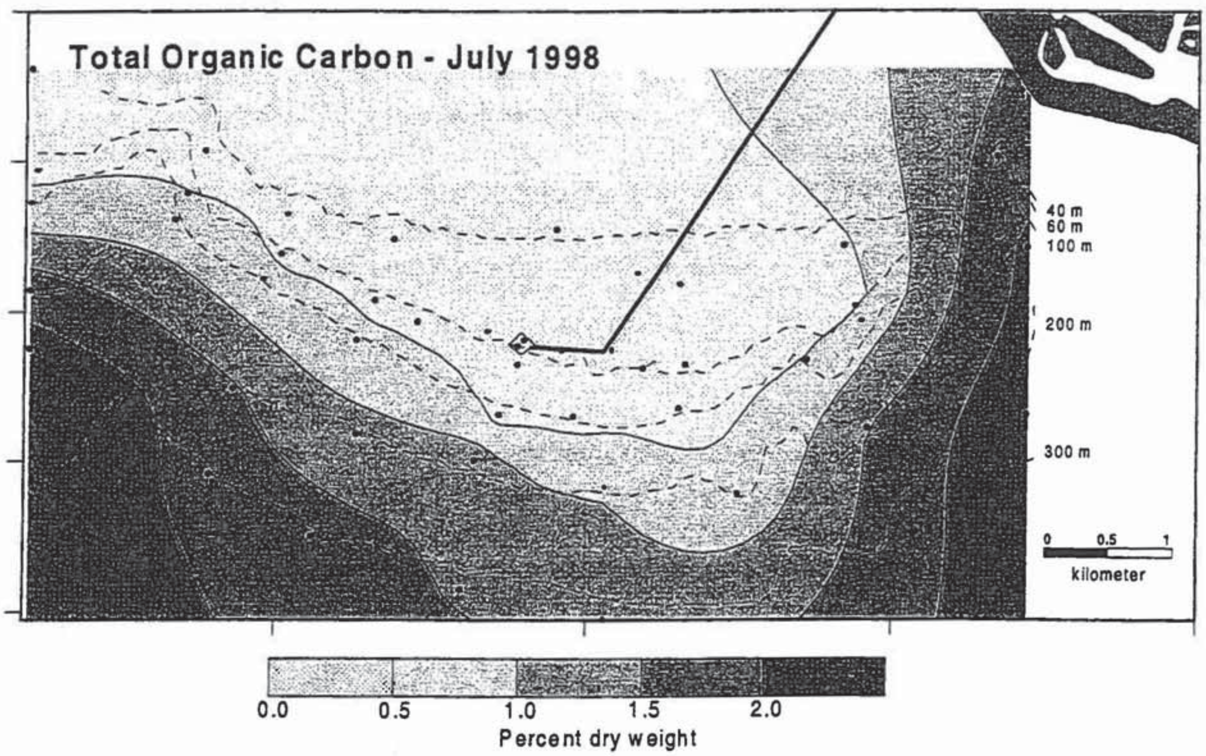
[1] Tetra Tech 1995 Technical review of District's reapplication.
[2] Hendricks and Eganhouse 1992.

In **Table 5-32** the Tetra Tech modeling results are compared to those from the Hendricks and Eganhouse (1992) study. These authors not only measured the organic matter content of the effluent but also placed sediment traps near the District's outfall. Measurements made over a one-year period indicate an organic loading rate that is significantly less than the Tetra Tech model prediction and yet still greater than measured sediment TOC values, which rarely exceed 1%. The organic loading associated with the six treatment scenarios was calculated by re-analyzing the Tetra Tech modeling effort, but assuming 38.2% of the TSS was organic carbon (instead of up to 80%). Projected organic loading rates for the various treatment scenarios are less than the Tetra Tech values due to the assumption concerning lower percentage of organic matter in TSS and to differences in mass loading for the respective scenarios. The values for the six scenarios agree more closely with the values from Hendricks and Eganhouse (1992), which were found to exceed measured values.

Comparison of the critical loading threshold of 28 to 46 $g/ft^2/yr$ with the values calculated for the six treatment scenarios indicates that the projected steady-state loading each of the various treatment scenarios is well below this threshold (**Table 5-32**). Critical loading for the Preferred Scenario and for Scenarios 1 and 5, if extrapolated for a one-year period instead of 90-day period, would fall within the range of 28 to 46 $g/ft^2/yr$. However, these organic loadings would be at the threshold of the beginning of some change in community composition but to where the community would be considered degraded. Furthermore, this represents the worst case as it is modeled for the area of maximum impact (0.10 square miles). All other areas near the outfall would have lower loadings and, thus, would be under the critical loading threshold. Since the OMP begin in 1985, there has been no indication that the communities immediately adjacent to the diffuser have been degraded. This provides further support that the model assumptions are too conservative and that the predicted organic loadings are not reflective of the actual environment near the outfall.

In addition to the organic loading from the wastewater discharge, the deposition of natural organic material must be included in the calculation to determine total organic loading to the sediments. There are few, measured values for natural organic fluxes. Hendricks and Eganhouse (1992) provide a conservative best estimate of 6 $g/ft^2/yr$, which was the highest value they measured in their sediment trap study. Therefore, 6 $g/ft^2/yr$ should be added to the steady state values presented in **Table 5-32** to predict the worst case deposition of organic loading to the sediments for an area of 0.10 square miles. The Preferred Scenario represents the highest, steady-state-organic loading with 27 $g/ft^2/yr$ of natural and wastewater-derived organic matter. This value is just below the critical loading value of 28 $g/ft^2/yr$, where some change in the biota might be expected.

Measured sediment TOC content in the District's study area shows that the area of enhanced organic carbon is small, almost all the area is apparently at or near background levels (**Figure 5-17**). Maximum TOC near the outfall rarely exceeds 1%, tends to be highest directly off the end of the diffuser, and does not extend much beyond the ZID. Areas of higher TOC are found throughout the study area. These tend to be associated with fine sediments as can be seen by the higher concentrations found in the canyons and in deeper waters. Furthermore, as will be discussed in the Biota section, the discharge does affect the surrounding community, but these effects tend to be enhancement of the food supply and not degradation of a community or exceedance of the organic loading critical threshold.



SOURCE: Lindstrom, 1999

Figure 5-17
Spatial Distribution of Sediment TOC
(% Dry Weight) July 1998

Calculations for organic matter loading for the Preferred Scenario approach the predicted critical threshold; however, values for this scenario are close to those for present conditions, for which there is no indication that organic loading to the sediments is a significant problem. Therefore, while the model predictions suggest a potential loading problem that should be verified, the empirical data indicate that organic loading since 1985 has not degraded the community, and, consequently, the organic loading calculated for the Preferred Scenario also is not expected to degrade the biota. No significant impact from organic loading of the sediments is expected from the Preferred Scenario.

The apparent disparity between the model prediction of organic sediment loading and actual measurement of organic matter in the sediments needs to be resolved. This disparity appears to stem from several sources, including conservative predictions and historical reasons. Two or three decades ago, when outfalls discharged large masses of solids that underwent minimal treatment, it was easy to measure a direct relationship among effluent TSS, organic sediment loading, and changes in the biota. As treatment levels have changed, the nature of wastewater effluent also has changed significantly. Hendricks and Eganhouse (1992) commented upon the disparity between sediment trap data and measured sediment loading. It is clear that present-day treatment practices successfully remove the larger particles and those that can be aggregated or flocculated most easily. The remaining particles that now comprise the TSS fraction are those particles most resistant to settlement and flocculation. Thus, when these wastewater particles are discharged into the receiving waters, these particles are relatively resistant to settlement. Modeling efforts that assume certain settling speeds or aggregation factors are not realistic for the present composition and character of modern effluents. These modeling efforts do not consider that these small wastewater particles either have little potential for settlement and, thus, will be transported away from the study area or that they will settle slowly to the bottom and become part of a mobile layer of material that remains near the bottom but is never incorporated into the sediments. This flux layer of small particles may touch the bottom, where they can provide food for organisms but are not incorporated into the sediment matrix and remain easily re-suspended by tidal current or wave-induced forces. This seems to account for some of the disparity between model predictions and field measurements of sediment organic matter. Also, spatial gradients in biota relative to the outfall often exceed those of measured sediment contaminants, again indicating that outfall effects can extend beyond measured sediment indicators.

Alternative Scenarios

The alternative scenarios all have lower organic loadings than the Preferred Scenario 2. Scenario 4 has the lowest loading values, and Scenarios 1 and 5 have values approaching those of the Preferred Scenario. No significant impacts from organic loading are predicted for these scenarios.

Organic loading is directly dependent upon the percentage of organics in the TSS and on the nature of the particles to settle or aggregate. The effects of the GWR System on these parameters are unknown and cannot be predicted until further studies are conducted.

Optional Discharge Locations

Given a 50:50 split of the final effluent between the existing, 120-inch outfall and the new outfall, the organic mass loading to the receiving sediments would be reduced by about 50%. The mass loading of organic matter would be distributed over an area approximately twice the present size. Therefore, the new outfall location would reduce the potential for organic loading of the sediments. Use of the new outfall would accommodate the projected increase organic mass loading to the receiving waters beyond present levels without significant impacts.

78-inch Outfall

The effluent discharge during an emergency to the 78-inch outfall would be of short duration (a matter of hours) and would result in a potential organic mass loading of 765 to 7,719 lbs (38.2% of the TSS load). Scenario 1 and 5 would have the greatest loading; the Preferred Scenario and Scenarios 3 and 6 would discharge 3,636 lbs; and Scenario 4 would have the lowest loading. Because only a small portion of this organic material would reach the bottom and because the resuspension and mixing nearshore are more influential and would limit organic deposition, no significant organic loading or impacts would occur for any of the proposed scenarios.

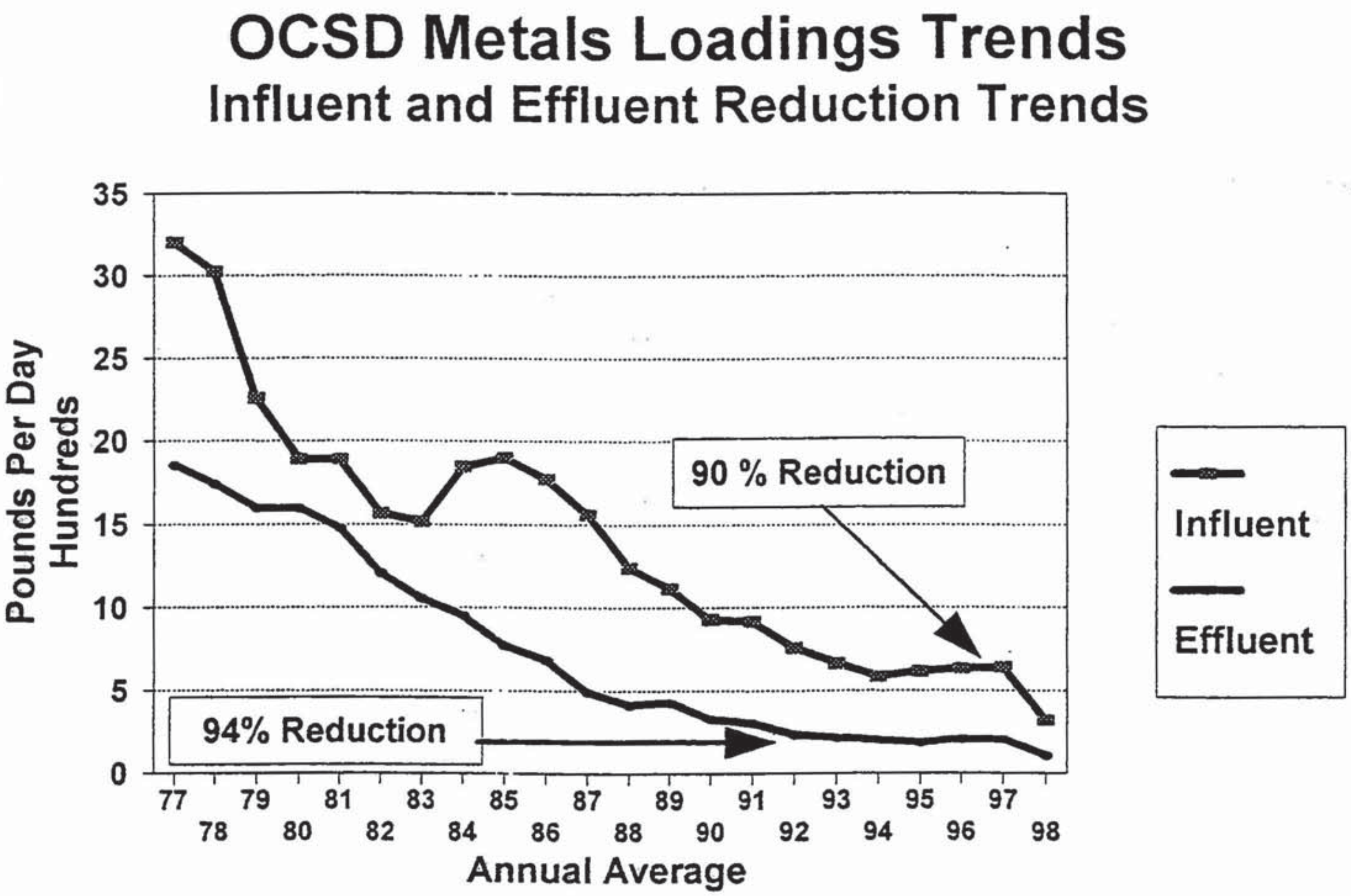
Metals

The California Ocean Plan requires that accumulation of wastewater contaminants in sediments not degrade the benthic organisms or the indigenous population. Metal accumulation in sediments can affect resident biota through alteration of habitat and quality and availability of food. Currently, there are no permit criteria for contaminant concentrations in marine sediments. The absolute and relative concentrations of metals in sediments are related to their minerals and to subsequent mixing and dilution with sediments from other geological sources. Metal contaminants are derived from numerous sources including point and non-point sources, and these contribute to natural sediment loads. Because most metals have strong affinities for small-sized particles, the distribution and fate of metal contaminants are largely controlled by the same transport and depositional processes discussed for organic matter. However, it is important to note that since treatment levels have improved, the majority of the trace metals in the effluent are no longer associated with particles but are found in the dissolved phase (Hendricks and Eganhouse 1992; Phillips and Hershelman 1996). This has profound implications because it indicates that metal loading to the sediments from wastewater particulates must be decreasing, but these decreases may be offset by increases in effluent toxicity.

The District regularly monitors effluent and sediment metal concentrations. Effluent metal concentrations have shown dramatic decreases, about 94% since the late 1970s (**Figure 5-18**) as have sediment metal concentrations (**Figure 5-19**). Decreasing metal concentrations in the effluent account for 48 to 62% of the variance (decreases) for sediment metal concentrations near the District's outfall (Phillips and Hershelman 1996)[1].

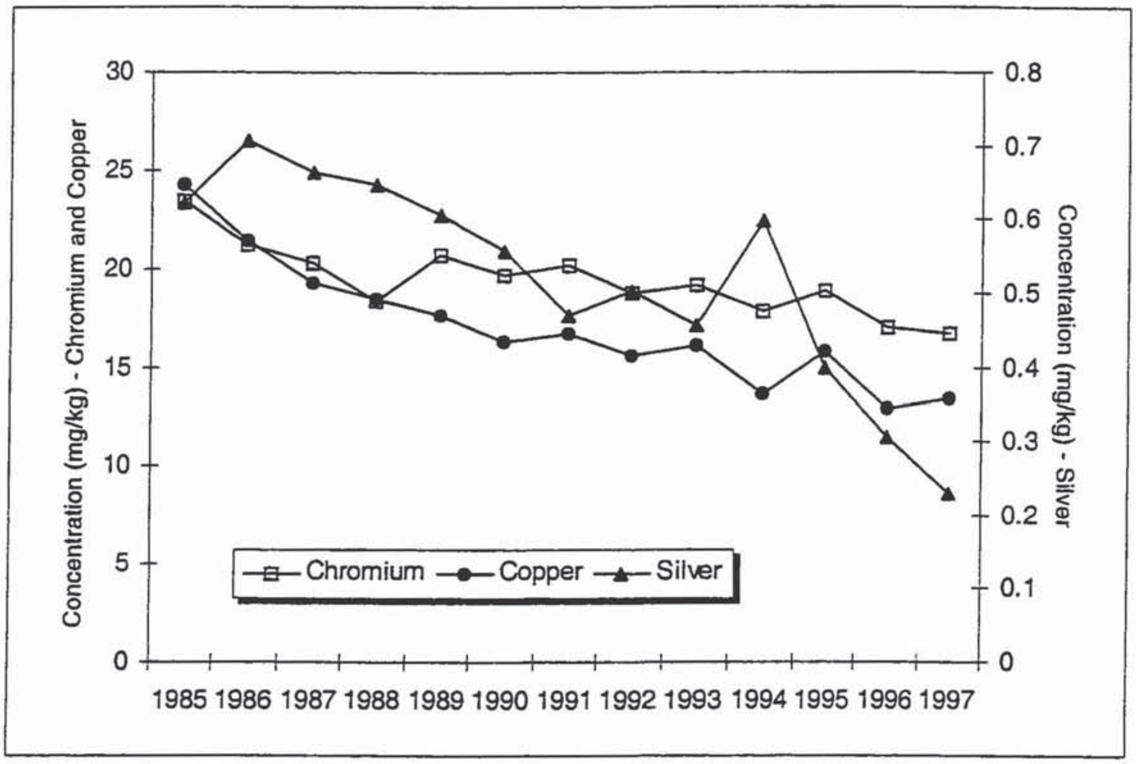
Within the District's study area, two basic patterns in sediment metal distribution are evident. Metals such as iron, arsenic, beryllium, chromium, lead, nickel, thallium, and zinc, all which have strong affinities for small-sized particles exhibit depth-related increases but negligible effects related to the wastewater discharge (e.g., **Figure 5-20**). Spatial patterns for cadmium, silver, and, to a lesser extent, copper and mercury show depth-related patterns, but these patterns are overlaid with well-defined gradients centered

[1] It is important to note that the measurement of sediment metal concentrations is highly dependent upon the laboratory extraction method. From 1985 to 1997 sediment metal concentrations for the District's OMP utilized a strong, acid-leach-extraction protocol. However, since 1997, the laboratory has used a total-extraction, which yields comparatively higher metal concentrations. Evaluation of these differences and their effect on the OMP are presented in the District's 1997-1998 Annual Report (CSDOC 1999).



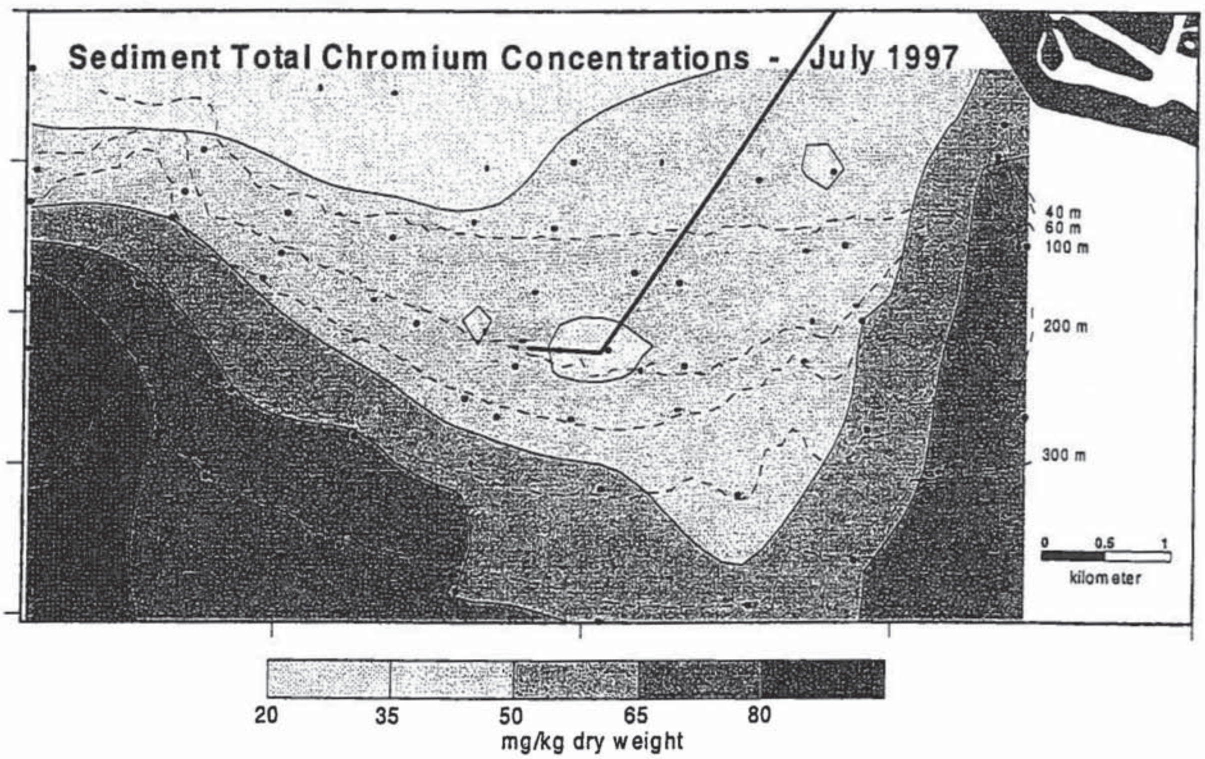
SOURCE: Lindstrom, 1999

Figure 5-18
OCSD Metals Loadings Trends 1977-1998



SOURCE: MEC Analytical Systems, 1999

Figure 5-19
Annual Mean Sediment Metals Concentrations 1985-1997



SOURCE: MEC Analytical Systems, 1999

Figure 5-20
Spatial Distribution of Sediment Chromium Concentrations July 1997

on the outfall (**Figure 5-21**). These gradients are also correlated with the distribution of wastewater markers, such as linear alkyl-benzenes. The sediment concentrations of metals that are enhanced near the outfall are within a factor of two of corresponding concentrations from reference areas identified during the 1994 Regional Survey (Schiff and Gossett 1997). While enhanced metal concentrations can be measured near the outfall, these levels are below biological-effects thresholds. This is supported by sediment toxicity studies conducted by the District. These studies find no sediment toxicity in bioassays using sediments from the areas of maximum metal loading (T. Gerlinger personal communication 1999).

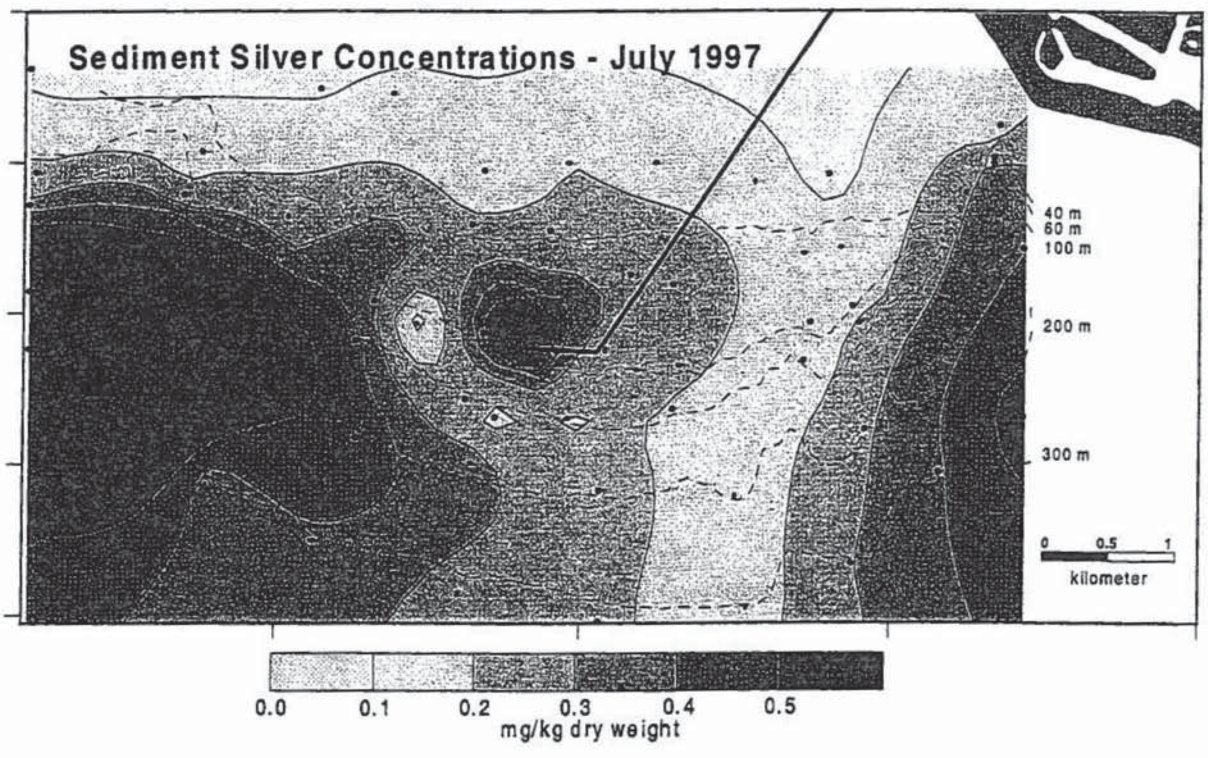
As can be seen in **Figures 5-18 and 5-19**, the effluent metal concentrations are reaching a plateau where further significant reductions may not be achieved. The metal loadings calculated for the six treatment scenarios range from 227 to 326 lbs/day (**Table 5-27 and Figure 5-22**). At the present time, metals loading to the ocean is 229 lbs/day. Since there is no indication of the biota being affected at this level and there is no sediment toxicity, there appears to be no significant impacts associated with this metal loading. It needs to be emphasized that most of this metal loading is now associated with the dissolved fraction of the effluent, and, thus, smaller amounts of these metals are reaching the bottom. As mentioned previously, the effects of the GWR on the composition and particle size of the final effluent require further study. The Preferred Scenario 2 would have the highest metal loading at 379 lbs/day, which is comparable to the loading characterizing the effluent in 1989/1990 (**Figure 5-18**). Based upon the District's OMP annual monitoring reports (e.g., CSDOC 1996a, 1997, 1998), the benthic community near the outfall represents a healthy and highly diverse biota enhanced by the organic food supply from the wastewater. There is no indication of a degraded community, and balanced indigenous population is present. Therefore, even though the Preferred Scenario represents a significant (65%) increase in metal loading compared to that of the present discharge, this increase is within the range of recent loads that were found not to significantly impact the biota. Therefore, no significant impacts are expected for the Preferred Scenario.

Alternative Scenarios

Scenario 3 would have the lowest metal loading of 227 lbs/day, comparable to the present level, and Scenario 6 would have the highest metal loading of the various alternatives with 326 lbs/day (**Table 5-27 and Figure 5-22**). The GWR system project increases the metal loading for the effluent from 8 percent (Scenario 6) to 26 percent (Preferred Scenario 2). All metal loading values for the alternatives are lower than those for the Preferred Scenario, and, therefore, no significant impact is expected for any of the alternative scenarios.

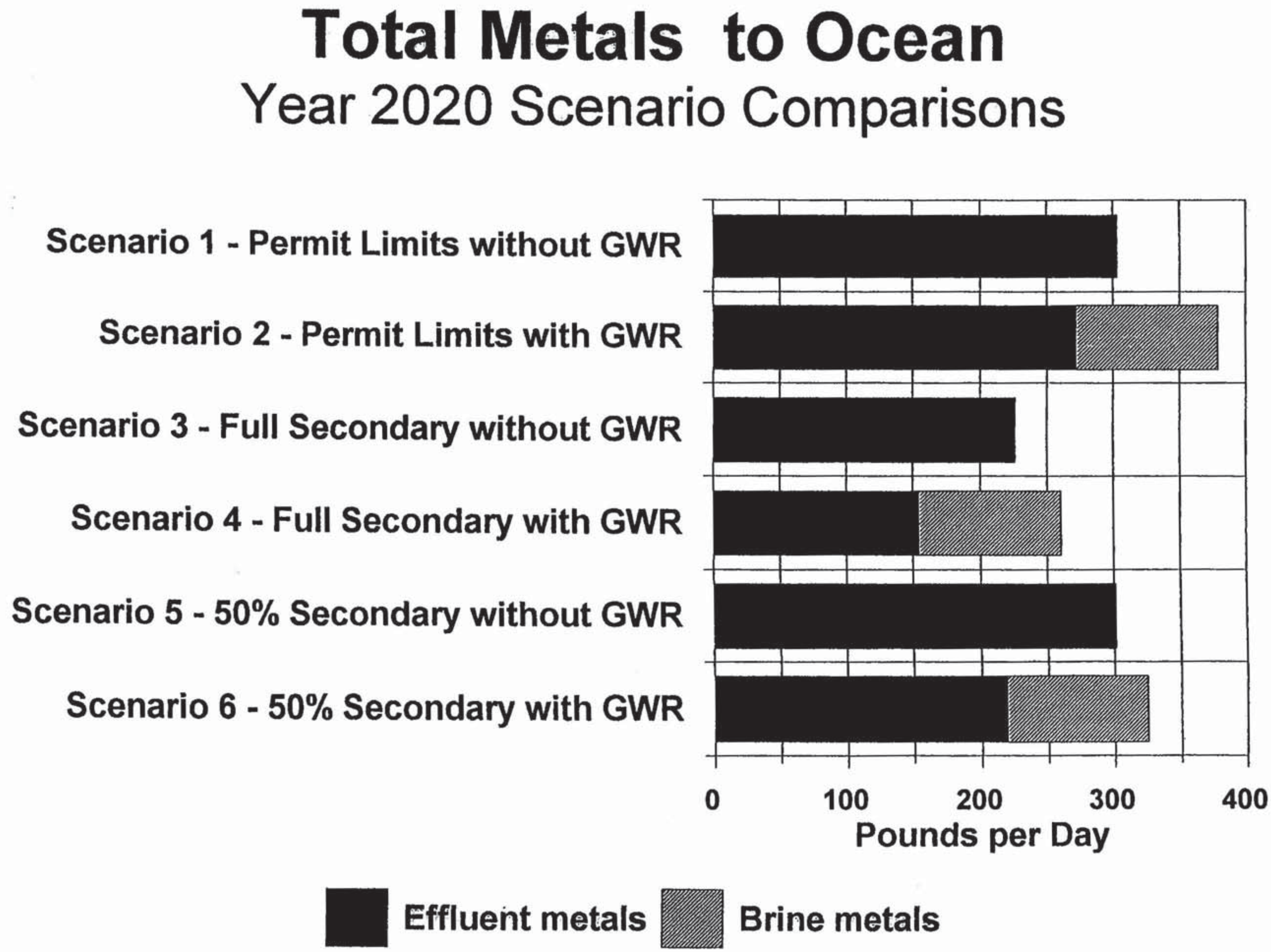
Optional Outfall Locations

Given a 50:50 split of the final effluent between the existing, 120-inch outfall and the new outfall, the metal mass loading to the receiving sediments will be reduced by about 50%. That is, the mass loading of metals will be distributed over an area approximately twice the present size. Therefore, the new outfall location would reduce the potential for loading of metals to the sediments. A new outfall allows increasing metal mass loading to the receiving waters beyond present and projected levels without significant impacts.



SOURCE: OCSD, Marine Monitoring Annual Report, 1999

Figure 5-21
Spatial Distribution of Sediment Silver Concentrations July 1997



SOURCE: Lindstrom, 1999.

Figure 5-22
Total Metals to Ocean
Year 2020 Scenario Comparisons

78-inch Outfall

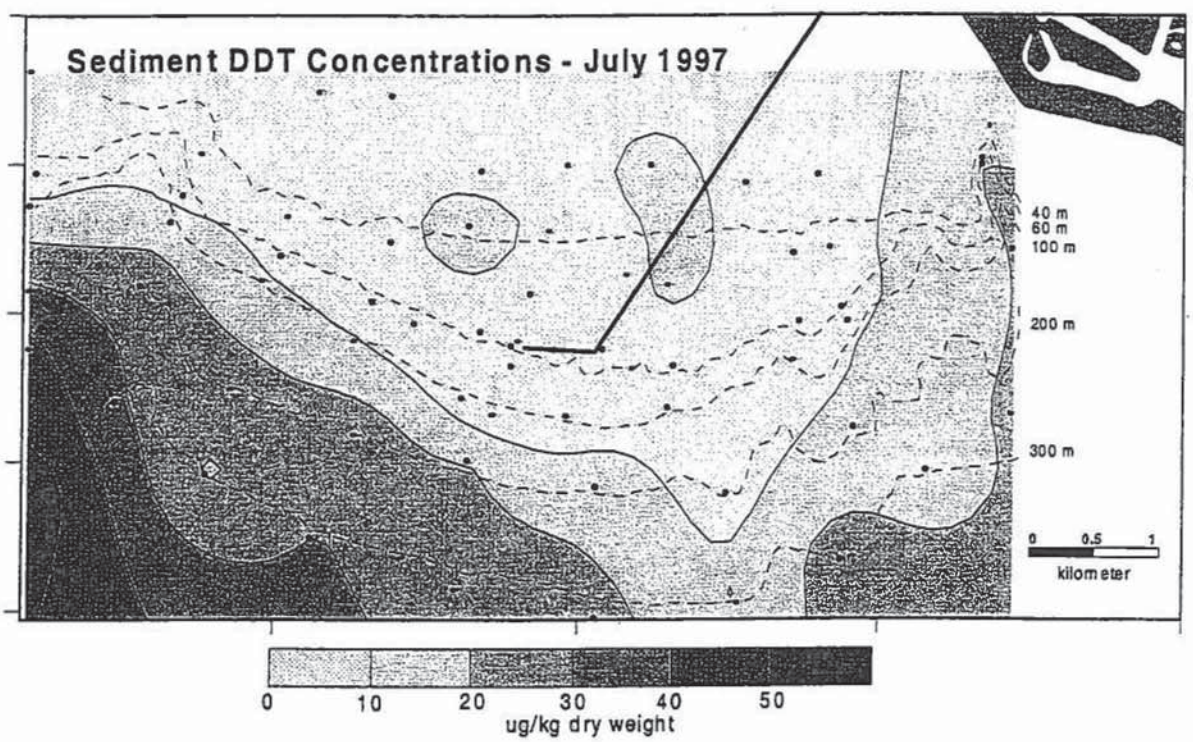
The effluent discharge during an emergency to the 78-inch outfall would be of short duration and would result in metal loading of 6 to 49 lbs (**Table 5-29**). Scenario 1 and 5 would have the greatest loading; the Preferred Scenario 2 and Scenario 6 would have an intermediate value (13 lbs); and Scenario 4 would have the lowest loading. Because the metal loads would be small, only a small portion of the wastewater particles would reach the bottom, and because re-suspension and mixing at the nearshore location would minimize metal deposition, no significant impacts to sediment quality would occur for any of the proposed scenarios.

Trace Organics (Pesticides, PAHs, and PCBs)

The California Ocean Plan requires that accumulation of wastewater contaminants in sediments not degrade the benthic organisms or the indigenous population. Organic compounds accumulating in the sediments can affect resident biota by their toxicity or through alteration of habitat and quality and availability of food. Currently, there are no permit criteria for contaminant concentrations in marine sediments.

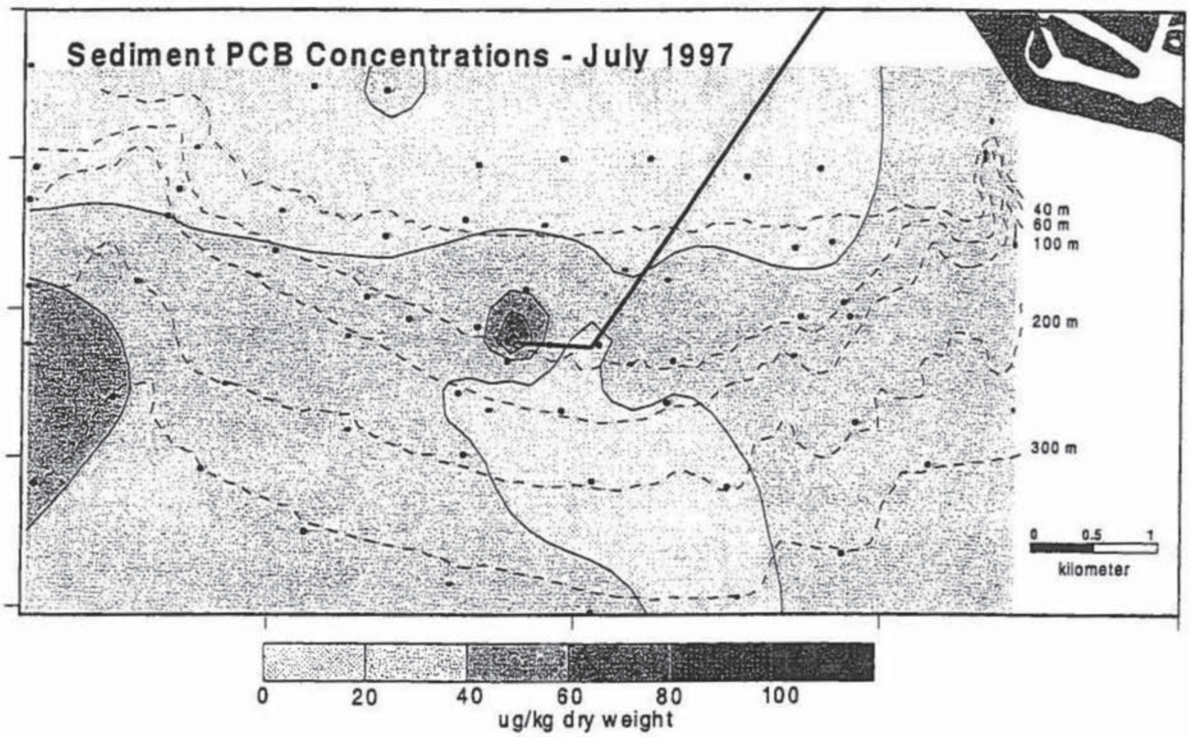
There are several classes of trace organic compounds that occur naturally in marine sediments. For example, polycyclic aromatic hydrocarbons (PAHs) in marine sediments can originate from natural oil seeps, erosion of shales, natural products of plankton and plants, or combustion products. Synthetic organic compounds, such as the pesticides DDT and polychlorinated biphenyls (PCBs), also are found in most marine sediments as a result of widespread use and historical, waste-disposal activities. Because many of these contaminants have been widely dispersed; they tend to be measurable in areas that are considered reference areas. Many of these compounds are believed to be carcinogenic and/or toxic to organisms. Many of these compounds occur at concentrations below analytical detection limits and, therefore, cannot be quantified in terms of mass loading.

The District's monitoring of the effluent for organic priority pollutants finds that most of the organic compounds are below detection limits. Water quality standards for 36 organic priority pollutants have been adopted by the EPA. Values of pollutants in District's effluent range from 230 to 1,300 times lower than the most restrictive (chronic) marine-water-quality criteria. The OMP finds patterns for some organic compounds centered at the outfall. DDT and its related metabolites appear to reflect regional depositional patterns with no gradients relative to the outfall (**Figure 5-23**). In contrast, concentrations of PCBs and PAHs show a pattern centered at the outfall (**Figure 5-24 and Figure 5-25**). PAHs were measured at the end of the diffuser and in submarine canyons. The average total PAH concentration for Stations 0 and ZB2 (at the end of the diffuser and within 197 ft of the discharge) was 1.57 mg/kg, which was one order of magnitude greater than the average PAH concentration at reference stations (0.12 mg/kg) (**Table 5-33**). Average concentration for stations beyond the ZID ranged from 0.08 to 0.15 mg/kg. There is little, relevant, comparative data. The immediate area at the end of the outfall has, at times, increased concentrations of PAHs, which is a localized effect, and because the biota at this location tends to be abundant and diverse and not indicative of a degraded community this localized effect is not considered significant. Most of the PAHs found in the District's discharge appear to be related to automobiles and combustion products from the burning of fossil fuels.



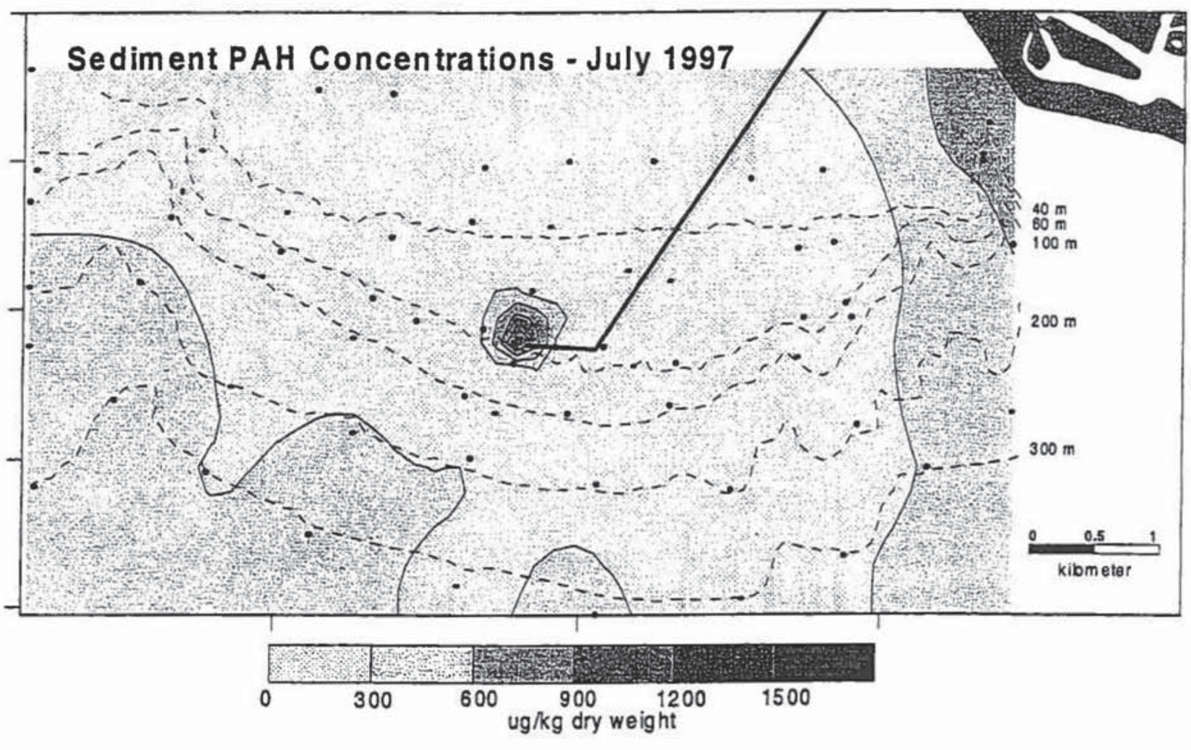
SOURCE: OCSD, Marine Monitoring Annual Report, 1999

Figure 5-23
Spatial Distribution of Sediment DDT and Metabolites Concentrations July 1997



SOURCE: OCSD, Marine Monitoring Annual Report, 1999

Figure 5-24
Spatial Distribution of Sediment PCB Concentrations July 1997



SOURCE: OCSD, Marine Monitoring Annual Report, 1999

Figure 5-25
Spatial Distribution of Sediment PAH Concentrations July 1997

TABLE 5-33
ANNUAL AVERAGE TOTAL DDT, PCB, AND PAH CONCENTRATIONS (µG/KG) IN 1997-98 SEDIMENT SAMPLES COMPARED WITH THOSE FROM THE 1994 SOUTHERN CALIFORNIA BIGHT PILOT PROJECT (SCBPP) AND EFFECTS LEVELS (ER-L AND ER-M).

	Total DDT	Total PCB	Total PAH
Districts			
Within ZID/Upcoast (0, ZB2)	7.0[1]	82[2]	1,570
Within ZID/Downcoast (4, ZB)	3.0	15	120
Nearfield/Upcoast (1, 5)	5.0	20	152
Nearfield/Downcoast (9,12)	2.9	12	80.8
Farfield (13, 37)	4.8	13	110
Reference (C, CON)	6.0[1]	9.4	116
SCCBPP[3]			
Average	40.8	13.3	ND (<330)
Median	10.0	26.0	ND
Outfall Average	147	43.0	ND
Non-Outfall Average	15.3	8.0	ND
Non-Santa Monica Bay Average	29.2	6.8	ND
ER-L	1.58	22.7	4,022
ER-M	46.1	180	44,792

ER-L = Effects-Range Low (Long and Morgan, 1991)
ER-M = Effects-Range Medium (Long and Morgan, 1991)
1 One anomalous high value from Station 0 (66 µg/kg), from Station C (42 µg/kg), and from Station CON (63µg/kg) eliminated.
2 One anomalous high value from Station 0 (1,460 µg/kg) eliminated.
3 Source: Schiff and Gossett (1998).

Measurable concentrations of PCBs concentrations are found at most stations in the study area, but the highest concentrations (82 µg/kg) were found at the end of the diffuser at Stations O and ZB2 (**Table 5-33**). Concentrations were less than 20 µg/kg for other station groups in the area. Concentrations were also higher in the nearby canyons. Comparison of these PCB concentrations with values from the 1994 regional surveys (SCCWRP 1994) finds comparable values for all areas except for the higher concentrations at the end of the diffuser. DDT concentrations within the District's study area generally were lower than concentrations found elsewhere in the SCB (**Table 5-33**). Thus, while organic contaminant concentrations are higher at the end of the diffuser, elevated concentrations are not found beyond the ZID. Areas of higher organic contaminants contain diverse and abundant biota. Apparently these concentrations of organic compounds are not degrading the existing biota, and, therefore, this effect is considered not significant.

Measured values of these organic compounds in the sediments are highly variable over long-time periods (CSDOC 1997). This level of variability has been observed by other researchers studying the District's outfall area (e.g., Anderson and Gossett 1987; Anderson et al. 1988; CSDOC 1996a; Phillips et al.

1997b). This high variability is suggestive of episodic discharges, possibly correlated with storm flows, that may come from erosion of historical deposits within the collection system. While erosion and discharges of historical deposits may occur episodically, the presence of these particles in sediments near the diffuser terminus can have significant effects on measured sediment concentrations. Subsequent dispersal by re-suspension and bottom currents minimizes accumulation of these particles so that subsequent measurements often do not correlate with previous measurements.

The effluent of the Preferred Scenario 2 is predicted to have levels of pesticides and PCBs that are similar to present levels, which are negligible. The majority of the organic compounds found in the effluent are not considered toxic and are not found on the EPA's priority pollutant list. For example, benzoic acid is a common organic compound often used for medicinal purposes. PAH compounds are expected to remain at concentrations less than 1 μg/kg, and mass loading is projected to be lower than 2.2 lbs/day (**Table 5-27**). Other organic compounds also will remain at comparable levels of about 100 μg/kg or 216 lbs/day. These levels are comparable to present discharge loads. Since no impacts have been found at the present levels, the Preferred Scenario is not expected to produce a significant impact to the biota.

Alternative Scenarios

With regard to organic compounds, the main difference among the scenarios relates to the GWR project. The Preferred Scenario 2 and Scenarios 4 and 6 have lower PAHs and other organic compounds masses compared to the scenarios without GWR (i.e., Scenarios 1, 3, and 5). While no significant impacts are expected from any of the treatment scenarios, GWR System implementation will remove more of the organic constituents from the wastewater, which should lower the potential for any possible effects. Thus, impacts would be lower for the Preferred Scenario and Scenarios 4 and 6 compared to Scenarios 1,3, and 5.

Optional Discharge Locations

Given a 50:50 split of the final effluent between the existing 120-inch outfall and the new outfall, the loading of other organic compounds to the receiving sediments would be reduced by about 50%. That is, the organic loading will be distributed over an area approximately twice the present size. Therefore, the new outfall location would reduce the potential for organic compounds to accumulate in the sediments. A new outfall also would eliminate or reduce the potential for episodic events to erode historical deposits within the pipes of the existing outfall and contribute other organic compounds to the sediments near the diffuser terminus. Impacts are considered not significant.

78-inch Outfall

The effluent discharged during an emergency to the 78-inch outfall would be of short duration and contain negligible amounts of other organic compounds. Because amounts are minimal, only a small portion of the wastewater particles would reach the bottom, and because resuspension and mixing due to the nearshore location would minimize deposition, no significant impacts would occur for any of the proposed scenarios.

Mitigation

None required.

BIOTA

Impact 5-7. Effluent discharge under the six proposed treatment scenarios and two discharge location options and with use of the 78-inch outfall at a rate of once every three years would not result in significant impacts to plankton, soft-bottom benthos, hard-bottom benthos, demersal fish, or macroinvertebrates. No mitigation is required.

The District's ocean outfall produces two types of impacts to the biota of the receiving water environment as documented by the OMP. First, there are discharge effects, which are related to the volume and composition of the discharge. Secondly, there are reef effects that result from the outfall pipe structure and associated rock ballast, since the outfall represents one of the largest, subtidal, artificial reefs in the SCB. These two effects produce different types of impacts to the receiving water communities, especially to the adjacent, soft-bottom communities, and have different spatial scales that overlap near the outfall diffuser. This section will first discuss community function, with emphasis on infaunal and epifaunal communities, as these are better known and regularly monitored by OMP. The effect of the six proposed treatment scenarios and three discharge options to the marine biota will follow.

The California Ocean Plan and the District's 301 (h) discharge permit require that the discharge of wastewater to the receiving waters shall not degrade the biota or balanced indigenous population (BIP). The EPA (1982) defines a BIP as "an ecological community which (1) exhibits characteristics similar to those of nearby, healthy communities existing under comparable but unpolluted conditions, or (2) may reasonably be expected to become re-established in the polluted water body segment from adjacent waters if sources of pollution were removed." The term population is intended to refer to a biological community within the receiving water body, rather than a reproductive unit of a single species as implied in the term. The EPA (1982) further states that for evaluations of the existence of a BIP, biological parameters near the discharge are to be compared with the range of natural variability found in similar, but unpolluted habitats. Biological parameters considered potentially important for evaluating a BIP include, but are not limited, to the following:

- Species composition, abundance, biomass, dominance, and diversity;
- Spatial/temporal distributions;
- Growth and reproduction of populations;
- Disease frequency;
- Trophic structure and productivity patterns;
- Presence or absence of certain indicator species;
- Bioaccumulation of toxic materials; and
- Occurrence of mass mortalities of fish and invertebrates.

The EPA (1982) also notes that the spatial extent of any discharge-related change is an important consideration for evaluating a BIP. For example, changes in community parameters within the ZID would not necessarily affect the BIP evaluation, so long as the change did not result in "extreme adverse impacts." Furthermore, changes beyond the ZID would not necessarily affect the BIP evaluation as long as these changes do not result in secondary impacts to other communities.

While there is a defined, but rather long and complex method to determine presence of a BIP, there is no formal definition of a degraded community. Numerous studies have been conducted on individual species and their responses to environmental impacts (stressors), but fewer studies have been made to infer or predict changes at the community level (Gray 1989). Environmental stress can be defined as a change that causes a response by a species or community. Studies focused on the response of communities to environmental stress have noticed similar responses in differing communities. For example, one of the first and most predictable community responses to stress is a reduction in species richness (number of species) and associated changes in diversity indices (generally lower). This reduction in species occurs whether the stressor is excessive organic loading (Gray 1979; Pearson and Rosenberg 1978), hydrocarbon contamination from an oil platform (Gray 1989), or gradients of inert, non-toxic titanium dioxide (Gray 1989). This reduction results from less-tolerant species being lost or displaced by more-tolerant species. This response happens early in the succession of communities from non-stressed to stressed conditions. As the stress continues or increases, more and more sensitive species are displaced, which leads to the second well-documented change to communities, the so-called retrogression to dominance by opportunistic species. That is, as more species are displaced, those remaining tend to be tolerant and/or opportunistic species, i.e., those most tolerant and/or able to recruit quickly. The community becomes dominated by a few, but often very abundant, opportunistic species.

Opportunistic species tend to be small, usually short-lived, and tolerant of highly stressed conditions. Opportunistic species are found in all communities, thus their presence is not necessarily an indication of a stressed or degraded community. For example, nearshore soft-bottom habitats may be totally disrupted by a large winter storm. Recovery of the community often begins with large number of opportunistic species, the early colonizers, dominating the community. This would not be an indication of a degraded community but more representative of an early successional stage for normal community development. Thus, additional information may be required to determine whether the community is at an early successional stage because of some natural event or degraded due to some environmental stress caused by human activity. This determination requires measurements in the environment, e.g., sediment TOC concentrations, toxicity, grain size, to evaluate potential causes.

As discussed previously, another useful indication of a degraded community is a change in community function, e.g., the change in an infaunal community from an organic processing and recycling community to an organic accumulation community. As discussed in that section, normal benthic communities have a great capacity to process organic matter and require organic matter inputs for food and reproduction. However, when the input of organic matter surpasses the ability of the community to process the material, the critical threshold or assimilative capacity of the community is exceeded, the biota begin to change, and the community function begins to shift. The change from an organic recycling to an organic accumulation community is not an "either-or" situation but rather represents a continuum or gradient of responses. Thus, when the critical threshold is approached, the most sensitive species become stressed, and, if the situation persists or increases, these sensitive species are displaced or die. As the stress or accumulation of organic material increases, more and more species become stressed and may be lost or displaced. Therefore, a working definition of a degraded community is one that is stressed to the point that the function of the community changes.

In evaluating the effects of different treatment and discharge scenarios upon the biota, effects will be considered as degrading (significant impacts) when the community has a significant decrease in species richness compared to a reference area and when the opportunistic species dominate the community. Furthermore, significant impacts would be indicated if the expected functioning of the community is measurably altered, which would most easily be observed by changes in trophic relationships within the community. Finally, if species richness and community function are not measurably affected, the range of observed changes falls within the range of natural variability, and the observed community changes do not cause secondary impacts to other components of the ecosystem, then most of the criteria for determining that a BIP is being maintained are fulfilled.

Plankton

A quantitative evaluation of the effects to planktonic biota from the proposed treatment and discharge scenarios is not possible due to insufficient data. Since there is no evidence to suspect significant discharge effects upon the planktonic biota, there has been no specific requirement in the District's OMP to monitor planktonic communities. The wastewater discharge has the potential to affect plankton in several ways:

- Turbidity from the wastewater plume could decrease light levels and affect photosynthetic capacity of the phytoplankton, i.e., decrease primary production.
- Nutrients from the wastewater could stimulate excessive primary production and possibly lead to "red tides."
- Toxicity of the wastewater could affect the survival and growth of plankton.

As described previously, there is little indication that the wastewater plume significantly affects light levels in the receiving waters. Discharge-related increases in suspended solids (the main cause for decreased light transmittance) in the receiving waters beyond the ZID are small, ranging from 0.25 to 0.38 mg/L for the present discharge. For the Preferred Scenario, increases would range from 0.29 to 0.44 mg/L. These values are about an order of magnitude less than the range of natural variability. Therefore, these concentrations of TSS in the water column represent typical conditions that plankton naturally experience and, thus, must be adapted to endure. That is, this represents an insignificant stress that is not expected to degrade or alter the community composition. Furthermore, the spatial extent of elevated TSS concentrations and lower light levels is mostly restricted to below the pycnocline, where plankton abundance is much lower compared to overlying waters. On occasion and generally only during stratified conditions, decreased light levels are measured beyond the ZID. The spatial extent of these excursions is limited to the nearfield area, and decreases are within the range of natural variability. Therefore, changes in light levels due to the small, additional load of TSS predicted for the Preferred Scenario are not expected to cause significant impacts as would be indicated by loss of species richness or change in community function.

Phytoplankton, in addition to requiring light for growth and primary production, require nutrients. Under ideal conditions, populations can double in a single day making planktonic communities some of the most productive systems in the world. While not much is known about planktonic communities in SCB, it is known that communities tend to be highly variable and patchy in their distribution. Nutrients occur in low concentrations in ocean waters and can be depleted quickly by the rapid uptake and utilization by plankton, such that nutrient availability tends to be the growth-limiting factor for plankton. Generally in the coastal waters of the SCB, nitrogen compounds are the primary, growth-limiting nutrient. The Preferred Scenario would discharge 55,513 lbs/day (9,193 mt/yr) of nitrogen nutrients, or an increase of 4,511 lbs/day (747 mt/yr) over the present discharge level (**Table 5-27**). This total represents about 5% of the nitrogen nutrients associated with annual upwelling periods. Other natural sources of nutrients come from the recycling of organic matter already in the environment, atmospheric inputs, and inputs from watersheds discharging to the coastal zone. So, the nutrients from the wastewater represent an even smaller percentage to the natural loads. Natural inputs from watersheds have decreased due to impoundment of drainages, and this probably has reduced the influx of nutrients to coastal waters, which, to some extent, is offset by wastewater discharges. While the nutrients in the wastewater have the potential to increase planktonic productivity and biomass, it must be remembered that the discharge tends to be below the pycnocline where plankton abundance is less compared to overlying waters. Thus, the potential for nutrients in the wastewater to over-stimulate plankton productivity is limited, due to the relatively small amount of nutrients discharged, the high initial dilutions, and the deep-water discharge location.

The concern is that wastewater nutrients could stress planktonic communities such that the communities would either be degraded and/or there would be population increases in undesirable species, such as dinoflagellates that can cause red tides. On the other hand, increases in nutrients can cause increases in planktonic biomass, which, in turn, can support higher trophic levels. For example, dinoflagellates are a preferred food of anchovies and may be critical for anchovy larval feeding success (Lasker 1975). Anchovy are a preferred food of halibut; thus, greater survival of anchovy larvae can lead to more halibut, an important commercial and sport fish. Thus, some modest enhancement of plankton may be a positive effect of the discharge. Phytoplankton blooms in the study area tend to be most common during upwelling season — spring and early summer, with red-tide blooms more common during fall and winter. Red-tide blooms of dinoflagellates have been very infrequent and not observed in recent years near the District's outfall (CSDOC 1997). Red tides appear more commonly closer to shore and in bays and harbors. Therefore, there is no evidence that nutrient discharges associated with the wastewater are degrading the existing planktonic communities or contributing to red-tide blooms. The Preferred Scenario would not cause significant impacts to the planktonic biota.

Chlorophyll concentrations are typically used as a surrogate for phytoplankton abundance or biomass. Chlorophyll maximum tend to be highly variable, reflecting the patchy distribution of phytoplankton. Increases in chlorophyll concentrations are often associated with upwelling, and chlorophyll maximum layers typically occur above the pycnocline. The District's OMP measures chlorophyll concentrations and has analyzed the data for correlations between nutrient nitrogen (measured as ammonium) and chlorophyll. This analysis revealed that for concentrations of ammonium above 0.05 mg/L, chlorophyll and, presumably, phytoplankton abundance are somewhat constant and not correlated with ammonium (CSDOC 1994). For concentrations of ammonium below 0.05 mg/L, chlorophyll concentrations were found the to be highly variable and, therefore, not correlated with ammonium. These results and the efforts of other researchers indicate that while nitrogen nutrients (i.e., ammonium) are important for primary production, other factors and nutrient sources are more significant in governing phytoplankton biomass (e.g., Cullen and Eppley 1981). Therefore, the District's wastewater discharge of nutrients does not appear to be large enough to cause significant effects to plankton.

It is important to mention that significant decreases in zooplankton populations in the SCB have been documented recently by Roemmich and McGowen (1995). Their study finds that since about 1970, ocean temperatures have been warmer than usual. This change is suspected to have been the major cause of a 70 to 80% reduction in macrozooplankton abundance and biomass. While the direct effects of temperature may be a contributing factor, secondary effects associated with the temperature change appear to have a more important contribution to the observed decreases in plankton. Secondary effects from warmer temperatures include stronger or more persistent water-column stratification and related decreases in upwelling periods and duration. These secondary effects would significantly reduce the natural cycling of upwelling that supplies the plankton in the photic zone with the needed nutrients to sustain abundance and biomass. Under these conditions, nutrients from surface inputs and wastewater discharges may be especially important in sustaining the indigenous populations. Similar, but smaller, natural changes in planktonic populations may be expected with other, large-scale, regional phenomena, e.g., the three-to-seven year cycles of El Niño events (Diaz and Markgraf 1992). Clearly, the natural range of changes in nutrient concentrations far exceeds the spatial scale and magnitude of outfall-related changes to nutrient concentrations.

Toxicity of the effluent to planktonic populations is unknown, but because of the high initial dilutions, it is unlikely that this effect would be significant. Toxicity testing of the effluent finds no significant levels of toxicity to marine test organisms; this is especially true at effluent dilutions comparable to those found after the initial dilution in the receiving waters beyond the ZID. The effects of GWR on effluent toxicity require additional study.

Alternative Scenarios

The Preferred Scenario will discharge 116,481 lbs/day of TSS, 55,513 lbs/day of ammonium as nitrogen, 379 lbs/day of metals, and 216 lbs/day of organic compounds (**Table 5-27**). The present effluent contains 106,250 lbs/day TSS, 51,000 lbs/day ammonium as nitrogen, 229 lbs/day metals, and 212 lbs/day of other organic compounds. The present levels are believed to be not significantly affecting the planktonic community, and, therefore, the small changes proposed for the Preferred Scenario are not expected to cause significant impacts to the planktonic community. Scenario 1 has the highest predicted TSS loading of 120,500 lbs/day, while Scenario 4 has the lowest loading of 48,228 lbs/day. Scenario 4 would have the least impact on water color and transmissivity, but all six treatment scenarios have TSS loadings within permit limits, and none of the scenarios would have significant effects to plankton. The nutrient loadings of the six treatment scenarios are similar and range from 50,315 (Scenario 6) to 56,434 lbs/day (Scenario 1). The nutrient loadings for all scenarios are within permit limits and are predicted not to produce significant impacts to the planktonic community. Metal loadings will increase from present levels for all scenarios except Scenario 3. The Preferred Scenario will have the most significant increase to 379 lbs/day, the other scenarios will discharge from 227 to 326 lbs/day. GWR will increase the metal loading 8 (Scenario 6) to 25% (Preferred Scenario). These increases in effluent metals are not expected to impact planktonic communities, but some small increases in effluent toxicity may result. Mass loading for other organic compounds will remain essentially unchanged from the present level for the Preferred Scenario and Scenarios 4 and 6. Scenarios 1, 3 and 6, without GWR, will have increases in other organic compounds. These increases are not expected to produce significant impacts to planktonic communities. GWR appears to provide a process to reduce other organic loading to receiving waters.

Optional Discharge Locations

Given a 50:50 split of the final effluent between the existing 120-inch outfall and the new outfall, the potential for mass loading effects would be reduced by about 50%. That is, the contaminants in the effluent would be distributed over an area approximately twice the present size. Therefore, the new outfall location would reduce the potential for wastewater loading to affect planktonic communities. A new outfall allows increased mass loading to the receiving waters beyond present levels but with impacts less than those described for the 120-inch outfall alone. These impacts are also not significant.

78-inch Outfall

The effluent discharged during an emergency to the 78-inch outfall would be of short duration and would entail minor mass loading of TSS, nutrients, metals, and other organic compounds (**Table 5-29**). The Preferred Scenario, as well as Scenarios 4 and 6 (those with the GWR), would have the lowest contaminant mass loading. Because of the short duration of the discharge, the small mass loadings, and the greater mixing nearshore from waves, no significant impacts would occur to planktonic communities for any of the proposed scenarios.

Kelp/Algae

Kelp beds dominated by the large, brown algae known as the giant kelp (*Macrocystis pyrifera*) are found on hard-bottom substrate scattered along nearshore areas of the SCB. However, there are no kelp beds located in the vicinity of District's outfalls. The closest kelp beds are located on rocky substrates 6.6 miles south of Newport Harbor, at least 10 miles from the outfalls, and near the mouth of the Los Angeles Harbor, located 18 miles north of the outfalls. Therefore, no impacts to kelp beds are expected from the proposed changes in treatment or discharge location.

Benthos

Soft-Bottom Communities

Benthic ecosystems are characterized by thousands of invertebrates and hundreds of fish species that derive and consume energy primarily from carbon and nitrogen sources in organic detritus or prey, either directly or through trophic-level interactions (Hargrave 1973; Rowe 1971). These interactions and the importance of organic carbon gradients (Pearson and Rosenberg 1978) and detrital fluxes (Sanders and Hessler 1969; SCCWRP 1987) are well documented as key factors influencing community composition. However, these relationships may be less distinct where disturbances (e.g., wave energy from storms, sediment transport near river discharges, and seasonal sand transport) disrupt natural gradients or the physical stability of habitats (Ebling et al. 1985; Lissner 1983; Oliver et al. 1980; Tegner and Dayton 1987; Thompson et al. 1993).

While the SCB may be one of the most studied coastal areas, there is surprisingly little known about the interrelationships of the habitats within this ecosystem. The recent publication, "The Ecology of the Southern California Bight" (Dailey et al. 1993), provides an excellent summary of our present state of knowledge. Clearly, we have only begun to understand the interplay between biotic and abiotic factors within the SCB. Due to the complexity of the SCB, the first attempts to develop carbon flow and food web budgets have taken place only recently (Hood 1993). This analysis indicates that organic carbon input from all the municipal outfalls within the SCB represents about 1% of the total carbon budget. Consequently, the District's wastewater discharge contributes significantly less than 1% of the SCB carbon budget. It is also clear that the majority of contaminant inputs to the SCB are no longer due to wastewater outfalls (e.g., compare cadmium and lead from river discharges [3,526 and 175,879 lbs, respectively, for 1986-88] to contributions from the major wastewater outfalls – 882 and 3,086 lbs for 1991 [SCCWRP 1992]). If one considers all the sources of contaminant inputs to the SCB, it is evident that the contribution of wastewater outfalls represents a small percentage to total inputs.

There have been several papers describing relationships between wastewater TSS mass loading and affects to infaunal communities (e.g., Bascom et al. 1979; Mearns and Word 1982). These studies showed that TSS mass loading could be used as a reasonable predictor of benthic effects as indicated by excess biomass and/or changes in infaunal trophic relationships. At the time of their publication, these studies were important as they focused attention upon the fact that wastewater discharges were causing degrading impacts to benthic communities over large areas, and the degree of these impacts was correlated with the mass of TSS. However, since 1985 the District's study area has not had excessive biomass or infaunal trophic values representative of degraded communities, and yet, the District's effluent is discharging substantial masses of TSS. What has changed since these early predictions? Since 1971, TSS mass loading to SCB receiving waters from wastewater outfalls has decreased from about 1,811,500 lbs/day in 1971 to less than 423,000 lbs/day in 1997 (Lindstrom 1999). More important than the decrease in TSS mass loading has been the effectiveness of source control and improved treatment that have reduced effluent contaminant concentrations and probably toxicity over the same period. For example, metals, including cadmium, chromium, and mercury, have been reduced by at least one order of magnitude, and organics such as DDT and PCBs have been reduced by at least three orders of magnitude (Lindstrom 1999). These trends indicate that the composition of TSS in the 1970s has little relation to the TSS composition of present-day effluents. Not only has the chemical and toxic nature of the effluent changed substantially in thirty years, but the physical nature of TSS has changed as well.

As discussed previously, present-day treatment methods selectively remove the larger particulates (those most likely to accumulate near the outfall), and the chemical treatment targets those particles most likely to aggregate and flocculate to form larger particles. Thus, modern effluents bear little resemblance to historical effluents, and, therefore, relationships derived for historic discharges should not be expected to predict future relationships. Early and important studies placed emphasis upon TSS, which, today, is a very poor surrogate for settleable solids (SS) when assessing benthic impacts. Benthic communities respond only to the amount of SS in TSS, as it is this portion that settles within a few hours of discharge. For assessing benthic impacts, the SS in the effluent need to be characterized and quantified. For modern effluents, the importance of TSS appears to be its potential for reducing light levels that may affect planktonic communities. Consequently, there is little basis for predicting the effects of the six treatment scenarios on benthic communities using TSS.

Since 1985, the Districts have managed the effluent TSS concentration to be within 45 to 55 mg/L, averaging about 50 mg/L. TSS mass loading remained relatively constant from 1985 to 1990, decreased in 1991 and 1992, and steadily increased since 1992 so that it now exceeds the 1985 mass loading (Lindstrom 1999). During this period, there have been substantial reductions in all contaminant concentrations in the effluent. Thus, while the TSS mass loading has been increasing over the past six years (from 83,000 to 106,000 lbs/day or an increase of 27.7%), there have been significant reductions in contaminant mass loading. Measured sediment metal concentrations have shown significant decreases correlated with lower concentrations in the effluent, and the infaunal community has shown fewer spatial effects and continued recovery of sensitive species nearer the outfall. Clearly there is no significant relationship of TSS with the benthic sediments or biota. If we were to use the increase in TSS over the last six years to model the recovery of the sediments and biota, then the prediction would indicate that the more TSS discharged, the better the benthic environment. Clearly, this is not the case. Thus, there is no model using TSS that is appropriate for predicting impacts for the six treatment scenarios.

Our best predictor of future relationships between the effluent and benthic impacts appears to be the temporal regression of effluent SS since 1985 (**Figure 5-16**). This figure indicates that SS have decreased on average about 22% since 1985 and over 33% since 1991. While the regression is poor, it does correlate positively with the observed trends for sediment metals and is inversely related to the trends of the infaunal community. Therefore, assumptions concerning the six treatment scenarios include that there will be no substantial changes in the concentration or amount of SS in the TSS.

The Preferred Scenario will increase the TSS mass loading from 106,250 to 116,481 lbs/day, an increase of about 10%. More importantly, the average daily flow will increase from 255 to 260 mgd, an increase of less than 2%. If SS remains the same at 0.4 mL/L, there will be essentially no change in the SS to the receiving waters and no additional impacts to the sediments or biota. One of the many unknowns in this prediction is what effect GWR will have on SS concentrations. This will require additional study to fully access the effects of proposed treatment scenarios. The basis for this prediction rests on the assumptions concerning SS in the effluent, maintaining contaminant mass loading near present levels, and the lack of observable impacts to the benthic biota at present loadings. The following discussion provides a brief overview of the infaunal community and recent trends.

Number of Species (Species Richness)

Since August 1985, the monitoring program has collected and identified over two million organisms representing over 1,270 taxa (**Table 5-34**). Seven hundred and fifteen taxa representing 136,268 organisms were collected during 1997-1998 for all stations and surveys combined (**Table 5-34**). Spatial distribution of the number of species and the relationship of species with water depth are depicted in **Figure 5-26**. The number of infaunal species generally decrease with water depth, with the highest number of species occurring between 145 and 191 ft, just inshore of the outfall (**Table 5-35**). These

findings are consistent with previous OMP findings and other studies of the SCB (e.g., Bergen et al. 1997). **Figure 5-26** clearly shows that the natural depth gradients largely determine species richness and are more significant than outfall effects. To minimize depth effects and to more easily detect discharge effects, the stations along the outfall depth contour were analyzed in greater detail. The result of this

TABLE 5-34
SUMMARY OF TOTAL SPECIES AND ABUNDANCES AND FOR MAJOR TAXA COLLECTED AT QUARTERLY AND ANNUAL STATIONS, 1997-98, AND 1985-1998.

Taxonomic Group	1997-1998			1985-1998		
	Quarterly	Annual	Combined	Quarterly	Annual	Combined
Polychaeta						
Number of species	263	229	292	384	335	416
Total abundance	69,873	10,550	80,423	1,019,323	134,598	1,153,921
Mollusca						
Number of species	103	88	117	230	165	256
Total abundance	9,434	1,605	11,039	213,935	26,733	240,668
Crustacea						
Number of species	174	137	204	288	254	336
Total abundance	26,098	3,600	29,698	492,025	43,801	535,826
Echinodermata						
Number of species	19	20	25	33	34	38
Total abundance	7,534	2,058	9,592	87,456	15,346	102,802
Minor Phyla						
Number of species	72	46	77	204	126	224
Total abundance	4,647	869	5,516	107,901	16,039	123,940
Total						
Number of species	631	520	715	1,139	914	1,270
Total abundance	117,586	18,682	136,268	1,920,640	236,517	2,157,157

SOURCE: County Sanitation Districts of Orange County, 1998

analysis is summarized in (**Table 5-36**). While there are significant seasonal patterns and temporal changes, there is no outfall effect on number of species.

This is indicated in **Table 5-36** by the lack of differences among areas and the lack of gradient or pattern with distance from the outfall. The 1997–98 data are consistent with this long-term analysis (**Figures 5-26 and 5-27**). The summer surveys observed similar numbers of species for most stations at the outfall depths but a small decrease for stations within the ZID and in Newport Canyon (Station C2). These latter stations typically have the lowest number of species (e.g., CSDOC 1998). The spatial pattern is more complex in winter, when there appear to be some enhancement of species near the outfall, fewer species in the midfield area, and comparable or higher numbers of species in the upcoast, farfield reference area. The winter results show no obvious gradient relative to the outfall. A Repeated measure analysis of variance (RMANOVA) analysis shows that there are significant seasonal effects, as shown in **Figure 5-27** by the occurrence of more species in summer than winter. The winter decline in species near the outfall appears to be more of a reef effect than a discharge effect (i.e., possibly due to greater predation in winter). Additionally, the analysis indicates that despite significant seasonal variability, the number of species is increasing for all areas, suggesting a negative correlation with decreasing SS as well as possible regional effects (**Figure 5-28**). For comparative purposes, reference survey values were 67.7 in 1985 and

TABLE 5-35
SUMMARY OF INFAUNAL COMMUNITY MEASURES FOR ALL STATIONS, JULY 1997 ANNUAL SURVEY

Station	Depth (ft)	Number of Species	Abundance	ITI	BRI	Dominance Index	Margalef Diversity	Shannon-Wiener Diversity	Evenness	Total Biomass
0	190	106	1214	48	29	13	14.79	3.16	0.68	6.14
1	190	96	404	69	26	30	15.83	3.97	0.87	4.48
2	154	134	750	79	25	39	20.09	4.17	0.85	11.74
3	197	101	488	72	26	27	16.15	3.94	0.85	8.98
4	187	114	627	71	23	30	17.54	4.03	0.85	6.38
5	194	100	438	79	20	31	16.28	3.99	0.87	7.30
6	121	121	521	84	20	42	19.18	4.26	0.89	6.45
7	121	119	508	82	23	43	18.94	4.16	0.87	13.54
8	144	151	905	80	22	41	22.09	4.06	0.81	19.24
9	197	113	520	71	21	34	17.91	4.06	0.86	5.24
C	184	114	424	86	14	42	18.68	4.18	0.88	7.50
10	187	102	495	83	22	28	16.28	3.91	0.85	10.03
11	98	101	429	85	26	35	16.50	4.08	0.88	18.74
12	194	119	598	73	20	34	18.46	4.10	0.86	4.51
13	197	119	736	79	18	26	17.88	3.88	0.81	9.68
14	105	99	592	80	21	29	15.35	3.83	0.83	3.79
15	105	108	593	83	29	36	16.76	4.12	0.88	20.01
17	285	82	480	80	18	23	13.12	3.66	0.83	7.76
18	302	86	390	79	18	27	14.25	3.94	0.88	5.32
19	305	100	500	83	16	31	15.93	3.98	0.86	10.11
20	318	101	585	82	17	33	15.69	3.91	0.85	7.04
21	138	121	601	85	20	36	18.75	4.08	0.85	20.26
22	154	112	530	86	19	34	17.70	4.07	0.86	8.84
23	328	93	470	79	20	30	14.95	3.96	0.87	27.80
24	646	56	201	86	19	21	10.37	3.58	0.89	4.87
25	656	58	199	86	23	21	10.77	3.44	0.85	3.70
26	102	107	451	83	20	34	17.34	3.86	0.83	3.59
27	643	56	187	83	18	25	10.51	3.71	0.92	19.16
28	98	112	438	83	29	39	18.25	4.10	0.87	13.06
29	328	105	445	84	14	32	17.05	4.03	0.86	4.49
30	138	106	425	86	16	32	17.35	4.04	0.87	9.92
31	144	116	417	86	20	42	19.06	4.14	0.87	8.74
32	180	118	404	82	18	48	19.50	4.42	0.93	3.42
33	318	110	409	84	19	42	18.13	4.22	0.90	7.01
34	98	129	421	85	23	44	21.18	4.16	0.86	3.95
35	89	125	648	87	26	38	19.15	4.13	0.86	14.65
36	148	109	473	89	20	31	17.54	3.70	0.79	9.50
37	194	122	472	78	18	44	19.65	4.28	0.89	3.70
38	325	80	428	82	22	24	13.04	3.65	0.83	6.22
39	630	79	245	79	14	28	14.18	3.84	0.88	2.56
40	1027	38	144	88	18	14	7.44	2.93	0.81	14.41
41	1027	30	59	90	14	16	7.11	3.02	0.89	1.24
42	1017	29	119	90	16	9	5.86	2.55	0.76	12.49
43	965	58	205	82	13	22	10.71	3.61	0.89	3.10
44	771	29	60	77	25	15	6.84	2.64	0.78	1.96
55	131	82	436	85	17	21	13.33	3.59	0.81	2.72
56	322	100	405	88	9	32	16.49	3.94	0.86	4.94
57	659	45	111	77	13	22	9.34	3.18	0.84	7.57
58	988	33	87	85	22	14	7.17	2.93	0.84	8.52
59	131	109	402	86	16	37	18.01	4.02	0.86	15.77
60	322	94	446	80	19	32	15.25	3.94	0.87	7.13
61	679	48	141	82	21	20	9.50	3.35	0.87	27.32
62	984	18	31	83	24	11	4.95	2.64	0.91	30.78
63	656	63	158	81	16	28	12.25	3.74	0.90	5.21
64	984	18	37	86	20	9	4.71	2.31	0.80	0.61
65	656	54	159	85	15	22	10.46	3.53	0.88	10.75
66	997	22	50	85	9	11	5.37	2.73	0.88	4.48
67	994	46	126	84	19	19	9.30	3.31	0.87	10.59
C1	95	64	487	31	44	11	10.18	2.98	0.72	3.44
C2	190	58	597	65	39	8	8.92	2.76	0.68	6.46
C3	318	30	175	68	37	7	5.61	2.49	0.73	6.28
C4	604	35	145	80	27	11	6.83	2.90	0.82	12.74
C5	1004	23	40	75	24	13	5.96	2.88	0.92	1.70
ZB	187	83	527	43	33	19	13.08	3.26	0.74	13.55
CON	197	116	409	87	11	42	19.12	4.19	0.88	8.59
ZB2	187	116	3259	20	29	7	14.22	2.39	0.50	10.77

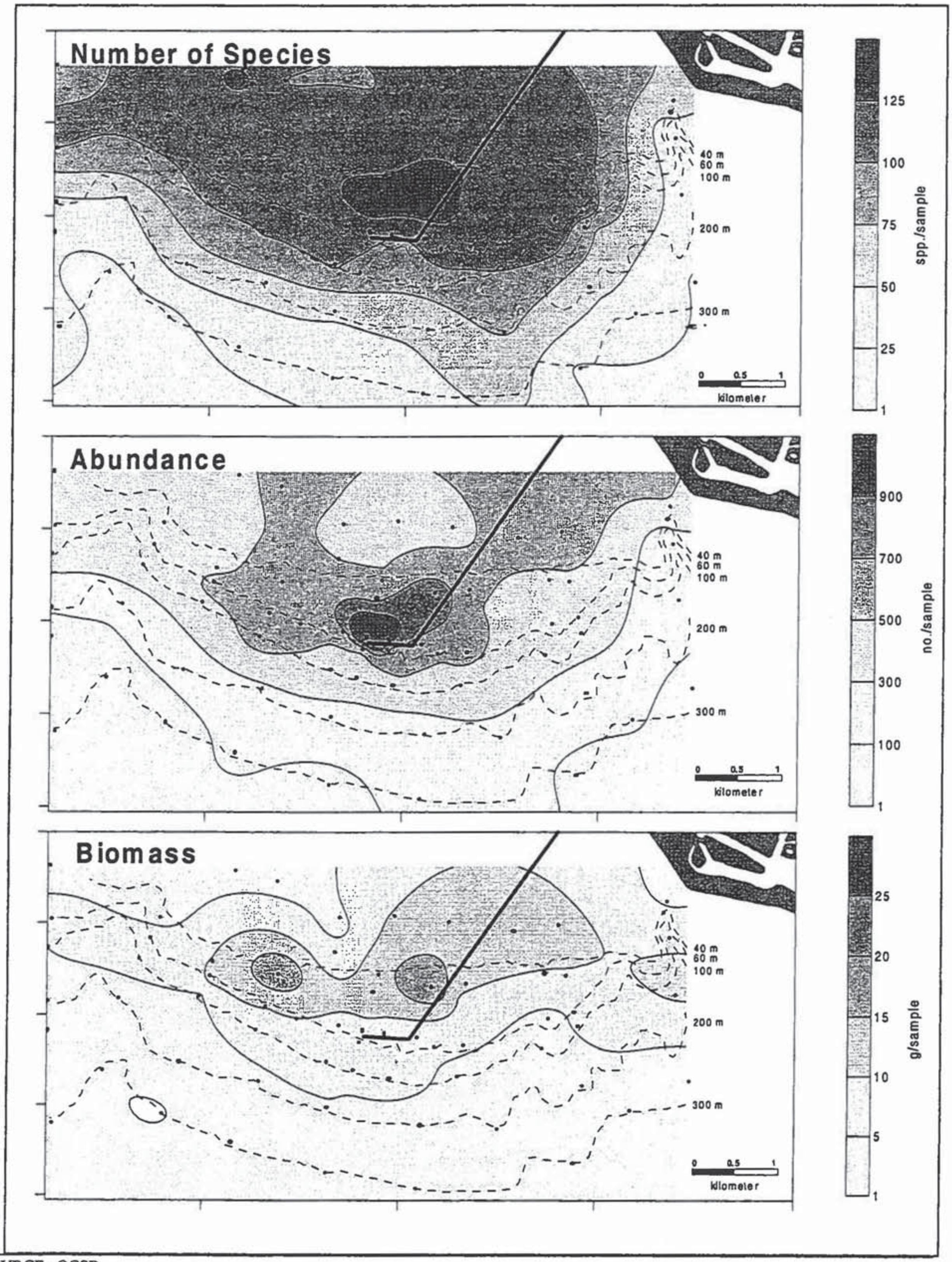
SOURCE: County Sanitation Districts of Orange County, 1998

TABLE 5-36
RESULTS OF REPEATED MEASURE ANOVAS ON INFAUNAL COMMUNITY MEASURES FOR GROUPED QUARTERLY STATIONS, 52 SURVEYS 1985–1998. SIGNIFICANCE = P< 0.05

	Are the areas different?	Which areas are different from the reference areas?	Is there a seasonal pattern?	After accounting for seasonality do the areas change through time?	Are there temporal changes which are different for the different areas?	Is there a gradient or pattern with distance from the outfall?	Does the slope of the gradient change through time?	Are area-wide changes indicated over time (regional)?
Number of Species	No	None	Yes	Yes	No	No	No	Yes
Total Abundance	Yes	NU WD WU	Yes	Yes	No	Yes	No	Yes
Total Biomass	Yes	ND	Yes	No	No	No	No	No
Shannon-Wiener Diversity Index	Yes	ND WD WU	Yes	Yes	No	Yes	No	Yes
Margalef Diversity Index	Yes	WD WU	Yes	Yes	No	Yes	No	Yes
Evenness	Yes	ND WD WU	Yes	Yes	No	Yes	No	Yes
Dominance	Yes	ND NU WD WU	Yes	Yes	Yes	Yes	Yes	Yes
Infaunal Trophic Index	Yes	ND NU WD WU	Yes	Yes	No	Yes	No	Yes
Benthic Resource Index	Yes	ND NU WD WU	Yes	Yes	No	Yes	No	Yes
Amphiodia spp.	Yes	ND NU WD WU	Yes	Yes	Yes	Yes	Yes	Yes
Capitella capitata	Yes	WD WU NU	Yes	Yes	Yes	Yes	No	Yes
Euphilomedes carcharodonta	Yes	ND NU WD WU	Yes	Yes	No	Yes	No	Yes
Parvilucina tenuisculpta	Yes	FF ND NU WD WU	Yes	Yes	Yes	Yes	Yes	Yes

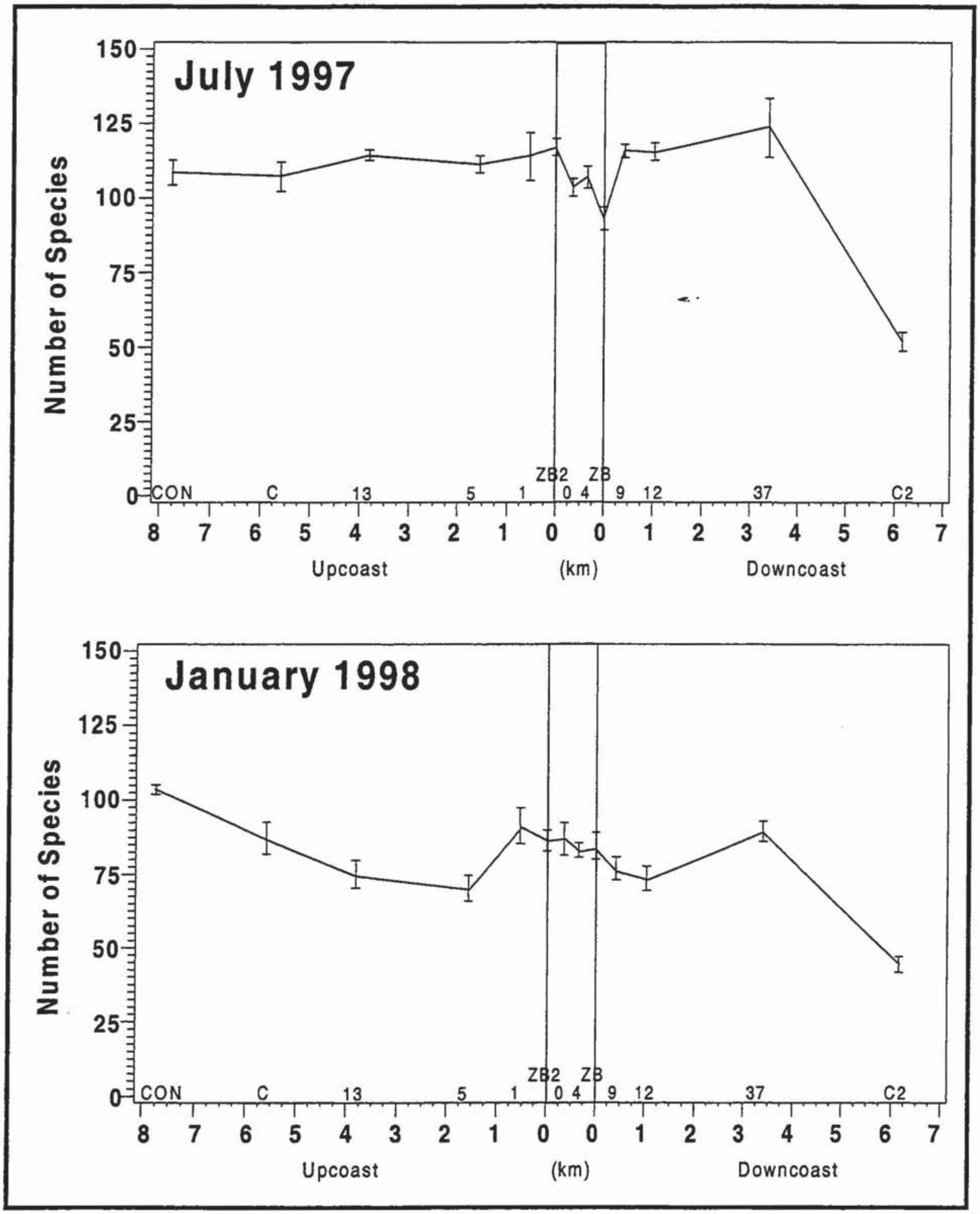
FF = Farfield (Station 13 & 37)
ND = Near Downcoast (Station 9 & 12)
NU = Near Upcoast (Station 1 & 5)
WD = Within ZID Downcoast (Station ZB & 4)
WU = Within ZID Upcoast (Station ZB2 & 0)

SOURCE: County Sanitation Districts of Orange County, 1998



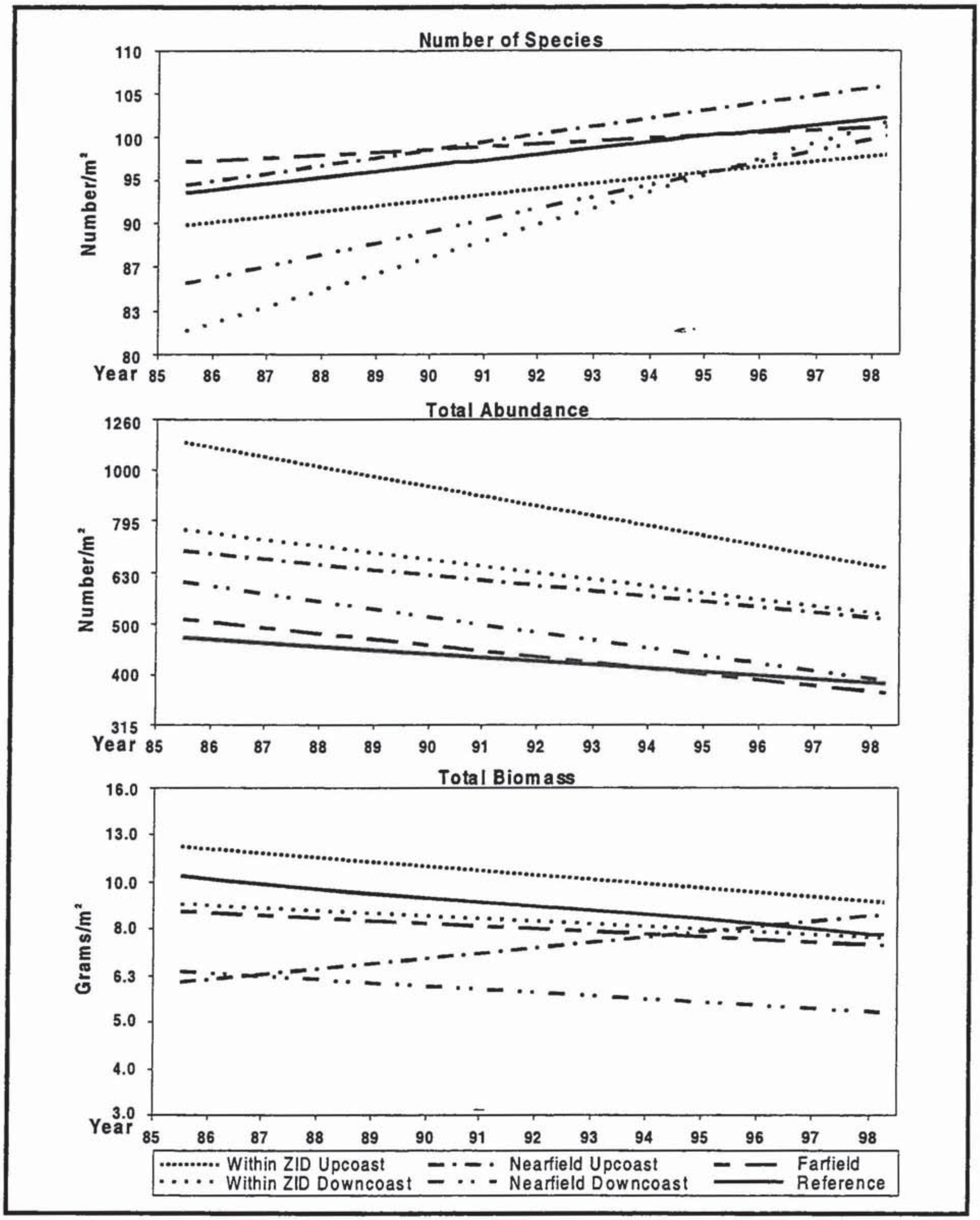
SOURCE: OCSD

Figure 5-26
Contour Plots for Mean Number of Species (upper), Abundance (middle), and Biomass (lower) for July 1997.



SOURCE: OCSD

Figure 5-27
Number of Species for the 13 Quarterly Stations for July 1997 (upper) and January 1998 (bottom). Bars indicate one standard error.



SOURCE: OCSD

Figure 5-28
Results of Repeated Measure ANOVA Analysis on Mean Number of Species (upper), Abundance (middle), and Biomass (lower) by Grouped Quarterly Stations, August 1985 – April 1998.

83.4 taxa per sample in 1990. Near-outfall stations have more species (on average) than Station Control in summer and fewer than Control in winter (**Figures 5-26 and 5-27**). Summer values at all stations generally exceed 100 species (except Station C2) and are much higher than the average number of species for SCCWRP regional studies.

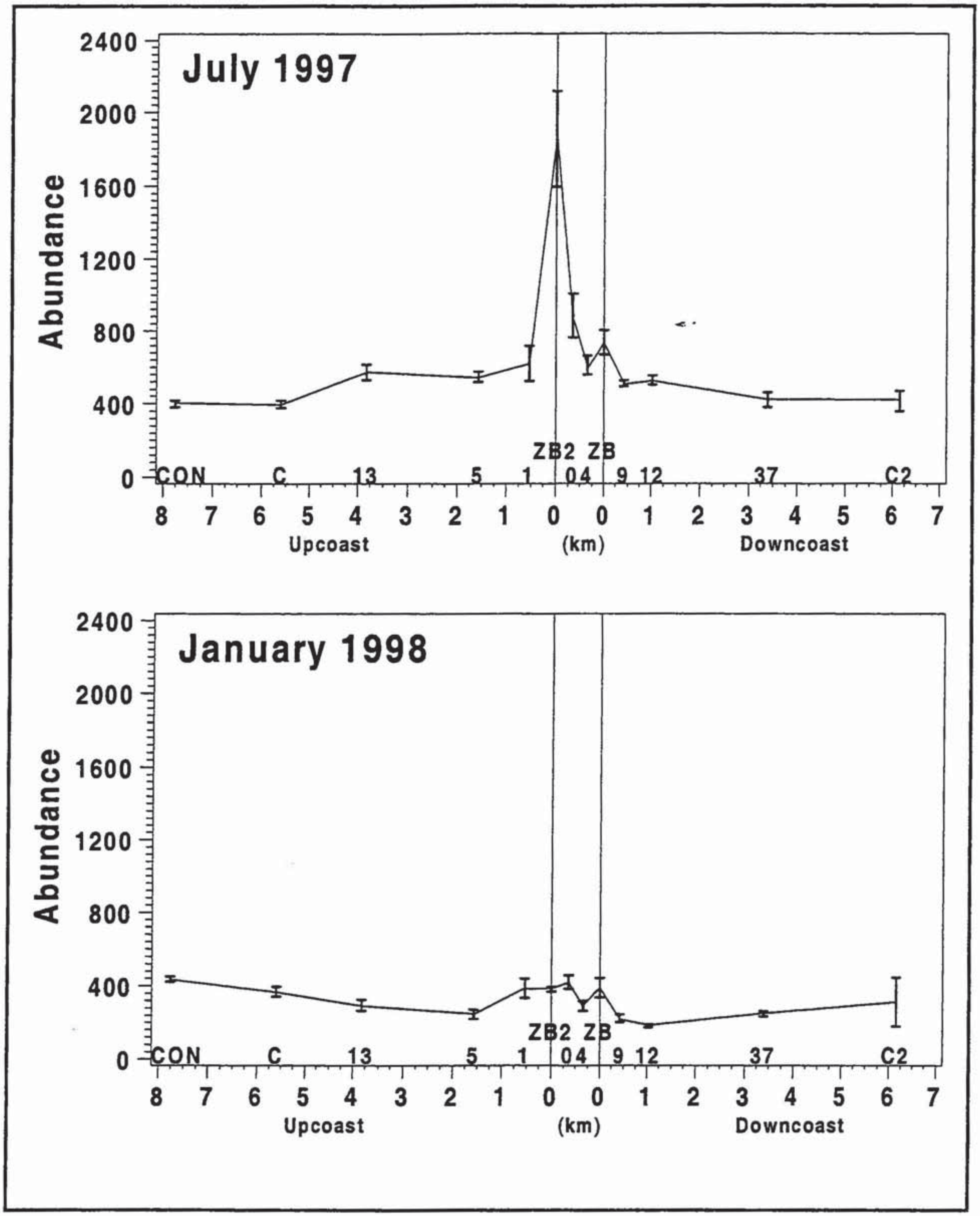
Thus, the present wastewater discharge and the outfall structure have no appreciable effects on species richness beyond the ZID. Therefore, the Preferred Scenario is also predicted not to cause significant impacts. Furthermore, since one of the first indications of a degraded and stressed community, a decrease in species richness, is not occurring, the contention that the community is not degraded and BIP is probably present is clearly supported. Therefore, the Preferred Scenario will not cause significant impacts to the benthic community.

Abundance

Enhanced abundance of some species near the outfall during summer is the most significant and measurable effect of the present wastewater discharge on the infaunal community (**Figure 5-26**). Abundance generally decreases with increasing water depth but is highest near the outfall, which is consistent with findings by other monitoring studies of the SCB (e.g., Bergen et al. 1997; SCCWRP 1992). Abundance is highest at Stations ZB2 and 0, closest to the end of the outfall diffuser (**Table 5-35, Figures 5-26 and 5-29**). Seasonal patterns in average abundance are typified by higher values in summer and dramatic decreases in winter, especially near the outfall (**Figure 5-29**). Near-outfall stations typically have significantly higher abundance than reference stations during summer and generally no significant enhancement in winter. Nearfield stations are located a little less than one mile from the diffuser, which defines the spatial extent of enhanced abundance in summer. During winter, the spatial extent of enhanced abundance is reduced to less than 1,600 ft from the diffuser The spatial extent and seasonality of enhancement effects, particularly during summer, are clearly seen in **Figure 5-29**.

RMANOVA analysis provides a long-term view of abundance patterns over the past 13 years and indicates significant outfall effects (**Table 5-36**). The analysis found significant differences among areas. Stations near the outfall (within one mile) have higher abundance than reference Stations C and Control 1. As observed in **Figure 5-29**, seasonal changes also are significant. Even accounting for seasonality, there were still significant, decreasing temporal trends in abundance for all the grouped stations (**Figure 5-28**). However, this figure shows that abundance is decreasing significantly faster near the outfall than at the farfield stations, thereby suggesting a decreasing outfall influence through time, correlating with decreasing SS concentrations.

Enhanced abundance is a predictable response to increased food supply (i.e., particulate organic carbon from the wastewater discharge). The dramatic decrease in winter abundance values for all stations indicates the magnitude of natural seasonal changes. This winter decrease is related to decreased SS reaching the bottom and disruption of the organic carbon gradients relative to the discharge. These changes occur because during winter, initial dilution increases due to less water-column stratification, current speeds are often greater, and flow rates associated with rain events are generally greater, all of which reduce the settling of SS near the outfall. Furthermore, gradients in organic matter accumulation from the wastewater discharge are disrupted by seasonal storms and wave events that re-suspend bottom particles and reduce gradients of fine organic particles relative to the discharge. The lack of significant



SOURCE: OCSD

Figure 5-29
Abundance for the 13 Quarterly Stations for July 1997 (upper) and January 1998 (lower). Bars indicate one standard error.

abundance gradients in winter (i.e., no outfall enhancement effect) reveals the temporary nature of enhanced abundance gradients due to the wastewater discharge. This supports the conclusion that present outfall effects are minor and ephemeral and that the Preferred Scenario will not cause additional significant effects. While enhanced abundance during summer is a measurable effect of the wastewater discharge, there is no decrease in species richness, and these changes do not entail changes in community function (see ITI below). It is therefore concluded that these changes are not representative of a degraded community and a BIP is present beyond the ZID boundary. The Preferred Scenario is expected to produce similar effects and, therefore, no significant impact to the infaunal community.

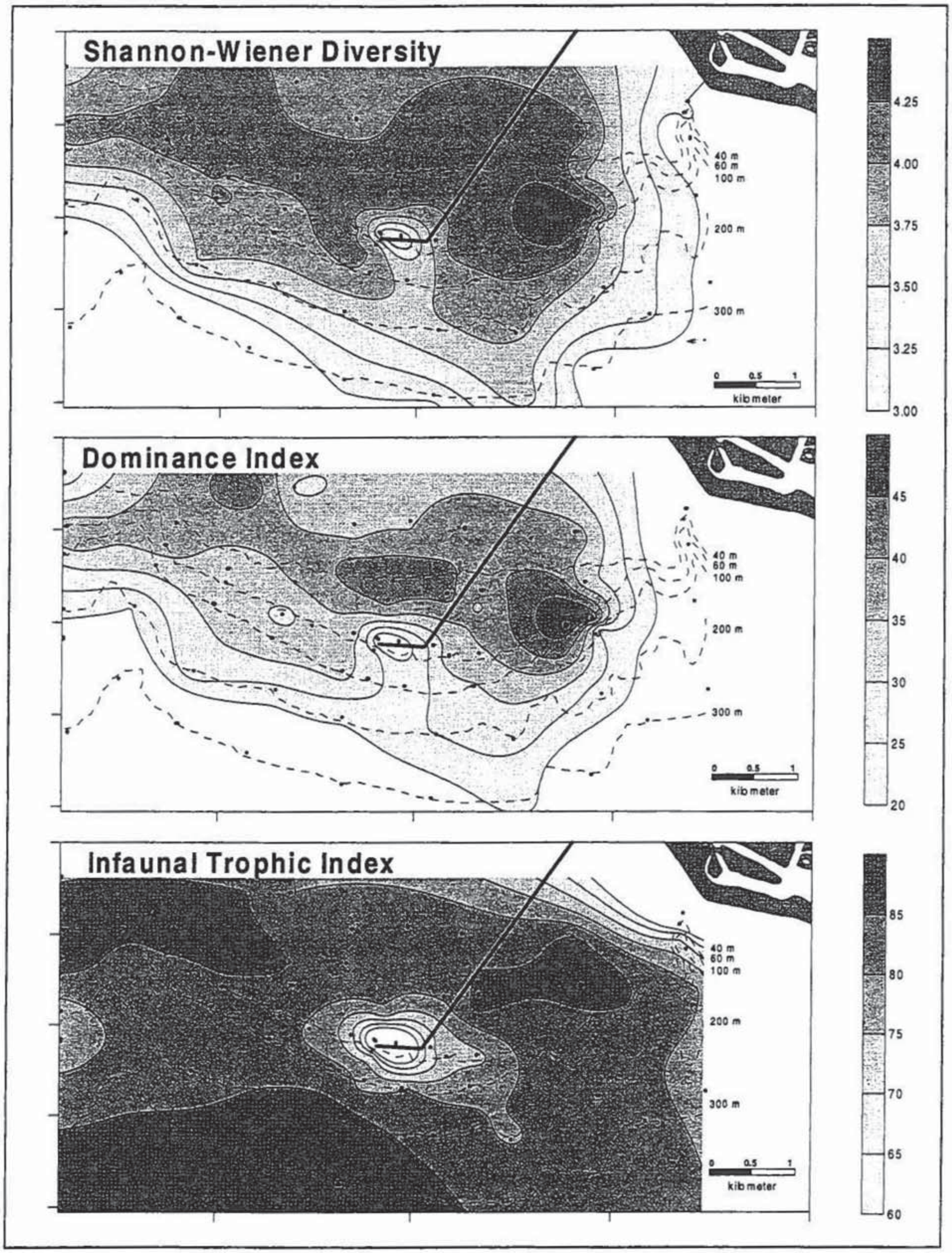
Biomass

Biomass measurements are significantly influenced by the occurrence of occasional, large organisms and, therefore, are generally much more variable than other community measures. For 1997–98, biomass tended to be highest inshore of the outfall area (**Figure 5-26**) and lower in winter compared to summer. This pattern correlates predictably with the abundance pattern. Seasonal patterns in biomass are significant, and there appears to be a decreasing temporal trend for most stations correlating with SS decreases. There are no significant gradients relative to distance from the outfall and no regional temporal trends (**Table 5-36**). Thus, there is no excess biomass as found near outfalls in the 1970s and no significant effect of the present wastewater discharge on the infaunal biomass. The Preferred Scenario is expected to produce similar effects and, therefore, no significant impact to the infaunal community.

Diversity Indices

Diversity indices are derived measures (based on the number of species and the distribution of their abundance) and are considered important because they appear to represent an attribute of a natural or organized community. However, most diversity indices have no biological basis. Diversity indices combine two aspects of community structure, the number of species (species richness) and the relative abundance of each species (equitability), into one value. Because the number of species and the equitability of species often vary independently, numerous methods have been used to calculate diversity. Results from two diversity indices are presented in this section: Shannon-Wiener and Dominance. These two diversity indices show similar patterns, with highest values inshore of the outfall, decreasing with depth offshore (**Table 5-35, Figure 5-30**). Farfield stations at the same depth as the outfall have higher diversity than stations near the outfall. This is expected due to the abundance gradient (diversity calculations are based on the number of species and abundance) noted above. Shannon-Wiener and Dominance indices indicate the spatial extent of diversity that is altered due to outfall effects (**Figure 5-30**). This diversity pattern correlates with the enhanced abundance patterns noted above as extending to some of the nearfield stations.

RMANOVA analysis found similar effects for the diversity measures. Dominance is the most sensitive index, showing significant differences in areas relative to the outfall and temporal trends that differed by area (**Table 5-36**). Shannon-Wiener diversity is less sensitive and indicates fewer differences. Both measures have significant seasonal effects. When corrected for seasonal changes, significant temporal trends are still evident (**Figure 5-31**). These trends in increasing diversity values reflect temporal increases in the number of species and declines in abundance over the study area, as described above. Both measures show significant gradients relative to distance from the outfall and reflect the regional



SOURCE: OCSD

Figure 5-30
Contour Plots for Mean Shannon-Weiner Diversity (upper), Dominance (middle), and Infaunal Trophic Index (lower) for July 1997.

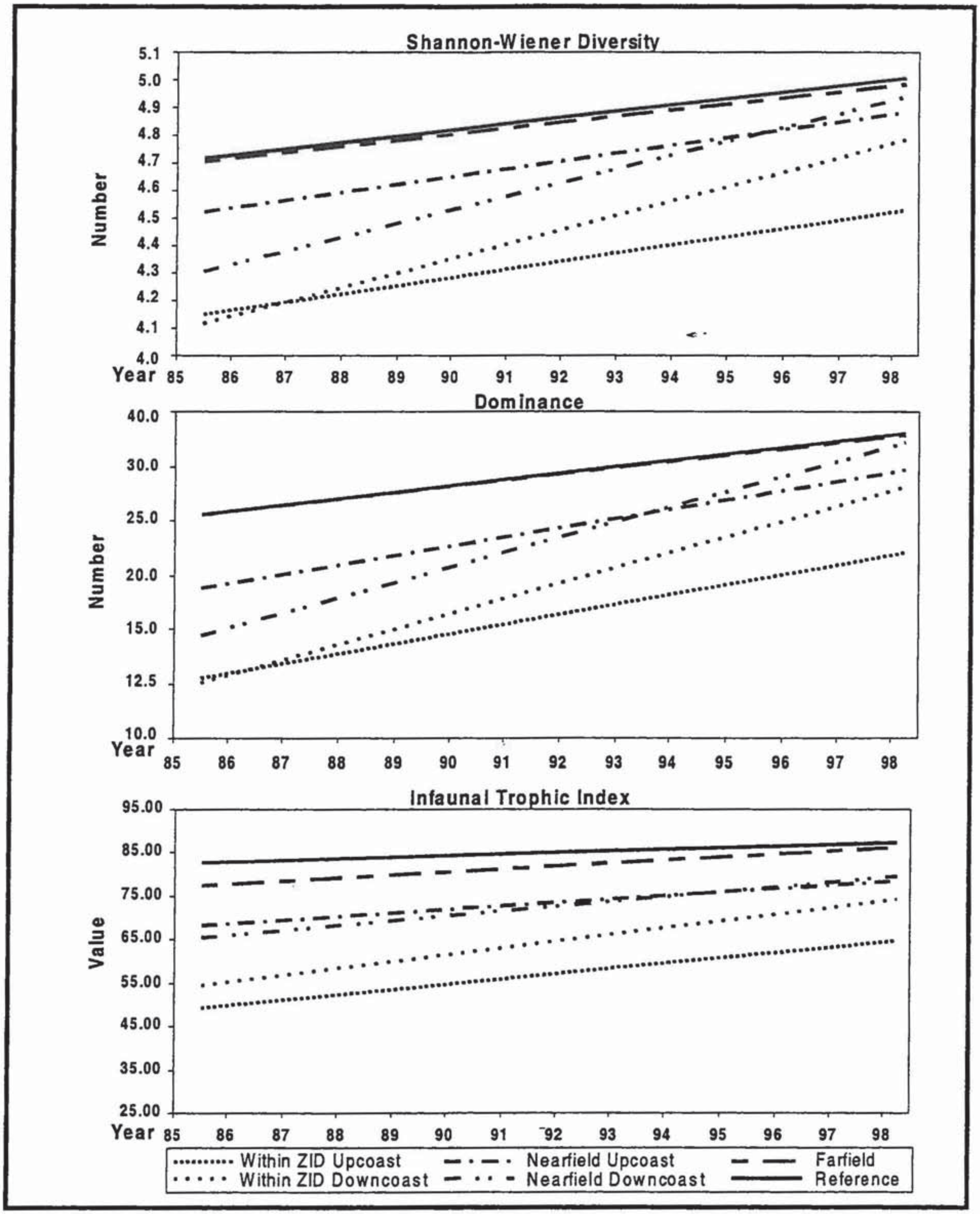


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Figure 5-31

Results of Repeated Measure ANOVA Analysis on Mean Shannon-Weiner Diversity (upper), Margalef Diversity (middle), and Dominance (lower) by Grouped Quarterly Stations, August 1985 – April 1998.

changes in species and their abundance. The temporal trends reflect a decreasing discharge effect, which is positively correlated with decreasing metal trends in sediments and the effluent and inversely correlated with the SS trend. The present wastewater discharge has a localized but decreasing effect on the infaunal diversity index, but all values beyond the ZID are comparable or higher than regional reference areas (CSDOC 1989). The Preferred Scenario is predicted to produce similar effects, and, therefore, the infaunal community will not be significantly affected so as to degrade the community or result in the loss of a BIP.

Infaunal Trophic Index (ITI)

The ITI is an index developed by Word (1978) and modified in 1980 (Version 2) to provide a measure of the "health" of the infaunal community. ITI values greater than 60 are considered indicative of "normal" communities, numbers between 30 and 60 represent "changed" communities indicating some stress but not a change in function, and values below 30 correspond to "degraded" communities reflecting fewer species and a change in community function. Values below 60 are usually associated with wastewater discharges, but only values below 30 are considered indicative of negatively impacted communities (Bascom et al. 1978).

The spatial pattern of ITI values for the July 1997 OMP survey clearly depicts an outfall gradient and low values in Newport Canyon (**Figure 5-30**). The spatial extent of the outfall effect is localized and generally corresponds to the enhanced abundance gradient. ITI values for the summer of 1997 are some of the lowest values seen near the outfall in over a decade. Stations within the ZID, Stations ZB2, ZB, and 0, have low values (43, 42, and 54, respectively), mainly due to a large, summer settlement of the polychaete worm *Capitella "capitata"* at these stations. Thus, there is considerable variability in the ITI values for these stations, reflecting the patchy distribution of *Capitella*. The recruitment of this worm likely is correlated with calm periods following storm disturbances and high organic carbon content of the sediments.

Winter ITI values show overall increases, with all stations having values greater than 70 (indicating normal communities). Stations ZB2, ZB, and 0 have mean winter values of 79, 78, and 78, respectively. Thus, community changes near the outfall are a seasonal phenomenon related to abundance patterns of a few species. Low ITI values in Newport Canyon indicate that large settlements of *Capitella* are not exclusively a near-outfall effect and also occur naturally in areas away from the outfall. While stations near the outfall may fall below ITI values of 60 in summer, indicating a possible changed community but not a degraded one, the number of species remains high. This suggests that the lower values are due mostly to enhanced abundance of relatively few opportunistic species rather than a loss of diversity. That is, the community shows responses to the wastewater discharge, but these responses are not indicative of a degraded community.

RMANOVA analysis finds significant differences for within ZID and nearfield station groups compared to reference groups (**Table 5-36**). This reflects the gradient in ITI values (**Table 5-35 and Figure 5-30**). Seasonal changes are significant and as dramatic as the seasonal abundance changes. Long-term, temporal trends are statistically significant after accounting for seasonal changes and show increasing values for all station groups (**Figure 5-31**). All station groups, except Stations ZB2 and 0, have average values exceeding 60. However, if present temporal trends continue, even this station group should exceed this average value during the next monitoring year (**Figure 5-31**). The ITI trends reflect patterns observed for the increasing number of species, decreasing abundance, and fewer opportunistic species near the outfall. The increasing trend for all station groups suggests some regional changes.

These results indicate that the present wastewater (1) causes minimal effects with a strong seasonal component, (2) effects have been reduced during the monitoring program, (3) "normal" communities are present beyond the ZID boundary, and (4) a BIP is being maintained in the District's study region. Consequently, the infaunal community near the outfall and for stations within the ZID is not degraded or significantly changed. Since the Preferred Scenario will produce similar effects, no significant impacts to the infaunal community are predicted.

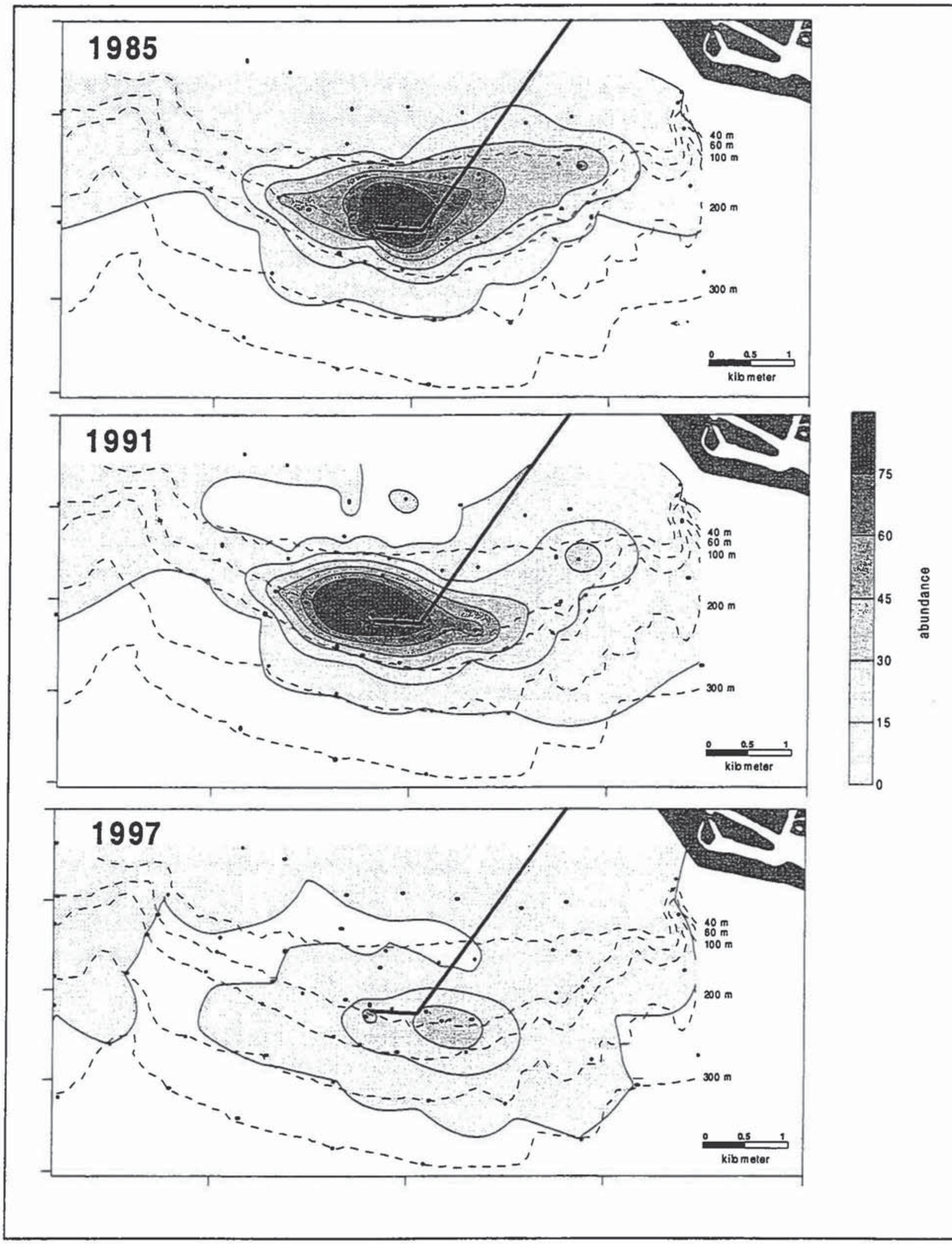
Indicator Species

Indicator species are those organisms that show strong abundance gradients relative to the wastewater discharge and often dominate the calculation of community measures. Thus, trends or patterns for these species help illustrate the spatial influence of the wastewater discharge.

The ostracod, *Euphilomedes carcharodonta,* has consistently been the most abundant infaunal species, with relatively high numbers near the outfall (**Figure 5-32**). However, possibly due to the warm water associated with El Niño, the abundance of this species was drastically reduced in 1997–98. Even though overall abundance was low, the highest numbers occurred near the outfall. This pattern is likely due to the success of this species in utilizing organic particles as a food source. RMANOVA results indicate a significant outfall gradient with more individuals at the within and nearfield stations groups than at the reference, and significant and fewer seasonal effects in winter than summer (**Table 5-36**). **Figures 5-32 and 5-33** show that the spatial extent of enhanced abundance may be decreasing through time, but this trend is not significant based on RMANOVA results. This would suggest that decreases in SS can be related to reduced enhancement, but the gradient relative to the outfall is not changing.

It is expected that this species will recover from the El Niño event and enhanced abundance will persist over several square miles. Since it is believed that this species feeds on the small wastewater organic particle fluxes at the sediment water interface, changes in SS will directly affect the abundance and spatial area of enhanced abundance. Therefore, the Preferred Scenario will contribute to enhanced abundance of this species, but this will not change from the patterns shown since 1985.

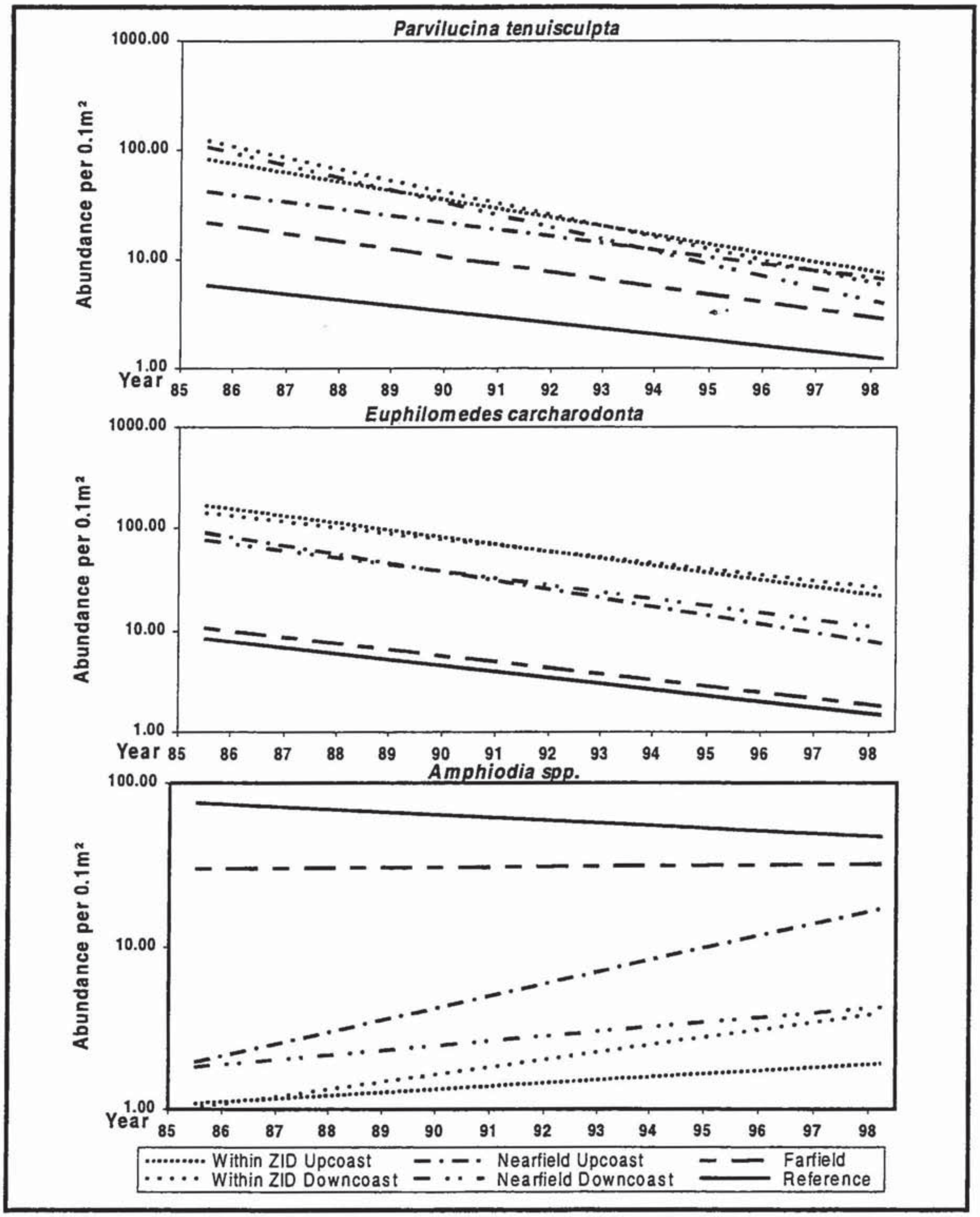
The clam, *Parvilucina tenuisculpta*, historically has ranked as the third most abundant species, although large population fluctuations and significant decreasing abundance have been observed since 1985 (**Figure 5-34**)(CSDOC 1996a). Reasons for these decreasing abundance are unknown but may be related to reductions in wastewater nutrient concentrations over time. This species occurs at high abundances near some wastewater outfalls (Fabrikant 1984) and was more abundant along the 330-ft depth contour than near the District's outfall in the early 1990s (**Figure 5-34**). More recently, abundances are found to be low but significantly higher near the outfall than at farfield and reference stations (**Table 5-36**). This suggests some influence of the discharge. RMANOVA analysis finds significant differences among all station groups relative to the reference station, thereby indicating a strong gradient with distance from the outfall. Seasonal effects are significant, and long-term decreasing trends are evident for all stations (**Figure 5-33**). Station groups near the outfall are decreasing at a significantly greater rate than at farfield



SOURCE: OCSD

Figure 5-32

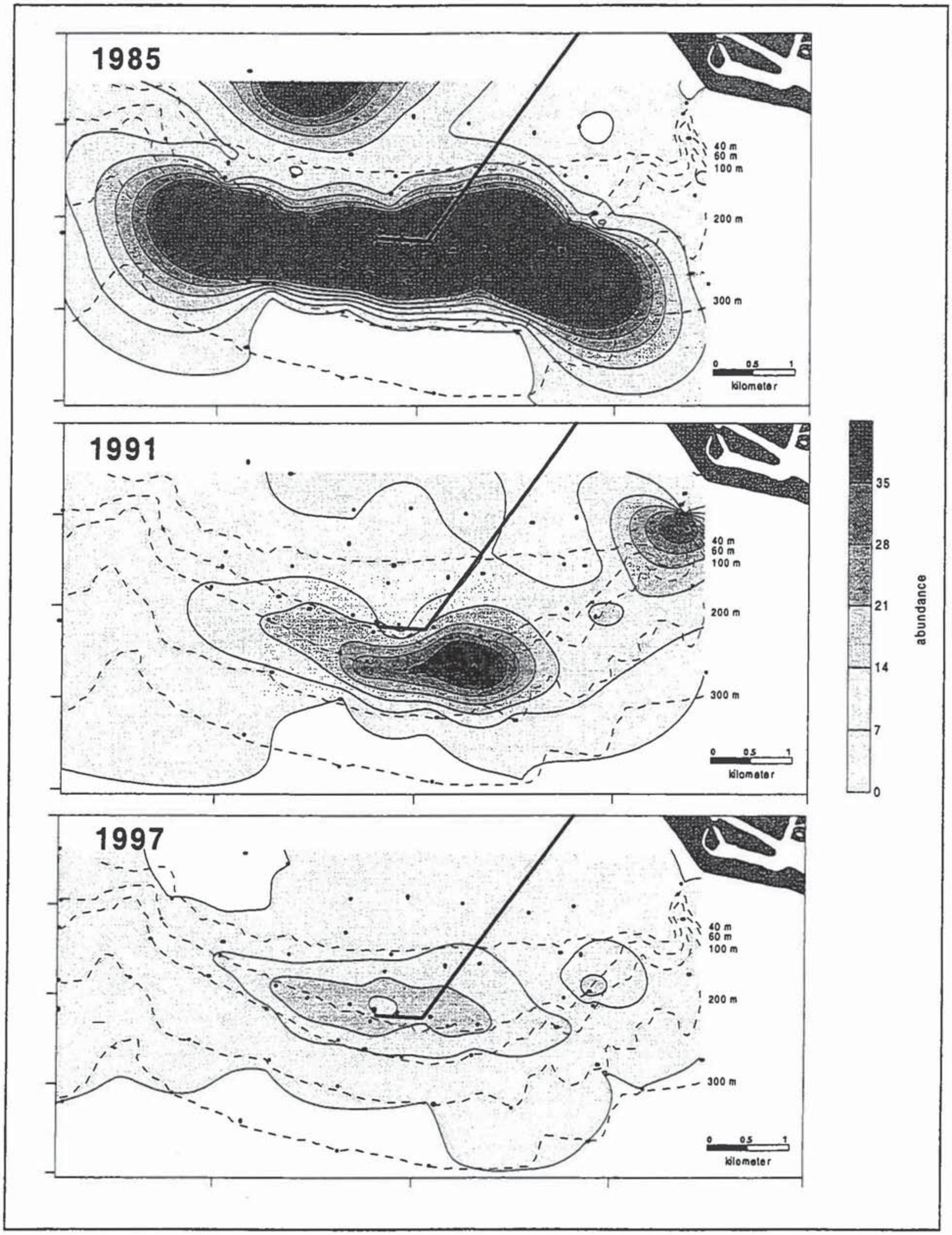
Contour Plots for Mean Abundance of *Euphilomedes carcharodonta* by Year, August 1985 (upper), July 1991 (middle), and July 1997 (lower).



SOURCE: OCSD

Figure 5-33

Results of Repeated Measure ANOVA Analysis on *Parvilucina tenuisculpta* (upper), *Capitella "capitata"* (middle), and *Amphiodia* spp. (lower) by Grouped Quarterly Stations, August 1985 – April 1998.



SOURCE: OCSD

Figure 5-34
Contour Plots for Mean Abundance of *Parvilucina tenuisculpta* by Year, August 1985 (upper), July 1991 (middle), and July 1997 (lower).

stations, indicating a decreasing outfall effect. However, decreasing trends at farfield stations are more indicative of area-wide changes suggesting regional effects. Thus, the decreasing trend for this species likely shows the combined effects of regional as well as outfall influences. The Preferred Scenario is not expected to change abundance patterns for this species as SS and nutrient loadings are calculated to be close to present levels.

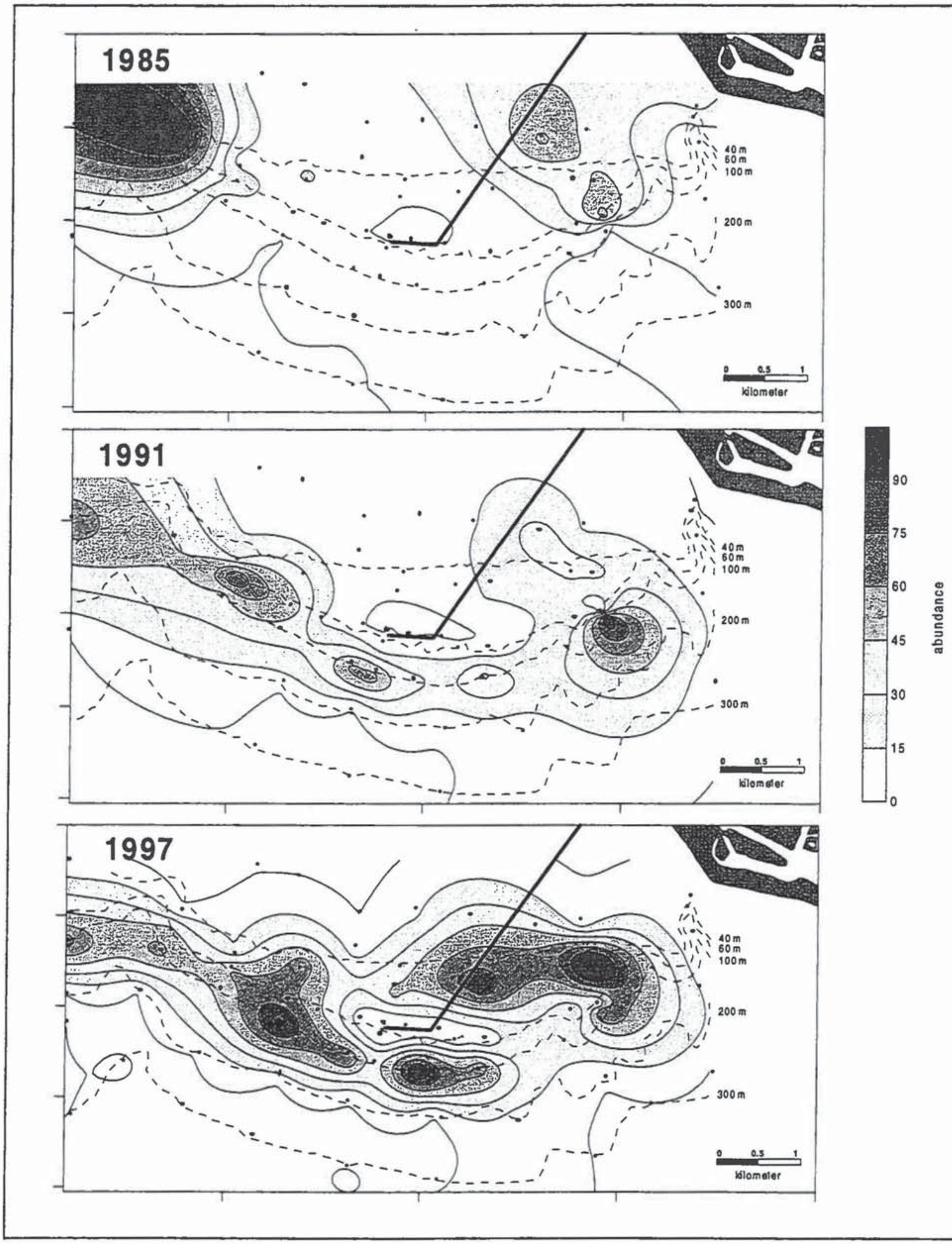
The brittlestar, *Amphiodia urtica*, is one of the most abundant species in soft-bottom, continental shelf habitats of the SCB (Bergen et al. 1997). This species was displaced close to the diffuser by outfall construction in the early 1970s, then abundances were initially enhanced once operations began (CSDOC 1996a). However, after two years of wastewater discharge, *Amphiodia* began to disappear and, within a few years, was virtually absent over a large area. Re-population of this species is a slow process because recruitment of juveniles is most successful to areas where adults already occur (Scanland 1995). Consequently, re-population is largely by immigration of adults. Beginning near the onset of the OMP in 1985, a continuous re-population has occurred for this species (**Figure 5-35**), correlated with reduced SS emissions, effective source control, and decreasing sediment contamination during the same period (Phillips and Hershelman 1996). A trend of significantly increasing abundance has been evident, especially along the 330-ft depth contour (**Figure 5-35**). While abundances at approximately 198 ft are significantly lower near the outfall (**Table 5-36**), they appear to be enhanced along the 100-m depth contour near the outfall. The depression of *Amphiodia* abundance near the outfall is responsible for lower ITI values near the outfall (see above), since the ITI calculation is sensitive to this species. RMANOVA analysis indicates that *Amphiodia* abundance trends are increasing near the outfall and decreasing at the reference station group. A lack of a trend is indicated for the farfield group (**Figure 5-33**). *Amphiodia* abundance has a significant seasonal component, and the slope of the outfall gradient has been decreasing through time thereby supporting the recovery conclusion. The increase of *Amphiodia* to areas closer to the outfall is expected to continue as indicated by the trend lines. However, full recovery near the outfall pipe structure is unlikely due to the "halo" effect from predation by reef dwellers on this species.

Thus, at some point in the near future, recovery from wastewater discharge effects is expected to reach an equilibrium with "reef effects" (CSDOC 1996a).

The loadings for the Preferred Scenario are calculated to be similar to the present conditions, which have contributed to the continued recovery of this species. Therefore, the Preferred Scenario is not expected to affect the recent trends, and no significant impact from this scenario is expected.

Large-scale Infaunal Community Spatial Patterns

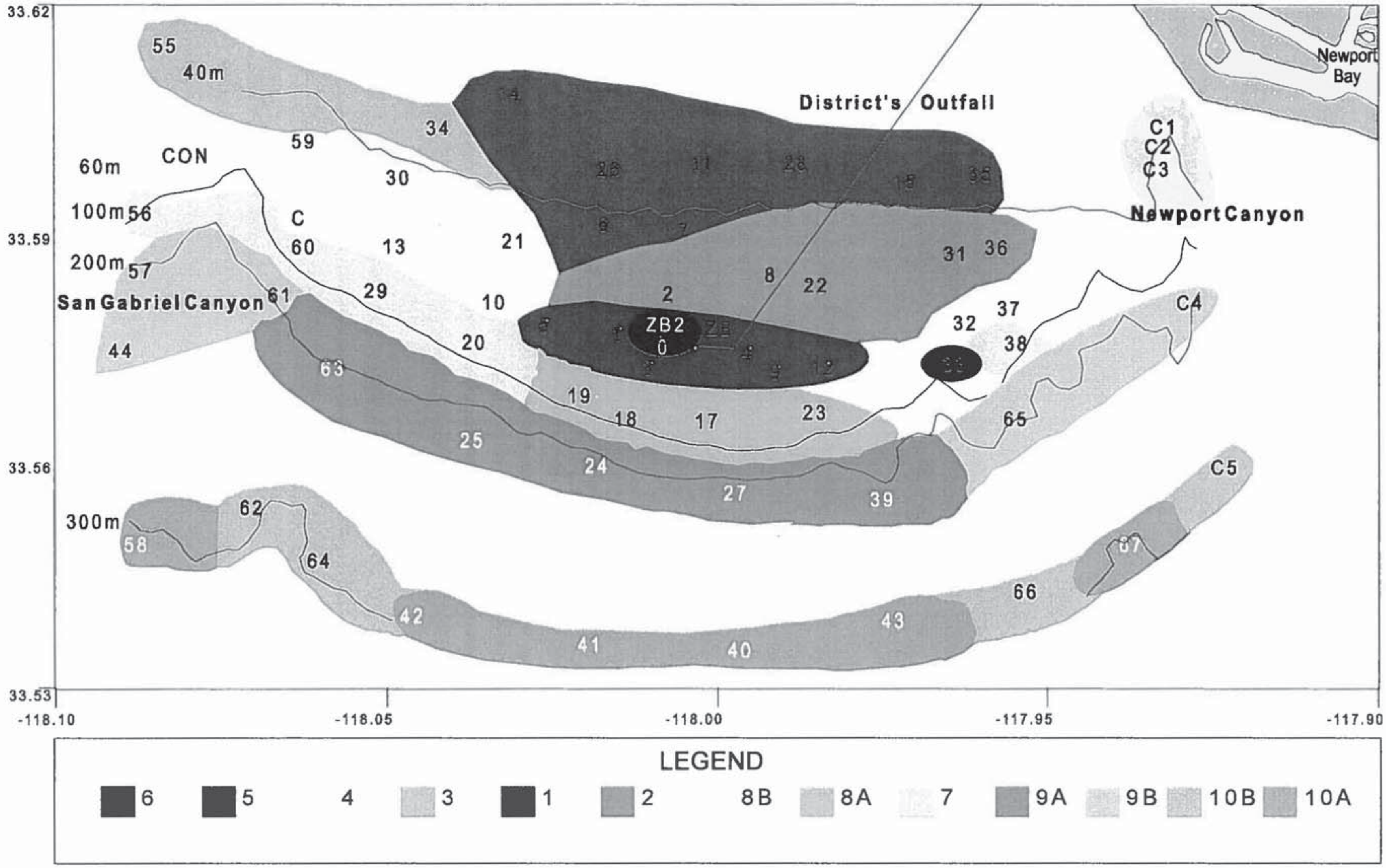
Multivariate cluster analysis was performed on the 66 stations sampled by the OMP in July 1997 to identify large-scale patterns in biological communities and habitats across the study region. Cluster analysis defines stations that have similar species composition and identifies species that most often group together based on their abundance. Cluster analysis was performed on the 206 most abundant (abundance >15) and frequently occurring (frequency >5) taxa. This resulted in the delineation of ten station and nine species clusters, most with several subgroups. The cluster groupings were similar to those documented in earlier reports (CSDOC 1996a, 1997, 1998; Diener et al. 1995) and were organized largely along depth contours, reflecting the importance of water depth in structuring infaunal communities (**Figure 5-36**). Key patterns include the spatial extent of outfall effects (station cluster 6-



SOURCE: OCSD

Figure 5-35

Contour Plots for Mean Abundance of *Amphiodia urtica* by Year, August 1985 (upper), July 1991 (middle), and July 1997 (lower).



SOURCE: OCSD

Figure 5-36
Map of Station Groups from Cluster Analysis for July 1997.

most affected and 5-slightly affected), differences between downcoast and upcoast stations largely due to sediment size patterns (station clusters 1 and 3, and 2 and 4), the uniqueness of shallow stations in Newport Canyon (station cluster 7), and the influence of canyons (9 A and B, 10 A and B).

The California Ocean Plan and the District's discharge permit require that beyond the ZID, marine communities shall not be degraded and a BIP must be maintained. The cluster analysis provides a graphical representation of the spatial extent of shifts in the composition of infaunal communities. As shown in **Figure 5-36**, the outfall affects a small portion of the study area reflecting the change in abundance and species patterns described above. While the spatial extent of the most affected and slightly affected areas changes from year to year, there has been a general trend of decreasing outfall influence, which correlates with the decrease in effluent and sediment contaminant concentrations and SS. As described above, observed changes in the infaunal community largely reflect enhanced abundances of some opportunistic indicator species, the recovery of the sensitive brittlestar, and ITI values generally indicative of normal communities. Effects include seasonal enhancement of infaunal abundance near the diffuser but no decrease in species richness. Therefore, while wastewater effects are measurable, these changes are not indicative of degraded communities, and a BIP is represented beyond the ZID. The Preferred Scenario differs little from the present discharge conditions, and, therefore, no significant impacts are predicted.

Alternative Scenarios

Predicting impacts associated with the treatment scenarios is difficult due to an unknown relationship between SS and TSS and an unknown impact of treatment type on SS. The effect of GWR on SS is also unknown; however, SS is assumed to increase with flow rate, which is substantially greater without GWR than with GWR. Because of lower TSS concentrations and loading, Scenario 3 might be expected to produce less SS loading and organic matter fluxes to the benthos, although this effect is unknown. The alternative scenarios will alter SS deposition to the benthic community and affect the food supply of the benthic community. These alterations will be reflected in changes in the enhancement gradients of abundance, most notably in summer, but are not expected to exceed the assimilative capacity of the community. The impact of treatment type to SS concentration is also unknown. If SS concentration is reduced by full secondary, Scenarios 3 and 4 might show less summer enhancement of the benthic community than current conditions. Flow rates are greater for Scenarios 1, 3, and 5 (an increase of 24.8%) than for the Preferred Scenario and Scenarios 4 and 6 because of GWR. If SS is proportional to flow rates, then Scenarios 1, 3, and 5 would all increase SS loading to the benthic community. This would have measurable effects upon the benthic community, increasing the enhanced abundance gradient seen in summer because of the additional food supply. This increase in SS would also increase the organic matter loading to the sediments, but, as calculated in **Table 5-32**, this increase would still be below the assimilative capacity of the benthic community, and significant shifts in community function would not be predicted.. Therefore, the alternative scenarios are not expected to cause significant effects to the benthic communities. The GWR scenarios all have increased metal loading, but because the relationship between SS and metal contaminants is unknown, metal loading to the sediments cannot be predicted. However, at present levels sediment toxicity is not apparent and, therefore, contaminant loads to the sediments are not significant. These conclusions are tentative and require additional information on the relationship between TSS and SS, the effects of the GWR on SS, and the organic content of SS and the associated change with treatment scenarios. Ongoing studies to further characterize the effluent will be important for providing some of this data; however, additional studies are clearly indicated.

Optional Discharge Locations

Predicting effects at a new outfall location are hindered by the same constraints already discussed. In general, a new outfall provides for reducing the loading at the present location and redistributing these materials over a new area. The combined effect is to lower loading over a larger affected area. This will reduce measurable effects at the present outfall and create new gradients relative to the new discharge location. There will be a larger area to assimilate organic loading, and organic loading will be far below critical thresholds. No significant impacts are predicted from any of the six treatment scenarios.

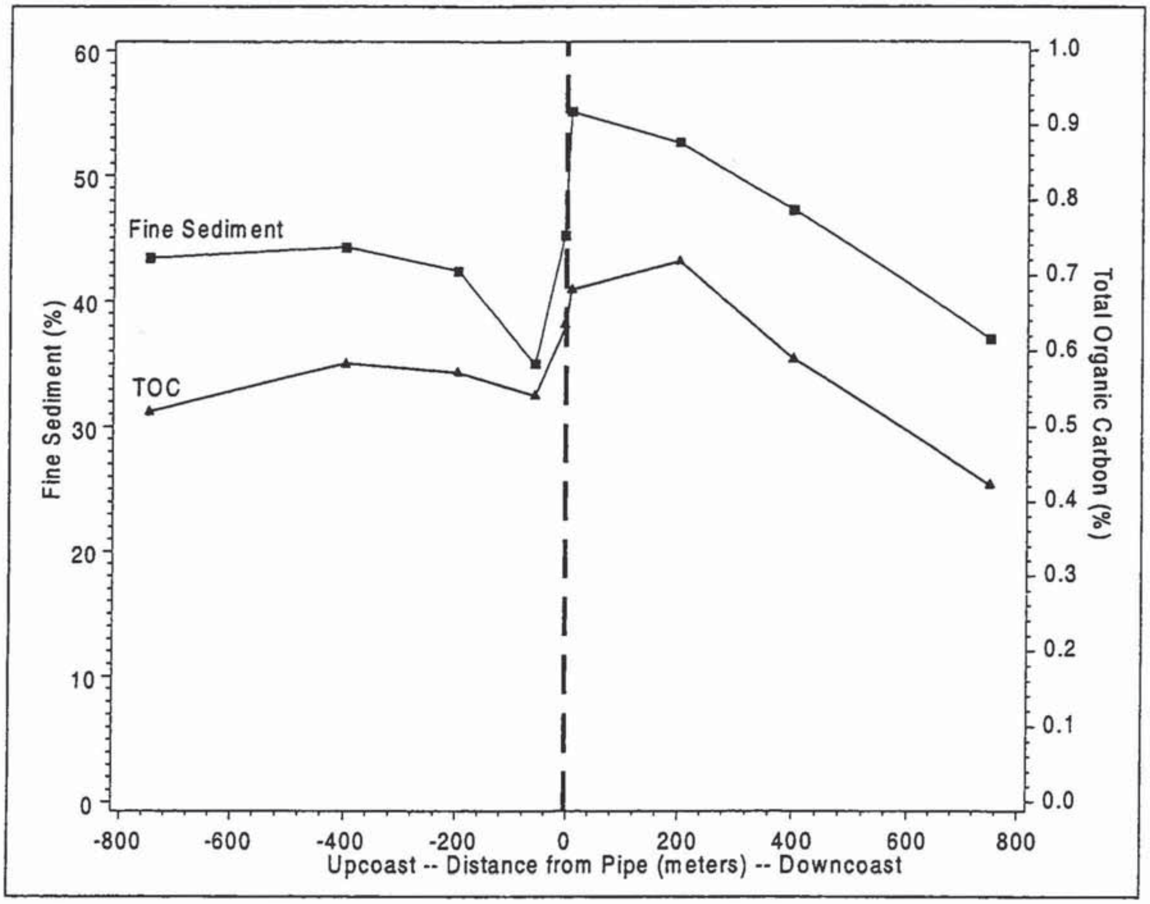
78-inch Outfall

The effluent discharged to the 78-inch outfall during an emergency would be of short duration and would entail minor mass loading of TSS, SS, nutrients, metals, and other organic compounds (**Table 5-29**). The Preferred Scenario as well as Scenarios 4 and 6, those with the GWR, would have the lowest contaminant mass loading. Because of the short duration of the discharge, the small mass loadings, and the greater mixing nearshore from waves, no significant impacts would occur to benthic communities for any of the proposed scenarios.

Hard-bottom Communities

The District's outfall represents one of the largest, artificial reefs in southern California. Because reefs are not natural to the area of the outfall, its presence and the hard-bottom habitat it provides enhance biological diversity and lead to increased productivity, which are viewed as beneficial. However, there is also the potential for alteration of the surrounding benthic community by predators attracted to the reef environment, as well as for physical alteration of the sediments due to disturbances of bottom currents by the reef. These reef effects upon the adjacent environment are clearly different from those effects associated with the wastewater discharge. Discharge effects change the adjacent community and environment by enhancing food resources, changing sediment quality by contamination, and altering water quality parameters. Compliance with wastewater discharge permits generally requires that the discharge does not adversely impact the environment and that a BIP persists near the discharge. Historically, gradients in the biota and sediments near discharges have been attributed to particle fluxes, mass loading, and contaminant levels; however, more recently, attention also has been directed towards the influence of the outfall structure and its effect on the adjacent environment. Thus, compliance assessments need to distinguish discharge effects from those associated with reef effects so as not to bias the evaluation.

In a recent study, the infaunal community was sampled and physical measurements were made at various distances from the outfall structure at two transects (CSDOC 1995a, 1996a; Diener et al. 1997). One transect was located in the wastewater discharge area, and another transect was located along the 97-ft depth contour, 1.6 miles inshore from the wastewater discharge area. The results of this study found significant alteration in grain size and sediment organic carbon content at the inshore transect, extending at least 650 ft down-current and less than 650 ft up-current from the pipe structure (**Figure 5-37**). While



SOURCE: OCSD

Figure 5-37
Percentage of Fine Sediments and TOC as a Function of Distance from Outfall Structure at 30m.

abundances of crustaceans and mollusks are usually enhanced near wastewater discharges, abundances of these groups decrease near the pipe structure at the inshore transect. Decreased abundance of these groups is consistent with the "halo" effect observed in other studies and is indicative of predation effects by reef residents. Abundance of polychaetes, particularly *Melinna oculata*, increase near the pipe structure at the inshore transect and is positively correlated with increase in fine sediments near the pipe. Changes in the number of infaunal species with distance from the pipe are not detected at the inshore transect. The brittlestar Amphiodia urtica, generally considered a sensitive indicator species of wastewater discharges, has depressed abundances at the inshore transect up to 1,300 ft from the pipe structure (**Figure 5-38**). Discharge effects upon this species extend much further. While recovery of this species over large areas near the discharge correlates with improved treatment strategies, effective source control, and decreasing sediment contaminant concentrations, our results indicate that this species may never fully recover to historical abundance levels near the pipe structure because of reef effects.

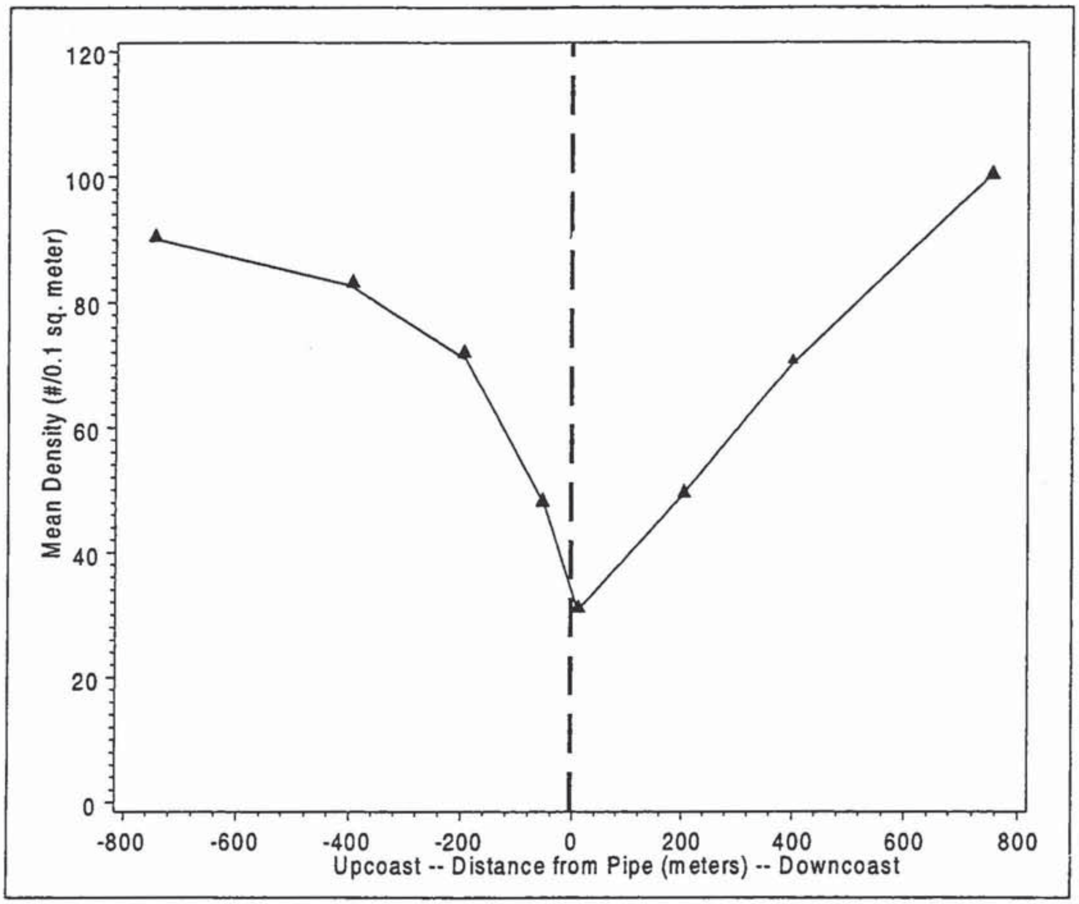
The District's outfall harbors a diverse and abundant biota typical of that found on natural and mature artificial reefs (CSDOC 1996a). Artificial reefs are viewed as beneficial because they provide increased habitat diversity, which enhances biological diversity, and because they are believed to increase productivity and greater fish stocks. It is for these reasons that millions of dollars have been spent building artificial reefs in the SCB. The OMP sampled the biota of the outfall reef from 1985 to 1997 and has shown that the biota on the outfall structure is comparable to that found on natural reefs (CSDOC 1995a). Therefore, the hard-bottom habitat created by construction of the outfall is not degraded, and the artificial habitat has contributed to increased biodiversity within the area.

The changes that affect the biota near the outfall are related to the changes in loading to the sediments and accumulation rates. Based upon inspection surveys and the OMP, the hard-bottom community has remained largely unchanged since 1985, and, thus, this community has experienced a greater range of changes than calculated for the six treatment scenarios. Therefore, the Preferred Scenario, as well as the alternative scenarios, will not significantly impact the hard-bottom community.

Demersal Fish and Epibenthic Macroinvertebrates

The District monitors demersal (bottom-living) fish and macroinvertebrates (larger invertebrates) to determine whether these organisms are being affected by the wastewater discharge and whether a BIP is present beyond the ZID. The OMP is designed to document community structure at specific locations and to assess whether changes result from impacts due to the wastewater discharge. The number of species, species composition, and abundance change in response to both natural and human-induced alterations to the environment. Comparison of community measures at reference stations with stations potentially impacted is used to distinguish natural gradients from those caused by the wastewater discharge. Natural factors that affect community measures include water depth, changes in sediment type, seasonal cycles, storms, river discharges, and longer-term climatic changes (e.g., El Niño events and ocean warming). Human-induced changes might include the input of organic particles (which may serve as a food source and enhance communities) and chemical contaminants (which might be toxic and lead to a reduction in community diversity) from point and non-point sources.

Water depth has been shown to be the most significant influence on demersal communities in the study area, with seasonal cycles having a smaller effect. Since 1985, the OMP has shown only minor changes in



SOURCE: OCSD

Figure 5-38

Density of *Amphiodia urtica* as a Function of Distance from Outfall Structure at 30m.

the demersal fish and macroinvertebrate community, which are related to the wastewater discharge. Both increases and decreases in species composition and abundance were observed. Enhancement appears to be related to the increased food sources (infaunal invertebrates) and organic wastewater particulates near the outfall. Generally, fewer macroinvertebrate species with lower abundance have been observed near the discharge area. However, this reduction appears to be more related to "reef effects" associated with predators living on the reef structure than to the wastewater discharge (CSDOC 1994, 1995a). Long-term trends of decreasing fish abundance appear to be a regional phenomenon and are not directly caused by the wastewater discharge. However, both July 1997 and January 1998 OMP surveys sampled the fewest number of specimens over the past 13 years. This decrease is correlated with the warmer than usual water temperatures associated with the major El Niño event during this period. Low abundance for some species appears to be a result of fish migration rather than mortality. For example, Pacific sanddabs have been the most common species at the 199-ft-depth contour, but they were notably absent during the present year and appeared to have moved to deeper waters. Unlike previous years when fish abundance and diversity was generally highest near the outfall, fish measures were more similar to local reference stations. However, the pattern of fewer macroinvertebrates near the outfall was more consistent with previous years.

During 1985-1998, 125,870 fish representing 112 species of fish and 143,383 macroinvertebrates representing 140 taxa were sampled, reflecting the high diversity of the study area. However, the number of fish caught in 1997-1998 was the lowest since the beginning of 1985, and the macroinvertebrate catch was the second lowest (**Table 5-37**). These low values correlate with the warmer waters and increased winter storm activities associated with the recent El Niño event. Additional factors correlated with fewer macroinvertebrates, and a decreasing temporal trend for the macroinvertebrate community (CSDOC 1996a) is related to the commercial sea cucumber fishery that has developed over the past decade. Otter trawling, used to harvest sea cucumbers, not only disrupts the bottom habitat but results in a substantial by-catch of fish and macroinvertebrates that are killed incidentally and not utilized. Since the Huntington Beach area represents up to 35% of the local sea cucumber landings (EJL & Assoc. 1995), these trawling activities could adversely affect macroinvertebrate community measures near the outfall.

Between 1985 and 1997, there was no significant difference in the number of fish species sampled at the outfall (Station T1) compared to two reference stations (Stations T3 and T11) (**Table 5-38**). While there are seasonal differences, these changes generally did not change the results for similarity of the outfall and reference areas. Deeper stations had more species, while the shallower stations had fewer species.

Wastewater discharge effects do not appear to impact the number of fish species near the outfall. Similar results are shown for the number of fish caught. While the differences are not statistically significant, the outfall often tended to have more and larger individuals. Because there was no difference between outfall and reference stations, diversity indices also showed no significant differences.

While the number of macroinvertebrates species sampled near the outfall tended to be lower than at the reference stations, these differences were not significant (**Table 5-38**). Similar results are shown for the abundance of macroinvertebrates and diversity indices. Seasonal effects were evident but did not affect results. There were significant decreasing temporal trends in the number of species per trawl for stations grouped by depth for the 188- and 450-ft depths, but these trends appear to be regional and not localized near the outfall.

TABLE 5-37
TOTAL OTTER TRAWL CATCH OF FISH, EPIBENTHIC MACROINVERTEBRATES, AND TOTAL INVERTEBRATES DURING EACH SURVEY (ALL STATIONS COMBINED PER SURVEY), AUGUST 1985 THROUGH JANUARY 1998.

Survey	Fish		Epibenthic Macroinvertebrates		Total Invertebrates	
	Total Individuals	Total Species	Total Individuals	Total Taxa	Total Individuals	Total Taxa
August 1985	11,846	50	4,563	51	4,841	70
January 1986	15,327	48	2,960	41	3,052	63
July 1986	5,766	42	2,409	53	2,702	103
January 1987	9,640	51	3,963	52	4,193	85
July 1987	3,959	43	2,777	50	3,327	98
January 1988	3,926	34	11,397	32	11,605	66
September 1988	6,945	43	3,548	41	3,673	66
January 1989	7,624	38	7,797	46	8,026	79
July 1989	4,129	43	4,887	46	5,048	81
January 1990	3,242	36	3,522	49	3,740	79
July 1990	3,286	53	3,316	46	3,535	79
January 1991	3,110	37	7,918	52	7,958	74
July 1991*	4,794	44	12,779	50	12,946	73
January 1992*	3,071	35	6,711	48	6,779	76
July 1992*	3,755	42	5,444	43	5,534	67
January 1993*	3,700	46	28,379	49	28,468	71
July 1993	4,458	55	3,057	49	3,125	61
January 1994	1,737	35	1,036	37	1,057	44
July 1994**	1,141	22	1,580	28	1,586	31
January 1995	5,023	50	6,043	41	6,093	49
July 1995	4,364	45	3,718	47	4,081	73
February 1996	2,890	35	782	32	810	43
July 1996	3,307	43	3,314	38	3,520	51
January 1997	4,379	52	1,648	34	1,685	46
July 1997	2,783	42	3,821	37	4,121	53
January 1998	1,668	40	811	33	865	57
TOTAL	125,870	112	143,383	140	147,712	333
Survey Mean	4,841	42.5	5,515	42.6	5,681	66.8

* For historical consistency, data are exclusive of extra trawl stations (TB and TC) and a third replicate sample collected at selected stations during 1991B1992, 1992B1993, and 1993B1994.

** Due to participation in the SCBPP, trawl Stations T3 and T10 were not sampled.

Totals for abundance and average number of species over all surveys are provided. Total invertebrates include epibenthic macroinvertebrates, infaunal invertebrates, and hard-bottom epifauna, but exclusive of mysids. Epibenthic macroinvertebrates exclude infauna, hard-bottom epifauna, pelagic species, and mysids.

TABLE 5-38
RESULTS OF ANOVA-SNK ANALYSES OF COMMUNITY MEASURES FOR TRAWL SURVEYS, ALL SUMMER DATA COMBINED, AUGUST 1985-JULY 1997

Non-transformed data are shown as "nt."

INDEX	Transfor-mation	p value									
DEMERSAL FISH											
Number of species (spp/trawl)	nt	<0.001	16.2	16.0	15.5	14.5	13.0	10.5	10.2	8.6	8.2
			T10	T14	T3	T1	T11	T2	T6	T0	T4
Total abundance (no./trawl)	log_{10}	<0.001	517	478	484	364	268	198	165	115	64
			T10	T1	T3	T11	T14	T2	T6	T0	T4
Total biomass (kg/trawl)	log_{10}	<0.001	12.6	10.7	10.2	9.7	9.1	7.0	5.1	4.5	3.3
			T10	T1	T14	T3	T0	T2	T11	T4	T6
Shannon-Wiener diversity	nt	0.031	2.11	1.82	1.69	1.63	1.58	1.51	1.47	1.46	1.41
			T14	T10	T1	T3	T6	T2	T4	T11	T0
Margalef diversity index	nt	<0.001	2.67	2.51	2.46	2.27	2.09	1.92	1.85	1.84	1.83
			T14	T10	T3	T1	T11	T6	T0	T2	T4
Dominance index	nt	0.109	4.5	3.83	3.42	3.17	3.15	3.04	2.92	2.81	2.73
			T14	T10	T1	T3	T6	T4	T0	T2	T11
Evenness index	nt	0.291	0.77	0.73	0.69	0.66	0.66	0.65	0.64	0.60	0.58
			T14	T4	T6	T10	T2	T0	T1	T3	T11
MACROINVERTEBRATES											
Number of species (spp/trawl)	rank	<0.001	14.6	13.0	12.0	11.9	10.7	8.0	7.2	4.2	3.6
			T11	T6	T3	T10	T1	T14	T2	T0	T4
Total abundance (no./trawl)	log_{10}	<0.001	1115	539	484	203	180	97	56	12	11
			T3	T10	T14	T11	T1	T6	T2	T0	T4
Total biomass (kg/trawl)	rank	<0.001	28.7	16.2	9.8	6.1	3.8	1.4	0.9	0.5	0.5
			T10	T14	T3	T11	T1	T0	T6	T2	T4
Shannon-Wiener diversity	nt	<0.001	1.80	1.74	1.38	1.31	1.19	1.01	0.98	0.74	0.51
			T11	T6	T2	T1	T10	T0	T4	T3	T14
Margalef diversity index	nt	<0.001	2.90	2.77	2.05	1.90	1.85	1.84	1.35	1.27	1.16
			T6	T11	T1	T2	T10	T3	T0	T4	T14
Dominance	log_{10}	<0.001	4.35	4.08	3.04	2.54	2.35	2.29	2.27	1.42	1.00
			T6	T11	T2	T1	T0	T10	T4	T3	T14
Evenness	nt	<0.001	0.77	0.74	0.71	0.68	0.68	0.57	0.48	0.30	0.24
			T4	T0	T2	T11	T6	T1	T10	T3	T14

SOURCE: County Sanitation Districts of Orange County, 1998

The OMP has shown little evidence of outfall effects on demersal fish and macroinvertebrates from the present discharge and those characterizing the discharge since 1985. Therefore, the range of effluent loading during this period is within the capacity of the biota not to be stressed or become degraded. This is in contrast to the 1970s, when mass loading of contaminants clearly affected not only the species composition, but fish were visibly diseased with tumors and fin rot. Again, while these changes are correlated with significant reductions in TSS mass loading, the decreases in contaminants and related toxicity are probably more important (CSDOC 1996a). The predicted change for the Preferred Scenario of only a 2% increase in flow rates and an increase of about 10% for TSS loading represents only minor changes from present conditions and, therefore, will not cause significant impacts to fish and macroinvertebrates.

Alternative Scenarios

Of the five alternative scenarios, Scenarios 4 and 6 will have lowest flow rates due to GWR. TSS mass loading for Scenario 4 is the lowest and less than half of that for the Preferred Scenario and Scenarios 1 and 5. Metal loading increases with the GWR, but organic compounds will be lower. As mentioned before, additional information is needed to evaluate the effects of the GWR. For the scenarios exclusive of the GWR, flow rates will increase by 27%. Scenarios 1 and 5 will have similar TSS loading representing an increase of about 13%, while Scenario 3 represents a 40% reduction in TSS loading. All factors being more or less equal, Scenarios 3 and 4 would produce the least impact, followed by Scenario 6, and Scenarios 1, 2, and 5 would be similar with the largest loading. While there are major differences among the scenarios, all scenarios appear to be in the range where minimal to no significant effect to fish and macroinvertebrates would be predicted.

Optional Discharge Locations

Since there are no or only minimal effects to the fish and macroinvertebrate communities from the present discharge, the use of a new outfall will not cause additional impacts. As pointed out before, the use of a new outfall distributes the mass loading of effluent contaminants over a larger area and, thus, reduces the gradients relative to the existing outfall and thereby reduces observable effects. The redistribution of loading to a large area provides the Districts with the opportunity to operate at higher loadings than presently permitted without causing significant impacts.

78-inch Outfall

The effluent discharged to the 78-inch outfall during an emergency would be of short duration and would entail minor mass loading of TSS, SS, nutrients, metals, and other organic compounds (**Table 5-29**). The Preferred Scenario, as well as Scenarios 4 and 6, those with the GWR, would have the lowest contaminant mass loading. Because of the short duration of the discharge, the small mass loadings, and the greater mixing nearshore from waves, no significant impacts would occur to fish and macroinvertebrate communities for any of the proposed scenarios.

Mitigation

No mitigation required.

PUBLIC HEALTH

Public health concerns in the area of discharge include pathogens in the water and concentrations of pollutants in the tissues of fish and shellfish consumed by humans.

Impact 5-8: Effluent discharge under the six proposed treatment scenarios for the two discharge locations (120-inch and 50:50 split 120-inch and new outfall) would not result in significant impacts to levels of pathogens in nearshore waters used for water-contact activities or where shellfish are harvested. No mitigation is required.

Pathogens

Concentrations of indicator bacteria in the effluent for the existing outfall are 1.3×10^7 most probable number(MPN)/100 ml for total coliforms, 4×10^6 MPN/100 ml for fecal coliforms, and 0.6 plaque forming units (PFU)/10 ml for enteric viruses (**See Appendix E** – data table for Effluent Quality Assumptions). Assuming an average dilution of 180 to 1 (range of 130-200:1), the expected concentration of total coliforms for samples collected in the ZID is 72,222 MPN/100 mL (65,000-100,000 MPN/100 mL). Fecal coliforms are expected to average 22,222 MPN/100mL (range 20,000-30,769 MPN/100 mL), and viruses average 0.0033 PFU/10ml (range 0.003-0.005 PFU/10 mL).

Measured concentrations for fecal coliforms in the receiving waters are much lower. Fecal coliform monitoring data collected by the OMP in offshore receiving waters from 1987 to 1998 showed that most values were <20 MPN/100ml (**Table 5-21**). Fecal coliform levels are greater in waters below the pycnocline compared to waters above and within the pycnocline except in shallow water samples. Values were >1,000 MPN/100ml in 7.2% of farfield samples, 15.7% of nearfield samples, 0.5% of shallow samples, and 19.5% of within ZID samples. Total coliforms and viruses were not measured in the receiving waters during this time frame.

Total coliform monitoring data collected in the surfzone from January 1997 to January 1999 (**Table 5-22**) showed that most values were <20 MPN/100 mL. Total coliforms were >1,000 MPN/100 mL in 6.2% of the samples. These high values are attributable to contamination from runoff and onshore sources and not to the wastewater discharge (CSDOC 1996c). Fecal coliforms and viruses were not measured in the surfzone during this time frame.

The NPDES permit (Order 98-5) issued new criteria for bacteriological objectives and modified the monitoring program to include sampling for total and fecal coliforms and enterococcus in the surfzone and total coliforms and *Escherichia coli* in offshore receiving waters. *Escherichia coli* densities are multiplied by 1.1 and reported as fecal coliform.

Based on the California Ocean Plan and the Santa Ana River Basin Plan, the new permit requires that within the nearshore zone and in the top 10 ft of the offshore zone out to three miles from shore, the following bacteriological objectives, shall be maintained:

1. Samples of water from each sampling station shall have a density of total coliforms <1,000 MPN (most probable number)/100 mL, provided that not more than 20 percent of the samples at any sampling station in any 30-day period exceed 1,000/100 mL and provided further that no single sample when verified by a repeat sample taken within 48 hours shall exceed 10,000 MPN per 100 mL.

This criterion applies to six offshore receiving water stations to a depth of 10 ft, where water-contact activity may occur (McGee, personal communication 1999).

2. The criterion for compliance in waters where shellfish may be harvested for human consumption is that the discharge shall not exceed a median most probable number of total coliforms of 70 per 100 mL and not more than 10 percent of the samples shall exceed 230 MPN per 100 mL.

This criterion applies to the surfzone, where shellfish may be harvested for human consumption (McGee, personal communication 1999).

3. Fecal coliform density, based on a minimum of not less than five samples for any 30-day period, shall not exceed a geometric mean of 200 per 100 mL nor shall more than 10 percent of the total samples during any 60-day period exceed 400 per 100 mL.

This criterion applies to the surfzone and six offshore receiving water stations to a depth of 10 ft (McGee, personal communication 1999).

In addition, if a surfzone station consistently exceeds a coliform objective or exceeds a geometric mean enterococcus density of 24 organisms per 100 mL for a 30-day period or 12 organisms per 100 mL for a six-month period, the Regional Board may require the Districts to conduct or participate in a survey to determine if the discharge is the source of the contamination.

There are no criteria for viruses.

Total coliform data collected in the surfzone from 1996 to 1997 were tested for compliance with the shellfish objective. Due to the important contribution of runoff to bacterial concentrations, rain days were excluded from these evaluations. There were 22 out of 4,221 events (0.5%) when coliform values exceeded the 10% permit limit and 246 out of 5,843 events (4.2%) when the median limit was exceeded (CSDOC 1997). This represents 99.5% and 95.8% overall compliance, respectively. Fecal coliforms were not measured in the surfzone, so a similar evaluation is not possible.

Offshore monitoring stations identified in the new permit were sampled for coliforms beginning July 1998. Concentrations of fecal coliforms in surface, nearshore waters are low and in compliance with the new permit criteria (McGee, personal communication 1999). Elevated concentrations of coliforms were found in deeper waters as has occurred in receiving waters during previous years (CSDOC 1996a).

For the Preferred Scenario, concentrations of pathogens in the effluent are 1.8 x 10^7 MPN/100 mL total coliforms, 6.4 x 10^6 MPN/100mL fecal coliforms, and 0.23 PFU/10 mL viruses (**Tables 5-26 and 5-27**). Assuming an average dilution of 180 to 1 and a worst case dilution of 100 to 1, the expected concentration of total coliforms for samples collected in offshore receiving waters is 100,000 MPN/100 mL (worst case 180,000 MPN/100 mL). This average concentration for total coliforms is at the upper end of the range of expected concentrations for the existing outfall (65,000-100,000 MPN/100 mL). The worst case concentration, based on a dilution of 100 to 1, is greater than the expected range for the existing outfall. Similarly for fecal coliforms, the expected concentration is 35,556 MPN/100 mL (worst case 64,000 MPN/100mL), both of which are above the range of concentrations for the existing discharge. Thus, the wastewater may increase concentrations of total and fecal coliforms in offshore receiving waters near the diffuser, particularly below the pycnocline. Surface waters are expected to move upcoast and not towards shore and, thus, would not impact areas where water-contact activities occur. Similarly, no change is expected at the shoreline, as there is no indication that the wastewater plume affects coliform values at the shoreline. While a low number of exceedances may occur, this number is expected to be similar to existing conditions. Compliance with the District's NPDES permit is expected, and no significant impacts are expected.

Alternative Scenarios

Concentrations of total and fecal coliforms and viruses for Scenarios 1, 3, 4, 5, and 6 are lower than those for the Preferred Scenario (**Tables 5-26 and 5-27**). Concentrations of total and fecal coliforms and viruses for Scenarios 3, 4, and 6 are lower than those for the existing discharge, and concentrations for Scenarios 1 and 5 are the same or lower than for the existing discharge. Thus, concentrations of pathogens for these scenarios would be similar to or less than those for the Preferred Scenario. Compliance with the District's NPDES permit is expected. Impacts would be not significant.

Optional Discharge Locations

A 50:50 split between the existing 120-inch outfall and the new outfall would not affect the concentration of coliforms. The diffuser of the new outfall would be located at the same depth as that of the existing outfall, and close enough to the 120-inch outfall that current patterns are expected to be similar. Contamination of the shoreline due to the wastewater discharge would not be expected to occur; thus, compliance with the District's NPDES permit is expected. Impacts would be not significant.

Mitigation Measures

No mitigation measures are required.

Impact 5-9: Effluent discharge to the 78-inch outfall at a rate of once every three years would result in short term but significant impacts to levels of pathogens in the nearshore waters used for water-contact activities or where shellfish are harvested.

78-inch Outfall

Given the Preferred Scenario, concentrations of coliforms in the effluent for the 78-inch outfall are predicted to be 4.5 x 10^7 MPN/100 mL total coliforms, 6.4 x 10^6 MPN/100mL fecal coliforms and >550 PFU/10 mL viruses (**Tables 5-28 and 5-29**). Scenarios 1, 5, and 6 would have similar concentrations of total coliforms, fecal coliforms, and viruses; Scenarios 3 and 4 would have lower concentrations of all pathogens compared to the Preferred Scenario. A worst-case, 10-hour discharge scenario is expected to result in contamination of nearshore waters for all scenarios. There would be less mixing of waters for the 78-inch outfall than for the 120-inch outfall because the ZID is smaller. Also, the diffuser for the 78-inch outfall is closer to shore, and contamination of shallow nearshore and surfzone waters due to the wastewater discharge is likely. It is expected that samples collected from the surfzone shortly after the emergency discharge through the 78-inch outfall would be out-of-compliance with the District's NPDES criteria, resulting in beach closures. This would be a significant impact for all scenarios.

EIR-Identified Mitigation

Measure 5-9a: Mitigation would involve pathogen reduction of the wastewater prior to discharge to the 78-inch outfall along with beach closure. Pathogen reduction may be accomplished by disinfection, which is not approved by the Regional Water Quality Control Board at the present time, or by microfiltration and other new technologies, in accordance with regulatory requirements.

Significance after Mitigation: Significant, unavoidable.

Impact 5-10: Effluent discharge under the six proposed treatment scenarios and two discharge locations and with the use of the 78-inch outfall at a rate of once every three years would not result in significant impacts to levels of pollutants in fish tissues (tissue burdens). No mitigation is required.

Tissue Burdens

Concentrations of chemical contaminants in tissues of fish and invertebrates reflect exposure conditions and pollution loading in the environment. Biota associated with bottom sedimentary environments can accumulate pollutants by ad/absorption of dissolved pollutant molecules from the water; filtration and/or ingestion of pollutant-containing, suspended-particulate matter or sediment particles and subsequent assimilation into body tissues; and ingestion and assimilation of pollutants from food sources. These mechanisms have the potential to produce biomagnification of pollutants to higher trophic levels, including human beings who consume impacted organisms.

The OMP for 1996-1997 measured concentrations of metals and organic contaminants in the tissues of fish near the outfall and at reference areas (CSDOC 1998). Contaminants were measured in muscle and liver tissues of two demersal flatfish — longfin sanddabs (*Citharichthys xanthostigma*) and hornyhead turbot (*Pleuronichthys verticalis*) — and in the muscle tissue of four hook-and-line-caught species — chub mackerel (*Scomber japonicus*), white croaker (*Genyonemus lineatus*), longfin sanddab, and vermilion *rockfish (Sebastes miniatus*). Tissue contaminants in shellfish were not measured in the 1996-1997 OMP; however, concentrations of priority pollutants in crab muscle tissue were low or nondetectable in long-term monitoring data (CSDOC 1996a).

Muscle and liver tissues of the two flatfish were analyzed for 13 priority pollutant metals. Muscle tissues of longfin sanddabs did not contain measurable concentrations of antimony, beryllium, cadmium, nickel, silver, or thallium, and lead was detected in only one sample. Copper was present at concentrations above the method detection limits in 5 of 11 samples, but the overall range in values was small and did not indicate any spatial pattern related to the outfall. Arsenic, mercury, selenium, and zinc were detected but at relatively uniform concentrations near and away from the outfall. Metal concentrations in muscle tissues of longfin sanddabs from areas near the outfall were considered similar to those in areas away from the influence of the wastewater discharge. Liver tissues samples of the sanddabs did not contain detectable concentrations of antimony, beryllium, chromium, nickel, or thallium. Concentrations of the other eight metals were detectable but at concentrations that were relatively uniform for areas near and away from the outfall. Sanddabs collected near the outfall had slightly higher concentrations of selenium but lower concentrations of arsenic, cadmium, copper, mercury, silver, and zinc in liver tissues. Antimony, beryllium, cadmium, chromium, lead, nickel, silver, and thallium were nondetectable in muscle tissues of hornyhead turbot. Copper and zinc concentrations were comparable for locations near and away from the outfall; selenium was higher near the outfall. Liver tissue was not collected in sufficient quantities to determine spatial effects. Overall, no significant effects from the wastewater discharge on metals concentrations in muscle or liver tissues of these two species were indicated.

The majority of chlorinated pesticides and PCBs measured in longfin sanddab and hornyhead turbot muscle tissues were not detected. However, all samples contained measurable concentrations of DDE, and all but one sample contained measurable concentrations of PCBs. Some liver tissue additionally contained measurable concentrations of other pesticides, including hexachlorocyclohexane isomers, aldrin, endrin, and endosulfan-B. Statistical comparisons of longfin sanddab muscle tissue DDE concentrations indicated no significant differences among the sites, whereas differences in muscle tissue PCB concentrations were statistically significant for areas near and away from the outfall. Compared with average values for contaminants in longfin sanddab liver tissues for other shelf areas, samples contained relatively low concentrations of DDT but high concentrations of PCBs. Differences between sites in hornyhead turbot tissues could not be evaluated statistically because of small sample size. Concentrations of total DDT in the livers of hornyhead turbot from outfall areas were comparable with those reported in other areas. Other comparative data are not available. Although there are higher concentrations of some contaminants, particularly PCBs, in tissues of fish collected near the outfall, the present data are not sufficient to determine whether these differences are related to the discharge, random spatial variability, and/or age-related accumulation.

Volatile and semi-volatile organic compounds in fish tissues were mostly nondetectable. There are no spatial patterns that indicate the wastewater discharge affects concentrations of these compounds in fish tissues. Therefore, these compounds do not appear to constitute a human health concern.

Concentrations of metals measured in muscle tissues of the four hook-and-line-caught species were below analytical detection limits for antimony, beryllium, chromium, nickel, silver, and thallium. Cadmium and lead were detected in half of the samples but at concentrations below the practical quantitation limits. Copper concentrations were below the practical quantitation limits for all species except chub mackerel. Selenium was detected in most samples, although concentrations were below the practical quantitation limits in several samples. Arsenic concentrations in chub mackerel and white croaker were below the practical quantitation limits but were detectable in vermilion rockfish and longfin sanddabs. Mercury and zinc were measurable in all samples. These data indicate some differences among species, such as slightly higher arsenic but lower mercury concentrations in longfin sanddabs and vermilion rockfish compared to those in the other two species. Mercury concentrations in all fish tissue samples were below the Food and Drug Administration Action Limit (1.0 mg/kg).

Muscle tissue from all four species of fish contained DDE, with minor amounts of DDD and DDT in some samples. All but white croaker from one survey also contained trace concentrations of other chlorinated pesticides, including aldrin, dieldrin, endrin, endosulfan-sulfate, hexachlorocyclohexane isomers, and endrin aldehyde. Concentrations of total DDT and total PCBs were below the Food and Drug Administration Action limits (5 mg/kg and 2 mg/kg, respectively).

Most priority pollutant volatile and semi-volatile compounds measured in fish tissues of these four species were nondetectable. Thus, these compounds do not constitute a human health concern.

The monitoring data suggest that the wastewater discharge does not affect metal concentrations in fish near the outfall. Elevated concentrations of PCBs occurred in liver tissues of longfin sanddabs near the outfall, as well as at other locations in the study area. These results suggest that other regional or historical sources of organic contaminants may have contributed to the elevated concentrations measured in some organisms. Contaminant concentrations in edible portions of fish potentially consumed by humans were below respective action limits. The conclusions of the current monitoring year agree with results of previous, long-term monitoring data (CSDOC 1996a).

Compliance criteria state that "the natural taste, odor, and color of fish, shellfish, or other marine resources used for human consumption shall not be altered" (State Water Resources Control Board 1997). No numerical or objective criteria for assessing taste, odor, and color of tissues have been established; however, characteristics of fish used for human consumption did not appear to be altered.

As discussed in Impact 5-6, the Preferred Scenario represents a 65% increase in metal loading compared to that of the present discharge. This increase is within the range of recent (1989/1990) loads. The effluent of the Preferred Scenario is predicted to have levels of pesticides and PCBs that are similar to present levels, which are negligible. Because long-term monitoring results do not indicate any spatial patterns relative to the outfall or any abnormal color or odor in fish collected near the outfall, changes in the effluent associated with the Preferred Scenario are not expected to affect concentrations of contaminants in fish or shellfish tissues. Impacts would be not significant.

Alternative Scenarios

Because long-term monitoring results do not indicate any spatial patterns relative to the outfall or any abnormal color or odor in fish collected near the outfall, changes in the effluent associated with the alternative scenarios are not expected to affect concentrations of contaminants in fish or shellfish tissues. Impacts would be not significant.

78-inch Outfall

Emergency use of the 78-inch outfall would be of short duration and, thus, would have relatively low discharge of contaminants. This short-duration, low-level discharge would not impact tissue burdens in fish or shellfish for any of the scenarios. Impacts would be not significant.

Mitigation Measures

No mitigation measures are required.

CLEAN OUT OF EXISTING OUTFALL

Impact 5-11: Clean out of the existing 120-inch outfall to remove accumulated sediments and debris would move contaminated sediments into the marine environment, which could

result in short-term water quality and sediment impacts affecting marine organisms. Less than significant after mitigation.

Sediments have been identified in the bottom of the existing 120-inch outfall. The District may need to clean out these accumulated sediments sometime in the future. Periodic hydraulic testing has been performed to determine if the outfall's performance is affected by the accumulated sediments, and samples have been collected of the material to determine constituents of concern. At this time, it the District may or may not need to clean out the outfall. If needed, the pipeline clean-out would involve additional testing of sediment material and development of a plan for removal of sediments without impacting water quality or benthic communities. This project would require RWQCB approval.

District-Proposed Mitigation

> **Mitigation 5-11:** If necessary, the District will develop plans to clean out the outfall using appropriate methods approved by the RWQCB to protect water quality in accordance with regulations. The plan will include methods to contain floatables and disperse the sediments so that impacts to benthic communities and water quality are minimized.

Significance After Mitigation: With mitigation, this impact would be less than significant.

NEW OUTFALL CONSTRUCTION

Impact 5-12. Laying pipeline for the new outfall would result in the permanent loss of hundreds of thousands of square feet of soft-bottom, benthic habitat, although this impact is considered not significant. Adjacent communities would be temporarily disrupted by increased sedimentation. Disturbance of bottom sediment may result in the short-term release of contaminants into the water column. Further studies are needed to determine impacts of the potential release of pathogens to areas of water contact. Potentially significant but can be mitigated. The ballast and exposed pipe would provide new, hard-substrate habitat, which is a long-term, beneficial impact.

Construction of the new outfall will cause varying degrees of impacts to the marine environment. These impacts would result from disturbances associated with trenching through the surfzone and subsequently burying the pipeline from the beach to subtidal waters at a depth of 23 ft. Beyond 23 ft, the pipeline will be laid on the sea floor and then ballasted in place with large boulders. This activity will have associated impacts, primarily to the benthic community. If a pull barge is utilized to lay the pipe, setting anchors will also impact the benthic community as well as the surrounding water quality.

Water Quality

Water quality impacts would result primarily from disturbances to the bottom sediments associated with trenching through the surfzone. The trenching activities near shore will cause an increase in turbidity and sedimentation. Disturbing bottom sediments may also release contaminants into the water column. In addition, the suspension of sediments containing organic carbon may increase biological oxygen demand causing a reduction in dissolved oxygen concentrations.

Bottom sediments would also be disturbed further offshore by both laying the pipeline and setting anchors that moor the pull barge. Typically, even properly placed anchors will drag on the sea floor causing the suspension of sediments. Also, the cable to each anchor would rest on the bottom for part of its length, gradually sweeping over the sea floor and disturbing bottom sediments.

All construction-related impacts to water quality would be temporary, occurring only during the construction period. Use of barriers to contain suspended sediments during trenching and pipelaying would reduce the area impacted. These impacts are not significant.

Sediments

As discussed in Impact 5-6 on Sediment Quality, the construction of a new outfall will add considerably to the size of the artificial reef represented by the outfalls. The new, hard-bottom substrate will provide habitat for molluscs and, in turn, add shell material to the sediments. This will result in an increase in the proportion of the large-particle-size fraction of the sediments. This impact is not significant.

Biota

Intertidal

Digging a trench through the intertidal zone, laying pipe, and moving heavy equipment on the beach would destroy invertebrates inhabiting the area along the pipeline route and possibly adjacent areas. At greatest risk are the less mobile organisms such as polychaetes and molluscs residing in the lower intertidal zone, although most invertebrates in the trench area are expected to be destroyed. Sandy intertidal areas are unstable environments subjected to seasonal sand movements and periodic turbidity from natural processes. Organisms inhabiting this environment are adapted to sudden changes and are able to reestablish themselves shortly after disturbances. The sandy intertidal habitat in the area of the new outfall should therefore recover soon after construction is completed. Because of their short duration, these impacts are not significant.

Increased levels of suspended contaminants due to the trenching activities nearshore would result in localized deterioration of water quality. Exposure to contaminants may affect intertidal organisms adjacent to the pipeline route. Increased sedimentation may bury sessile intertidal organisms in surrounding areas. Use of barriers would reduce the area affected. These impacts are not significant.

Plankton

Turbidity generated by the trenching activities nearshore and pipe-laying activities offshore would reduce light availability and, thus, photosynthetic activity of phytoplankton. High turbidity may also interfere with the feeding behavior of zooplankton. These impacts to the plankton would be temporary, occurring only during the construction period. Use of barriers to contain turbidity would reduce the area impacted and minimize impacts. These impacts are not significant.

Benthos

Laying pipeline from the beach to the diffuser would result in the direct loss of hundreds of thousands of square feet of soft-bottom benthic habitat. Most of the benthic organisms residing along the pipeline route would be buried by the pipe or rocks used to ballast the pipe. Setting anchors to moor the pull barge and the sweep of the anchor cables along the sea floor would also destroy benthic organisms. While this loss of benthic organisms is large, the community will recover following completion of construction, and impacts are not significant.

In addition to these direct impacts to the benthos, turbidity generated by the pipe-laying activities could negatively impact filter-feeding organisms by impairing respiration and feeding. If turbidity is severe, suspended sediments may bury sedentary organisms. Benthic organisms may also be adversely affected by increased levels of contaminants released due to the disturbance of bottom sediments. Use of barriers to contain turbidity would reduce the area impacted and minimize impacts. These impacts are not significant.

The ballast and exposed pipe would provide new, hard-substrate habitat, which would increase diversity and productivity. This is a beneficial impact.

Fish

Fish exposed to suspended sediments in the laboratory have been shown to suffer mortality as well as sublethal signs of stress (O' Connor et al. 1977). However, fish have the ability to move and avoid the area in response to sediment turbidity. Adult fish are expected to escape from areas of high turbidity and continue to avoid the area as long as sediment suspension persists. Turbidity associated with construction activities would be temporary and localized and would be unlikely to have any significant impact on fish.

The noise and activity of construction may frighten fish away from the project area. Any departure of fish would be temporary, and fish are expected to return to the area when construction of the outfall ends.

Sedentary, infaunal organisms along the pipeline route would be killed when the pipe is positioned. Since these organisms comprise the food of many demersal fish, fish populations would suffer a loss of some food organisms. However, this loss would likely be minimal and not significant.

The additional hard-bottom habitat created by the new outfall would attract fish and increase diversity. The pipeline and ballasting rocks would serve as shelter for many fish. These fish would forage along the sandy areas bordering the pipeline and return to the structure for protection. The newly-created habitat would be a beneficial impact.

Public Health

Disturbances to bottom sediments during construction may release pathogens into surrounding waters. Use of barriers to contain these sediments would reduce the area impacted; however, waters closest to the pipeline route may contain levels of coliforms that exceed California Ocean Plan criteria. Further studies will be needed to determine levels of coliforms in sediments in the construction area and possible contamination of surrounding waters during construction.

District-Proposed Mitigation

> **Measure 5-12:** The District should conduct additional detailed, site-specific studies for the siting of a new second 120-inch ocean outfall. These studies should clarify the extent of marine resources that would be affected by construction and identify appropriate mitigation measures to minimize the area of disturbance.

Significance After Mitigation: Less Than Significant. Disruption of benthic organisms within the footprint of the new outfall structure is unavoidable, but this is not expected to result in long-term significant impacts to the marine ecology. As discussed, installation of a second outfall would expand the artificial reef structure in the area and increase habitat and species diversity.

CUMULATIVE EFFECTS

Impact 5-13: Increased effluent discharge to the ocean through the existing and/or new 120-inch deep water outfall under any of the six treatment scenarios would contribute to cumulative point and non-point waste discharges into the Southern California Bight region. However, the OCSD's deep water effluent discharge would not be cumulatively considerable or result in a significant impact to water or sediment quality or designated beneficial uses of the marine environment. Less than Significant. Use of the 78-inch outfall for infrequent peak wet weather discharges would contribute to significant cumulative pollutant loads (particularly pathogens) to the nearshore environment during wet weather events. Partially mitigable, but Significant, unavoidable.

Cumulative Effects

Continued discharge by OCSD wastewater effluent to San Pedro Bay is one of several discharges that are occurring on the San Pedro shelf. These discharges include: municipal and industrial outfalls, including Huntington Beach power plant and oil platform process waters and the Los Angeles County Sanitation District's outfall off Whites Point on the Palos Verdes Peninsula; two designated ocean dumping sites; and pollutant loadings from a wide variety of nonpoint sources, rivers, and harbors.

Regional Wastewater Discharges

The JWPCP of Los Angeles County discharges an average of about 350 mgd of treated municipal wastewater through two outfalls at Whites Point. The outfalls are approximately 44 km (27 miles) west and 9 km (6 miles) north of the existing Sanitation District's outfall and at about the same depth. Historically, this outfall region has been shown to have a large area of changed or degraded benthic communities as a result of the discharge of solids and toxics, particularly DDT and its derivatives through the late 1960s. Historical modeling has shown that the JWPCP and Sanitation District's outfalls will have little effect on each other with respect to impact on benthic communities, except for historical DDT contamination near the JWPCP outfall, which contributes to higher DDT levels in benthic fish, which are mobile. The presence of the San Gabriel Canyon between the two wastewater systems further reduces the low probability that contaminated sediments from the two discharges would interact. The JWPCP treatment facilities are being upgraded to provide full secondary treatment for the entire flow by the year 2003 and reclamation/reuse activities continue to expand resulting in improvements in marine water quality in recent years and into the future since flow increases in their service area have not been dramatic.

A sewage outfall pipe discharges approximately 0.50 mgd to San Pedro Channel off Santa Catalina Island. This outfall (City of Avalon) is approximately 46 km (29 miles) southwest of the OCSD outfall. The relatively small volume of this discharge, its distance from the mainland shore, and prevailing currents in the San Pedro Channel are such that this outfall is unlikely to measurably contribute to pollution loading to the San Pedro Basin.

South of the OCSD outfall, an outfall 2,438 m (8,000 feet) offshore of the Aliso Beach Pier discharges some 20 mgd from a full secondary treatment plant that services primarily residential and commercial users.

Five oil production platforms occur in San Pedro Bay off Huntington Beach, and some of these discharge produced waters extracted during extraction operations. Two of these platforms are located within 5 km (3 miles) of shore. The content of produced water varies significantly as a result of the geological formation and treatment method and typically consists of a brine with trace amounts of volatile hydrocarbons, dissolved nonvolatile organics, heavy metals, and various chemicals used to maximize recovery of oil from the produced fluids. NPDES permitting establishes requirements for such discharges. Oil and gas production in the vicinity of the OCSD outfall is not expected to increase in the future due to the difficulty in permitting new extraction facilities and the diminishing yields of existing facilities.

Ocean Dumping Operations

EPA Region 9 has permitted a designated ocean dumping site for dredge spoils disposal near the Newport Submarine Canyon. The designated site is located in 180 m (590 feet) of water approximately 13 km (8 miles) south of the breakwater at San Pedro. This site is approximately 26 km (16 miles) west of the existing OCSD outfall. The amount of dredge spoils that is disposed of at the site has been substantial over time and its use continues. Contaminated spoils material that exceeds criteria established by the U. S. Army Corps of Engineers cannot be disposed of at the site (EPA 1988). Numerical simulations of dredge spoils disposal at the site suggests that silts and clays from the discharge will be diluted to negligible levels within 1.5 km (1 mile) of the discharge point (EPA 1988). Disposal operations at this site have the potential to impact the OCSD outfall area. Diffuse plumes from the OCSD outfall and this ocean disposal site may interact in the deep waters of the San Pedro Basin, but the interaction or cumulative effect is expected to be inconsequential at the concentrations that might remain in these plumes at such distances.

A large-scale dredging program has been underway in Newport Bay. Approximately 2.4 million $yards^3$ of sediment were disposed of at a designated ocean dump site in the Newport Canyon (LA-3) approximately 8 km (5 miles) from shore and 8 km (5 miles) southeast of the OCSD outfall. This volume of solids equals over 100 years of solids discharge from the OCSD outfall.

Non-Point Source Contamination

Major nonpoint sources of pollutants in the San Pedro Bay area include Los Angeles/Long Beach Harbor, surface runoff from storm drains and seasonal riverine discharges from the San Gabriel and Santa Ana Rivers.

The Los Angeles/Long Beach Harbor is a major industrial and commercial area. Chen and Lu (1974) concluded that sediments from the Los Angeles/Long Beach Harbor were an important source of PCBs to the San Pedro Basin. Drake et al. (1985) and Karl et al. (1980) indicate that outflow from the harbor and the Los Angeles River moves south across the San Pedro shelf into deeper water of the San Pedro Basin. The San Gabriel Canyon is likely to serve as a barrier to transport of contaminated sediments southeastward to the area around the Sanitation District's outfall.

The Santa Ana River, when it flows, is a major nonpoint source of pollutants. Monitoring data has shown that pollutants expected to occur in high concentrations in stormwater runoff include fecal coliforms, pesticides and fertilizers typically used on lawns, and heavy metals (particularly copper, zinc and mercury) and organic loading from streets and parking lots (particularly PAHs). The effect of these pollutants is most likely to be apparent near shore.

Limited data on the magnitude or quality of water from nonpoint sources has been compiled, but efforts by the Southern California Coastal Water Research Project are underway to a compile regional inventory on what is known. It is known that the contribution from these sources can be significant for certain pollutants, particularly those associated with automobiles. A comparison of total solids and estimated annual waste loads from the Santa Ana River and urban runoff are compared with that of the OCSD discharge in **Table 5-40**. It is important to note that nonpoint sources in Orange County are generally highly seasonal and associated with storm events. However, the magnitude of waste loads can, on the average, be significant when compared to treated wastewater impacts which occur continuously. Also, their impacts occur in urban surface water areas (or flood control channels), marine waters (particularly the surf zone in the case of the Santa Ana River), or the storm drainage system.

Marinas and pleasure boats have continued to become less and less of a potential nonpoint sources of fecal coliforms (from human waste) and oil and grease (with the advent of four stroke engines) as a result of enactment of increasingly stringent laws to control such sources. High fecal coliform counts in marine waters are often found near areas heavily used by marine birds and marine mammals. Effects from these sources, particularly sanitation devices on pleasure boats, are expected to be minor throughout the region.

Cumulative Impact on Assimilative Capacity

Cumulative nutrient loadings from various sources are not likely to result in any adverse environmental effect in the San Pedro Basin or San Pedro Shelf because the levels are so low on a regional level as to be easily assimilated into phytoplankton production. No red tide conditions have been associated with discharge of point or non-point pollutant loadings to date. Problems from nutrient loading are expected only in confined water areas with poor circulation, or if the volume of effluent to receiving water is relatively high. This is not the condition at the OCSD outfall or any other discharge as a result of stringent pollution control regulations and permitting.

Cumulative loading of heavy metals and synthetic organic compounds such as PCB, DDT, and chlorinated hydrocarbons have historically been of some concern because these had build up in sediments to levels where adverse effects are noticed. The evidence of over the past 14 years of monitoring around the OCSD outfall indicates that levels of contamination by metals and toxic organics in the sediments have dropped as mass loadings from the outfall have dropped. These data are consistent with oceanographic data, which suggests that episodic storm events may transport contaminated sediments along the isobath until they reach submarine canyons, which then serve as conduits for eventual deposition in deep regions of the San Pedro Basin. Thus, the cumulative effect of pollutant discharge of heavy metals and contaminated sediments eventually may be most noticeable in the deep parts of the San Pedro Basin.

The capacity of San Pedro Bay to assimilate the cumulative pollutant load from discharges is not easily calculated. Large-scale, long-term environmental monitoring programs are being implemented as part of the regional wastewater discharges and ocean dumping programs and, these programs are be able to detect adverse environmental conditions and monitor trends in contaminant levels. To date, the data indicate that water quality and sediment conditions in San Pedro Bay have been improving over the past 15 years, and that the incidence of pollutant-related diseases in fish and shellfish have declined to background conditions.

TABLE 5-39
COMPARISONS OF FLOW AND CONSTITUENT MASS EMISSIONS FROM WASTEWATER DISCHARGES AND RIVER DISCHARGES

	Total Wastewater Discharges[a] (1997)	District's Wastewater Discharge (1998)	Annual Average Santa Ana River Discharge[b] (1988-1995)
Flow Volume (MGD)	1,136	255	243
TSS (lbs/day)	448,760	106,219	--
Silver (lbs/day)	33.9	4.2	--
Cadmium (lbs/day)	2.2	0.9	0.3
Chromium (lbs/day)	25.7	12.8	0.3
Copper (lbs/day)	356	78.8	5.4
Mercury (lbs/day)	0.18	--	0.1
Nickel (lbs/day)	213.6	46.9	--
Lead (lbs/day)	3.4	4.2	0.7
Zinc (lbs/day)	492	85.2	31.2
tDDT (lbs/day)	0.01	--	--

[a] = Data from SCCWRP (1999) unpublished for combined emissions from the four major wastewater discharges.

[b] = Data from SCCWRP (1992); values based on averages of low- and high-flow conditions.

-- = No data

MGD = Million gallons per day

tDDT = Total DDT

SOURCE: County Sanitation Districts of Orange County, *Mitigation Measures*

Measure 5-13: To mitigate the cumulative contribution from use of the 78-inchg outfall, the District will implement Mitigation Measure 5-9, above to provide additional pathogen reduction as allowed and/or required by the RWQCB.

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