This section describes the results, data analysis, and recommendations for the 2003-2004 Monitoring Program.

4.1 HYDROLOGY: PRECIPITATION AND FLOW

The monthly rainfall during the 2003-2004 storm season was compared to the long-term pattern of rainfall in Figure 4-1. During this storm season, the total rainfall was about 8.4 inches. Figure 4-2 shows that the total annual rainfall of 8.4 inches during the 2003-2004 storm season in downtown Los Angeles was just about half the average annual rainfall. The average annual rainfall over 131 seasons at Station # 716, Ducommun Street in downtown Los Angeles is about 15.51 inches. Table 4-1 summarizes the hydrologic and meteorologic conditions of each station-event monitored during this storm season. A collection of 2003-2004 season hydrographs for each storm event from the monitored sites is included in Appendix A. Each hydrograph includes the time of the first and last composite sample aliquot collection, the sample volume interval, and the percent of storm sampled.

4.2 STORM WATER QUALITY

An inventory of the composite and grab samples taken for the chemical and biological analysis and toxicity analysis during the 2003-2004 monitoring season is included in Tables 4-2, 4-2a, and 4-3.

4.2.1 Mass Emission Analysis

This section provides a description of wet weather and dry weather mass emission results generated during the 2003-2004 monitoring season.

The County analyzes for an extensive number of individual water quality constituents, the results of which are included in Appendix B. A comparison was made between mass emission water quality results and the water quality objectives outlined in the Ocean Plan, the Basin Plan, and the CTR. The freshwater final acute criteria set by the California Department of Fish and Game was also used to provide water quality standards for chlorpyrifos and diazinon. The Municipal Storm Water Permit specifically requires the County to assess the pollutant loading for the sampling events that are analyzed for the complete list of constituents following the 2003-2004 storm season. In addition, the Municipal Storm Water Permit requires the identification and analysis of any long-term trends in storm water or receiving water runoff. An analysis of the correlation between pollutants of concern (metals and PAHs) and TSS loadings for the sampling events was also performed.

Comparison Study

As required by the Municipal Storm Water Permit, a comparison to the applicable water quality standards from the Basin Plan, the Ocean Plan, or the CTR for mass emission monitoring was conducted. The lowest possible standard of the three documents was used for the comparison study. The California Department of Fish and Game provided freshwater final acute criteria water quality standards for chlorpyrifos and diazinon. The Basin Plan is designed to enhance

water quality and protect the beneficial uses of all regional waters. The Ocean Plan is applicable to point source discharges to the ocean. The CTR promulgates criteria for priority toxic pollutants in the State of California for inland surface waters and enclosed bays and estuaries. Constituents that exceeded the applicable water quality standards are highlighted in Appendix B and Table 4-4. Table 4-4 and Figure 4-3 summarize this comparison analysis.

The following conclusions were drawn from the mass emission comparison study:

Wet Weather

Since the Municipal Storm Water Permit requires only three wet weather samples at each mass emission monitoring station, a 33% exceedance indicates only one sample exceeded the water the water quality standard, a 67% exceedance indicates two samples exceeded the water quality standard and 100% exceedance indicates all three samples exceeded the water quality standard.

- The monitoring program has identified the nearly ubiquitous existence of bacteria in wet weather for all seven of the mass emission monitoring stations. Densities of total coliform, and fecal coliform, and fecal enterococcus exceeded the public health criteria of the Basin Plan for each storm at each monitoring station 100% of the time, with the exception of Malibu Creek and San Gabriel River, which only exceeded the total coliform and fecal objectives 67% of the time. As during the 2002-2003 storm season, the Malibu Creek station shows generally lower indicator bacteria counts than the other mass emission stations.
- The ratio of fecal coliform to total coliform Basin Plan standard was exceeded 100% of the time in all watersheds except, San Gabriel River and in Coyote Creek, where it was exceeded 33% and 67% of the time respectively, and in Malibu Creek where there was no exceedance of the ratio.
- There was no clear trend between total coliform densities and storm events. However, Ballona Creek, Malibu Creek, Coyote Creek, San Gabriel River, and Dominguez Channel monitoring stations each had the highest total coliform density during the December 25, 2003 storm.
- 33% of the dissolved oxygen samples from the Los Angeles River and Coyote Creek monitoring stations were below the minimum Water Quality Objective of the Basin Plan. No other stations exceeded this Objective.
- 100% of the total copper samples exceeded the Ocean Plan water quality standard at the Los Angeles River, Coyote Creek, and Dominguez Channel monitoring stations. Ballona Creek, San Gabriel, and Santa Clara River monitoring stations exceeded the standard in 67% of the samples and Malibu Creek monitoring station exceeded the standard in 33% of the samples.
- Only the Coyote Creek, Dominguez Channel, and Santa Clara River monitoring stations exceeded the California Department of Fish and Game's water quality criteria for diazinon. The exceedances occurred in 33% of the stations' corresponding samples.
- Except for Ballona Creek and Dominguez Channel, samples from all the monitoring stations were within the pH water quality standard limits. Ballona Creek and Dominguez Channel exceeded the pH water quality standard limits in 33% of its samples.

- 33% of the dissolved copper samples taken at the Coyote Creek monitoring station and Dominguez Channel monitoring stations and 67% of the dissolved copper samples taken at the Ballona Creek monitoring station exceeded the CTR water quality standard.
- 33% of the dissolved lead samples collected at the Los Angeles River monitoring station exceeded the CTR water quality standard. This is the only monitoring station that showed exceedance for dissolved lead.
- San Gabriel River and Los Angeles River exceeded the cyanide Ocean Plan water quality standard in 100% of its samples. Coyote Creek, Dominguez Channel, and Santa Clara River exceeded the standard in 67% of its samples.
- All of the total zinc samples from the Los Angeles River and Dominguez Channel monitoring stations exceeded the Ocean Plan water quality standard. 67% of the total zinc samples from Ballona Creek monitoring station, and 33% from the Coyote Creek and Santa Clara River monitoring stations exceeded the Ocean Plan water quality standard. None of the samples from the Malibu Creek and the San Gabriel River Monitoring stations exceeded the total zinc standard. Only Ballona Creek and Dominguez Channel monitoring stations exceeded the CTR water quality standard for dissolved zinc in 33% and 67% of the samples respectively.
- The Basin Plan water quality standard for TDS was exceeded in 33% of the samples at the Malibu Creek monitoring station. No other monitoring stations had any exceedance for this constituent.
- The Ocean Plan water quality standard for turbidity was exceeded in 33% of the samples at the Malibu Creek and Santa Clara River monitoring stations.
- Total aluminum samples exceeded the Basin Plan water quality standard in 67% of the samples at the Santa Clara River monitoring station, and 33% of the total aluminum samples at the Los Angeles River, Coyote Creek, and Dominguez Channel monitoring stations.

Dry Weather

Since the Municipal Storm Water Permit requires only two dry weather samples at each monitoring station, a 50% exceedance indicates only one sample exceeded the water quality standard and a 100% exceedance indicates both samples exceeded the water quality standard.

- There were no exceedances for any of the dissolved metals during dry weather.
- The California Department of Fish and Game's water quality criteria for diazinon was exceeded only at the Coyote Creek monitoring station, in 50% of its samples.
- Overall, there were a smaller percentage of exceedances for total coliform, fecal coliform, and fecal enterococcus during dry weather at all seven of the monitoring stations. Also, for most of the dry weather samples, the coliform densities were significantly lower than the densities for the wet weather samples.
- The total coliform criteria set in the Basin Plan was exceeded in 100% of the samples at the San Gabriel River monitoring station and in 50% of the samples at the Ballona Creek, Los Angeles River, Coyote Creek and Santa Clara River monitoring stations. No other monitoring station exceeded the total coliform criteria.

- The fecal coliform criteria were exceeded in 50% of the samples for all of the monitoring stations except Coyote Creek, which exceeded the criteria in 100% of the samples.
- Fecal enterococcus criteria was exceeded in 100% of the samples at the Los Angeles River, Coyote Creek, San Gabriel River, and Dominguez Channel monitoring stations and in 50% of the samples at the Ballona Creek and Santa Clara River monitoring stations. No exceedance of the Fecal Enterococcus criteria was detected at the Malibu Creek monitoring station.
- The ratio of fecal coliform to total coliform Basin Plan standard was exceeded in 50% of the samples at all of the monitoring stations except at San Gabriel River and Santa Clara River, which had no exceedances.
- Unlike the wet weather samples, the Basin Plan water quality criteria for chloride was exceeded at two of the mass emission stations during dry weather. Coyote Creek exceeded in 50% of the samples and Santa Clara River exceeded in 100% of the samples.
- 50% of the total copper samples exceeded the Ocean Plan water quality standard at the Ballona Creek, Malibu Creek, Coyote Creek, San Gabriel River, and Dominguez Channel monitoring stations. The Los Angeles River exceeded the standard in 100% of the samples. No exceedance was found at the Santa Clara River monitoring station.
- Except for Ballona Creek, samples from all the monitoring stations were within the pH water quality standard limits. Ballona Creek exceeded the pH water quality standard limits in 50% of its samples.
- The Ocean Plan water quality standard for total zinc was exceeded in 50% of the samples at the Los Angeles River monitoring station. This is the only monitoring station that showed exceedances.
- TDS was exceeded in 50% of the samples at the Malibu Creek monitoring station. No other monitoring stations had any exceedance for this constituent.
- Los Angeles River and Coyote Creek exceeded the Ocean Plan water quality standard for cyanide in 100% of the samples, and San Gabriel River exceeded the Ocean Plan water quality standard for cyanide in 50% of the samples. . No other monitoring stations had any exceedance for cyanide.

Loading and Trend Analysis

An estimation of the total pollutant loads due to storm water and urban runoff for each mass emission station is shown on Table 4-11. As required by the Municipal Storm Water Permit, samples were collected and analyzed for TSS at all mass emission stations equipped with automated samplers for all storm events that resulted in at least 0.25 inches of rainfall. The concentrations for TSS for each storm is shown on Table 4-9 and the total pollutant loading for TSS for each mass emission station is shown on Table 4-10. By analyzing the pollutant loading at each mass emission station, it is possible to see if there is any correlation between storm events and the amount of pollutant loading. An analysis of trends in storm water or receiving water quality is represented in Figure 4-4. Although it is difficult to see any sustained trends at this time, they will become more apparent in years to come as sampling continues.

The following conclusions were deduced from the loading analysis:

- The total runoff volume at the Los Angeles River monitoring station was consistently higher than at the other monitoring stations. Los Angeles River also has approximately two times or more surface runoff area than the other watersheds. This creates more potential for surface runoff pollution and likely explains, in part, the increased loading of constituents at the Los Angeles River monitoring station when compared to the other monitoring stations.
- The storm on October 31, 2003 at the Los Angeles River and Coyote Creek monitoring stations produced TSS loadings of 22,919 tons and 12,095 tons respectively. The storm on December 25, 2003 at the Malibu Creek, Los Angeles River, Coyote Creek, and Santa Clara River monitoring stations produced TSS loadings of 47,200 tons, 37,140 tons, 4,473 tons, and 6,526 tons, respectively. Los Angeles River also produced loadings of 19,753 tons and 12,008 tons during the February 2, 2004 and February 21, 2004 storms respectively. The loading during all other storm events at all the monitoring stations was below 4,000 tons. The Los Angeles River is the largest contributor of TSS out of the seven mass emission stations monitored.
- Ballona Creek, San Gabriel River, and Dominguez Channel had generally lower TSS and metals loadings than the other monitoring sites.
- The December 25, 2003 storm produced the highest TDS loadings at the Malibu Creek, Coyote Creek, Los Angeles River, and Coyote Creek monitoring stations. The storm on February 2, 2004 produced the lowest TDS loading at all stations.
- Metal loading was the greatest for the Los Angeles River.
- Total and dissolved zinc appear to have the greatest loadings at different storms for different monitoring stations. Total and dissolved zinc appeared the greatest at the Los Angeles and Coyote Creek monitoring stations during the October 31, 2003 storm, at Malibu Creek and Santa Clara River monitoring stations during the storm of December 25, 2003, and at the Ballona Creek, San Gabriel River and Dominguez Channel monitoring stations during the storm of February 2, 2004.

The following conclusions were drawn from the trend analysis:

- The high levels of zinc found at monitoring stations between 1994-2000 were not present in the samples taken during the 2001-2002 and 2002-2003 storm season. During the 2003-2004 storm season the high levels of zinc were again absent, except for an exceedance at the Los Angeles River monitoring station.
- The rainfall during the 2003-2004 storm season was slightly higher than half the annual rainfall average and the amount of rainfall recorded during the 2002-2003 storm season. However, it appears that there is an increased loading as compared to the 2002-2003 storm season.

Pollutant Loading Example

At the request of the RWQCB, below is an example of the pollutant loading calculation:

Site: Ballona Creek Mass Emission Station

Storm event: 12/25/2003

Constituent: Nitrate

Concentration: 4.75mg/L

Runoff Volume: 481.8 acre-ft (440 acre-ft Runoff + 41.8 acre-ft Base Flow)

1lb = 454 g

1g = 1,000 mg = $1x10^6$ µg

1L = 0.03531467 ft^3

1 ft^3 = 2.2957 x 10^{-5} acre-ft

Pollutant Loading = (Pollutant Concentration)(Runoff Volume)

Pollutant Load = (4.75 mg/L)(481.8 acre-ft)(1g/1,000 mg)(1 lb/454g)(1 ft^3/2.2957 x 10^{-5} acre-ft)(1L/0.03531467 ft^3)

Pollutant Load = 6223 lbs.

Conversion factors

Correlation Study

An analysis of the correlation between metals and TSS levels for the mass emission monitoring was performed. The study was only conducted on metals because the PAH samples at all of the monitoring stations were non-detects.

A trend line was projected on each of the metals-versus-TSS plots and the coefficient of determination (R^2) was calculated to see if there was any correlation between the concentrations for each metal and TSS for the mass emission monitoring stations (Figure 4-5). The closer the value of R^2 is to the number one, the stronger the correlation of the two variables.

The following conclusions were deduced from the correlation study analysis:

- Unlike other watersheds, the Dominguez Channel, San Gabriel River, Santa Clara River and Ballona Creek watersheds showed no strong correlation between metals and TSS, except for dissolved chromium, dissolved copper, dissolved lead and dissolved nickel in the case of San Gabriel River, dissolved chromium and total Zinc in the case of Dominguez Channel, dissolved nickel, total arsenic, dissolved iron and dissolved lead in the case of Santa Clara River, and dissolved copper, total copper, dissolved antimony and total antimony in Ballona Creek monitoring stations. The strongest correlation between metals and TSS occurred at the Coyote Creek watershed, followed by Los Angeles River and Malibu Creek watersheds.

- There were no strong correlations from any of the watersheds, except for the Los Angeles River and Coyote Creek watersheds for the following constituents: total aluminum, total chromium, and total lead. R2 for the Los Angeles River and Coyote Creek for these constituents ranged between 0.9641 and 0.9874, whereas R2 for the rest of the watersheds had a range high of 0.4994.
- Excluding Dominguez Channel and Santa Clara River, all of the monitoring sites showed a strong correlation between dissolved copper and TSS, with R2 values ranging from 0.6824 to 0.9244 (most of them closer to the upper range).
- Four of the mass emission monitoring sites, Malibu Creek, Los Angeles River, Coyote Creek, and Dominguez Channel, showed a correlation between total aluminum and TSS, with R2 values of 0.7337, 0.9571, 0.9675, and 0.8904, respectively.
- Four of the mass emission stations showed a strong correlation between dissolved antimony and TSS. Ballona Creek, Malibu Creek, Los Angeles River and Coyote Creek showed R2 values of 0.8929, 0.9999, 0.9647, and 0.9874, respectively.
- Four of the mass emission stations showed a strong correlation between dissolved nickel and TSS. Malibu Creek, Los Angeles River, Coyote Creek and San Gabriel River showed R2 values of 0.8561, 0.9999, 0.9757, and 0.8167, respectively.

4.2.2 Tributary Monitoring Analysis

This section provides a description and analysis of wet weather and dry weather tributary results generated during the 2003-2004 monitoring season.

Though only a requirement for the first storm of the season, tributary monitoring analyzes included all of the water quality constituents monitored under the mass emission monitoring program, the results of which are included in Appendix B. Flow was also measured and is reported as hydrographs, which can be found in Appendix A. In order to identify the sub-watersheds where storm water discharges are causing or contributing to exceedances of water quality standards, a comparison was made between tributary water quality results and the water quality objectives outlined in the Ocean Plan, the Basin Plan, and the CTR. The lowest possible standard of the three documents was used for the comparison study. The freshwater final acute criteria set by the California Department of Fish and Game was also used to provide water quality standards for chlorpyrifos and diazinon.

Since the tributary monitoring stations collect samples from sub-watersheds within the Los Angeles River watershed, the results from the Los Angeles River mass emission station were also used in the analysis. It was not possible to accurately identify any problems based on dry weather results as only two samples were taken at each tributary monitoring station in compliance with the Municipal Storm Water Permit as modified by the Los Angeles Regional Water Quality Control Board. Constituents that exceeded the applicable water quality standards are highlighted in Appendix B and Table 4-5. Table 4-5 and Figure 4-3 summarize this comparison analysis.

The following conclusions were drawn from the wet weather tributary comparison study:

- As with the mass emission monitoring program, the tributary monitoring program identified the nearly ubiquitous existence of bacteria during wet weather at all six stations. Densities of

total coliform, fecal coliform, and fecal enterococcus exceeded the public health criteria of the Basin Plan for each storm at each monitoring station 100% of the time. This corresponds to the results obtained from the Los Angeles River mass emission station.

- The ratio of fecal coliform to total coliform Basin Plan water quality standard was exceeded 100% of the time in all sub-watersheds, except Aliso Creek, Bull Creek and Burbank Western which exceeded in 75% of the samples.
- 50% of the samples from all the subwatersheds exceeded the Ocean Plan limit for cyanide, except Aliso Creek and Burbank Channel, which exceeded the Ocean Plan limit in 25% of the samples.
- Bull Creek exceeded the Ocean Plan water quality standard for turbidity in 50% of the samples. Rio Hondo exceeded the turbidity standard in 25% of the samples.
- Diazinon criteria was exceeded in 25% of the samples were from Aliso Creek, Verdugo Wash, and Rio Hondo monitoring stations. There were no exceedances from the rest of the sub-watersheds.
- Total Copper exceeded the Ocean Plan water quality standard in 75% -100% of the samples at all of the tributary stations.
- Except at Arroyo Seco and Bull Creek, CTR water quality standard for dissolved copper was exceeded by 50%-100% of the samples from all the sub-watersheds. No exceedances of the standard were noted from Arroyo Seco and Bull Creek monitoring stations.
- Total nickel exceeded the Ocean Plan water quality standard in 25% of the samples from the Bull Creek monitoring station..
- 25% of the total lead samples exceeded the Ocean Plan water quality standard at Bull Creek, Verdugo Wash, and Rio Hondo Channel monitoring stations.
- All the sub-watersheds exceeded the total zinc Ocean Plan water quality standard in 50% of the samples, except at Aliso Creek and Verdugo Wash where the standard was exceeded by 75% and 25% of the samples, respectively.
- Aliso Creek exceeded the CTR water quality standard for dissolved copper in 25% of the samples. There were no exceedances from the other tributary monitoring stations.

The following conclusions were drawn from the dry weather tributary comparison study:

- Densities of total coliform and fecal coliform exceeded the public health criteria of the Basin Plan from all monitoring station by 50% of the samples, except at Bull Creek where they were exceeded by 100% of the samples.
- Fecal enterococcus exceeded the public health criteria of the Basin Plan from all monitoring stations except at Bull Creek and BurbankWestern where the Criteria was exceeded by 50% of the samples.
- The ratio of fecal coliform to total coliform Basin Plan water quality standard was exceeded by 50% of the samples in Bull Creek , Arroyo Seco, and Rio Hondo Channel. There were no exceedances from other sub-watersheds.

- 100% of the samples from the Los Angeles River and Coyote Creek, and 50% of the samples from the San Gabriel River monitoring stations exceeded the Ocean Plan limit for cyanide.
- CTR water quality standard for dissolved copper was exceeded by 50% of the samples Aliso Creek, Burbank-Western and Rio Hondo monitoring stations. No exceedances of the standard were noted from other tributary monitoring stations.
- Total Copper exceeded the Ocean Plan water quality standard in 100% of the samples from Aliso Creek and Burbank-Western and 50% of the samples from the Arroyo Seco and Rio Hondo tributary monitoring stations.
- Thee total zinc Ocean Plan water quality standard was exceeded in 50% of the samples, at Burbank-Western and Rio Hondo Channel tributary monitoring stations. No exceedance of the standard was noted from any other tributary monitoring stations.
- Unlike the wet weather samples, the Basin Plan water quality criteria for chloride was exceeded at two of the tributary monitoring stations. The chloride criteria was exceeded by 50% of the samples from Burbank Western and Verdugo Wash monitoring stations.

4.2.3 Water Column Toxicity Analysis

This section describes the water column toxicity results generated during the 2003-2004 storm season. Water column toxicity monitoring was performed at all mass emission sites in accordance with the Municipal Storm Water Permit. In total, four samples were analyzed for toxicity at each site. Dry weather samples were collected on October 28, 2003, and January 13, 2004. The results obtained from these samples are found in Table 4-8a. Note that a sample was not collected at San Gabriel River mass emission site on January 13, 2004, as there was no water flowing at that time. Wet weather samples were collected during the first rain event of the season on October 31, 2003, and also on February 2, 2004. The results obtained from these samples are found in Table 4-8b.

A minimum of one freshwater and one marine species was used for toxicity testing, specifically Ceriodaphnia dubia (water flea) 7-day survival/reproduction and Strongylocentrotus purpuratus (sea urchin) fertilization Results calculated from the Ceriodaphnia dubia and sea urchin tests included the No Observed Effect Concentration (NOEC), 50% Lethal Concentration (LC50), 50% Inhibitory Concentration (IC50), and toxicity unit (TU). NOEC is the highest concentration causing no effect on the test organisms. LC50 is the concentration that produces a 50% reduction in survival. IC50 is the concentration causing 50% inhibition in growth or reproduction. TU is defined in the permit as 100/(LC50 or IC50). A TU value greater than or equal to one is considered substantially toxic and requires a toxicity identification evaluation (TIE).

The following conclusions were deduced from water column toxicity testing:

- Ceriodaphnia dubia reproduction was only significantly affected by exposure to the wet weather samples collected from the Santa Clara River mass emission station on November 2, 2003. This sample from Santa Clara River had a TU value equal to 1.27, which triggered a TIE study in accordance with the Permit. The initial component of the TIE study was to conduct a “baseline” test to determine the final TIE test dilutions. The “baseline” tests were

conducted and toxicity was not observed in any of the samples, indicating no purpose in continuing with the TIE analysis. The fact that a slight amount of toxicity was observed in the initial chronic tests indicated that the toxicant was most likely associated with volatile compound(s). The compound(s) apparently dissipated to non-toxic levels between the time of the initial toxicity tests and initiation of "baseline" testing.

- Sea urchin fertilization was only significantly affected by exposure to the wet weather samples collected from the Ballona Creek, Los Angeles River, Coyote Creek and Dominguez Channel mass emission stations on February 2, 2004. These samples from the Ballona Creek, Los Angeles River, Coyote Creek and Dominguez Channel had TU values equal to 1.21,1.28,1.34, and 1.47, respectively. In accordance with the Permit, a TIE was attempted on these samples. The initial component of the TIE study was a "baseline" test to determine the final TIE test dilutions. Toxicity was not observed in any of the samples during the "baseline tests", indicating no purpose with furtherance of the TIE analysis. The fact that a slight amount of toxicity was observed in the initial chronic tests indicated that the toxicant was most likely associated with volatile compound(s). The compound(s) apparently dissipated to non-toxic levels between the time of the initial toxicity tests and initiation of "baseline" testing.
- Sea urchin fertilization was only significantly affected by exposure to the dry weather samples collected from the, Los Angeles River, Coyote Creek and Dominguez Channel mass emission stations on January 13, 2004. These samples from Los Angeles River, Coyote Creek and Dominguez Channel had TU values equal to 2.21, 3.43, and 1.17, respectively which triggered a tie study. The initial component of the TIE study was a "baseline" test to determine the final TIE test dilutions. Toxicity was not observed in any of the samples during the "baseline tests", indicating no purpose in continuing with the TIE analysis. The fact that a slight amount of toxicity was observed in the initial chronic tests indicated that the toxicant was most likely associated with volatile compound(s). The compound(s) apparently dissipated to non-toxic levels between the time of the initial toxicity tests and initiation of "baseline" testing.

4.2.4 Trash Monitoring Analysis

This section describes the trash monitoring results generated during the 2003-2004 storm season. Catch basin inserts and Continuous Deflective System (CDS) units were installed in various land uses across the watersheds of the Los Angeles River and Ballona Creek for monitoring trash discharge rates. The trash collected was separated into two categories: (1) Anthropogenic and (2) Sediment and Vegetation. After separating into these categories, the trash collected from each device then was weighed and recorded. The land uses monitored were commercial, high density single family residential, industrial, low density single family residential, and open space/parks. Three CDS units were installed during the 2002-2003 storm season, and two additional CDS units were installed in the 2003-2004 storm season. However, one of CDS unit was decommissioned due to operating issues. Table 4-12a and Table 4-12b summarize the results of the sampling events with totals for the collected anthropogenic trash and the sediment/vegetation per land use. The Municipal Storm Water Permit requires a minimum of one photograph at each mass emission station after the first storm event and three additional storm events per year. Pictures can be found in Appendix C.

The following conclusions were drawn from the sampling results for anthropogenic trash in Los Angeles River and Ballona Creek watersheds:

Los Angeles River Watershed

- The largest amount of trash collected in this watershed occurred at the first storm event of 2003-2004 storm season. This amount of trash collected was 5.37 lbs/acre.
- The total of trash collected from the Industrial land use was the largest contributor of the entire storm season. The trash collected was 10.58 lbs/acre. The Commercial land use was second largest contributor with 6.74 lbs/acre. High Density Single Family Residential and Open Space/Parks were third and fourth trash contributor with 2.52 lbs/acre and 1.97 lbs/acre, respectively. Low Density Single Family Residential produced a least trash among the five monitoring land uses. It was 1.08 lbs/acre.

Ballona Creek Watershed

- The largest amount of collected trash in this watershed occurred at the second storm event of 2003-2004 storm season. This amount of collected trash was 0.56 lbs/acre.
- The total of trash collected from the Commercial land use was the largest contributor of the entire storm. The amount of trash collected was 4.63 lbs/acre. The second largest trash generated was at High Density Single Family Residential land use with the amount of 2.12 lbs/acre. It is followed by Low Density Single Family Residential, Industrial, and Open Space/Parks land uses with 1.52 lbs/acre, 1.31 lbs/acre, and 1.48 lbs/acre, respectively.

4.2.5 Identification of Possible Sources

This section describes the possible sources of the constituents that did not meet the water quality standards during the 2003-2004 monitoring season in all or most of the watersheds, as discussed above in Section 4.2.1 and 4.2.2.

The source of bacteria is hard to pinpoint. According to the *Draft Total Maximum Daily Load to Reduce Bacterial Indicator Densities at Santa Monica Bay Beaches* published on November 8, 2001 by the California Regional Water Quality Control Board, Los Angeles Region, urban runoff from the storm drain system may have elevated levels of bacterial indicators due to sanitary sewer leaks and spills, illicit connections of sanitary lines to the storm drain system, runoff from homeless encampments, illegal discharges from recreational vehicle holding tanks, and malfunctioning septic tanks among other things. Fecal matter from animals and birds can also elevate bacteria levels.

An article titled *Residential Sources of Contamination* on EPA's website states that elevated levels of chloride may be a result of fertilizers, animal sewage, industrial wastes, minerals, or seawater. It also shows that many metals, such as aluminum, silver, iron, and zinc, could be a result of natural deposits.

According to the report *Regulating Copper in Urban Stormwater Runoff* by G. Fred Lee, PhD and Anne Jones-Lee, PhD, copper can come from brake pads or industrial (such as the textile

industry) and mining sources. A metals source study is discussed in the article *Loadings of Lead, Copper, Cadmium, and Zinc in Urban Runoff from Specific Sources* by A.P. Davis, M. Shokouhian, and S. Ni. The study concludes that significant levels of metals were found from urban areas, especially in highway runoff. The abstract identifies important sources, such as building siding for lead, copper, cadmium, and zinc, vehicle brake emissions for copper and tire wear for zinc. Atmospheric deposition was also identified as an important source of cadmium, copper, and lead.

4.2.6 Recommendations

New monitoring components conducted during the 2003-2004 monitoring season included collecting two dry weather samples at each of the tributary monitoring stations as recommended in the 2002-2003 monitoring report. In addition, all required samples were taken, including dry weather and toxicity samples. Below are some recommendations that were identified based on results of monitoring in the 2003-2004 monitoring season.

Many of the polychlorinated biphenyls, SOVs, and chlorinated pesticides cannot be compared to the water quality standards because there are no standards listed in the Basin Plan, Ocean Plan, or CTR. However, even if there were water quality standards, all of these constituents were not detected at any of the mass emission or tributary monitoring stations. We recommend discontinuing sampling for these constituents, except during the first storm event of every year.

Some constituents sampled at the tributary stations, particularly total and dissolved copper, and total zinc continued to show exceedances of water quality standards during this second year of monitoring. The Municipal Storm Water Permit requires the initiation of a focused effort to identify sources of pollutant within that sub-watershed when a constituent exceeds a water quality standard in three out of four samples. To identify the possible sources of these pollutants, LACDPW compared them with the water quality data collected from the land-use monitoring stations. The land-use of all tributary monitoring stations is predominantly high density single family residential. The land-use monitoring water quality data indicate that total and dissolved copper, and total zinc were also typically found from the same land-use, high density single family residential. As two seasons have been spent gathering data at Los Angeles River tributary monitoring sites, verifying results, it is recommended that tributary monitoring be moved to Ballona Creek tributaries for the 2004-2005 season.

In order to identify and better understand the source(s) of pollution, mass emission monitoring, toxicity monitoring, trash monitoring, and tributary monitoring will be continued in the future in addition to the regional monitoring and special studies, as required by the Municipal Storm Water Permits.