EXECUTIVE SUMMARY

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The Orange County Sanitation District (District) conducts extensive ocean monitoring to evaluate potential environmental and public health effects from its discharge of highly treated wastewater off of Huntington Beach and Newport Beach, California. The effluent is released over 7 km offshore in 60 m of water. The data collected are used to determine compliance with receiving water conditions as specified in the District's National Pollution Discharge Elimination System (NPDES) permit (R8-2012-0035, CA0110604), jointly issued in 2012 by the U.S. Environmental Protection Agency, Region IX (EPA) and the Regional Water Quality Control Board, Region 8 (RWQCB). This report focuses on monitoring results and conclusions from July 2012 through June 2013.

Results showed that ocean depth is the primary determinant of the distribution of organisms within the monitoring area. While minor changes in receiving water and sediment characteristics were identified near the outfall, these changes were typically small and not suggestive of causing adverse effects on biota. Biological communities beyond the zone of initial dilution (ZID) were generally healthy, diverse, and comparable to those occurring under similar environmental conditions throughout the Southern California Bight (SCB).

WATER QUALITY

Minor changes in measured water quality parameters related to the discharge of wastewater to the coastal ocean were measured. Plume-related changes in temperature, salinity, dissolved oxygen (DO), pH, and transmissivity were measurable beyond the initial mixing zone during some surveys, but usually extended only a few kilometers away from the outfall. Results were consistent with previous findings and none of these changes were determined to be environmentally significant since they fell within natural ranges to which marine organisms are exposed and overall compliance with California Ocean Plan (COP) criteria remained high (98–100%, Chapter 2).

The spatial extent of the wastewater plume was apparent in subsurface patterns of salinity and colored dissolved organic matter (CDOM) with changes occurring near the outfall during most surveys, but primarily below 15 m water depth. In contrast, levels and patterns in DO, pH, and light transmission primarily responded to natural processes. One exception was the apparent depression in median oxygen concentration at the outfall, perhaps due to the secondary entrainment of deeper lower oxygen water by the rising effluent plume.

Measures of potential climate change effects—low DO and pH—indicated that, while there were a few instances of waters with the potential to affect living organisms encroaching up onto the shelf, the vast majority of the samples, both regionally and locally, was presently above levels of concern. Lower levels of DO and pH were found at depth (typically below 60 m) and probably had advected into the study area.

Direct measures of the wastewater plume were nutrients (ammonia) and bacteria. Monitoring at the 120″ outfall showed maximum ammonia concentrations were 20 times less than the COP objective for chronic toxicity to marine organisms. Average values at all depths and for all seasons were two orders of magnitude lower than this objective. Only 14% of the ammonium samples were above the detection limit of 0.02 mg/L and the vast majority of these (90%) occurred below 15 m. The low levels, along with the lack of association with chlorophyll-*a*, suggests that these concentrations were not environmentally significant.

Since effluent disinfection began in August 2002, offshore bacterial concentrations have remained low and predominately below measurement detection levels. This was the case for 2012-13 where 77–88% of the samples fell below the lower method detection limit of 10 MPN/100.

Overall, the measured environmental and public health effects to the receiving water continue to be relatively small, with values that remain within the ranges of natural variability for the study area. The limited observable plume effects occurred primarily at depth, even during the winter when stratification was weakest. In summary, results support the conclusion that the discharge is not greatly affecting the receiving water environment and that beneficial uses were maintained.

SEDIMENT QUALITY

Sediment quality (chemistry and physical characteristics) was consistent with results from previous years, suggesting that the wastewater discharge has minimal potential for adverse impact on biota outside the ZID. Organic loading was minimal and did not create anaerobic sediment conditions or exceed thresholds that would promote a shift towards declining conditions beyond the ZID. There were only minor changes to sediment grain size, which were localized near the outfall. Sediment sulfide concentrations were generally low and comparable among middle shelf stations.

Sediment concentrations of total phosphorus and total nitrogen were measured for the first time in the monitoring program. Concentrations were largely depth-dependent with higher concentrations occurring at the deeper stations. Concentrations were comparable at outfall depth stations indicating no measurable outfall influence.

Most sediment metal concentrations throughout the monitoring area, including within the ZID, were below sediment quality guidelines. Only silver at two near-ZID stations exceeded the guideline. However, sediment toxicity testing at those two stations showed no measurable toxicity indicating a low potential risk of adverse effects to natural invertebrate communities.

Concentrations of polychlorinated biphenyls (PCBs) in sediments near the outfall were comparable to other middle shelf stations. Only station located near the outfall terminus exceeded the ERM. However, the infaunal community was characterized as reference by both benthic community health indices used, indicating no adverse effect on biota.

Sediment dichloro-diphenyl-trichloroethane (DDT) concentrations did exceed the ERL at most 60-m sites, but the spatial patterns were unrelated to the outfall. DDT is a legacy contaminant that has not been discharged since early 1980s and is found throughout the SCB. Polycyclic aromatic hydrocarbons (PAH) were higher at the outfall compared to farfield sites, but at concentrations well below the ERL.

Nine stations were tested for sediment toxicity and evaluated using mean Effects-Range -Median Quotient (mERMq) analysis. While MERMq results showed that two of these stations had a moderate potential for high sediment toxicity, (driven by unusually high sediment silver concentrations), none showed toxicity, suggesting that the silver was not in a bioavailable form. This indicates a low likelihood of effluent impacts on biota.

BIOLOGICAL COMMUNITIES

Infaunal Invertebrate Communities

Similar to previous years, results showed that natural features of the study region, including bottom depth, sediment grain size, and complex bathymetry (e.g., submarine canyon habitats), accounted for the larger-scale spatial patterns of infaunal (small invertebrates) communities within the monitoring area. Station proximity to the outfall diffuser was only a minor factor and only affected those stations closest to the outfall.

A trend of decreasing diversity and abundances for the infaunal communities within the ZID began in 2005 and continued through 2011. The trend began at within-ZID stations but eventually extended to the closest stations beyond the ZID (<1 km). In 2012-13, biological communities beyond the ZID were generally healthy, diverse, and comparable to those occurring under similar environmental conditions throughout the SCB. Results showed improving benthic community health as evidenced by a return to normal invertebrate communities at all sites outside of the ZID.

Demersal Fishes and Macroinvertebrates

Results for demersal fishes and macroinvertebrates were generally consistent with past findings. Bottom depth, the outfall pipe acting as an artificial reef, regional influences (e.g., El Niño, La Niña), and normal oceanographic cycles were more important than the effluent discharge in affecting the distribution and abundance of fishes in the study area. Demersal fish and macroinvertebrate communities near the outfall were comparable to local and regional reference stations with results within the range of values for non-POTW (Publically Owned Treatment Works) sites throughout the SCB. The results indicated that the outfall area was not degraded and that it supported normal fish and macroinvertebrate populations.

Tissue Contaminants in Fish

The accumulation of contaminants by fish can occur due to both direct exposure to contaminated water and sediments, and the ingestion of contaminated prey. Contaminants were examined in fish muscle and liver tissues. Consistent with previous results, 2012-13 tissue concentrations of mercury, DDT, PCB, and other chlorinated pesticides in fish collected at near-outfall and farfield locations were below federal and state action levels and/or health advisory limits. PCB concentrations were generally higher in fish collected at the outfall compared to those in fish collected at the farfield station, but were well below the state and federal action levels. PCBs, like DDT, are legacy contaminants that are still found in sediments due to their long degradation times. The detection of PCBs in fish tissues is the result of this prolonged exposure, and not current discharge practices.

Fish Health

The types and frequencies of external health problems for fish can be important indicators of environmental health. Examination of fishes for ectoparasites, tumors, fin erosion, and skin lesions showed that fishes in the monitoring area were generally healthy. External parasites and other external abnormalities occurred in less than 1% of the fishes collected, with no evident outfall influence. These results were consistent with previous years and indicate that the outfall is not an epicenter of disease.

CONCLUSION

The findings and conclusions for the 2012-13 monitoring effort were consistent with long-term reported findings that showed limited impacts to the receiving water, sediment, and infaunal, trawl fish, and macroinvertebrate communities. Plume-related changes to receiving water temperature, salinity, DO, pH, and transmissivity observed beyond the ZID were well within the range of natural variability. Low concentrations of bacteria in water contact zones, in concert with the limited distributions of ammonia and absence of associations of the wastewater plume with phytoplankton blooms, suggest that the discharge had no discernible impact on environmental or human health. The low levels of contaminants in fish tissues and the low incidents of external abnormalities and diseases in fish demonstrated that the outfall was not an epicenter of disease.