EXECUTIVE SUMMARY

ES.0 EXECUTIVE SUMMARY

ES.1 Introduction

This document presents the results of the 2006-2007 municipal urban runoff monitoring conducted by Weston Solutions, Inc. on behalf of the San Diego County Municipal Copermittees identified as dischargers of urban runoff in Order No. 2001-01 of the San Diego Regional Water Quality Control Board (RWQCB). Order No. 2001-01was used as the basis for the 2006-2007 monitoring program due to delays with the new permit (Order No. R9-2007-0001) which was finalized on January 24, 2007. This report fulfills the requirements of Order No. 2001-01 Attachment B, IV. *Submittal of Receiving Waters Monitoring Requirements* for Long-term Mass Loading Monitoring; Urban Stream Bioassessment Monitoring; Ambient Bay and Lagoon Monitoring, and Coastal Receiving Water Monitoring. A general overview of coastal storm drain outfall monitoring is provided in Section 13. Coastal storm drain outfall monitoring and San Diego Bay toxic hotspots monitoring, also required in Attachment B of Order 2001-01 (carried out by the appropriate jurisdictions and not conducted by Weston), are included as attachments to this document.

This report discusses activities and findings comprised of the following:

- Chemical and toxicity testing of storm water runoff from 11 mass loading stations located within major watersheds of the County of San Diego.
- Rapid stream bioassessments at 27 stations in fall 2006 and spring 2007.
- Dry weather, coastal outfall, and (limited) third party data as it relates to watershed water quality assessment.

The main objectives of this monitoring program are to comply with NPDES Order 2001-01 and determine the ecological health of receiving waters in the region based on chemical, physical, and biological evidence.

ES.2 Methods

ES.2.1 Storm Water Methods

Mass loading stations were located at the base of each selected watershed as far downstream as possible in each watershed and upstream of any tidal influence. Mass loading stations (MLS) for this season were located along the Santa Margarita River (by Camp Pendleton), San Luis Rey River, Agua Hedionda Creek, Escondido Creek, San Dieguito River, Peñasquitos Creek, Tecolote Creek, San Diego River, Chollas Creek, Sweetwater River, and Tijuana River. Three storm events were monitored during the 2006-2007 wet-weather monitoring season at each mass loading station with the exception of the Santa Margarita River, which is voluntarily monitored by the Navy. The Santa Margarita MLS was not monitored during the 2006-2007 monitoring season by the Copermittees.

ES.2.1.1 Stream Flow Rating

During storms, the flow rate at each of the monitoring sites was determined by water velocity and stream stage (water level) sensors that are typically secured to the bottom of the channel. However, to

better quantify flow rates and produce a more complete rating curve, each of the streams was also assessed using the classical stream rating method developed by the United States Geological Survey.

ES.2.1.2 Storm Water Analyses

Storm water samples were analyzed for conventional chemical analytes, total and dissolved metals (antimony, arsenic, cadmium, chromium, copper, lead, nickel, selenium, and zinc), organophosphate pesticides (Diazinon and Chlorpyrifos), and toxicity to bioassay test organisms. Synthetic pyrethroids were analyzed at a subset of the mass loading stations which included Agua Hedionda Creek, Tecolote Creek, and Chollas Creek. These analyses were performed on flow-weighted composite samples. Grab samples were used to measure some of the general physical parameters (pH, conductivity, biochemical oxygen demand, and oil and grease) and bacterial indicators (total coliform, fecal coliform, and enterococcus).

ES.2.1.3 Toxicity Testing

Toxicity testing was performed to assess the potential toxicity of storm water runoff at mass loading stations. Freshwater toxicity testing included the use of acute, chronic, and reproductive tests with a freshwater cladoceran (*Ceriodaphnia dubia*), acute tests with a freshwater amphipod (*Hyalella azteca*), and chronic tests with a freshwater alga (*Selenastrum capricornutum*).

ES.2.2 Stream Bioassessment Monitoring

Weston conducted stream bioassessments pursuant to RWQCB Order No. 2001-01 to assess the ecological health of the watersheds in San Diego County. The assessments were undertaken using a protocol that samples and analyzes populations of benthic macroinvertebrates. A total of 25 different stream monitoring reaches were assessed in San Diego County in the surveys of October 2006 and May 2007. Three of these sites were considered to represent reference conditions.

The stream bioassessment monitoring includes sampling and identification of benthic macroinvertebrates present, assessment of the physical habitat of the stream, and water quality measurements, including water temperature, specific conductance, pH, dissolved oxygen, and chlorophyll.

ES.2.3 Ambient Bay and Lagoon Monitoring

The Ambient Bay, Lagoon, and Coastal Receiving Water Monitoring Program (ABLM) completed three years of monitoring during the summer of 2005. The data collected under this program were evaluated to determine if any linkage was observed between sediment conditions in the bays, estuaries, and lagoons and the freshwater conditions at upstream mass loading stations. A final report was prepared and was included as Appendix J in the San Diego County Municipal Copermittees 2005-2006 Urban Runoff Monitoring Report (Weston, 2007).

The ABLM program was not conducted during the 2006-2007 monitoring season. The methods used to perform the ABLM program are described in the San Diego County Municipal Copermittees 2005-2006 Urban Runoff Monitoring Report (Weston, 2007).

ES.2.4 Watershed Management Area Assessment Methods

The watershed assessment included an identification and prioritization of constituents of concern (COC) based upon the prioritization system developed in the interim guidance document "Watershed Data Assessment Framework" (June 2004). Wet weather results were compared to water quality objectives to identify constituents that were above criteria and persistently occurred within the watershed to determine if they were a COC. Dry weather information was assessed from locations upstream of the mass loading stations and compared to dry weather action levels. Dry weather exceedances were then assessed to determine if they correspond to wet weather constituents of concern. Toxicity was evaluated for persistence in each watershed and the triad data assessment approach was applied to determine if Toxicity Identification Evaluations were needed in the watersheds.

Water quality exceedances were assessed for the frequency of occurrence within each watershed to categorize COCs as high, medium or low. The intended identification of frequency of occurrence is to provide a tool to watershed groups for prioritizing water quality concerns and identifying activities and management actions.

The methodology from the Baseline Long-term Effectiveness Assessment (BLTEA) report (WESTON, MOE, & LWA, 2005) was used to create water quality priority ratings using the five years of monitoring data collected at the end of the 2005-2006 monitoring season. This data set was used by the Copermittees to prioritize activities based on the available data set for the next permit cycle. The water quality priority ratings establish a process to relate water quality information to the overall effectiveness of the management program. Water quality characterization and prioritization is achieved through the water quality priority rating process conducted for each of the constituent/stressor groups on a sub-watershed and watershed basis. The tables are updated every five years and are presented for the purposes of reviewing program activities. The detailed methods used to prepare the 2005-2006 water quality priority ratings tables can be found in the San Diego County Municipal Copermittees 2005-2006 Urban Runoff Monitoring Report (Weston, 2007).

Statistical Methods

Statistical analyses for watersheds included comparison of the magnitude of the ratio of observed concentrations to the WQOs, Mann-Kendall trend analysis, and summary statistics for dry weather results. The nonparametric Mann-Kendall test for linear trend was used to evaluate whether a constituent or toxicity has increased or decreased significantly since the base year (Mann, 1945; Kendall, 1975). The test is non-parametric, rank order based, and insensitive to missing values. Sen's slope estimator (Sen, 1968) was used to estimate the magnitude of change over time when a significant trend was observed.

ES.3 Regional Watershed Comparison Statistical Methods

Statistical analyses for the regional assessment included comparison of the magnitude of the ratio of observed concentration to the WQOs, Mann-Kendall trend analysis, regional trend analysis (test of homogeneity), and multivariate cluster analysis. The regional assessment of the magnitude of WQO ratios for key constituents was based on the ratio of the annual mean concentration for the past six years of data to the appropriate WQO. These comparisons provide for identification of water quality issues specific to a watershed or common among several or all watersheds in the region.

ES.4 Urban Runoff Monitoring Results

Results of the monitoring and assessment conducted for the 2006-2007 program are presented on a watershed basis, which meets the requirements set forth in Order 2001-01. It is important to note that value can also be derived through examination of region-wide trends and relationships presented in Section 13, Regional Assessments, in this report.

ES.4.1 Santa Margarita River Watershed Management Area

The Santa Margarita River Watershed Management Area (WMA) (HU 902.00) is the second largest in the San Diego hydrologic region. It covers over 473,971 acres; about 73.5% of the Santa Margarita River Watershed lies within Riverside County. The remainder of the watershed lies within unincorporated San Diego County. The City of Oceanside has jurisdiction over about 155 acres. The southwestern portion of the watershed is dominated by Camp Pendleton Naval Reservation and Marine Corps Base. This has kept the lower river and estuary from being developed and therefore, this region supports a variety of valuable habitats and other beneficial uses. Most of the WMA, about 66%, is undeveloped. The next highest land uses are agriculture (18%), military (8%), residential (4%), and parks (4%). The Santa Margarita River WMA has one mass loading station established in 2001 to characterize storm water runoff within the watershed. Marine Corps Base Camp Pendleton is not a named Copermittee under the MS4 Permit (Order 2001-01). However, Camp Pendleton voluntarily contributes to the monitoring effort by providing sample collection and analysis in the Santa Margarita River. Sample collection is coordinated by the United States Navy for Camp Pendleton through separate contractors, and the results are provided to the Copermittees.

ES.4.1.1 Storm Water Monitoring

The Navy did not perform monitoring at the Santa Margarita River MLS during the 2006-2007 wet weather monitoring period. Comparison of results to benchmark water quality objectives and loading analyses was not performed since no storms were monitored during the 2006-2007 wet weather monitoring period.

ES.4.1.2 Stream Bioassessment

Bioassessment monitoring in the Santa Margarita River WMA occurred at a total of three monitoring sites, including a reference site in Sandia Creek. All of the sites had mostly undisturbed habitat conditions, and the Index of Biotic Integrity quality ratings ranged from Very Poor to Good. The Willow Glen Road site was rated Very Poor for both surveys by the IBI, and observed to expected (O/E) taxa ratios were also below the impairment threshold for both surveys. The Camp Pendleton site was rated Poor for both surveys by the IBI, but was slightly above the O/E impairment threshold for May 2007. Neither the IBI nor O/E implicated any impairment at the Sandia Creek reference site. As in past surveys, the monitoring sites in Santa Margarita River were among the highest rated of the urban affected sites in San Diego County, with lower IBI scores in May. This was the first year that an IBI rating of Very Poor was given to a site in the Santa Margarita River. However, biological metric values and water quality measures indicated that this watershed is still one of the least impacted in San Diego County. Since the beginning of the program, the Willow Glen Road site has had a mean IBI score of 18.3 and a mean observed over expected (O/E) ratio of 0.70. The O/E ratio was above the impairment threshold for four of the ten surveys. The Camp Pendleton site has had a mean IBI score of 22.2 and a mean O/E ratio of 0.70. The O/E ratio was above the impairment threshold for three of the nine surveys.

ES.4.1.3 Ambient Bay and Lagoon Monitoring

The Ambient Bay and Lagoon Monitoring Program was completed in 2005-2006 and was not performed as part of the 2006-2007 monitoring program activities.

ES.4.1.4 WMA Assessment

No wet weather data was collected during the 2006-2007 monitoring period. Therefore, the WMA assessment was evaluated using the existing wet weather data, current dry weather data from 2006, and current rapid stream bioassessment data. For the Santa Margarita River WMA, turbidity and fecal coliform were identified as high frequency of occurrence COC, TSS was identified as a medium frequency of occurrence COC, and TDS and total copper were identified as low frequency of occurrence COC. There was no evidence of persistent toxicity found in Santa Margarita River. However, toxicity was observed for *Hyalella azteca* during the one event monitored during the 2005-2006 wet weather season. In addition, the ability to evaluate this watershed monitoring data is difficult due to the limited data collected over the past two monitoring seasons. Statistically significant increasing trends are observed for total coliform and enterococci and significant decreasing trends are observed for fecal coliform.

Based on the triad matrix, there was evidence of persistent water quality objective exceedances (turbidity), no evidence of persistent toxicity, and no indications of benthic alteration.

In addition to the WMA assessment findings, the water quality priority ratings for the overall Santa Margarita River WMA identified only dissolved minerals as a high priority (A) rated constituent. Several (B) ratings were identified which include heavy metals, sediments, pesticides, nutrients, gross pollutants, bacteria, benthic alterations, and toxicity. The two remaining constituent groups (organics and oil and grease) were assigned the lowest priority (D) rating.

ES.4.2 San Luis Rey River Watershed Management Area

The San Luis Rey River Watershed is the third largest watershed in San Diego County. The San Luis Rey WMA contains the most unincorporated land of all watersheds in San Diego County with 95.2% of the WMA being unincorporated, or County jurisdiction lands. The City of Oceanside comprises about 4.4% of the watershed and small portions of Escondido, Vista, and Riverside County make up the remainder of the WMA. Land use within the watershed is classified primarily as undeveloped (54%). Other uses include agricultural (15%), residential (15%), parks (9%), military (3%), transportation (2%), and commercial recreation (1%).

ES.4.2.1 Storm Water Monitoring Summary

Total dissolved solids and fecal coliform continue to be the constituents frequently measured above the WQO during wet weather monitoring events. There is a statistically significant increasing trend in fecal coliform at levels above the WQO. However, the magnitude of change is relatively flat and is within the observed variability of bacterial data. Increasing trends were also noted for total coliform, enterococci, BOD, and nitrate. Other constituents including TSS, turbidity, BOD, pH, and Diazinon have been detected at levels above the WQO but at a lower frequency. Turbidity is the only constituent with values detected above the WQOs for wet weather data, dry weather action levels, and ambient third party data. The cause of occasional, infrequent toxicity during mass loading station monitoring is unknown.

Measured storm event loads were compared to loading values derived from the National Stormwater Quality Database (NSQD) (Pitt et al., 2004). Measured loads for total dissolved solids and bacterial indicators were greater than expected for all three storm events sampled. Most of the constituents measured were within the expected range or lower than expected. In particular, metals consistently showed lower than expected loads for all the storm events sampled.

ES.4.2.2 Stream Bioassessment

Bioassessment monitoring in the San Luis Rey River WMA occurred at three sites, two urban affected sites in the San Luis Rey River and one reference site in Doane Creek, a small tributary on Mt. Palomar. The San Luis Rey River sites had Index of Biotic Ratings of Very Poor for both sites and both surveys. The in-stream physical habitat of these sites was marginal, which could limit macroinvertebrate colonization, but it may be noted that the sites have a similar habitat other sites with substantially higher IBI scores. The reference site in Doane Creek was the highest rated site in the County program, with the greatest taxonomic diversity and many highly sensitive, infrequently encountered organisms. Since the beginning of the program, the upstream San Luis Rey River site has had a mean IBI score of 6.7 and a mean O/E ratio of 0.50. The downstream San Luis Rey site has had a mean IBI score of 4.7 and a mean O/E ratio of 0.39. The mean O/E ratio represents a 50% and 61% loss of expected taxa respectively for each site.

ES.4.2.3 Ambient Bay and Lagoon Monitoring Program

The Ambient Bay and Lagoon Monitoring Program was completed in 2005-2006 and was not performed as part of the 2006-2007 monitoring program activities.

ES.4.2.4 WMA Assessment

For the San Luis Rey River WMA, TDS and fecal coliform were the only high frequency of occurrence COC followed by turbidity, nitrate, and total coliform which were all low frequency of occurrence COC. There was no evidence of persistent toxicity in San Luis Rey River; however, the benthic community appeared to be limited by unknown factors. A review of the scatterplots and trends shows statistically significant increasing trends for fecal coliform, total coliform, enterococci, BOD, and nitrate. Of these significant trends, only fecal coliform is above the WQO. All other trends are below the WQO (or do not have a WQO) and do not appear to be an immediate concern. Turbidity is the only constituent with values detected above the WQOs for wet weather data, dry weather action levels, and ambient third party data. The cause of occasional, infrequent toxicity during mass loading station monitoring is unknown.

Similar to previous years, fecal coliform and TDS were identified as having a high frequency of occurrence. However, both TDS and fecal coliform are not considered in the triad decision making process since they are not believed to induce a toxic response to aquatic organisms. Therefore, based on the triad decision matrix, there is no evidence of persistent water quality objective exceedances, no evidence of persistent toxicity, and indications of benthic alteration.

In addition to the WMA assessment findings which indicate TDS and fecal coliform as constituents of concern, the 2001-2006 water quality priority ratings found no high priority (A) ratings for the San Luis Rey River WMA. Several (B) priority ratings were identified and include dissolved minerals, bacteria and benthic alteration. All other constituents were given either a (C) or (D) rating.

ES.4.3 Carlsbad Watershed Management Area

The Carlsbad Watershed Management Area (WMA) is the second most densely populated WMA in the San Diego Region. Population is projected to be nearly 633,000 people by the year 2020. The Carlsbad WMA is under the jurisdiction of several cities; about 18.5% of the WMA is within Carlsbad, 13% in Escondido, 11% in San Marcos, and between 8-9% each in Encinitas, Vista, and Oceanside. Solana Beach comprises less than 1% of the WMA. The remaining 31% of the WMA is unincorporated lands under the jurisdiction of the County of San Diego. The most common land use within the watershed management area is residential (35%), followed by undeveloped (21%), parks (14%), transportation (12%), and agriculture (7%). Industrial, commercial, public facility, commercial recreation, water and lands under construction make up the remaining 11% of the land use within the watershed. The Carlsbad WMA has two monitored mass loading stations (MLS), one on Agua Hedionda Creek and one on Escondido Creek. The contributing runoff area into these two MLS consists of nearly 60,000 acres, approximately 44% of the Carlsbad WMA.

ES.4.3.1 Storm Water Monitoring Summary

Agua Hedionda Creek

Bacterial indicators (particularly fecal coliform) turbidity, total suspended solids and total dissolved solids have frequently been detected above the WQOs in the Agua Hedionda Creek sub-watershed. Toxicity in Agua Hedionda Creek has been observed in at least one storm event in each season since 2001-2002. Toxicity to *Hyalella azteca* has been most commonly observed in recent years. Statistically significant increasing trends were observed for ammonia, chemical oxygen demand, TSS, turbidity, dissolved phosphorus, fecal coliform, total coliform, total copper, total lead, total nickel, and *Hyalella azteca* toxicity, while significant decreasing trends were evident for Diazinon and dissolved arsenic. Constituents detected above the wet weather WQO during the 2006-2007 storm season and above the 2006 dry weather action levels include fecal coliform and turbidity. Fecal coliform results were above the water quality objective at the MLS during all three storms in 2006-2007 and were above the dry weather action levels four times. Turbidity was above the water quality objective at the MLS during all three storms in 2006-2007 and above the dry weather action level 14 times.

Measured storm event loads were compared to loading values derived from the National Stormwater Quality Database (NSQD) (Pitt et al., 2004). Measured loads for ammonia, total nitrogen and bacterial indicators were greater than expected for a majority of the storm events sampled. In particular, metals consistently showed lower than expected loads for all the storms events sampled.

Escondido Creek

Fecal coliform, total dissolved solids and turbidity have persistently been detected above WQOs in the Escondido Creek sub-watershed. Toxicity to *Ceriodaphnia* has only been observed during two storm events in the 2001-2002 monitoring season. Significant increasing trends were observed for total coliform, total copper and total zinc, while a significant decreasing trend was observed for Diazinon. Constituents detected above the wet weather WQO during the 2006-2007 storm season and above the 2006 dry weather action levels include fecal coliform and turbidity. Fecal coliform was above the water quality objective at the MLS during all three storms in 2006-2007 and was above the dry weather action level two times. Turbidity was above the water quality objective at the MLS during all storms sampled in 2006-2007 and above the action level during 9 of 61 dry weather monitoring events in 2006.

Measured storm event loads were compared to loading values derived from the National Stormwater Quality Database (NSQD) (Pitt et al., 2004). Measured loads of total dissolved solids, BOD_5, ammonia, total nitrogen and bacterial indicators were greater than expected for a majority of the storm events sampled. Metals, primarily chromium, lead, nickel and zinc, were within the expected range or lower than expected.

Third party data collected in 2006 and 2007 indicated that total dissolved solids, total suspended solids, turbidity, dissolved oxygen, chloride, sulfate, nitrate, and fecal coliform were detected above WQOs in various locations along Escondido Creek.

ES.4.3.2 Stream Bioassessment

Agua Hedionda Creek

Two bioassessment monitoring sites on Agua Hedionda Creek were sampled, one at Melrose Drive and one at El Camino Real. Index of Biotic Integrity scores rated the benthic communities Very Poor at both sites, with slightly higher scores at the El Camino Real site. The O/E ratios also indicated a degraded benthic community at both sites. Since the beginning of the program, the Melrose Drive site has had a mean IBI score of 8.2 and a mean O/E ratio of 0.55. The downstream site at El Camino Real has had a mean IBI score of 10.1 and a mean O/E ratio of 0.58. Neither index rated either site above the impairment threshold for any of the surveys. Of particular interest at the El Camino Real Site, is the prevalence of *Hyalella azteca* populations while this site has observed toxicity during all three storms to *Hyalella azteca*. This finding may suggest that toxicity to this organism occurs only during storm events when sediments are more likely to be mobilized, and that it may be only a short term effect. The Buena Vista Creek monitoring site at College Blvd. was sampled as a replacement site for the Tijuana River site which was dry in October 2006. Index of Biotic Integrity scores rated the benthic communities Very Poor at this site.

Escondido Creek

Two bioassessment monitoring sites on Escondido Creek were sampled, one at the Harmony Grove Bridge and one in Elfin Forest. Index of Biotic Integrity scores rated the benthic communities Very Poor at both sites, although the October survey in Elfin Forest had an O/E ratio that was very near the impairment threshold. The site also had relatively good taxonomic diversity including one highly intolerant organism, *Tinodes*. Since the beginning of the program, the Harmony Grove Bridge site has had IBI scores and O/E values indicating a high level of impairment. The Elfin Forest site has had O/E ratios above the impairment threshold in two surveys, and the mean ratio for October surveys indicates a seasonally low level of impairment at the site.

ES.4.3.3 Ambient Bay and Lagoon Monitoring Program

The Ambient Bay and Lagoon Monitoring Program was completed in 2005-2006 and was not performed as part of the 2006-2007 monitoring program activities.

ES.4.3.4 WMA Assessment

Agua Hedionda Creek

The Agua Hedionda Creek sub-watershed accounts for 10% of the Carlsbad Watershed. Land use within the contributing runoff area is primarily residential (38%), undeveloped (23%), and parks (13%). The WMA assessment identified TSS, TDS, turbidity, total coliform, fecal coliform, and enterococci as high frequency of occurrence constituents of concern; Diazinon was identified as medium frequency of

occurrence COC, while ammonia, COD, nitrate, and total copper were identified as low frequency of occurrence COC.

Based on the triad matrix, there was evidence of persistent constituent detections above water quality objectives, evidence of persistent toxicity, and indications of benthic alteration. Based on the triad assessment findings, TIEs are recommended to identify the causative agent of toxicity to *Hyalella azteca* in Agua Hedionda Creek storm water samples.

Escondido Creek

For the Escondido Creek sub-watershed which accounts for approximately 33% of the Carlsbad Watershed, land use within the contributing runoff area is predominantly undeveloped (32%), residential (29%), and parks (16%). TDS, turbidity, total coliform and fecal coliform, were identified as high frequency of occurrence constituents of concern; enterococcus was identified as a medium frequency of occurrence COC, while TSS and nitrate were identified as low frequency of occurrence COC.

Based on the triad matrix, there was evidence of persistent water quality objective exceedances (TDS and turbidity), no evidence of persistent toxicity, and indications of benthic alteration.

The WMA assessment findings agreed with the water quality rating priorities, which found dissolved minerals, sediments, nutrients, and bacteria as high priority (A) rated constituents for the overall Carlsbad WMA. Benthic alteration and toxicity were assigned (B) ratings. All other constituents were given either a (C) or (D) rating.

ES.4.4 San Dieguito River Watershed Management Area

The San Dieguito River Watershed Management land area is 221,307 acres. The watershed drains into the San Dieguito Lagoon located between the cities of Del Mar and Solana Beach. The San Dieguito Lagoon provides 260 acres of wetland habitat, of which 86 acres are characterized as open water. The San Dieguito River Watershed includes portions of the cities of Del Mar, Escondido, Poway, San Diego, and Solana Beach, but is largely within an unincorporated area (79.8%) of San Diego County. Land use in the watershed is primarily undeveloped land (42%). Other major uses are residential (19%), parks (17%), and agriculture (15%). Transportation, commercial, industrial, public facilities, and water comprise the remaining 7% of the watershed.

ES.4.4.1 Storm Water Monitoring Summary

Total dissolved solids and elevated levels of bacterial indicators, specifically fecal coliform, appear to be the primary water quality concerns within the watershed. Toxicity was observed during two of the three monitoring events within the 2006-2007 monitoring period. Toxicity was observed to *Ceriodaphnia dubia* during the first and second storm events. Toxicity was also observed to *Selenastrum capricornutum* during the first event. Statistically significant increasing trends were evident for total suspended solids, total phosphorus, TKN, and total nickel. Constituents detected above the wet weather WQO during the 2006-2007 storm season and above the 2006 dry weather action levels included fecal coliform and turbidity.

Measured storm event loads were compared to loading values derived from the National Stormwater Quality Database (NSWD) (Pitt et al., 2004). Measured loads for total dissolved solids, total nitrogen, and bacterial indicators were greater than expected for the majority of storm events sampled. Most of

the constituents measured were within the expected range or lower that expected. In particular, metals consistently showed lower than expected loads for all the storms events sampled.

ES.4.4.2 Stream Bioassessment

Bioassessment sampling occurred at two sites in the San Dieguito River WMA. Samples were collected from Green Valley Creek at West Bernardo Drive and San Dieguito River below Lake Hodges Dam in October 2006 and May 2007. The macroinvertebrate community of Green Valley Creek had an Index of Biotic Integrity rating of Poor in October and Very Poor in May. The San Dieguito River site was also rated Poor in October and Very Poor in May. Both sites had IBI score ranges with statistically significant seasonal differences. The O/E ratios concurred with this for the Green Valley Creek site, but the ratios were seasonally similar for the San Dieguito River site. Since the beginning of the program, the Green Valley Creek site has had a mean IBI score of 9.7 and a mean O/E ratio of 0.54. The O/E rated the site above the impairment threshold for the October 2004 survey. San Dieguito River has had a mean IBI score of 12.9 and a mean O/E ratio of 0.62. The O/E rated the site above the impairment threshold for the October surveys of 2002, 2003, and 2004.

ES.4.4.3 Ambient Bay and Lagoon Monitoring

The Ambient Bay and Lagoon Monitoring Program was completed in 2005-2006 and was not performed as part of the 2006-2007 monitoring program activities.

ES.4.4.4 WMA Assessment

For the San Dieguito River WMA, total dissolved solids were identified as a high frequency COC, fecal coliform was identified as a medium frequency COC, and turbidity, total coliform, and enterococcus were identified as low frequency COCs. Based on the triad decision matrix, there was no evidence of persistent detections above the WQO, no evidence of persistent toxicity, but there was evidence of benthic alteration. In addition to the WMA assessment findings, the water quality priority ratings did not find any high priority (A) rated constituents for the San Dieguito River WMA. Several constituents received B ratings which include dissolved minerals, gross pollutants, bacteria, benthic alteration, and toxicity. All other constituents were given either a C or D priority rating.

Similar to previous years, the triad decision matrix found there was no evidence of persistence exceedances of WQO (TDS not considered based on the methods section), no evidence of persistent toxicity, but there was evidence of benthic alteration.

ES.4.5 Los Peñasquitos Creek Watershed Management Area

The Los Peñasquitos Creek Watershed Management Area (WMA) includes two hydrologic areas: Miramar Reservoir (HA 906.10) and Poway (HA 906.20) and is the second smallest watershed in the San Diego region. The Los Peñasquitos WMA is drained by Los Peñasquitos Creek and drains into Los Peñasquitos Lagoon near the northern border of the City of San Diego within the Torrey Pines State Reserve. Los Peñasquitos Lagoon also receives inputs from Carroll Canyon, just south of Los Peñasquitos Creek, and McGonigle Canyon to the north. The Los Peñasquitos Creek Watershed is mostly contained in the City of San Diego; 83.2% of the watershed is contained in the City. The remaining areas of the watershed include the Cities of Poway (14.9%) and Del Mar (0.1%). Land use within the watershed is relatively equally divided between parks and recreation (30%), residential (27%), and

vacant/undeveloped (15%). Other uses are comprised of transportation (12%), industrial (7%), public facilities/utilities (3%), commercial (3%), and agriculture (1%).

ES.4.5.1 Storm Water Monitoring Summary

Total dissolved solids, turbidity, and elevated levels of bacterial indicators, specifically fecal coliform, appear to be the primary water quality concerns within the watershed. A statistically significant increasing trend was only noted for total nickel. However, total nickel concentrations are well below, and have never exceeded the WQO benchmark.

Three sites were sampled under the Surface Water Ambient Monitoring Program (SWAMP) within the Los Peñasquitos Watershed in 2002, including Los Peñasquitos Creek, Soledad Canyon Creek, and Poway Creek. At the station located in Los Peñasquitos Creek in the same vicinity as the mass loading station, parameters with results above the water quality objective (WQO) included turbidity, pH, sulfate, Diazinon, methyl parathion, and toxicity. Results from the other two stations within the Los Peñasquitos Watershed were similar to those found in Los Peñasquitos Creek. Sulfate, manganese, and toxicity were above the WQO at all sites. Turbidity and Diazinon concentrations were above the WQO sporadically.

Measured storm event loads were compared to loading values derived from the National Stormwater Quality Database (NSQD) (Pitt et al., 2004). Measured loads for total dissolved solids and bacterial indicators were greater than expected for a majority of the storm events sampled. Most of the constituents measured were within the expected range or lower than expected. In particular, metals consistently showed lower than expected loads for all the storms events sampled.

ES.4.5.2 Stream Bioassessment

Bioassessment monitoring in the Los Peñasquitos WMA was conducted at two sites. The upstream site was in Los Peñasquitos Creek in Poway, and the downstream site was in Los Peñasquitos Creek adjacent to the MLS. Both of the sites had Index of Biotic Integrity ratings that were in the Very Poor category for both surveys, and had O/E ratios that also indicated degraded biotic conditions. Since the beginning of the program, the upstream Los Peñasquitos Creek site has had a mean IBI score of 9.6 and a mean O/E ratio of 0.67. The O/E rated the site above the impairment threshold for the October 2001 and October 2005 surveys. The downstream Los Peñasquitos watershed site has had a mean IBI score of 11.7 and a mean O/E ratio of 0.58. The O/E rated the site slightly above the impairment threshold for the October 2002 and October 2004 surveys.

ES.4.5.3 Ambient Bay and Lagoon Monitoring

The Ambient Bay and Lagoon Monitoring Program was completed in 2005-2006 and was not performed as part of the 2006-2007 monitoring program activities.

ES.4.5.4 WMA Assessment

Within the Los Peñasquitos Creek WMA, TDS and fecal coliform were the only high frequency of occurrence constituents of concern (COC) followed by turbidity, total coliform and enterococci which were all low frequency of occurrence COC. There was no evidence of persistent toxicity in Los Peñasquitos Creek WMA; however, the benthic community appeared to be limited by unknown factors. A statistically significant increasing trend was noted only for total nickel. However, total nickel concentrations are well below, and have never exceeded the WQO benchmark.

Based on the triad decision matrix, there was no evidence of persistent exceedances of WQO (TDS and bacteria are not considered as toxic constituents based on the triad decision matrix), no evidence of persistent toxicity, but there was evidence of benthic alteration.

In addition to the WMA assessment findings, the water quality priority ratings identified high priority (A) ratings for dissolved minerals, sediments, bacteria and benthic alteration. However, the bacteria finding is based on the 2002 303(d) list which has since been delisted. All other constituents were given either a C or D priority rating.

ES.4.6 Mission Bay Watershed Management Area

The Mission Bay Watershed Management Area (WMA) includes three hydrologic areas: Scripps, Miramar, and Tecolote. The Mission Bay WMA is entirely contained within the City of San Diego. Land use within the watershed is primarily parks (26.5%) and residential (26.4%). Other uses are transportation (17.9%), public facilities/utilities (4.7%), industrial (4%), commercial (3.6%), and agriculture (0.2%). Over 60% of the watershed is privately-owned land. The remaining portions are mostly locally-owned with a small percentage of land being state and federally-owned.

ES.4.6.1 Storm Water Monitoring Summary

Turbidity, total suspended solids, total lead, and elevated levels of bacterial indicators, specifically fecal coliform, appear to be the primary water quality concerns within the watershed. Based on the period of record, there is a significant downward trend in BOD, nitrate, oil and grease, and Diazinon concentrations at the MLS and a significant increasing trend in enterococci concentrations at the MLS. A review of the scatterplots and trends indicate significant downward trends for BOD, Diazinon, nitrate, and oil and grease concentrations. A significant increasing trend for enterococcus concentrations was also observed.

Measured storm event loads were compared to loading values derived from the National Stormwater Quality Database (NSQD) (Pitt et al., 2004). Measured loads for total dissolved solids and bacterial indicators were greater than expected for a majority of the storm events sampled. Most of the constituents measured were within the expected range or lower than expected. In particular, several metals consistently showed lower than expected loads for all the storms events sampled.

ES.4.6.2 Stream Bioassessment

Two stream bioassessment monitoring sites were sampled in the Mission Bay WMA. One site was in Rose Creek, downstream of Highway 52, and the other site was in Tecolote Creek in the lower reach of Tecolote Canyon Natural Park. The macroinvertebrate community of both sites had Index of Biotic Integrity ratings of Very Poor in the October and May surveys. The O/E ratios were in general agreement with the IBI scores, indicating degraded biotic conditions at the sites. The Tecolote Creek site had substantial seasonal variation in the total IBI score, which was even more pronounced with the O/E ratio, a pattern that has been consistent for this site throughout the duration of the program. These two sites also had some of the highest specific conductance readings of all of the county monitoring sites. Though synthetic pyrethroids were detected during all three monitoring events, *Hyalella azteca*, a species sensitive to synthetic pyrethroids, was found to be the most abundant species during the October surveys. Since the beginning of the program, the Rose Creek site has had a mean IBI score of 12.5 and a mean O/E ratio of 0.58. The O/E rated the site above the impairment threshold for the October 2002

and October 2005 surveys. Tecolote Creek has had a mean IBI score of 16.2 and a mean O/E ratio of 0.52. Both indices rated the site below the impairment threshold for all surveys.

ES.4.6.3 Ambient Bay and Lagoon Monitoring

The Ambient Bay and Lagoon Monitoring Program was completed in 2005-2006 and was not performed as part of the 2006-2007 monitoring program activities.

ES.4.6.4 WMA Assessment

For the Mission Bay WMA, turbidity, total coliform, and fecal coliform were identified as high frequency of occurrence COCs, while TSS, enterococcus, and total lead, were identified as a medium frequency of occurrence COCs. A review of the scatterplots and trends indicate significant downward trends for BOD, Diazinon, nitrate, and oil and grease concentrations.

Similar to previous years, the triad decision matrix found evidence of persistent exceedances of WQO (turbidity), no evidence of persistent toxicity, and evidence of benthic alteration.

In addition to the WMA assessment findings, the water quality priority ratings found high priority (A) ratings for the heavy metals, dissolved minerals, nutrients, bacteria, and toxicity categories and found a B priority rating for the sediments category.

ES.4.7 San Diego River Watershed Management Area

The San Diego River Watershed is the second largest watershed in San Diego County. The San Diego River WMA land area is 277,543 acres and includes four hydrologic areas: Lower San Diego, San Vicente, El Capitan, and Boulder Creek. The San Diego River Watershed contains the second largest percentage of unincorporated land in San Diego County; 74.7% of the watershed is unincorporated. The remaining areas of the watershed include the cities of El Cajon, La Mesa, Poway, San Diego, and Santee. Land use within the watershed is primarily undeveloped (47%), parks and recreation (21.0%), and residential (17.8%). Other uses include transportation (5.7%), agriculture (1.9%), commercial (1.2%), and industrial (1.2%).

ES.4.7.1 Storm Water Monitoring Summary

Turbidity, TDS, and elevated levels of bacterial indicators, specifically fecal coliform, appear to be the primary water quality concerns within the watershed. A review of the scatterplots and trends shows statistically significant decreasing trends for dissolved arsenic, dissolved copper, and nitrate. Turbidity and TSS had statistically significant increasing trends. The Padre Dam data also indicates that dissolved oxygen levels are a concern during the summer months as they fell below the WQO of 5 mg/L in 20 of 24 samples collected between June and September 2006. Additional third party data was received from the City of La Mesa. Both dry and wet weather data were collected for the purposes of evaluating land use contributions within the City of La Mesa. Constituents with sample results above the WQO include turbidity, TDS, and fecal coliforms. Turbidity was the only constituent measured above the WQO during the storm event in the Alvarado Channel location (Alv-1), while fecal coliforms and turbidity were above the WQO during the storm event in the Alvarado Channel location (Alv-2). During dry weather sampling, fecal coliforms and TDS were above the WQO at the Alv-1 location, while fecal coliforms only were above the WQO at the Alv-2 location.

Based on the period of record, there is a statistically significant downward trend in dissolved arsenic, dissolved copper, and nitrate concentrations, while there is a significant increasing trend in TSS and turbidity.

Measured storm event loads were compared to loading values derived from the National Stormwater Quality Database (NSQD) (Pitt et al., 2004). Measured loads for total dissolved solids and bacterial indicators were greater than expected for a majority of the storm events sampled. Most of the constituents measured were within the expected range or lower than expected. In particular, metals consistently showed lower than expected loads for all the storm events sampled.

ES.4.7.2 Stream Bioassessment

Bioassessment monitoring in the San Diego River WMA occurred at three monitoring sites, including two urban sites and one reference site. The urban sites were in Mission Trails Regional Park and near Morena Blvd. in Mission Valley. The Mission Trails site had an Index of Biotic Integrity rating of Very Poor for both the October 2006 and May 2007 surveys; the Mission Valley site had an IBI rating of Very Poor for both the October 2006 and May 2007 surveys. The reference site on Boulder Creek had IBI ratings of Fair for both the October 2006 and May 2007 surveys. The reference site's O/E ratio indicated that the benthic community was unimpaired and that the water quality at this site in Boulder Creek was likely very good.

ES.4.7.3 Ambient Bay and Lagoon Monitoring

The San Diego River is not included as part of the Ambient Bay and Lagoon Monitoring program.

ES.4.7.4 WMA Assessment

For the San Diego River WMA, turbidity and fecal coliform were identified as high frequency of occurrence COCs followed by TDS as a medium frequency COC, and total coliform, and enterococcus, which were identified as low frequency of occurrence COCs. TDS during wet weather monitoring and monthly monitoring within the watershed by Padre Dam showed a medium frequency of occurrence, but appears to be related to groundwater influences and local conditions.

Based on the triad decision matrix, there was evidence of persistent exceedances of WQO (turbidity), no evidence of persistent toxicity, and evidence of benthic alteration.

In addition to the WMA assessment findings, the water quality priority ratings found a high priority (A) rating for bacteria and found a (B) priority rating for the sediments and dissolved minerals categories. All other constituents were given either a (C) or (D) priority rating which means the constituents were low priorities or lacked sufficient data to support a higher priority rating. In the Stressor Groups category, benthic alterations were also given an A priority rating.

ES.4.8 San Diego Bay Watershed Management Area

The San Diego Bay Watershed Management Area (WMA) covers over 282,580 acres. San Diego Bay is the largest estuary in San Diego County and has been extensively developed as a port. It covers 10,532 acres of water and 4,419 acres of tidelands. Only 17% to 18% of the original Bay floor remains undisturbed by dredge or fill. Ninety percent of the original salt marshes and 50% of the original mudflats have been filled or dredged for development. The San Diego Bay WMA consists of three major

watersheds, including the Pueblo San Diego Watershed, the Sweetwater Watershed, and the Otay Watershed. The Chollas sub-watershed within the Pueblo San Diego Watershed and the Sweetwater Watershed are currently monitored in this program. The Otay Watershed has not been sampled during this monitoring program since the majority of runoff is captured in the Otay Reservoir and prevents flows downstream. The wet weather monitoring station was removed from this watershed after the 2001-2002 monitoring season and was not replaced. However, dry weather data is collected in the Otay Watershed. The differences in water quality between the Pueblo San Diego and Sweetwater Watersheds likely reflect the differences in land uses. The Pueblo Watershed is highly urbanized in comparison to the Sweetwater Watershed. The Chollas sub-watershed within the Pueblo San Diego Watershed drains a very densely populated, urban area. Nearly 65% of the drainage area is residential and another 17% is commercial. The Sweetwater Watershed drainage area consists of 50% vacant or undeveloped land, 30% residential, and only 10% commercial.

ES.4.8.1 Storm Water Monitoring Summary

Chollas Creek

The Pueblo San Diego Watershed is a highly urbanized watershed. Water quality problems within Chollas Creek are typical of dense residential and commercial areas with frequent water quality exceedances of turbidity, TSS, bacterial indicators, total and dissolved copper, total lead, and total zinc. In addition, a shift in the use of pesticide compounds may be evident in the Chollas sub-watershed, resulting in a shift in the observed toxicity. Previous results in the Chollas sub-watershed have indicated that the presence of Diazinon at concentrations above the WQO often coincide with incidence of acute and chronic toxicity to *Ceriodaphnia dubia*. During the 2006-2007 monitoring season, the constituent Diazinon was detected above the WQO during the October 14, 2006 monitoring event, which is the first exceedance since the 2003-2004 monitoring season and chronic toxicity to *Ceriodaphnia dubia* was also observed during this event. Diazinon concentrations in subsequent monitoring events during the 2006-2007 monitoring season were below the laboratory detection limit, and no other toxicity to *Ceriodaphnia* was observed. Persistent toxicity to *Hyalella azteca* continues to be observed in Chollas Creek storm water samples.

Malathion, which is commonly used for mosquito control, has been detected in every sample over the past three monitoring seasons at the Chollas Creek MLS including three results over the WQO.

A review of the scatterplots and trends for the Pueblo San Diego Watershed indicates statistically significant increasing trends for nitrite, turbidity, total copper, and total zinc and decreasing trends for Diazinon, MBAS, and TDS. It should be noted, however, that nitrite has never exceeded the WQO. Turbidity concentrations have been at least three times higher than the WQO at the Chollas Creek MLS in five of the past six monitored events. The decreasing trend detected by the Mann-Kendall analysis for Diazinon is primarily driven by the three consecutive years of elevated concentrations observed in the 2001-2004 monitoring seasons combined with the past three years of concentration values near or below the laboratory detection limit. Similarly, the decreasing trend for MBAS is driven by the decline in concentrations observed from the two exceedances observed between the years 2000-2002 to recent results consistently below the WQO. Though there is an observed statistically significant downward trend for TDS, this constituent is nearly always below the WQO, exceeding the WQO only once in the past 13 years of monitoring at the Chollas Creek MLS.

The most common dry weather monitoring results above the action levels include conductivity, total and fecal coliform, enterococcus, MBAS, and turbidity in the Pueblo San Diego Watershed.

Measured storm event loads at the Chollas Creek MLS site were compared to loading values derived from the EMC National Stormwater Quality Database (NSQD) (Pitt et al., 2004). This comparison shows that mean EMC loads were greater than the expected loads in all three monitored events for the modeled constituents TSS, TKN, dissolved phosphorus, total phosphorus, total copper, total coliform, and fecal coliform. EMC loads were greater than expected loads in two of the three monitored events for the constituents TDS, BOD, COD, total cadmium, dissolved copper, total lead, and total zinc. Storm event constituent loads were within the expected load in three out of three wet weather events for oil and grease and two out of three events for nitrate and nitrite.

Third party data indicated that turbidity and fecal coliform are constituents with results above the WQO during wet weather and MBAS and dissolved oxygen are constituents with results above the WQO during dry weather in additional monitoring events conducted in the Chollas Creek watershed. These results coincide with data collected as part of wet and dry weather monitoring in the 2006-2007 Receiving Waters Monitoring Program.

Toxicity identification analyses performed on Chollas Creek samples during the 2005-2006 and 2006-2007 monitoring seasons suggested synthetic pyrethroids as the causative agent of storm water toxicity.

Sweetwater River

Fecal coliform, total dissolved solids, and turbidity have persistently been detected above WQOs in the Sweetwater Watershed. Toxicity to *Ceriodaphnia* has only been observed during a single storm event in the past two monitoring seasons. Significant increasing trends were observed for pH and dissolved phosphorus. The trend for pH was within the WQO range, and results for total phosphorus were also below the benchmark WQO.

Measured storm event loads at the Sweetwater River MLS site were compared to loading values derived from the EMC National Stormwater Quality Database (NSQD) (Pitt et al., 2004). Measured loads of total dissolved solids and bacterial indicators were greater than expected for a majority of the storm events sampled. Most of the constituents measured were within the expected range or lower than expected. In particular, metals consistently showed lower than expected loads for all storm events.

Dry weather results indicated that the conventional constituents conductivity, nitrate, pH, and turbidity and the bacterial indicators were all detected above the dry weather action levels.

Third party data collected within the Sweetwater Watershed also indicate that the constituents TDS and fecal coliform are above WQO.

ES.4.8.2 Stream Bioassessment

Chollas Creek

Bioassessment monitoring was conducted at one monitoring site in the Pueblo San Diego Watershed, located in Chollas Creek at Federal Blvd. The Chollas Creek site had Index of Biotic Integrity ratings of Poor to Very Poor. The O/E ratios of the site also indicated that the site had degraded macroinvertebrate communities.

Sweetwater River

Stream bioassessment monitoring occurred at two sites in the Sweetwater Watershed. The Sweetwater River monitoring sites were in low-gradient, depositional reaches of the river. Each of the Sweetwater River sites had IBI scores rated Very Poor in both surveys. The O/E ratios also indicated a degraded

biological community at the sites. Since the beginning of the program, the upstream Sweetwater River site has had a mean IBI score of 9.3 and a mean O/E ratio of 0.56. The downstream Sweetwater River site had a mean IBI score of 6.1 and a mean O/E ratio of 0.47. Both indices rated each site below the impairment threshold for all surveys.

ES.4.8.3 Ambient Bay and Lagoon Monitoring Program

The Ambient Bay and Lagoon Monitoring Program was completed in 2005-2006 and was not performed as part of the 2006-2007 monitoring program activities.

ES.4.8.4 WMA Assessment

Chollas Creek

In the Chollas Creek sub-watershed, the constituents TSS, turbidity, total and fecal coliform, enterococcus, total copper, total lead, and total zinc were all identified as high frequency COCs. The constituents COD, Diazinon, and dissolved copper were identified as medium frequency COCs. The constituents pH and conductivity were identified as low frequency COCs. The pesticides found above WQOs in the watershed are frequently detected in storm water runoff. Malathion is frequently above the WQO, and the data suggests that synthetic pyrethroids are the causative agent of persistent toxicity to *Hyalella azteca.*

Based on the triad decision matrix for Chollas Creek, there was evidence of persistent water quality objective exceedances, there was evidence of persistent toxicity, and evidence of benthic alteration. Results of the TIE suggested that synthetic pyrethroids are the causative agent of toxicity towards *Hyalella azteca* in Chollas Creek storm water samples collected during the 2005-2006 and 2006-2007 monitoring seasons. A total of seven synthetic pyrethroids were detected in Chollas Creek during the 2006-2007 monitoring season.

Sweetwater River

The Sweetwater watershed drainage area consists of 50% vacant or undeveloped land, 30% residential, and only 10% commercial. The contrast in land use compared to Chollas Creek may likely be the reason for better observed (based on data assessed) water quality in the Sweetwater River. The constituents fecal coliform, and enterococcus were identified as high frequency COCs. TDS was identified as a medium frequency COC. The constituents conductivity, turbidity, nitrate, and total coliform were identified as low frequency COCs.

Based on the triad decision matrix for Sweetwater River, there was no evidence of persistent water quality objective exceedances (fecal coliform not considered in triad assessment); there was no evidence of persistent toxicity, and evidence of benthic alteration.

For the San Diego Bay WMA, there were no high priority (A) ratings based on the water baseline long-term effectiveness assessment water quality priority ratings. Only dissolved minerals, bacteria, and toxicity were designated with (B) priority ratings. The WMA assessment for the Chollas sub-watershed is relatively comparable to the water quality priority rating for the Pueblo San Diego Watershed but is not representative of the overall WMA. Specific water quality issues are likely related to the land use found in this highly urbanized setting. Turbidity, TSS, bacteria, and total copper, lead and zinc had a high frequency of occurrence in the Pueblo San Diego Watershed, while only fecal coliform and enterococcus had a high frequency of occurrence in the Sweetwater Watershed. There was evidence of benthic alteration in both watersheds. In comparison, the water quality priority ratings found a (D) rating for the heavy metals category, a (C) rating for the sediment category, and a (B) priority rating for the bacteria

category, for the overall WMA, suggesting that the major water quality concerns are primarily focused in the lower and more urbanized areas of the watershed.

ES.4.9 Tijuana River Watershed Management Area

The Tijuana River Watershed Management Area (WMA) is the largest of the San Diego watersheds covering over 1.1 million acres. Mexico governs the majority of the Tijuana River Watershed (73%) with the remaining areas belonging to the United States. Undeveloped areas account for 58% of United States lands, with another 25% devoted to parks. The River flows through the cities of Tecate and Tijuana, Mexico, and runoff contributions come from both Mexico and the United States.

ES.4.9.1 Storm Water Monitoring Summary

Conventional constituents most prevalent in the Tijuana River that pose the greatest concern are typical of conditions found with untreated wastewater. BOD, COD, TSS, turbidity, and nutrients (un-ionized ammonia-N and total phosphorus) consistently are found above the water quality objectives. Additionally, although total coliform and enterococci do not have corresponding water quality objectives, results for these bacterial indicators have consistently been observed at highly elevated densities and are also indicative of conditions found with untreated wastewater. Pesticides have also been frequently observed above the WQO in the Tijuana River MLS samples. Diazinon, in particular, has been above the water quality objectives in 17 of the last 18 monitored events and has been identified in previous years as the likely cause of toxicity in the Tijuana River. Malathion has also been observed in concentrations above the water quality objective in 8 of the last 15 monitored events, and in 2 of 3 events in the 2006-2007 monitoring season. A review of the trends shows statistically significant increasing trends for nitrate, TOC, TSS, turbidity, total and fecal coliform, total arsenic, total lead, and total zinc and the acute survival endpoint for *Hyalella azteca*. The increasing trend for *Ceriodaphnia dubia* survival indicates an increase in the toxicity to this species. Statistically significant decreasing trends are evident for conductivity, TDS, Diazinon, dissolved arsenic, and dissolved nickel.

Measured storm event loads at the Tijuana River MLS site were compared to the loading values derived from the EMC National Stormwater Quality Database (NSQD) (Pitt et al., 2004). Measured loads of most of the constituents were greater than expected for a majority of the storm events sampled. Only cadmium and dissolved lead were consistently within the expected range or lower than expected.

ES.4.9.2 Stream Bioassessment

Two stream bioassessment monitoring sites were sampled in the Tijuana River WMA. One site in Campo Creek was sampled in October 2006 and May 2007, and one site in the Tijuana River at the border fence was sampled in May 2007 only. The Index of Biotic Integrity rating for the Campo Creek site was Very Poor for the October 2006 survey and Fair for the May 2007 survey. The results of the O/E analysis show that the Campo Creek monitoring site had observed to expected taxa ratios of 0.37 and 0.62. This implies that the benthic community has lost an estimated 63 to 38 percent of the biodiversity expected to occur at the site. These results indicate that for the May survey, the site was above the impairment threshold according to the IBI, but was below the O/E impairment threshold. The Tijuana River site was rated Poor, but based on an assessment of individual metrics and observations made in the field, the investigators in this study feel that this rating is much higher than indicated by the actual benthic community quality.

ES.4.9.3 Ambient Bay and Lagoon Monitoring

The Ambient Bay and Lagoon Monitoring Program was completed in 2005-2006 and was not performed as part of the 2006-2007 monitoring program activities.

ES.4.9.4 WMA Assessment

For the Tijuana River WMA, ammonia, all three bacterial indicators, TSS, turbidity, and Diazinon were identified as high frequency of occurrence COC. Medium frequency COC were identified as BOD, COD, total phosphorus, total copper, and total lead. The constituents MBAS, dissolved phosphorus, Malathion, total zinc, and dissolved copper were identified as low frequency of occurrence COC. The elevated densities of all three bacterial indicators and elevated levels of BOD, COD, un-ionized ammonia, and nutrients (total phosphorus) are indicative of raw wastewater discharges.

Based on the triad matrix, there was evidence of persistent water quality objective exceedances, evidence of persistent toxicity, and no evidence of benthic alteration based on IBI scores. However, the IBI scores appear to over-estimate the actual conditions in the downstream sample locations. The water quality degradation and persistent toxicity observed from monitoring at the MLS in the lower Tijuana River is likely causing benthic alterations downstream of the United States border. There are no bioassessment monitoring sites south of the United States border.

The water quality priority ratings agreed with the WMA assessment findings for the Tijuana Valley sub-watershed, but since this sub-watershed is only 7% of the entire Tijuana River WMA, it suggests that the high priorities and COCs may be more localized to the area near the MLS. The overall Tijuana River WMA did not have any high priority (A) ratings. The highest rated constituents were heavy metals, sediments, pesticides, bacteria, benthic alteration, and toxicity, which were all assigned a B priority rating. All other categories received either a C or D priority rating.

ES.5 Regional Assessments

This section presents a regional assessment of the Receiving Waters Monitoring Program results. Whereas the previous sections presented the results on a watershed management area basis, this regional assessment provides an analysis of inter-relationships across watersheds. This section includes a regional assessment of wet weather data from the mass loading station monitoring, evaluations of storm water modeling and event mean concentrations, dry weather investigations, stream bioassessment, coastal outfall monitoring, and third party data investigations. Statistical analyses for regional assessment included the magnitude of the ratio of observed concentration to the WQOs, Mann-Kendall trend analysis, regional trend analysis (test of homogeneity), and multivariate cluster analysis.

ES.5.1 Cross Watershed Comparison

A comparison of the spatial distribution of the highlighted values for the 2006-2007 wet season indicates the following by constituent group:

- Bacteria – Bacterial concentrations were elevated throughout the region for all three of the bacterial indicators. Fecal coliform concentrations were above the WQO in 25 of the 30 samples collected during the season. The highest concentrations were observed at the Tijuana River MLS, not unexpected due to inadequate sewage treatment infrastructure.

- Total Dissolved Solids (TDS) – TDS concentrations were observed above the WQO at the MLS during all storm events sampled in the San Luis Rey, Carlsbad, San Dieguito, and Los Peñasquitos watersheds. Concentrations fluctuated in the Mission Bay, San Diego River, and Sweetwater River watersheds. In contrast, concentrations of TDS in all wet weather samples were below the WQO at the Chollas Creek and Tijuana River watersheds. Higher TDS concentrations may indicate greater contributions from higher dissolved mineral salts from groundwater/base flow and imported water.

- Total Suspended Solids (TSS) - Comparing TSS concentrations regionally, concentrations were consistently above WQOs in samples collected from Agua Hedionda Creek, Chollas Creek, and the Tijuana River. TSS concentrations were below the WQO during all three storm events at San Luis Rey, Los Peñasquitos, and Sweetwater Rivers and occasionally (one storm event) in most of the other watersheds. High concentrations of TSS indicate potential land erosion issues. The intensity and duration of storm events can affect TSS concentrations. Similar results were observed for turbidity concentrations.

- Nutrients – Total phosphorus, Nitrate, Nitrite, and Ammonia – Phosphorus concentrations were above the WQO during two of the three wet weather events at the Tijuana River. All other nitrate, nitrite and total phosphorus observed concentrations were below WQOs across the region. Ammonia observed concentrations were above the un-ionized Ammonia as N WQO for one wet weather event in Escondido Creek, two of three events at Chollas Creek, and all three wet weather events at Tijuana River.

- Pesticides – Diazinon was measured at concentrations above the WQO during one event at Agua Hedionda and Chollas Creek MLS, and all three events at Tijuana River MLS. Malathion was also found above the WQO during the same storm events at Agua Hedionda Creek and Chollas Creek, and for two of the three events at the Tijuana River MLS. Synthetic pyrethroids were detected at Agua Hedionda, Chollas Creek, and Tecolote Creek at levels likely to cause an effect to *Hyalella azteca* based on published literature values.

- Total Metals – Cadmium, Copper, Lead and Zinc – Cadmium concentrations were above the WQO for two storm events in Chollas Creek, and one storm event in Tecolote Creek. Copper, lead, and zinc concentrations were above the WQO during all three storm events in Chollas Creek and Tijuana River and during one event in Tecolote Creek. Copper and lead concentrations were above the WQO at the San Diego River MLS. Copper observed concentrations were above the WQO for two of three events at Agua Hedionda Creek, and for one event at Escondido Creek. For the 2006-2007 wet season, water quality issues regarding total metals were limited to these MLS.

- Dissolved Metals – Copper results were above the WQO during all three storm events in Chollas Creek, while lead concentrations were above the WQO for one event. For the 2006-2007 wet season, exceedance of water quality objectives for dissolved metals in 2006-2007 was limited to Chollas Creek MLS. This is primarily a result of the low hardness found in these watersheds and may be a function of increased impervious area.

- Toxicity – Toxicity results were similar to previous years at the Tijuana River MLS where all three sample events were toxic for *Ceriodaphnia dubia* and *Hyalella azteca*. Toxicity to *Hyalella*

azteca was observed for all three events in Chollas Creek and Agua Hedionda and is likely attributable to the presence of synthetic pyrethroids. Toxicity to *Ceriodaphnia dubia* was also observed during the first storm event in Chollas Creek and Agua Hedionda where Diazinon and malathion were detected. Single toxic episodes to either *Ceriodaphnia dubia* and/or *Hyalella azteca* were also noted at San Luis Rey River, San Dieguito River, Los Peñasquitos, San Diego River, and Sweetwater River. Toxicity to *Selenastrum capricornutum* was only observed during one event at the San Dieguito River MLS.

ES.5.1.1 Summary of Statistical Analyses

On a regional basis, TSS annual mean concentrations have exceeded the WQO in 8 of the 11 MLS over the last six years indicating that TSS, which is an indicator of sediment loading, is a regional water quality issue. Higher TSS levels may be associated with an increase in land disturbance activities and erosion in the region and increased impervious areas upstream of creek and river sections that may be subject to bank erosion from greater and more sustained peak flows.

Notable long-term trends at other MLS include:

- Bacteria - One significant decreasing trend was found for fecal coliform at Santa Margarita River. All other significant trends are increasing including enterococci at Santa Margarita River, San Luis Rey River, and Tecolote Creek; for fecal coliform in the Agua Hedionda Creek, San Luis Rey River, and Tijuana River; and for total coliform in the Santa Margarita River, San Luis Rey River, Agua Hedionda Creek, Escondido Creek, and Tijuana River. The fecal coliform concentrations in the San Luis Rey River have increased from below the WQO to above the WQO during the past three monitoring years. These results are in agreement with other observations indicating bacterial indicators as a regional concern throughout San Diego County.

- Sedimentation - Trend analyses of the conventional constituents indicated a statistically significant increasing trend for two constituents. Significant increasing trends for turbidity were found at Agua Hedionda Creek, Chollas Creek, San Diego River, and Tijuana River. A regional trend analysis (test for homogeneity) revealed that turbidity levels are increasing regionally. Significant trends were identified for TSS in Agua Hedionda Creek, San Dieguito River, San Diego River, and the Tijuana River. A test for homogeneity (regional analysis) for TSS was not valid because not all stations had increasing trends. TSS concentrations in Agua Hedionda Creek and Tijuana River have been above the WQO for several years. San Diego River also shows an increasing trend, although results are below the WQO during the past monitoring year. San Dieguito River also shows an increasing trend for TSS.

- Nutrients - Statistically significant increasing trends were observed for nitrate at the San Luis Rey River and Tijuana River. Significant decreasing trends for nitrate were observed at San Diego River and Tecolote Creek. Dissolved phosphorus also exhibits increasing trends in Agua Hedionda Creek and Sweetwater River. Although increasing trends for these two nutrients were observed, the concentrations are well below the WQO.

- Pesticides - Regional concentrations of Diazinon have been steadily decreasing below the WQO except at the Tijuana River, where concentrations remain above the WQO, but are much lower than from the years 2001-2004. Similar patterns, but with a smaller magnitude, are shown for Chlorpyrifos. These trend analyses and comparisons to WQO indicate a significant decrease in Diazinon concentrations in wet weather samples for most watersheds. Agua Hedionda Creek,

Chollas Creek, Escondido Creek, Tecolote Creek, and Tijuana River all show significant decreasing trends. However, an exceedance was noted during the 2006-2007 monitoring season at Chollas Creek and Agua Hedionda Creek. Regional trend analysis (test for homogeneity of stations) shows a significant decreasing trend. No significant trends were found for Chlorpyrifos; in 2006-2007 all test results were below detection limits for this pesticide. Since the EPA has banned the retail sale of Diazinon and Chlorpyrifos, and with the increased public outreach and education regarding the handling of pesticides in general, a decreasing trend for these compounds should continue. However, the pesticide manufacturer's change to synthetic pyrethroids is a concern. The Regional Monitoring Workgroup has developed a monitoring workplan to assess synthetic pyrethroids in the region in both sediments and storm water.

- Metals - Trend analysis of the wet weather data shows significant decreasing trends for dissolved arsenic in Agua Hedionda Creek, San Dieguito River, and Tijuana River. Total metals appear to be increasing across the region, with significant increasing trends for total copper in Agua Hedionda Creek, Chollas Creek, and Escondido Creek. Total lead results are also increasing at Agua Hedionda Creek and Tijuana River. Total nickel concentrations are increasing at Agua Hedionda Creek, Los Peñasquitos Creek, and San Dieguito River. Total zinc concentrations are increasing at Chollas Creek, Escondido Creek, and Tijuana River

The interpretation of the cluster analysis shows that there are seven major clusters of station/date, and four major clusters of constituents. The results of the cluster analysis show one cluster group consisting almost exclusively of the Tijuana River MLS; the rest of the cluster groups are initially divided by monitoring year. As in prior years, within each of these annual clusters there are two main subgroups that represent differences in concentrations of total hardness, TDS, and conductivity. The MLS with consistently higher results for these three constituents are San Luis Rey River, Los Peñasquitos Creek, San Dieguito River, Tecolote Creek, and Sweetwater River. Agua Hedionda Creek and Chollas Creek are consistently lower in these constituents while the remainder of the MLS, Escondido Creek, and San Diego River are more variable.

ES.5.2 Storm Water Modeling

ES.5.2.1 Static Storm Water Modeling

One method of evaluating measured storm event loads is to compare the results with what may be expected through land use runoff modeling. Pollutant loads were modeled using spatial data with a spreadsheet model. Load predictions were based on three factors: (1) storm event rainfall interpolated across the watershed from the County's ALERT rain gage network, (2) each watershed's impervious surfaces, and (3) the watershed land use.

Event Mean Concentration (EMC) values for each land use type were taken from the National Stormwater Quality Database (NSQD) (Pitt et al., 2004). This database represents monitoring data collected from nearly 4000 separate storm events over nearly a ten-year period from more than 200 municipalities throughout the country. The data characterize the EMCs from specific land use types. Measured loads (estimated for the entire storm event) were compared to the 25th and 75th percentile loads estimated through land use and rainfall modeling.

Across the region, some estimated measured loads were consistently greater than expected loads, while some constituent estimated loads were lower than expected. Oil and grease loads were usually as

expected (between the 25th and 75th percentiles), as well as dissolved cadmium and chromium (30 out of 30 events). TDS loads were generally greater than expected (29 out of 30 events), as well as fecal and total coliform (30 out of 30 events). Dissolved lead and zinc were generally below expected loads (28 out of 30 and 25 out of 30, respectively). All other constituents exhibited mixed results of above and below expected loads.

ES.5.3 Rapid Stream Bioassessment Results

A total of 25 different stream monitoring reaches were assessed in San Diego County in the surveys of October 2006 and May 2007. Three of these sites were considered to represent reference conditions. A total of 51 different monitoring reaches have been sampled since May 2001.

Taxonomic identification of samples collected in October 2006 produced 104 taxa from a total of 11,774 individuals. The May 2007 samples produced 102 taxa from 12,193 individuals.

The most abundant organisms in October 2006 in the study region were *Hyalella azteca* (Amphipoda: Hyalellidae), chironomid midges (Diptera: Chironomidae), *Gammarus* (Amphipoda: Gammaridae), *Corbicula* (Bivalvia: Corbiculidae), and *Simulium* (Diptera: Simuliidae). The most abundant organisms in May 2007 in the study region were chironomid midges, *Simulium*, *Baetis* (Ephemeroptera: Baetidae), *Hyalella azteca*, and Ostracods. The majority of organisms from the urban affected sites were moderately or highly tolerant to stream impairments. Organisms highly sensitive to impairments were encountered infrequently at the urban affected sites, but their presence even in low numbers was significant. Non-reference sites that supported highly sensitive organisms included Campo Creek in Campo and Escondido Creek in Elfin Forest.

The Index of Biotic Integrity ratings of the monitoring sites ranged from Very Good to Very Poor in both October 2006 and in May 2007. IBI scores for the reference sites were higher than all urban influenced sites in the October 2006 survey, and Campo Creek in Campo was the only urban site that scored higher than a reference site in May 2007. The May 2007 survey produced consistently lower IBI scores across the entire region than the October 2006 survey, with 19 of the 24 sites scoring lower in May.

Analysis of the ratio of observed organisms to expected organisms (O/E) indicated that most of the urban sites were moderately to highly degraded. This analysis was mostly in agreement with the IBI scores in determining impairment of the benthic communities. For the 2006/2007 surveys, there were conflicting results for several sites that showed the O/E analysis as rated above the impairment threshold while the IBI rated the site as impaired. These included Escondido Creek in Elfin Forest, San Diego River in Mission Trails Park, and Santa Margarita River on Camp Pendleton.

Of all of the watersheds in San Diego County, the Santa Margarita River watershed had the least impaired benthic macroinvertebrate communities. Campo Creek in the upper Tijuana River WMA was also relatively unimpaired, as evidenced by the presence of highly intolerant organisms. The remaining watersheds have substantially greater amounts of urbanization, and the IBI results generally indicate that greater water quality impairment occurs in the lower portions of the watersheds as the impacts of urban runoff become cumulative and/or the stream type becomes warmer and more depositional.

After 6½ years of bioassessment surveys, there has been little trend towards degradation or improvement at any of the monitoring sites. Regionally, the County average IBI scores for most of the San Diego sites for May surveys have been quite consistent while there has been a slow and moderate

decline for October surveys. Individual seasons or years have produced better conditions for the macroinvertebrates, and the data reflects variability in the ecological conditions.

ES.5.4 Ambient Bay and Lagoon Monitoring

As previously mentioned, the Ambient Bay and Lagoon Monitoring Program was completed in 2005-2006 and was not performed as part of the 2006-2007 monitoring program activities.

ES.5.5 Dry Weather Data Analysis Results

During the 2006 dry weather monitoring program, out of 9,526 individual field and analytic samples, 865 samples had results measured above the dry weather action levels. The constituent with the greatest number of exceedances for all land uses and conveyance types, and the highest rate of exceedance for 2006, was total coliform.

Analysis of the several years of dry weather data (2002-2006), as related to land use, shows that total coliform has been the constituent with the greatest rate of exceedance. Turbidity ranked second and enterococcus third. This pattern is relevant for the San Diego Region, and for the five years of dry weather data evaluation.

The pattern of exceedance by land use and conveyance type is explained by the number of individual samples collected within each land use and conveyance. In other words, the proportion of exceedances within each land use or conveyance is similar to the proportion of the number of sites per land use or conveyance type. No single land use or conveyance type stands out as exceeding an action level more often than the proportion of monitoring sites for that land use or conveyance type.

ES.5.6 Third Party Regional Data

Third party data include data collected under the Surface Water Ambient Monitoring Program (SWAMP) in 2002 from the Carlsbad, Los Peñasquitos, and Mission Bay Watersheds, in 2003 from the Santa Margarita, San Dieguito, and Otay Watersheds, and in 2004 from the San Luis Rey and San Diego River Watersheds. Also included are data collected in 2005 and 2006 by the Padre Dam Water Quality Monitoring Program conducted in the San Diego River Watershed. Additional Third party data were submitted from the City of La Mesa (La Mesa Field and Water Quality data), the Port of San Diego (Sweetwater River Authority monitoring data), and the Carlsbad Watershed Copermittees (Carlsbad Watershed Protection Grant and Escondido Creek-Hale Avenue monitoring data).

The SWAMP data show persistent problems with sulfate and manganese in most of the watersheds, particularly at the base of the watershed. Dissolved minerals are typically associated with naturally occurring processes. However, land use activities may result in increased concentrations of these constituents. Of interest is the decrease in Diazinon detections above the WQO in the 2003 and 2004 data; this constituent was frequently found above the WQO in the 2002 data.

The 2005 and 2006 Padre Dam data provide some additional information for the water quality assessment of the San Diego River WMA. This program provided measurement of TDS which was not measured in the SWAMP program. This constituent was the one most frequently found in

concentrations above the WQO benchmark at all six sites sampled, followed by dissolved oxygen which was low during the summer months at all sites except Forrester Creek.

The City of La Mesa Field and Water Quality data provided additional information for the Chollas, Sweetwater, and San Diego River watersheds. Again, TDS was the constituent most often above the WQO benchmarks, followed by fecal coliform. Two of the field results also showed low levels of dissolved oxygen.

The Sweetwater Authority ambient monitoring data provided by the Port of San Diego (1997-2004), showed that TDS exceeded the WQO benchmark in 434 of 443 samples. Only one other sample for fecal coliform was above the WQO benchmark, all other constituents were below the WQO benchmarks.

Carlsbad Watershed Copermittee Grant Data provided additional ambient monitoring information for the Carlsbad Hydrologic Unit. Of the 96 samples collected over the monitoring period (December 2004-October 2006), only nitrate and fecal coliform results exceeded any WQO benchmarks. Nitrate exceeded the WQO benchmark twice during the monitoring period, and fecal coliform exceeded 25 of the 96 samples. At least one sample from each site exceeded the fecal coliform WQO benchmark over the monitoring period.

Carlsbad Watershed Copermittee Escondido Creek-Hale Avenue data were provided, and are assumed to be grab samples collected from the receiving water. Again, TDS was the constituent most often above the WQO benchmark (all 2006 samples and 17 of 24 samples in 2007). Chloride, sulfate, and dissolved oxygen results were often outside WQO benchmarks during 2006 and 2007. Fecal coliform results were also often above the WQO benchmark.

ES.6 Program Review

During the 2001-01 permit issue process, the Copermittees were required to review historical data and develop future recommendations. This was developed in the "San Diego Region Previous Storm Water Monitoring and Future Recommendations Report" (MEC, 2001). This report presented monitoring objectives for the 2001-01 permit term. The overall goal of monitoring expressed in the report was to "understand conditions of receiving waters within each watershed, identify water quality problems within each watershed, and take actions to correct those problems so that beneficial uses are not degraded or impaired." The design of the program included core monitoring, regional monitoring, and special studies.

The intent of the monitoring design was to identify watersheds with water quality problems using the information collected during wet weather events at the base of the watershed, benthic community information, and information collected in the lagoons and embayments. This "prioritization" of watersheds was intended to provide a mechanism to focus special studies and upstream investigations into identification of the contributing sources to the water quality problems, as well as to provide additional characterization of those watersheds.

The program design that was implemented in the 2001-2002 permit year was intended to provide:

- Information relating to chemical, physical, and biological impacts to receiving waters resulting from urban runoff,
- Indication of the overall health and long-term trends in water quality in the receiving waters.

To date these two over-arching goals have been met by the monitoring design, however, additional questions resulting from the collected data have yet to be answered. Such questions include a temporal question "What are the dry weather (ambient) concentrations of the urban runoff constituents?" and a spatial question "How do the constituents of concern vary throughout the watershed?"

In 2004, the Storm Water Monitoring Coalition (SMC) developed a Model Storm Water Monitoring Guidance Document. San Diego Region Copermittees had representatives who participated in the development of the guidance document. The SMC developed the guidance by framing five management questions which urban runoff monitoring programs should consider. The SMC acknowledged that these questions may not all be of equal importance to jurisdictions, but rather can assist jurisdictions and jurisdictional groups in refining their monitoring programs. The five questions are:

1. What are the water quality conditions in the watershed?
2. Are water quality conditions in the watershed getting better or worse?
3. Are beneficial uses being impacted?
4. What is the relative contribution of urban runoff to the conditions in the watershed?
5. What are the sources to urban runoff that contribute to water quality conditions?

Order No. 2001-01 was scheduled to expire on February 21, 2006. The draft tentative order for the next permit cycle was released by the RWQCB (Order R9-2006-0011) on March 10, 2006. A second revision was prepared in June 2006. A revised draft order was then released on August 30, 2006, following comments received during the public comment period. With the delays in finalizing the new permit, the Copermittees were required to perform an additional year of monitoring under the guidelines of Order No. 2001-01. Therefore, the monitoring conducted in 2006-2007 continued the monitoring program initiated in the 2001-2002 storm season. The RWQCB adopted the new permit (Order R9-2007-0001) on January 24, 2007. Monitoring under the new permit will begin during the 2007-2008 monitoring period.

The following describes the degree to which the monitoring program presented in this report addresses each question:

Question 1: What are the water quality conditions in the watershed? This question is partially addressed through the current NPDES program, but a comprehensive watershed assessment is not provided by the current program. The current monitoring program evaluates wet weather discharges at the base of the watershed for toxicity effects to freshwater organisms and chemical, bacterial, and general physical parameters. Monitoring conducted through the 2006-2007 monitoring season included bacterial monitoring at coastal outfalls, dry weather illicit discharge and illegal connection investigations, benthic community assessment at several locations within the watershed, and chemistry and toxicity analyses at limited locations within the watershed's MS4 system.

Question 2: Are water quality conditions in the watershed getting better or worse? This question is partially addressed in the following ways:

- Long-term trend assessment at the mass loading stations can provide an indication of improvements in the watershed.
- Long-term trend assessment of the quality of the benthic community within the watershed.

Question 3: Are beneficial uses being impacted? This question is only addressed in the monitoring program through comparison to water quality objectives and benchmarks. For example, bacterial counts exceeding water quality objectives indicate an impact to recreational beneficial use. This question may also be partially addressed through jurisdictional and watershed urban runoff management programs (e.g. number of beach closures, sewage spills, and reporting of impacts to sensitive habitats).

Question 4: What is the relative contribution of urban runoff to the conditions in the watershed? To answer the question of "relative" contribution requires knowledge of baseline conditions or a reference (non-urbanized) area for comparison. This question is partially addressed by comparing the normalized storm event loading within the watershed to loading values derived from the National Stormwater Quality Database (NSQD) (Pitt et al., 2004).

The rapid stream bioassessment program provides a comparison of reference sites to urbanized areas. While the bioassessment surveys do not directly measure constituents directly, it does provide a relative assessment of ecological health of a watershed. The current program also provides comparison between watersheds. This comparison of watersheds together with an assessment of different land use characteristics and an evaluation of concentrations of constituents of concern, occurrence and magnitude of toxic effects, and benthic community health yields an understanding of the impacts related to urbanization and various land uses.

Question 5: What are the sources to urban runoff that contribute to water quality conditions? There are a variety of approaches to answer this question. The current program provides a mechanism to understand potential sources in urbanized watersheds. For example, Diazinon in urban watersheds comes from residential, commercial, or agricultural pest control. Where further source characterization and identification is required, a more focused study would be needed to answer the question. Additionally, the Copermittees report on potential water quality pollutant sources through industrial permit inspections, illicit discharge and illegal connection investigations, and through developing source inventories and threat to water quality tables as exemplified in the Baseline Long Term Effectiveness Assessment Report (Weston, MOE,& LWA, 2005).

Under Order 2001-01, Copermittee monitoring program's ability to fully answer the five management questions was limited by the prescriptive requirements of the NPDES permit. Currently the watershed data assessment uses the wet weather monitoring data at the mass loading stations, the benthic community assessments within the watersheds, dry weather information, limited third party data, and the Clean Water Act 303(d) listing to provide management recommendations to stakeholders.

Up to this monitoring year, 2006-2007, the Copermittee monitoring program has set the stage for answering these questions with gathering basic status and trend information. The program was initially designed to be adaptive through time and focus efforts toward identifying water quality problems in watersheds. Once watersheds with problems were identified, the adaptive part of the program is intended to move monitoring and assessment upstream in those priority watersheds to fully answer the management questions (MEC, 2001). This adaptive philosophy is the same philosophy presented in the Model Monitoring Document. The SMC did not intend that permit monitoring would comprehensively address all five questions, nor was the intent that the stepwise approach as presented in the Model Monitoring Document would be followed in a linear, stepwise fashion, but rather that monitoring would be conducted based upon a prioritization of needs (SMC, 2004).

Monitoring conducted under Order 2001-01 has provided advancement in understanding water quality conditions throughout San Diego County's watersheds by providing monitoring at the base of 11

watersheds throughout the region. The current data from the monitoring program provides a strong foundation to form the basis of existing knowledge about water quality that was not available for all watershed management areas prior to 2001-2002. Using this information, the Copermittees can refine their monitoring program to better address specific management questions and yield more baseline information against which improvements in water quality can be measured. Copermittees presented their recommended approach toward program evolution in the Report of Waste Discharge presented in 2005.

The adoption of the new permit (Order R9-2007-0001) on January 24, 2007 has resulted in many new changes and program enhancements. The new program focuses the regional monitoring program into a more condensed watershed approach by evaluating the watersheds spatially (through the implementation of temporary watershed assessment stations upstream or in areas that have not been studied) and temporally (by conducting two ambient and two storm water monitoring events per year). The ambient bay and lagoon monitoring program is required to be revised. New programs are also required to be implemented to assess emerging pollutants and pollutants that have not been recently addressed (e.g. synthetic pyrethroids and trash). A new requirement to assess periphyton will provide additional useful data to bolster the rapid stream bioassessment program. The new permit also requires the Copermittees to develop source identification and MS4 outfall monitoring programs.

As of the writing of this report, the Copermittees have developed several workplans and are in the process of developing programs to comply with these new permit requirements as listed below:

- Monitoring Workplan for the Assessment of Synthetic Pyrethroids in San Diego County (County of San Diego, 2007).
- Monitoring Workplan for the Assessment of Trash in San Diego County (County of San Diego, 2007).
- Periphyton (algae) monitoring and ash-free dry mass (AFDM) and chlorophyll-A analyses will be conducted in accordance with the EPA's Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers.
- The Copermittee Monitoring Workgroup submitted a revised ABLM monitoring workplan on September 1, 2007. However, with the implementation of the Lagoons Investigative Order (R9-2006-0076) and the Bight '08 program, this program may receive amendments based on correspondence with the Regional Water Quality Control Board.
- The Copermittee Monitoring Workgroup is currently developing MS4 Outfall and Source Identification workplans. These workplans will be submitted by July 1, 2008.

Based on the review of the information obtained from the new monitoring permit, the previous 2001-01 monitoring program, and historical monitoring data, recommendations are presented in the next subsections for the next iteration of the monitoring program as the San Diego Region moves forward with continuing to understand urban runoff and its impacts.

ES.7 Recommendations

The recommended actions resulting from the triad assessments for each WMA or MLS are summarized in Section 14.3. Recommendations include continuing water quality monitoring in all watersheds to gather long-term trend information, investigating upstream sources of contaminants, consider the potential role of physical habitat disturbance, and conducting TIEs in Agua Hedionda Creek storm water samples.

Since the EPA has banned the retail sale of Diazinon and Chlorpyrifos, and with the increased public outreach and education regarding the handling of pesticides in general, a decreasing trend for the organophosphate pesticide compounds is evident and should continue. Continued monitoring of the organophosphate compounds should show an overall decrease in the number of WQO exceedances and concentrations over time with the expectation that residual public supply and use will eventually be exhausted. However, the pesticide manufacturer's shift to synthetic pyrethroids does warrant concern. The Copermittees have implemented a new workplan to assess the presence of synthetic pyrethroids in the San Diego Region. Based on the findings of the recent TIE investigations performed in Chollas Creek and the detections of several pyrethroid compounds in every storm event monitored in Chollas Creek, analyses of this compound class were added to the constituent list during the 2006-2007 monitoring period for Agua Hedionda Lagoon, Tecolote Creek, and Chollas Creek. Based on the detections of these compounds, confirmatory TIEs are recommended for Agua Hedionda Creek only.