Executive Summary

The City of San Diego (City) conducts extensive ocean monitoring to evaluate potential environmental effects from the discharge of treated wastewater to the Pacific Ocean via the Point Loma Ocean Outfall (PLOO). The data collected are used to determine compliance with receiving water conditions as specified in the National Pollution Discharge Elimination System (NPDES) permit for the City's Point Loma Wastewater Treatment Plant (PLWTP).

The primary objectives of the Point Loma ocean monitoring program are to a) measure compliance with NPDES permit requirements and 2001 California Ocean Plan (Ocean Plan) standards, and b) assess any impact of wastewater discharged through the outfall on the local marine environment, including effects on water quality, sediment conditions, and marine organisms. The study area encompasses approximately 184 km^2 of coastal waters centered around the PLOO discharge site, which is located approximately 7.2 km offshore of the PLWTP at a depth of nearly 100 m. Shoreline monitoring extends from Mission Beach southward to the tip of Point Loma, while regular offshore monitoring occurs in an adjacent area at sites ranging from about 9 to 116 m in depth.

The City conducts other types of studies in addition to its regular monitoring for Point Loma that are useful for evaluating patterns and trends over time or that span broader geographic regions, thus providing additional information to help distinguish reference areas from sites that may be affected by anthropogenic influences. For example, prior to the initiation of wastewater discharge at the present deepwater location in late 1993, the City conducted a 2½-year baseline study designed to characterize background environmental conditions in the Point Loma region. Additionally, a broader geographic survey of benthic conditions is typically conducted during the summer each year at sites ranging from northern San Diego County (around La Jolla–Del Mar) south to the U.S./Mexico international border as part of the monitoring program for the South Bay Ocean Outfall. Results of the 2009 regional survey are included in the annual receiving waters monitoring report for the South Bay outfall region. The City also collaborates with other organizations on larger-scale, regional monitoring projects that span the entire Southern California Bight (SCB). These bight-wide surveys include the original pilot project in 1994, and subsequent Bight'98, Bight'03, and Bight'08 projects (see Chapter 1).

The receiving waters monitoring activities for the Point Loma region are separated into several major components, which are organized into seven chapters in this report. Chapter 1 presents a general introduction and overview of the Point Loma ocean monitoring program, as well as background information on wastewater treatment processes at the PLWTP, including the initiation of chlorination in late 2008. In Chapter 2, data regarding various physical and chemical parameters are evaluated to characterize oceanographic conditions and water mass transport potential for the region. Chapter 3 presents the results of water quality monitoring conducted along the shore and in local coastal waters, including measurements of fecal indicator bacteria (FIB) to determine compliance with Ocean Plan water-contact standards. Assessments of benthic sediment quality and the status of soft-bottom macrobenthic invertebrate communities are presented in Chapters 4 and 5, respectively. Chapter 6 presents the results of trawling activities designed to monitor communities of demersal (bottom dwelling) fishes and megabenthic invertebrates. Bioaccumulation assessments to determine if contaminants are present in the tissues of local fishes captured via trawls or by hook and line are presented in Chapter 7. In addition to the above activities, the City supports other projects relevant to assessing the quality of ocean waters in the region. One such project involves aerial and satellite imaging studies of the San Diego/Tijuana coastal regions. The results of these remote sensing efforts conducted during 2009 are incorporated herein into discussions and interpretations of oceanographic and water quality conditions (see Chapters 2 and 3).

This report focuses on the results and conclusions of all ocean monitoring activities conducted in the Point Loma region from January 2009 through December 2009. An overview and summary of the main findings for each of the major components of the program are included below.

Oceanographic Conditions

The Point Loma outfall region was characterized by relatively normal oceanographic conditions in 2009 that were typical of previous years. This included seasonal patterns such as coastal upwelling with corresponding phytoplankton blooms in the spring, maximum stratification (layering) of the water column in mid-summer, and reduced stratification during the winter and fall. Although some differences in salinity, dissolved oxygen, pH, and transmissivity were observed close to the discharge site, it was also clear that variation among stations was small and restricted to a highly localized area around the outfall. Remote sensing observations revealed no evidence of the wastewater plume reaching near-surface waters, even during the winter and fall when the water column was only weakly stratified. This is consistent with results from the bacteriological surveys (see below). Overall, the observed variations in ocean conditions in 2009 were consistent with expectations due to typical seasonal cycles, as well as with changes in larger patterns reported for the California Current System. Together, this suggests that other factors such as the upwelling of cool, nutrient-rich deep waters during the spring months, the occurrence of associated plankton blooms, and the effects of large-scale oceanographic events may best explain most of the temporal and spatial variability observed in the region.

Water Quality

There was no evidence that wastewater discharged to the ocean via the PLOO reached surface or near-shore recreational waters in 2009. For example, the wastewater plume was not detected in any aerial or satellite imagery taken during the year. Although elevated counts for fecal indicator bacteria (FIB) such as total coliforms, fecal coliforms and/or enterococcus were occasionally detected along the shore and at a few nearshore stations, concentrations of these bacteria tended to be relatively low overall. In general, elevated FIB densities were limited to instances when contamination was most likely associated with rainfall (i.e., storms), wildlife, heavy recreational use, or decaying plant material (e.g., kelp and seagrass). The elevated FIB counts that could likely be attributable to wastewater discharge were limited to offshore waters at depths of 60 m or below. This finding supports previous water quality analyses for the region, which have indicated that the PLOO wastefield typically remains offshore and submerged in deep waters.

Compliance with the 2001 California Ocean Plan water contact standards was very high in 2009. For example, all of the kelp stations and six of the eight shore stations off Point Loma were in complete compliance with all four of the Ocean Plan standards throughout the year. The few exceedances that occurred during the year at shore stations D8 and D11 generally reflected trends in elevated bacterial levels between the months of January–March and in December when rainfall was greatest.

Sediment Conditions

Ocean sediments at stations surrounding the PLOO in 2009 were comprised primarily of fine sands and coarse silt, which is similar to patterns seen in previous years. Differences in the particle size composition of Point Loma sediments are likely affected by both anthropogenic and natural influences, including outfall construction materials, offshore disposal of dredged materials, multiple geological origins of different sediment types, and recent deposits of detrital materials. There was no evident relationship between sediment composition and proximity to the outfall discharge site.

Overall, sediment quality at the PLOO monitoring sites was similar in 2009 to previous years, and there were few clear patterns in contaminant accumulation relative to the discharge site. The only exceptions were slightly elevated sulfide and

BOD levels at a few stations located within about 300 m of the outfall. Sediment concentrations of the various trace meals, organic loading indicators, pesticides (e.g., DDT), PCBs and PAHs remained within the typical range of variability for San Diego and other coastal areas of southern California. The potential for degradation by any of the detected chemical contaminants was further evaluated by using the Effects Range Low (ERL) and Effects Range Median (ERM) sediment quality guidelines as benchmarks. None of the contaminants detected in 2009 exceeded either their ERL or ERM. Additionally, the highest concentrations of several contaminants occurred at sites relatively distant from the outfall. For example, concentrations of several organic indicators and metals were highest in sediments from the northern-most stations. In contrast, several pesticides, PCBs, and PAHs were detected mostly in sediments from stations located south of the outfall. This latter pattern is consistent with other studies that have suggested that sediment contamination at these and other southern stations off San Diego is most likely due to misplaced deposits (short dumps) of sediments originally destined for the LA-5 dredged materials disposal site.

Macrobenthic Communities

Benthic macrofaunal communities surrounding the PLOO in 2009 were dominated by ophiuroid-polychaete based assemblages, with few major changes having occurred since monitoring began in 1991. Polychaete worms and ophiuroids (brittle stars) were the most abundant and diverse taxa in the region. Although many of the assemblages present during the year were dominated by similar species, the relative abundance of these species varied among sites. The brittle star *Amphiodia urtica* was the most abundant and widespread species in the region, while the bivalve *Axinopsida serricata* was the second most widespread benthic invertebrate. Overall, these assemblages were typical of those occurring in other mid-depth areas of the SCB with similar, relatively fine sediment habitats.

Benthic conditions off Point Loma did reflect some changes in 2009 that may be expected near large ocean outfalls, although these effects were restricted to a relatively small, localized region within about 300 m of the outfall diffuser legs. For example, some descriptors of benthic community structure (e.g., infaunal abundance, species diversity) or populations of indicator species (e.g., *A. urtica*) have shown small changes over time between reference areas and sites located nearest the outfall. However, results for the benthic response index (BRI) were characteristic of undisturbed sediments. In addition, changes in macrofaunal community structure that did occur during the year were similar in magnitude to those that have occurred previously and elsewhere off southern California. Overall, macrofaunal assemblages in the region remain similar to those observed prior to wastewater discharge and to natural indigenous communities characteristic of similar habitats on the southern California continental shelf. There was no evidence that wastewater discharge has caused degradation of the marine benthos in the PLOO monitoring region.

Demersal Fishes and Megabenthic Invertebrates

Pacific sanddabs continued to dominate fish assemblages surrounding the PLOO during 2009 as they have for many years. This species occurred at all stations and accounted for 50% of the total fish catch. Other characteristic, but less abundant fish included halfbanded rockfish, Dover sole, longspine combfish, shortspine combfish, plainfin midshipman, California lizardfish, English sole, and pink seaperch. Although the overall composition and structure of the local fish assemblages varied among stations, most differences were due to fluctuations in Pacific sanddab populations.

Assemblages of relatively large (megabenthic) trawl-caught invertebrates in the region were similarly dominated by a single species, the white sea urchin *Lytechinus pictus*. Consequently, variations in megabenthic community structure off Point Loma generally reflect changes in the abundance of this urchin, as well as other common species such as the sea pen *Acanthoptilum* sp, the sea stars *Astropecten verrilli* and *Luidia foliolata*,

the sea cucumber *Parastichopus californicus*, and the brittle star *Ophiura luetkenii*.

Overall, the 2009 trawl survey results indicate that trawl-caught fish and invertebrate communities in the region are unaffected by wastewater discharge. Although highly variable, patterns in the abundance and distribution of these organisms were similar at stations located near the outfall and farther away, suggesting a lack of significant anthropogenic influence. Instead, changes in these communities appear to be more likely due to natural factors such as seasonal water temperature fluctuations or large-scale oceanographic events (e.g., El Niño), as well as the mobile nature of many species.

The types and frequencies of external health problems for fish can be important indicators of environmental impact. Examinations of trawl-caught fish for evidence of disease (e.g., tumors, fin erosion, skin lesions) or the presence of ectoparasites showed that local fish populations remain healthy. For example, external parasites and other external abnormalities occurred in less than 2% of the fish collected in the Point Loma region during 2009. Overall, these results were consistent with findings from previous years and provided no indication of outfall effects.

Contaminants in Fish Tissues

There was no clear evidence to suggest that tissue contaminant loads in fish captured at the PLOO monitoring sites were affected by the discharge of wastewater in 2009. Although several metals, two pesticides, and various PCB congeners were detected in liver tissues from flatfish and muscle tissues from rockfish sampled in the region, these contaminants were found in fishes distributed widely among stations and showed no patterns that could be attributed to wastewater discharge. Further, all contaminant values were within the range of those reported previously for southern California fishes. Finally, while some muscle tissue samples from sport fish collected off Point Loma had arsenic and selenium concentrations above the median international standard for shellfish, and some samples had mercury and PCB levels that exceeded OEHHA fish contaminant goals, concentrations of mercury and DDT were still below U.S. FDA human consumption limits.

The occurrence of both trace metals and chlorinated hydrocarbons in the tissues of Point Loma fishes may be due to many factors, including the widespread distribution of many contaminants in coastal sediments off southern California. Other factors that affect the bioaccumulation and distribution of contaminants in local fishes include the different physiologies and life history traits of various species. Exposure to contaminants can vary greatly between species and even among individuals of the same species depending on migration habits. For example, fish may be exposed to pollutants in a highly contaminated area and then move into a region that is less contaminated. This is of particular concern for fishes collected in the vicinity of the PLOO, as there are many other point and non-point sources in the region that may contribute to contamination.

Conclusions

The findings and conclusions for the 2009 ocean monitoring effort for the Point Loma outfall region were consistent with previous years. Overall, there were limited impacts to local receiving waters, benthic sediments, and marine invertebrate and fish communities. There was no evidence that the PLOO wastefield reached surface waters or nearshore recreational areas during the year. Although elevated bacterial levels did occur along the shore and at various kelp bed sites, such instances were largely associated with higher rainfall during the wet season and not to shoreward transport of the wastewater plume. There were also no outfall related patterns in sediment contaminant distributions, or in differences between the various macrobenthic invertebrate and fish assemblages. The general lack of disease symptoms in local fish populations, as well as the low level of contaminants detected in fish tissues, was also indicative of a healthy marine environment. Finally, benthic habitats in the region remain in good condition similar to much of the Southern California Bight mainland shelf.