EXECUTIVE SUMMARY

The Santa Monica Bay receiving water monitoring program is promulgated under NPDES Permit No. CA0109991, Waste Discharge Requirements Order No. 94-021 for the Hyperion Treatment Plant (HTP), City of Los Angeles. The HTP NPDES Permit was adopted on May 11, 1994 by the Regional Water Quality Control Board (Regional Board), Los Angeles, and issued jointly with the Regional Administrator, United States Environmental Protection Agency, Region IX (USEPA), San Francisco. Under this permit, extensive monitoring of effluent quality, microbiology, ambient water quality, benthic sediments and macrofauna, demersal fish and invertebrates, and priority pollutant tissue concentrations of trawled organisms and sportfish through focused monitoring is required to determine impacts, if any, from the HTP treated effluent discharged into Santa Monica Bay. This biennial assessment report contains Santa Monica Bay monitoring data collected during the period from January 2003 through December 2004. The Regional Board and USEPA suspended some elements of HTP's routine monitoring program in 2003 to offset the City of Los Angeles' participation efforts for the Southern California Bight 2003 Regional Monitoring Survey (Bight'03). The annual summary of effluent and receiving water data is reported separately to the Regional Board and USEPA.

On November 23, 1998, a full secondary treatment process was implemented at HTP thereby significantly improving the quality of the treated wastewater being discharged into the marine environment. The full secondary process was augmented in calendar years 1999–2000 with additional pure oxygen activated sludge modules, secondary clarifiers, and egg-shaped digesters to achieve a very high quality effluent. During the period from January 2003 through December 2004, HTP discharged an average of 317 MGD of treated wastewater into Santa Monica Bay through Serial Discharge Port No. 002 (5-Mile Outfall).

This report provides an assessment of HTP's secondary-treated effluent and its impact on water quality, benthic invertebrates and fishes, and on contaminant levels in the sediment and sport fish in Santa Monica Bay. A modified benthic sampling program was submitted and accepted by the RWQCB in December 1998 and implemented in January 1999. This sampling program modified the former sampling grid to create a combination fixed-station and random-station array in order to more effectively assess any effects from HTP's secondary-treated discharge on Santa Monica Bay. This modified program continued to be employed during the period reported here.

Bacterial concentrations within the Bay, including the shallow waters along its beaches, also were examined to assess the impact of the HTP discharge. Past studies have indicated water quality along the Santa Monica Bay shoreline to be impacted primarily by nonpoint urban runoff sources and not the Hyperion discharge. As a result, the shoreline

stations were re-positioned nearer to storm drains in 1995, so as to monitor the stormwater runoff. In December 2001, the shoreline monitoring program was placed in the Los Angeles County Municipal Stormwater Separate Sewer System (MS4) permit. Both a dry- and a wet-weather TMDL (Total Maximum Daily Load), addressing impairment of Santa Monica Bay Beaches due to bacteria, became effective July 15, 2003. These TMDLs required development of a Coordinated Shoreline Monitoring Plan for Santa Monica Bay Beaches. This was developed and submitted to the Regional Board in April 2004. This plan required sampling points to be located at point zero, which is the point where the flow from the storm drain reaches the surf. Several stations reported herein were relocated to point zero on November 1, 2004.

Effluent Quality

Completion of Hyperion Treatment Plant's secondary treatment expansion and the subsequent discharge of fully secondary-treated effluent beginning in November 1998 resulted in a marked and immediate improvement of the quality of effluent discharged into Santa Monica Bay; this "high quality treatment" continued through this reporting period. The efficient removal of solids from wastewater has resulted in fewer solids and associated pollutants being discharged. During 2003–2004, removal efficiencies were still high with little change from the previous reporting period (2001-2002). The removal of most constituents remained about the same. In 2003 there was a one-time permit exceedence in the effluent settleable solids that was remediated within hours. Due to a mechanical failure during a routine test of the One-Mile gates in March 2004, approximately 100,000 gallons of unchlorinated secondary effluent was discharged through the One-Mile Outfall. All other permit limits were met and in many cases surpassed for the remaining effluent monitoring constituents during this reporting period, extending from January 2003 to December 2004.

Microbiology Water Quality – Shoreline and Inshore

The development of dry- and wet-weather TMDLs for bacteria at Santa Monica Bay Beaches impacted our shoreline monitoring program. On November 1, 2004 most stations were relocated a distance of 50 yards to site them at point zero. More changes will be implemented in 2005. Most, including removal of the shoreline monitoring requirement from HTP's NPDES Permit, have already been implemented. These changes result from the recognition that storm drains, and not the Hyperion discharge, are the major source of bacteria, and presumably pathogens, to the Santa Monica Bay beaches. The new monitoring program is documented in a Coordinated Shoreline Monitoring Plan that was approved by the Regional Board April 28, 2004.

The Hyperion Treatment Plant effluent has never been observed to impact water quality of the shoreline or inshore stations of Santa Monica Bay. Bacterial standards at shoreline stations during 2003-2004 were most often exceeded at Stations S01 (Surfrider Beach), S04 (Santa Monica Storm Drain), S06 (Santa Monica Storm Drain), S09 (Mother's Beach, Marina Del Rey), S10 (adjacent to Ballona Creek), S11 (Culver Blvd, Playa Del Rey), S16 (Redondo Beach Pier), and S17 (Ave I, Redondo Beach). The fewest exceedances were at stations S13 (40th Street, Manhattan Beach), S14 (Manhattan Beach Pier), S15 (Hermosa Beach Pier), and S18 (Malaga Cove). The sites with the fewest exceedances are all in the southern portion of the Bay. Those with the greatest number of exceedances tend to be stations adjacent to a flowing storm drain and/or a heavily used pier. Noticeably higher bacterial concentrations were detected at two inshore stations, IS08 and IS11 (off Ballona Creek and in King Harbor, respectively). These elevated concentrations appear to be related to local influences rather than to the Hyperion Treatment Plant discharge.

Generally, higher bacterial concentrations were found at the point zero stations (those located at

the point where the flow from the storm drain reaches the surf) than at stations 50 yards away. Since sampling sites were relocated to point zero on November 1, 2004, only two month's data exist for point zero. The validity of this observation of higher bacterial concentrations at point zero will become clearer in the future as more point zero samples are collected. It is, however, an expected result if the storm drains are the major sources of bacteria. The highest bacteria concentrations typically occur during or following rain events, providing additional evidence that storm drains are the major source of bacteria. The growing evidence of storm drains as the major source of bacteria to Santa Monica Bay beaches, along with the generally low bacterial concentrations at inshore stations, lends additional credibility to the conclusion that the HTP discharge makes little or no contribution to bacterial levels at these beaches.

Following conversion to full secondary treatment in November 1998, the HTP effluent has shown a substantial improvement and reduction in its bacterial levels. Additionally, the number of floatable materials such as plastic and rubber goods, which often originate from HTP, has declined from previous years as a result of the revamp in the treatment process. This pattern continued during this reporting period.

Water Quality – Offshore

All Santa Monica Bay water quality objectives provided in HTP's 1994 NPDES Permit were met during 2003-2004. Materials of sewage origin were not observed during any of the water quality surveys. The wastewater field was identified during most surveys for this reporting period, January 2003 through December 2004. When stratified oceanic conditions were present, the wastewater field remained submerged, moved in variable directions, and generally was detected within 2 km of the outfall although it could be detected at distances up to 5.8 km. The addition of new sensors for chlorophyll and colored dissolved organic material (CDOM) enable better distinction between particulate matter that can be attributed to the discharged wastewater and those that can be attributed to natural production (i.e., phytoplankton). This will allow an investigation of potential impacts of the wastewater field on primary production.

Sediment Chemistry

The sediment chemistry program provides an assessment of the accumulation of metals and organic pollutants in the vicinity of HTP's 5-Mile Outfall in Santa Monica Bay. The City's Environmental Monitoring Division (EMD) participated in the Bight 2003 Regional Monitoring Survey (Bight '03) during the summer of 2003. Participation in this effort led to most regularly scheduled NPDES compliance stations being substituted for stations selected for the Bight '03 survey. Only five stations from the existing program were sampled in 2003. The sediment samples were collected from all 44 NPDES stations during summer of 2004.

Fine-grained sediments were found in the northwest part of the Bay along the Malibu shelf at stations B3, C1, and E1 and graded to muddy sands in the central and southern portions of the Bay. Sulfide was detected at one of the five stations in 2003 and 34 out of 44 stations in 2004. Cyanide was detected in only one station during 2003 and six stations in 2004.

All nine metal pollutants were detected at all sampling sites during 2003 and 2004. Their maximum concentrations were measured at station E6 (in the vicinity of the 7-Mile Outfall). Four Base Neutral Acid (BNA) compounds were detected in 2003, and seven were detected in 2004. Three pesticides and two PCBs were detected during 2003 and 2004, and their detected levels were higher in 2003.

The fraction of silt and clay in sediments generally increased with sampling site depth; pollutants did not exhibit similar distributions. Metal pollutants, which could be introduced into the Bay from aerial fallout and storm drains, were most concentrated

near the 7-Mile and 5-Mile Outfalls. Derivatives of DDT and PCBs, conversely, were more concentrated in the southern region of the Bay near the Palos Verdes Shelf.

To assess the biological impact of bulk sediment contamination in Santa Monica Bay, the concentrations of metal and organic pollutants were compared with their Effective Range-Low (ER-L) and Effective Range-Median (ER-M) values. During 2003, most metal pollutants at all five Santa Monica Bay stations were below their ER-M values, but exceeded their ER-L values. All metals at all 44 stations were below their ER-M values during 2004. The average concentration of total DDT in the Bay exceeded its ER-L, but was below its ER-M value; whereas, the average concentration of total PCB was below both ER-L and ER-M values.

Macrofaunal Assemblages

Several analytical techniques were employed to assess the benthic macrofaunal data, each contributing to the understanding of macrofaunal community structure in Santa Monica Bay. Community indices form the starting point from which gross community characteristics are identified and/or graphed, whereas cladistic or parsimony analyses with subsequent multivariate ordinations provide a means to discern station relationships and community characteristics within the various areas of the Bay and over time.

The vast array of community indices generally showed similar patterns when mapped back on the cladograms or onto the ordinations. Total phylogenetic diversity appeared to map the closest. Other measures (such as the BRI, H', d) also showed close concordance with the cladograms. Quantitative taxonomic diversity, which is not sample size dependent reached similar values very early in the historic trending of the outfall samples suggesting saturation with higher taxa in the community can occur very rapidly.

Species numbers continue to increase since Hyperion Treatment Plant went to full secondary treatment, with the highest number of taxa (148) in our sampling array now being found at the 5-Mile Outfall station, Z2. Both parsimony analyses from 2003 and 2004 indicate the spatial extent of impact (outfall footprint) continues to decline with improved treatment, as the 5-Mile Outfall stations, Z1 and Z2, formed small clades, or groups (NMDS plots) with their immediate station neighbors NA2, NA3, and NB3.

Historical trending of the 5-Mile Outfall stations Z1 and Z2 from the parsimony analyses shows a stunning change in community structure over time associated with improved treatment process. Independent mapping of mass-emission data from 1983 through 2004, community indices, pollution-tolerant, and pollution-sensitive species, all produced near perfect maps or distribution patterns explaining macrofaunal community patterns. A subset of the macrofauna, namely, the pollution-sensitive Peracarida, was analyzed via parsimony and EPCA as a multivariate in-situ indicator. The pattern was similar, with pollution-sensitive species now recolonizing the area after full secondary treatment went into affect. Almost all of the single occurrences from the peracarid and macrofauna data sets were restricted to the 1999-2004 clade of the respective cladograms, underscoring the lack of randomness in the distribution of rare species, and their value in bio-monitoring.

These data and analyses strongly suggest the 5-Mile Outfall area is well on its way to recovery.

Trawled Organisms

The trawl-caught fish and epibenthic megainvertebrate community during the 2003-2004 sampling period was analyzed using the same broad range of analytical techniques to assess community structure in Santa Monica Bay as was employed for the macrofaunal analyses. An analysis of the trawl-caught organism community (megainvertebrates and fish) at the 5-Mile Outfall

station, Z2, over time from 1983 through 2004 was conducted also.

The analyses demonstrate that there have been noticeably more taxa added to Station Z2 collections since 1999 than to collections at other Santa Monica Bay stations of similar depth and substrate during that time period. This increase, coinciding with the massive plant operational upgrade completed in 1998, is a strong signal suggesting a profound positive effect of the treatment upgrade upon the trawl community at Z2. Furthermore, most of the added taxa are common elsewhere in Santa Monica Bay and have occurred throughout the 21-year sample collection span analyzed here, but not at Z2 until recently.

The 1983 through 2004 Z2 temporal analyses show a striking pattern between the pre- and post-full secondary treatment sampling event subsets. Over time, one can see the early, general temporal alliance becoming more refined with diversity of the trawl-caught community increasing after Hyperion Treatment Plant implemented full secondary treatment.

Tissue Chemistry

Analyses of chemical contaminants in the tissues of selected trawled fish and invertebrates, and rig-caught sportfish is required under HTP's NPDES Permit. The trawled organisms are closely associated with the sea bottom throughout much of their lives. Thus, they are more likely to bioaccumulate pollutants from contaminated sediments and potential bottom-dwelling prey compared to organisms living higher in the water column. The analysis of pollutants in rig-caught fish are of considerable interest to the public, as fishermen also seek these species.

Thirteen samples of hornyhead turbot were analyzed in 2003 and sixteen in 2004. Analyses were conducted on both muscle and liver tissues. Cyanide was detected in 53.8% of muscle tissue in 2003, but was not detected in 2004. Cyanide was detected in 30.8% of the liver tissue samples in 2003, but only in 12.5% in 2004. Five metals (arsenic, copper, mercury, lead, and zinc) were detected in muscle samples during 2003. All nine monitored metals were detected in every muscle tissue sample in 2004 and in every liver sample during both years. Among the detected metal pollutants, zinc and arsenic generally had the highest concentrations; the arsenic levels were generally higher than zinc in 2003, but the levels of zinc was the highest in 2004. p,p'-DDE and PCB 1260 were the most frequently detected organic pollutants in both muscle and liver samples during both years. Total DDT concentrations in both muscle and liver tissue were highest in fish collected from station C9a followed by station Z2 during both years. Conversely, total PCB levels were highest in fish tissues from station Z2 followed by station C9a in both years.

The California scorpionfish was the numerically dominant sportfish collected in both years. In tissues from these fishes, arsenic, copper, mercury, and zinc were the most frequently detected of the nine monitored metals. The most frequently detected pesticides and PCBs were p,p'-DDD, o,p'-DDE, p,p'-DDE, and PCB 1260. For BNA compounds, isophorone, ethylphthalate, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, and di-n-octylphthalate were detected more frequently.

The organic pollutants of greatest concern are the chlorinated hydrocarbons, mainly, DDTs and PCBs. In the 2003 survey, five sportfish species, California scorpionfish, copper rockfish, bocaccio, starry rockfish, and brown rockfish, had average concentrations of DDT derivatives greater than 0.1 mg/kg, the standard limit used by the California Office of Environmental Health Hazard Assessment (OEHHA). In 2004, only California scorpionfish, copper rockfish, and starry rockfish contained average concentrations of DDT derivatives greater than 0.1 mg/kg. None of the 12 sportfish species collected in 2003 and 2004 had PCB average levels greater than 0.1 mg/kg.

The tissue concentrations of metals, particularly mercury also are a public health concern.

Although mercury was detected in all sportfish tissue sampled in 2003 and 2004, the mercury concentrations in all samples were well below the FDA action level (1.0 mg/kg). The average concentrations of all detected metals in the muscle tissues of hornyhead turbot or individual species of sportfish surveyed in 2003 and 2004, were below the International Action Limit Median values.