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LOS ANGELES COUNTY 2002-2003 STORMWATER MONITORING REPORT

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MONITORING PROGRAM OBJECTIVES

The major objectives of the Monitoring Program outlined in the Municipal Storm Water Permit are to:

- Assess compliance with the Los Angeles County Municipal Storm Water Permit No. CAS004001;
- Measure and improve the effectiveness of the Stormwater Quality Management Plans (SQMPs);
- Assess the chemical, physical, and biological impacts of receiving waters resulting from urban runoff;
- Characterize storm water discharges;
- Identify sources of pollutants; and
- Assess the overall health and evaluate long-term trends in receiving water quality.

The Monitoring Program, developed to address these objectives, has several elements: core monitoring, which includes mass emission monitoring, water column toxicity monitoring, tributary monitoring, shoreline monitoring, and trash monitoring; regional monitoring, which includes estuary sampling and bioassessment; and three special studies, which include the new development impacts study in the Santa Clara watershed, the peak discharge impact study, and the Best Management Practice (BMP) effectiveness study.

SUMMARY OF MONITORING RESULTS

CORE MONITORING

Mass Emission Monitoring

The purpose of mass emission monitoring is to estimate the mass emissions from the Municipal Separate Storm Sewer System (MS4), assess trends in the mass emissions over time, and determine if the MS4 is contributing to exceedances of water quality standards by comparing results to applicable standards in the Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties (Basin Plan), the California Ocean Plan (Ocean Plan), or the California Toxics Rule (CTR), and with emissions from other discharges.

During the 2002-2003 monitoring season, flows were measured and water quality samples were taken at the following seven mass emission monitoring sites: Ballona Creek, Malibu Creek, Los Angeles River, Coyote Creek, San Gabriel River, Dominguez Channel, and Santa Clara River. All mass emission sites, except the Santa Clara River site, are equipped with automated samplers with integral flow meters for collecting flow-composite samples. Four storm events and two dry weather events were sampled at each mass emission site. Total Suspended Solids (TSS) were collected from five storm events at the Santa Clara mass emission site, six storm events at Malibu Creek, San Gabriel River, and Dominguez Channel mass emission sites, seven storm events at Ballona Creek and Coyote Creek mass emission sites, and from eight storm events at the Los Angeles River mass emission site.

Based on results of the mass emission monitoring, three different water quality analyses, i.e., a comparison to appropriate water quality standards, an analysis of pollutant loadings and trends, and an evaluation of the correlation between metals/polycyclic aromatic hydrocarbons (PAHs) and total suspended solids (TSSs), were conducted.

Summaries of the analyses are as follows:

Comparison Study

A comparison of the monitoring results to the applicable water quality standards in the Basin Plan, the Ocean Plan, or the CTR was conducted. The lowest possible standard of the three documents was used for the comparison study. The California Department of Fish and Game provided fresh water 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.

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

Wet Weather

- 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, 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, which only exceeded the total coliform objective half of the time. As during the 2001-2002 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 75% of the time in all watersheds, except in Ballona Creek and Dominguez Channel where it was exceeded 100% of the time.
- For all monitoring stations, there was no clear trend between bacteria densities and storm events. However, Ballona Creek, Malibu Creek, San Gabriel River, Dominguez Channel, and Santa Clara River monitoring stations each had the highest total coliform density during the March 15, 2003 storm.
- For all monitoring stations except Malibu Creek, 50-100% of the total copper samples exceeded the Ocean Plan water quality standard.
- Coyote Creek, San Gabriel River, and Santa Clara River exceeded the California Department of Fish and Game's water quality criteria for diazinon 50% of the time.

- 50% of the dissolved copper samples taken at the Los Angeles River and Coyote Creek monitoring stations and 100% of the dissolved copper samples taken at the Dominguez Channel monitoring station exceeded the CTR water quality standard.
- 50% of the dissolved lead samples collected at the Dominguez Channel monitoring station exceeded the CTR water quality standard. This is the only monitoring station that showed exceedances.
- San Gabriel River exceeded the cyanide Ocean Plan water quality standard in 75% of the samples. Ballona Creek, Los Angeles River, Coyote Creek, and Santa Clara River exceeded the standard in 50% of the samples.
- 75% of the total zinc samples from the Dominguez Channel monitoring station exceeded the Ocean Plan water quality standard. All the other stations except Ballona Creek had exceedances in 25% of the samples. Dominguez Channel also exceeded the CTR water quality standard for dissolved zinc in 50% samples.
- Sulfate and TDS were each exceeded in 50% of the samples at the Malibu Creek monitoring station. No other monitoring stations had any exceedances for these constituents.
- The Ocean Plan water quality standard for turbidity was exceeded in 50% of the samples at the San Gabriel River monitoring station.
- 50% of the total aluminum samples at the Santa Clara River monitoring station exceeded the Basin Plan water quality standard.
- Nitrite-N exceeded the Basin Plan water quality standard in 50% of the samples at the Coyote Creek monitoring station.

Dry Weather

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

- There were no exceedances for any of the dissolved metals or diazinon during dry weather.
- 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 and Dominguez Channel monitoring stations and in 50% of the samples at the Malibu Creek and Los Angeles River monitoring stations. No other monitoring station exceeded the total coliform criteria. The fecal coliform criteria was exceeded in 50% of the samples for all of the monitoring stations except San Gabriel River 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, and Dominguez Channel monitoring stations and in 50% of the samples at the other four monitoring stations.

- 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 Los Angeles River and Dominguez Channel, which had no exceedances.
- Unlike the wet weather samples, the Basin Plan water quality criteria for chloride was exceeded at three of the mass emission stations during dry weather. San Gabriel River and Dominguez Channel 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, Los Angeles River, and Dominguez Channel monitoring stations. The San Gabriel River exceeded the standard in 100% of the samples.
- Ballona Creek, Malibu Creek, Los Angeles River, and Dominguez Channel were not within the pH water quality standard limits for 50% of the samples and Coyote Creek was not within the pH water quality standard limits for 100% of the samples. All of samples not within the pH limits showed high alkalinity. During wet weather, only 25% of the pH samples showed exceedances at Ballona Creek and Los Angeles River monitoring stations.
- The Ocean Plan water quality standard for total zinc was exceeded in 50% of the samples at the Malibu Creek, Los Angeles River, Coyote Creek, and Dominguez Channel monitoring stations.
- 100% of the total nickel samples exceeded the Ocean Plan water quality standard at the San Gabriel River monitoring station. 50% of the total nickel samples exceeded the standard at Ballona Creek, Los Angeles River, and Santa Clara River monitoring stations.
- Los Angeles River, Coyote Creek, and San Gabriel River exceeded the Ocean Plan water quality standard for cyanide in 50% of the samples.
- 50% of the dissolved oxygen samples at the Santa Clara River monitoring station were below the minimum water quality objective in the Basin Plan.
- Malibu Creek exceeded the Basin Plan water quality objective for sulfate in 50% of the samples.

Loading and Trend Analysis

An estimation was made of the total pollutant loads due to storm water and urban runoff for each mass emission station. An analysis of trends in storm water or receiving water quality was also conducted.

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 March 15, 2003 at the Ballona Creek, Malibu Creek, and Los Angeles River monitoring stations produced TSS loadings of 9,619 tons, 5,236 tons, and 53,027 tons, respectively. Ballona Creek and Los Angeles River also produced loadings of 6,395 tons and 12,181 tons, respectively, during the February 11, 2003 storm. 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 TSSs out of the seven mass emission stations monitored.

- San Gabriel River, Dominguez Channel, and Santa Clara River had generally lower TSS and metals loadings than the other monitoring sites.
- The February 11, 2003 storm produced the highest TDSs loadings at the Malibu Creek, Coyote Creek, Dominguez Channel, and Santa Clara River monitoring stations. The storm on December 16, 2002 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 loading during the February 11, 2003 storm at all of the monitoring stations except San Gabriel River.

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 storm season. During the 2002-2003 storm season the high levels of zinc were not present again, except for several exceedances at the Dominguez Channel monitoring station.

- The rainfall during the 2002-2003 storm season was only 0.06 inches below the annual rainfall average. However, it was about three times higher than amount of rainfall recorded during the 2001-2002 storm season. This may explain, in part, the increased loading as compared to the 2001-2002 storm season.

Correlation Study

An analysis of the correlation between metals/PAHs and TSS levels was performed. The study focused on metals because the PAH samples at all of the mass emission 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 TSSs. 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 Malibu Creek and San Gabriel River watersheds showed no strong correlation between metals and TSSs, except for dissolved arsenic and in the case of Malibu, dissolved zinc. Besides the R^2 values for dissolved arsenic and dissolved zinc, all of Malibu Creek's and San Gabriel River's R^2 values were below 0.3852 and below 0.5823, respectively.
- There were no strong correlations from any of the watersheds for the following constituents: total arsenic, total chromium, dissolved lead, and total nickel.
- Excluding Malibu Creek and San Gabriel River, all of the monitoring sites showed a strong correlation between total copper and TSSs, with R^2 values ranging from 0.4445 to 0.9856 (most of them closer to the upper range).
- Three of the mass emission monitoring sites, Ballona Creek, Coyote Creek, and Dominguez Channel, showed a correlation between total aluminum and TSSs, with R^2 values of 0.9158, 0.8199, and 0.8294, respectively.
- Five of the mass emission stations showed a strong correlation between dissolved antimony and TSSs. Ballona Creek and Los Angeles River showed a negative correlation, with R^2 values of 0.5347 and 0.799, respectively. Coyote Creek, Dominguez Channel, and Santa Clara River showed positive correlations, with R^2 values of 0.8151, 0.9777, and 0.7409, respectively.

Water Column Toxicity Monitoring

The purpose of water column toxicity monitoring is to evaluate the extent and causes of toxicity in receiving waters and to modify and utilize the SQMP to implement practices that eliminate or reduce sources of toxicity in storm water.

Composite samples were taken at all mass emission monitoring stations. In total, four samples were analyzed for toxicity at each site. Dry weather samples were collected on October 9, 2002, and April 23, 2003. Wet weather samples were collected during the first rain event of the season on November 8, 2002, and also on December 12, 2002.

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. The sea urchin fertilization test could not be performed on the October 9, 2002 wet weather sample because the purple sea urchin did not spawn due to seasonal variability.

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 survival was only significantly affected by exposure to the wet weather samples collected from the Coyote Creek and Dominguez Channel mass emission stations on November 8, 2002. These samples from Coyote Creek and the Dominguez Channel had a TU value equal to 4.40 and 1.33, respectively. In accordance with the Permit, a TIE was performed on these samples. The TIE for the sample collected from Coyote Creek found that the toxicity was due to one or more non-polar organic compounds as well as metabolically-activated organophosphates. The TIE for the sample collected from the Dominguez Channel found that the toxicity was due to one or more non-polar organic compounds and cationic metals as well as metabolically-activated organophosphates. The remaining samples were not substantially toxic to Ceriodaphnia dubia survival.
- Ceriodaphnia dubia reproduction was only significantly affected by exposure to the wet weather samples collected from the Coyote Creek and Dominguez Channel mass emission stations on November 8, 2002. These samples from Coyote Creek and the Dominguez Channel had a TU value equal to 3.65 and 1.33, respectively. In accordance with the Permit, a TIE was performed on these samples. The TIE for the sample collected from Coyote Creek found that the toxicity was due to one or more non-polar organic compounds as well as metabolically-activated organophosphates. The TIE for the sample collected from the Dominguez Channel found that the toxicity was due to one or more non-polar organic compounds and cationic metals as well as metabolically-activated organophosphates. The remaining samples were not substantially toxic to Ceriodaphnia dubia reproduction.
- Sea urchin fertilization was only significantly affected by exposure to the wet weather samples collected from the Coyote Creek and Ballona Creek mass emission stations on November 8, 2002. These samples from Coyote Creek and Ballona Creek had TU values equal to 1.16 and 1.45, respectively. In accordance with the Permit, a TIE was performed on these samples. The TIE for the sample collected from Coyote Creek found that the toxicity was due to one or more non-polar organic compounds and cationic metals as well as metabolically-activated organophosphates. The TIE for the sample collected from Ballona Creek found that the toxicity was due to particulate-bound toxicants, one or more non-polar organic compounds and cationic metals. The remaining samples were not substantially toxic to sea urchin fertilization.

Tributary Monitoring

The purpose of tributary monitoring is to identify sub-watersheds where storm water discharges are causing or contributing to exceedances of water quality standards, and to prioritize drainage and sub-drainage areas that need management actions.

Sampling for the 2002-2003 season was conducted at six tributary monitoring stations in the Los Angeles River Watershed. The tributaries monitored included Aliso Creek, Bull Creek, Burbank Western System Channel, Verdugo Wash, Arroyo Seco Channel, and Rio Hondo Channel. Five storm events and one dry event were sampled at each tributary monitoring site.

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 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 the dry weather results since only one sample was taken at each tributary monitoring station, as required by the Municipal Storm Water Permit.

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 80-100% of the time in all sub-watersheds, except Bull Creek which only exceeded in 40% of the samples.
- Bull Creek and Verdugo Wash exceeded the Ocean Plan water quality standard for turbidity in 80% of the samples. Rio Hondo exceeded the turbidity standard in 40% of the samples.
- Diazinon criteria was exceeded at each tributary monitoring station. 60% of the samples were exceeded at Aliso Creek monitoring station, 40% of the samples were exceeded at Arroyo Seco Channel and Rio Hondo Channel monitoring stations, and 20% of the samples were exceeded at Bull Creek, Burbank Western Channel, and Verdugo Wash monitoring stations. Los Angeles River only exceeded the diazinon criteria in 25% of the samples.
- 60% of the samples at the Verdugo Wash monitoring station exceeded the Basin Plan water quality standard for total aluminum. There were no exceedances at Los Angeles River monitoring station.
- Total Copper exceeded the Ocean Plan water quality standard in more than 60% of the samples at all of the tributary stations except Bull Creek, which exceeded the standard in 20% of the samples.
- Total Zinc exceed the Ocean Plan water quality standard in 40-60% of the samples at Burbank Western Channel, Verdugo Wash, Arroyo Seco Channel, and Rio Hondo Channel.
- 80%, 50%, and 40% of the total lead samples exceeded the Ocean Plan water quality standard at Verdugo Wash, Arroyo Seco Channel, and Burbank Western Channel, respectively.
- Rio Hondo Channel exceeded the CTR water quality standard for dissolved copper in 100% of the samples. Burbank Western Channel exceeded in 80% of the samples, Aliso Creek exceeded in 50% of the samples, and Arroyo Seco Channel exceeded in 25% of the

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samples. The other tributary monitoring stations exceeded the standard in 20% of the samples.

- 40% of the samples at Burbank Western System and Rio Hondo Channel exceeded the Ocean Plan water quality standard for cyanide.
- Though there were no dissolved oxygen or nitrite-N exceedances at Los Angeles River monitoring station, 20% of the samples at Burbank Western Channel and Arroyo Seco Channel exceeded the Basin Plan criteria for each constituent.
- Burbank Western Channel and Verdugo Wash exceeded the CTR water quality standard for dissolved lead in 40% of the samples and Rio Hondo Channel exceeded in 20% of the samples. There were no exceedances at the Los Angeles River monitoring station.

Shoreline Monitoring

The City of Los Angeles is required to monitor shoreline stations to evaluate the impacts to coastal receiving waters and the loss of recreational beneficial uses resulting from storm water/urban runoff. Also, the Municipal Storm Water Permit requires the City of Los Angeles to annually assess shoreline water quality data and submit it to the Principal Permittee for inclusion in the monitoring report. Therefore, the City of Los Angeles' assessment is included in Appendix D of this monitoring report.

Trash Monitoring

The objectives of trash monitoring are to assess the quantities of trash in receiving waters after storm events and to identify areas impaired for trash. Visual observations of trash were made and a minimum of one photograph at each mass emission station was taken after four storm events including the first storm event.

In addition, a minimum of ten representative sites for each land use monitored were sampled. On average, each sampling site contained a minimum of five catch basins fitted with inserts with a total of 256 inserts within the Los Angeles Watershed Management Area (WMA) and 309 inserts within the Ballona Creek WMA. Three structural full capture devices were installed downstream of three separate sampling sites within the Ballona Creek WMA. All of the upstream catch basins were fitted with inserts. Each insert and the full capture devices were emptied within 72 hours of every rain event of 0.25 inches or greater.

For each catch basin insert and Continuous Deflective System (CDS) devices, the anthropogenic trash was separated from the sediment and vegetation and weights were recorded per device. 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 monitoring of two additional CDS units will commence during the 2003-2004 storm season.

The following conclusions were drawn from the sampling results for anthropogenic trash:

- The amount of trash collected for the first storm event of the season constituted 39.4% of the total trash collected during the entire season for the Los Angeles River and the Ballona Creek watersheds combined.

- In the Los Angeles River watershed, the commercial landuse was the largest contributor of trash during the first storm of the season with 40.5%. The industrial landuse was the second largest contributor with 35.8% of the total trash collected. Open Space/Parks, High Density Single Family Residential, and Low Density Single Family Residential combined to produce 23.7 % of the trash with Low Density Single Family Residential producing only 2.6%.
- In the Ballona Creek watershed, the Low Density Single Family Residential was the largest contributor of trash during the first storm of the season with 32.1%. The remaining landuses combined for the remaining 67.9% with a relatively even distribution of approximately 17% each, on average.
- Based on the total amount of trash collected for the Los Angeles River watershed during the 2002-2003 storm season, the largest contributors by landuse were the industrial and the commercial landuses with 46.4%, and 33.9 %, respectively, for a combined 80.3% of the total trash collected. High Density Single Family Residential and Open Space/Parks contributed 8.6% and 8.8%, respectively. Low Density Single Family Residential produced only 2.3%.
- Based on the total amount of trash collected for the Ballona Creek watershed during the 2002-2003 storm season, the Low Density Single Family Residential and the commercial landuses combined to produce about half of the total trash collected. Low Density Single Family Residential produced 26.0% and the commercial landuse produced 25.1%. Open Space/Parks and industrial produced 17.8% and 16.5%, respectively. High Density Single Family Residential produced the least trash with 14.5% of the total.

REGIONAL MONITORING

Estuary Sampling

The LACDPW is participating in the coastal ecology committee of the Bight 2003 project coordinated by the Southern California Coastal Waters Research Project (SCCWRP). The two primary objectives of Bight '03 are to estimate the extent and magnitude of ecological change in the Southern California Bight (SCB) and to determine the mass balance of pollutants that currently reside within the SCB. The goal of the estuary monitoring program is to sample estuaries for sediment chemistry, sediment toxicity, and benthic macroinvertebrate diversity to determine the spatial extent of sediment fate from storm water, and the magnitudes of its effects. In Los Angeles County, the estuaries being sampled are those of: Malibu Creek, Ballona Creek, Los Angeles River, San Gabriel River, and Dominguez Channel.

Since the beginning of 2003, LACDPW staff has been involved in the design of the sampling program through regular attendance of the Bight '03 Coastline Ecology Committee meetings. To date, SCCWRP and the Committee have developed a work plan, which includes the following schedule:

- Collect samples by September 2003
- Submit data by September 2004

- Submit reports to SCCWRP by September 2006
- SCCWRP to complete executive summary no later than December 2006

Bioassessment

The LACDPW must perform annual bioassessments on streams in Los Angeles County beginning in October 2003. On May 22, 2003, a list of 20 stream sampling sites was approved by the Los Angeles Regional Water Quality Control Board (RWQCB). The sampling sites are located in each of the six major watersheds throughout Los Angeles County.

SPECIAL STUDIES

New Development Impacts Study in the Santa Clara Watershed

The objective of the New Development Impacts Study in the Santa Clara watershed is to evaluate the effectiveness of the Standard Urban Storm Water Mitigation Plan (SUSMP) Best Management Practices at reducing pollutants in storm water runoff. This evaluation will be accomplished by comparing the water quality of runoff from a new development constructed in accordance with SUSMP requirements to a development similar in size and land use constructed prior to the adoption of SUSMP requirements.

On August 1, 2002, with the assistance of the City of Santa Clarita, LACDPW submitted a work plan for the study to the Los Angeles RWQCB for approval. Following discussions and revisions to the proposal, the RWQCB accepted a revised work plan on April 10, 2003. Sampling will begin in the 2003-04 storm season, and results will be included in the 2003-2004 storm water monitoring report.

Peak Discharge Impact Study

The goal of this study is to assess the potential cause and effect relationships between stream erosion and urbanization in watersheds in Los Angeles County and to create, if possible, an Index of Biological Indicators with data from surrounding counties. The Southern California Coastal Waters Research Project (SCCWRP) is managing the project on behalf of the County and Flood Control District. A committee comprised of members of the Southern California Stormwater Monitoring Coalition is overseeing progress of the study.

In March, 2003, the contractor developed a set of site-selection criteria in coordination with the Stormwater Monitoring Coalition. As of July 2003, the contractor reported having tentatively selected three out of the ten required test sites. A draft work plan is scheduled for submission to the Stormwater Monitoring Coalition in September 2003. Final report submittal is scheduled for Spring 2004.

BMP Effectiveness Study

The Flood Control District is participating in the Santa Monica Bay Restoration Commission's (SMBRC) "Performance Evaluation of Structural BMPs for Stormwater Pollution Control in the

Santa Monica Bay Watershed" study to fulfill this requirement. The SMBRC's study is in the site selection stage.

Recommendations

New monitoring components conducted during the 2002-2003 monitoring season included tributary monitoring and trash monitoring at mass emission stations. The Santa Clara River mass emission monitoring station was also added to the monitoring program. In addition, all required samples were taken, including dry weather and toxicity samples. Below are some recommendations that were identified based on results from the 2002-2003 monitoring season.

The Municipal Storm Water Permit requires only one dry weather sample to be taken at each tributary monitoring station. Although it was possible to see the various concentrations from each subwatershed, these values may not be entirely reliable due to the inherent variability of many constituents, especially bacteria. LACDPW recommends taking at least two dry weather samples at each tributary station to better characterize the concentrations of each constituent and verify the accuracy of the results of the first sample.

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 sampling for these constituents for one more year. If they are not detected, we recommend to discontinue sampling for these constituents, except during the first storm event of every year.

Some constituents sampled at the tributary stations showed exceedances of water quality standards. The Municipal Storm Water Permit requires the initiation of a focused effort to identify sources of pollutant within that subwatershed when a constituent exceeds a water quality standard in three out of four samples. We recommend looking at the landuse make up of the watersheds and use water quality data collected from the landuse monitoring stations to begin identifying possible trends or correlations based on landuse. We also recommend using water quality data collected by SCCWRP in their landuse studies.

We collected valuable data from the first year of the tributary monitoring in the Los Angeles River Watershed. We believe that one year worth of data is not sufficient as there can be variability from year to year. Based on discussions with staff from the RWQCB, we recommend performing a second year of monitoring in the Los Angeles River Watershed in order to make better use of the data we collect in order to assist us in prioritizing drainage and sub-drainage areas that need management actions.

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 Permit.

This section describes the field and laboratory methods used to implement the Monitoring Program, which includes precipitation and flow monitoring, storm water sampling, and laboratory analyses.

3.1 PRECIPITATION AND FLOW MEASUREMENT

3.1.1 Precipitation Monitoring

For every monitoring station, a minimum of one automatic tipping bucket (intensity measuring) rain gage is located nearby or within the tributary watershed. Large watersheds may require multiple rain gages to accurately characterize the rainfall. The LACDPW operates various automatic rain gages throughout the county. Existing gages near the monitored watersheds are also utilized in calculating storm water runoff and are essential to develop runoff characteristics for these watersheds.

3.1.2 Flow Monitoring

Flow monitoring equipment is needed to trigger the automated samplers because the Monitoring Program requires flow-weighted composites for many constituents. Flows are determined from measurements of water elevation as described below.

The water elevation in a storm drain is measured by the stage monitoring equipment, and the flow rate is derived from a previously established rating table for the site or calculated with an equation such as Manning's. The LACDPW uses rating tables generated from analysis of storm drain cross sections and upstream/downstream flow characteristics. The rating tables are modified if it is demonstrated in the field through stream velocity measurements that calculated table values are incorrect. Previous storm water flow measurement efforts indicates that all stations will require multiple storm events to gather the data necessary for calibration of the measurement devices.

The automatic samplers utilize pressure transducers as the stage measurement device. However, pressure transducers are only accurate as flow measurement devices in open channel flow regimes. Therefore, for stations monitoring flows in underground storm drains, efforts were made to select drains that do not surcharge (flow under pressure) during events smaller than a 10-year storm event.

3.2 STORM WATER SAMPLING

3.2.1 Sample Collection Methods

Grab and composite sample collection methods, defined below, were used during the 2002-2003 storm season.

- **Grab Sample** - a discrete, individual sample taken within a short period of time, usually less than 15 minutes. This method is used to collect samples for constituents that have very short holding times and specific collection or preservation needs. For example, samples for coliforms are taken directly into a sterile container to avoid non-resident bacterial contamination.

- **Composite Sample** - a mixed or combined sample created by combining a series of discrete samples (aliquots) of specific volume, collected at specific flow-volume intervals. Composite sampling is ideally conducted over the duration of the storm event.

During a storm event, grab samples were collected during the initial portion of the storm (on the rising limb of the hydrograph) and taken directly to the laboratory.

Flow composite storm samples were obtained using an automated sampler to collect samples at flow-paced intervals. Samples collected at each station were combined in the laboratory to create a single flow-weighted sample for analysis.

During the storm season, the sampler was programmed to start automatically when the water level in the channel or storm drain exceeded the maximum annual dry weather stage. A sample was collected each time a set volume of water had passed the monitoring point (this volume is referred to as the pacing volume or trigger volume). The sample was stored in glass containers within the refrigerated sampler. A minimum of eight liters of sample was required to conduct the necessary laboratory analyses for all the constituents. The automated sampler was deactivated by field personnel when the water level in the channel or storm drain fell to about 120 percent of the observed maximum annual dry weather flow stage.

Samples were retrieved from the automated samplers as soon as possible to meet laboratory analysis holding time requirements. As samples were collected, rainfall and runoff data were logged and stored for transfer to the office.

3.2.2 Field Quality Assurance/Quality Control Plan

Properly performed monitoring station set up, water sample collection, sample transport, and laboratory analyses are vital to the collection of accurate data. Quality Assurance/Quality Control (QA/QC) is an essential component of the monitoring program.

Evaluation of Analytes and QA/QC Specifications for Monitoring Program (Woodward-Clyde, 1996a) describes the procedures used for bottle labeling, chain-of-custody tracking, sampler equipment checkout and setup, sample collection, field blanks to assess field contamination, field duplicate samples, and transportation to the laboratory.

An important part of the QA/QC Plan is the continued education of all field personnel. Field personnel were adequately trained from the onset and informed about new information on storm water sampling techniques on a continuing basis. Field personnel also evaluate the field activities required by the QA/QC Plan, and the Plan is updated if necessary.

Bottle Preparation

For each monitoring station, a minimum of three sets of bottles was available so that up to two complete bottle change-outs could be made for each storm event. Bottle labels contained the following information:

- LACDPW Sample ID Number

- Station Number
- Station Name
- Sample Type (Grab or Composite)
- Laboratory Analysis Requested
- Date
- Time
- Preservative
- Temperature
- Sampler's Name

Bottles were cleaned at the laboratory prior to use, then they were labeled and stored in sets. Each station was provided with the same number, types, and volumes of bottles for each rotation unless special grab samples were required. Clean composite sample bottles were placed in the automated sampler when samples were collected. This practice ensured readiness for the next storm event. All bottles currently not in use were stored and later transported in plastic ice chests. Composite sample bottles were limited to a maximum of 2-1/2 gallons each, to ensure ease of handling.

Chain-of-Custody Procedure

Chain-of-custody forms were completed to ensure and document sample integrity. These procedures establish a written record which tracks sample possession from collection through analysis.

Field Setup Procedures

All field sampling locations were fixed sites, with the sampler placed on a public road or flood control right-of-way. After sample collection, field staff prepared the sampler for collection of the next set of samples either in storm mode or in dry weather mode. Inspection of visible hoses and cables was performed to ensure proper working conditions according to the site design. Inspection of the strainer, pressure transducer, and auxiliary pump was performed during daylight hours in non-storm conditions.

The automated sampler was checked at the beginning of the storm (during grab sample collection) to ensure proper working condition and to see if flow composite samples were being collected properly. Dry weather collection techniques were similar, with grab and 24-hour composite samples being collected.

Bottles were collected after each event and packed with ice and foam insulation inside individually marked ice chests. Chain-of-custody forms were completed by field staff before transportation of the samples to the laboratory. Under no circumstance were samples removed from the ice chest during transportation from the field to the laboratory.

Travel Blanks and Field Duplicates

Potential field contamination was assessed through analysis of travel blanks and duplicate grab samples. Field travel blanks were collected for each monitoring station during every sampling event to quantify post sampling contamination. The monitoring program also included field duplicates to assess the precision of laboratory results. A field duplicate, the origin of which was unknown to the laboratory, was collected for each sampling event. This methodology for assessing post sampling contamination and laboratory testing procedures provided data to measure the precision and accuracy of the laboratory results.

3.3 LABORATORY ANALYSES

The Department of Agricultural Commissioner/Weights and Measures (ACWM) Environmental Toxicology Laboratory provides water quality laboratory and related services to the LACDPW. The ACWM lab is state certified to perform the water quality analyses contracted by LACDPW. The ACWM Lab maintains a laboratory analysis program that includes Quality Assurance and Quality Control protocols consistent with the objectives of the monitoring program required by the Permit.

3.3.1 Chemical and Biological Analysis

The suite of analyses and associated minimum levels (MLs) for samples collected at mass emission stations are specified in the Municipal Storm Water Permit. All the laboratory methods used for analysis of the storm water samples are approved by the California Department of Health Services and are in conformance with U.S. Environmental Protection Agency (USEPA) approved methods.

Table 3-1 shows all the constituents monitored during the 2002-2003 reporting period, including constituents analyzed with composite or grab samples. The table lists the method number, the PQL (which is the same as ML as defined in the Municipal Storm Water Permit), the method detection limit (MDL), and other relevant information for each constituent.
The Municipal Storm Water Permit defines MDL and ML (i.e. PQL) as follows:
MDL means the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. ML means the concentration at which the entire analytical system must give a recognizable signal and acceptable calibration point. The ML is the concentration in a sample that is equivalent to the concentration of the lowest calibration standard analyzed by a specific analytical procedure, assuming that all the method specified sample weights, volumes, and processing steps have been followed. Throughout this report, "0" for sample results indicates the analyte concentration is less than the ML.
The primary objective of the laboratory QA/QC program is to ensure that the analyses are scientifically valid, defensible, and of known precision and accuracy. The ACWM laboratory maintains QA/QC procedures (as described in their Quality Assurance Manual) in accordance with requirements of the California Department of Health Services. The ACWM laboratory standard operation procedures include method validation, equipment calibration, preventive maintenance, data validation procedures, assessment of accuracy and precision, corrective actions, and performance and system audits. ACWM Lab conducted the QA/QC review and data validation for the 2002-2003 monitoring data, and the QA/QC documentation is available within

the ACWM Lab files. The validated data as provided by the ACWM Lab were used for data analysis and interpretation with no further QA/QC review.

3.3.2 Toxicity Analysis

The samples were subjected to the Ceriodaphnia dubia 7-day survival and reproduction tests in addition to the Strongylocentrotus purpuratus (sea urchin) fertilization test as a measure of toxicity. Performed as multi-concentration tests, sample concentrations of 100%, 56%, 32%, 18%, 10% and 0% (N-control) were used to determine the level of toxicity. These tests were conducted under guidelines prescribed in *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms* (US EPA, 1995).

Water quality measurements (temperature, pH, dissolved oxygen, hardness, conductivity, and alkalinity) were made for each sample at the beginning and throughout each test. These measurements were performed to ensure there were no large variations in water quality, which can affect the accuracy of the toxicity tests.

This section describes the results, data analysis, and recommendations for the 2002-2003 Monitoring Program.

4.1 HYDROLOGY: PRECIPITATION AND FLOW

The monthly rainfall during the 2002-2003 storm season was compared to the long-term pattern of rainfall in Figure 4-1. During this storm season, the total rainfall was about 15.45 inches, which is about three times more than the rainfall recorded during the 2001-2002 storm season. Figure 4-2 shows that the total annual rainfall of 15.45 inches during the 2002-2003 storm season in Los Angeles County was very close and just below the average annual rainfall. The average annual rainfall over 130 years 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 2002-2003 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 number of aliquots per composite, 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 2002-2003 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 2002-2003 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 2002-2003 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.

4.2.1.1 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

- 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, 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, which only exceeded the total coliform objective half of the time. As during the 2001-2002 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 75% of the time in all watersheds, except in Ballona Creek and Dominguez Channel where it was exceeded 100% of the time.
- For all monitoring stations, there was no clear trend between bacteria densities and storm events. However, Ballona Creek, Malibu Creek, San Gabriel River, Dominguez Channel, and Santa Clara River monitoring stations each had the highest total coliform density during the March 15, 2003 storm.
- For all monitoring stations except Malibu Creek, 50-100% of the total copper samples exceeded the Ocean Plan water quality standard.
- Coyote Creek, San Gabriel River, and Santa Clara River exceeded the California Department of Fish and Game's water quality criteria for diazinon 50% of the time.
- 50% of the dissolved copper samples taken at the Los Angeles River and Coyote Creek monitoring stations and 100% of the dissolved copper samples taken at the Dominguez Channel monitoring station exceeded the CTR water quality standard.
- 50% of the dissolved lead samples collected at the Dominguez Channel monitoring station exceeded the CTR water quality standard. This is the only monitoring station that showed exceedances.

- San Gabriel River exceeded the cyanide Ocean Plan water quality standard in 75% of the samples. Ballona Creek, Los Angeles River, Coyote Creek, and Santa Clara River exceeded the standard in 50% of the samples.
- 75% of the total zinc samples from the Dominguez Channel monitoring station exceeded the Ocean Plan water quality standard. All the other stations except Ballona Creek had exceedances in 25% of the samples. Dominguez Channel also exceeded the CTR water quality standard for dissolved zinc in 50% samples.
- Sulfate and TDS were each exceeded in 50% of the samples at the Malibu Creek monitoring station. No other monitoring stations had any exceedances for these constituents.
- The Ocean Plan water quality standard for turbidity was exceeded in 50% of the samples at the San Gabriel River monitoring station.
- 50% of the total aluminum samples at the Santa Clara River monitoring station exceeded the Basin Plan water quality standard.
- Nitrite-N exceeded the Basin Plan water quality standard in 50% of the samples at the Coyote Creek monitoring station.

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 or diazinon during dry weather.
- 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 and Dominguez Channel monitoring stations and in 50% of the samples at the Malibu Creek and Los Angeles River monitoring stations. No other monitoring station exceeded the total coliform criteria. The fecal coliform criteria was exceeded in 50% of the samples for all of the monitoring stations except San Gabriel River 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, and Dominguez Channel monitoring stations and in 50% of the samples at the other four monitoring stations.
- 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 Los Angeles River and Dominguez Channel, which had no exceedances.
- Unlike the wet weather samples, the Basin Plan water quality criteria for chloride was exceeded at three of the mass emission stations during dry weather. San Gabriel River and Dominguez Channel 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, Los Angeles River, and Dominguez Channel monitoring stations. The San Gabriel River exceeded the standard in 100% of the samples.
- Ballona Creek, Malibu Creek, Los Angeles River, and Dominguez Channel were not within the pH water quality standard limits for 50% of the samples and Coyote Creek was not within the pH water quality standard limits for 100% of the samples. All of samples not within the pH limits showed high alkalinity. During wet weather, only 25% of the pH samples showed exceedances at Ballona Creek and Los Angeles River monitoring stations.
- The Ocean Plan water quality standard for total zinc was exceeded in 50% of the samples at the Malibu Creek, Los Angeles River, Coyote Creek, and Dominguez Channel monitoring stations.
- 100% of the total nickel samples exceeded the Ocean Plan water quality standard at the San Gabriel River monitoring station. 50% of the total nickel samples exceeded the standard at Ballona Creek, Los Angeles River, and Santa Clara River monitoring stations.
- Los Angeles River, Coyote Creek, and San Gabriel River exceeded the Ocean Plan water quality standard for cyanide in 50% of the samples.
- 50% of the dissolved oxygen samples at the Santa Clara River monitoring station were below the minimum water quality objective in the Basin Plan.
- Malibu Creek exceeded the Basin Plan water quality objective for sulfate in 50% of the samples.

4.2.1.2 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 March 15, 2003 at the Ballona Creek, Malibu Creek, and Los Angeles River monitoring stations produced TSS loadings of 9,619 tons, 5,236 tons, and 53,027 tons,

respectively. Ballona Creek and Los Angeles River also produced loadings of 6,395 tons and 12,181 tons, respectively, during the February 11, 2003 storm. 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 TSSs out of the seven mass emission stations monitored.
- San Gabriel River, Dominguez Channel, and Santa Clara River had generally lower TSS and metals loadings than the other monitoring sites.
- The February 11, 2003 storm produced the highest TDSs loadings at the Malibu Creek, Coyote Creek, Dominguez Channel, and Santa Clara River monitoring stations. The storm on December 16, 2002 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 loading during the February 11, 2003 storm at all of the monitoring stations except San Gabriel River.

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 storm season. During the 2002-2003 storm season the high levels of zinc were not present again, except for several exceedances at the Dominguez Channel monitoring station.
- The rainfall during the 2002-2003 storm season was only 0.06 inches below the annual rainfall average. However, it was about three times higher than amount of rainfall recorded during the 2001-2002 storm season. This may explain, in part, the increased loading as compared to the 2001-2002 storm season.

Pollutant Loading Example

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

Site:	Malibu Creek Mass Emission Station
Storm event:	12/16/2002
Constituent:	Nitrate
Concentration:	4.6 mg/L
Runoff Volume:	36.5 acre-ft (Runoff = 28.4 acre-ft + Base Flow = 8.1 acre-ft)

1lb = 454 g

$1\text{g} = 1{,}000\ \text{mg} = 1\text{x}10^{6}\ \mu\text{g}$

$1\text{L} = 0.03531467\ \text{ft}^3$

$1\ \text{ft}^3 = 2.2957 \times 10^{-5}$ acre-ft

Pollutant Loading = (Pollutant Concentration)(Runoff Volume)

Pollutant Load = (4.6 mg/L)(36.5 acre-ft)(1g/1,000 mg)(1 lb/454g)(1 ft^3/2.2957 x 10^{-5} acre-ft)(

Pollutant Load = 456.2

Conversion factors

4.2.1.3 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 TSSs 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 Malibu Creek and San Gabriel River watersheds showed no strong correlation between metals and TSSs, except for dissolved arsenic and in the case of Malibu, dissolved zinc. Besides the R^2 values for dissolved arsenic and dissolved zinc, all of Malibu Creek's and San Gabriel River's R^2 values were below 0.3852 and below 0.5823, respectively.
- There were no strong correlations from any of the watersheds for the following constituents: total arsenic, total chromium, dissolved lead, and total nickel.
- Excluding Malibu Creek and San Gabriel River, all of the monitoring sites showed a strong correlation between total copper and TSSs, with R^2 values ranging from 0.4445 to 0.9856 (most of them closer to the upper range).
- Three of the mass emission monitoring sites, Ballona Creek, Coyote Creek, and Dominguez Channel, showed a correlation between total aluminum and TSSs, with R^2 values of 0.9158, 0.8199, and 0.8294, respectively.
- Five of the mass emission stations showed a strong correlation between dissolved antimony and TSSs. Ballona Creek and Los Angeles River showed a negative correlation, with R^2 values of 0.5347 and 0.799, respectively. Coyote Creek, Dominguez Channel, and Santa Clara River showed positive correlations, with R^2 values of 0.8151, 0.9777, and 0.7409, 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 2002-2003 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 since only one sample was taken at each tributary monitoring station, as required by the Municipal Storm Water Permit. 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 80-100% of the time in all sub-watersheds, except Bull Creek which only exceeded in 40% of the samples.
- Bull Creek and Verdugo Wash exceeded the Ocean Plan water quality standard for turbidity in 80% of the samples. Rio Hondo exceeded the turbidity standard in 40% of the samples.
- Diazinon criteria was exceeded at each tributary monitoring station. 60% of the samples were exceeded at Aliso Creek monitoring station, 40% of the samples were exceeded at Arroyo Seco Channel and Rio Hondo Channel monitoring stations, and 20% of the samples were exceeded at Bull Creek, Burbank Western Channel, and Verdugo Wash monitoring stations. Los Angeles River only exceeded the diazinon criteria in 25% of the samples.
- 60% of the samples at the Verdugo Wash monitoring station exceeded the Basin Plan water quality standard for total aluminum. There were no exceedances at Los Angeles River monitoring station.
- Total Copper exceeded the Ocean Plan water quality standard in more than 60% of the samples at all of the tributary stations except Bull Creek, which exceeded the standard in 20% of the samples.
- Total Zinc exceed the Ocean Plan water quality standard in 40-60% of the samples at Burbank Western Channel, Verdugo Wash, Arroyo Seco Channel, and Rio Hondo Channel.

- 80%, 50%, and 40% of the total lead samples exceeded the Ocean Plan water quality standard at Verdugo Wash, Arroyo Seco Channel, and Burbank Western Channel, respectively.
- Rio Hondo Channel exceeded the CTR water quality standard for dissolved copper in 100% of the samples. Burbank Western Channel exceeded in 80% of the samples, Aliso Creek exceeded in 50% of the samples, and Arroyo Seco Channel exceeded in 25% of the samples. The other tributary monitoring stations exceeded the standard in 20% of the samples.
- 40% of the samples at Burbank Western System and Rio Hondo Channel exceeded the Ocean Plan water quality standard for cyanide.
- Though there were no dissolved oxygen or nitrite-N exceedances at Los Angeles River monitoring station, 20% of the samples at Burbank Western Channel and Arroyo Seco Channel exceeded the Basin Plan criteria for each constituent.
- Burbank Western Channel and Verdugo Wash exceeded the CTR water quality standard for dissolved lead in 40% of the samples and Rio Hondo Channel exceeded in 20% of the samples. There were no exceedances at the Los Angeles River monitoring station.

4.2.3 Water Column Toxicity Analysis

This section describes the water column toxicity results generated during the 2002-2003 storm season. Water column toxicity monitoring was performed at all mass emission site 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 9, 2002, and April 23, 2003. The results obtained from these samples are found in Table 4-8a. Wet weather samples were collected during the first rain event of the season on November 8, 2002, and also on December 12, 2002. 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. The sea urchin fertilization test could not be performed on the October 9, 2002 wet weather sample because the purple sea urchin did not spawn due to seasonal variability.

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 survival was only significantly affected by exposure to the wet weather samples collected from the Coyote Creek and Dominguez Channel mass emission stations on November 8, 2002. These samples from Coyote Creek and the Dominguez Channel had a TU value equal to 4.40 and 1.33, respectively. In accordance with the Permit, a TIE was performed on these samples. The TIE for the sample collected from Coyote Creek found that the toxicity was due to one or more non-polar organic compounds as well as metabolically-activated organophosphates. The TIE for the sample collected from the Dominguez Channel found that the toxicity was due to one or more non-polar organic compounds and cationic metals as well as metabolically-activated organophosphates. The remaining samples were not substantially toxic to Ceriodaphnia dubia survival.

- Ceriodaphnia dubia reproduction was only significantly affected by exposure to the wet weather samples collected from the Coyote Creek and Dominguez Channel mass emission stations on November 8, 2002. These samples from Coyote Creek and the Dominguez Channel had a TU value equal to 3.65 and 1.33, respectively. In accordance with the Permit, a TIE was performed on these samples. The TIE for the sample collected from Coyote Creek found that the toxicity was due to one or more non-polar organic compounds as well as metabolically-activated organophosphates. The TIE for the sample collected from the Dominguez Channel found that the toxicity was due to one or more non-polar organic compounds and cationic metals as well as metabolically-activated organophosphates. The remaining samples were not substantially toxic to Ceriodaphnia dubia reproduction.

- Sea urchin fertilization was only significantly affected by exposure to the wet weather samples collected from the Coyote Creek and Ballona Creek mass emission stations on November 8, 2002. These samples from Coyote Creek and Ballona Creek had TU values equal to 1.16 and 1.45, respectively. In accordance with the Permit, a TIE was performed on these samples. The TIE for the sample collected from Coyote Creek found that the toxicity was due to one or more non-polar organic compounds and cationic metals as well as metabolically-activated organophosphates. The TIE for the sample collected from Ballona Creek found that the toxicity was due to particulate-bound toxicants, one or more non-polar organic compounds and cationic metals. The remaining samples were not substantially toxic to sea urchin fertilization.

4.2.4 Trash Monitoring Analysis

This section describes the trash monitoring results generated during the 2002-2003 storm season. For each catch basin insert and Continuous Deflective System (CDS) devices, the anthropogenic trash was separated from the sediment and vegetation and weights were recorded per device. 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 monitoring of two additional CDS units will commence during the 2003-2004 storm season. Table 4-12 summarizes 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:

- The amount of trash collected for the first storm event of the season constituted 39.4% of the total trash collected during the entire season for the Los Angeles River and the Ballona Creek watersheds combined.
- In the Los Angeles River watershed, the commercial landuse was the largest contributor of trash during the first storm of the season with 40.5%. The industrial landuse was the second largest contributor with 35.8% of the total trash collected. Open Space/Parks, High Density Single Family Residential, and Low Density Single Family Residential combined to produce 23.7 % of the trash with Low Density Single Family Residential producing only 2.6%.
- In the Ballona Creek watershed, the Low Density Single Family Residential was the largest contributor of trash during the first storm of the season with 32.1%. The remaining landuses combined for the remaining 67.9% with a relatively even distribution of approximately 17% each, on average.
- Based on the total amount of trash collected for the Los Angeles River watershed during the 2002-2003 storm season, the largest contributors by landuse were the industrial and the commercial landuses with 46.4%, and 33.9 %, respectively, for a combined 80.3% of the total trash collected. High Density Single Family Residential and Open Space/Parks contributed 8.6% and 8.8%, respectively. Low Density Single Family Residential produced only 2.3%.
- Based on the total amount of trash collected for the Ballona Creek watershed during the 2002-2003 storm season, the Low Density Single Family Residential and the commercial landuses combined to produce about half of the total trash collected. Low Density Single Family Residential produced 26.0% and the commercial landuse produced 25.1%. Open Space/Parks and industrial produced 17.8% and 16.5%, respectively. High Density Single Family Residential produced the least trash with 14.5% of the total.

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 2002-2003 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 2002-2003 monitoring season included tributary monitoring and trash monitoring at mass emission stations. The Santa Clara River mass emission monitoring station was also added to the monitoring program. In addition, all required samples were taken, including dry weather and toxicity samples. Below are some recommendations that were identified based on results from the 2002-2003 monitoring season.

The Municipal Storm Water Permit requires only one dry weather sample to be taken at each tributary monitoring station. Although it was possible to see the various concentrations from each subwatershed, these values may not be entirely reliable due to the inherent variability of many constituents, especially bacteria. LACDPW recommends taking at least two dry weather samples at each tributary station to better characterize the concentrations of each constituent and verify the accuracy of the results of the first sample.

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 sampling for these constituents for one more year. If they are not detected, we recommend to discontinue sampling for these constituents, except during the first storm event of every year.

Some constituents sampled at the tributary stations showed exceedances of water quality standards. The Municipal Storm Water Permit requires the initiation of a focused effort to identify sources of pollutant within that subwatershed when a constituent exceeds a water quality standard in three out of four samples. We recommend looking at the landuse make up of the watersheds and use water quality data collected from the landuse monitoring stations to begin identifying possible trends or correlations based on landuse. We also recommend using water quality data collected by SCCWRP in their landuse studies.

We collected valuable data from the first year of the tributary monitoring in the Los Angeles River Watershed. We believe that one year worth of data is not sufficient as there can be variability from year to year. Based on discussions with staff from the RWQCB, we recommend performing a second year of monitoring in the Los Angeles River Watershed in order to make better use of the data we collect in order to assist us in prioritizing drainage and sub-drainage areas that need management actions.

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 Permit.

Coyote Creek Monitoring Station (S13)

The Coyote Creek Monitoring Station is located at the existing ACOE stream gage station (Stream Gage No. F354-R) below Spring Street in the lower San Gabriel River watershed. Although this site is not required for monitoring per the NPDES Permit, the site was added to assist in determining mass loading for the San Gabriel River watershed. At this location, the upstream tributary area is 150 square miles (extending into Orange County). The sampling site was chosen to avoid backwater effects from the San Gabriel River. Coyote Creek, at the gauging station, is a concrete lined trapezoidal channel. The Coyote Creek sampling location has been an active stream gauging station since 1963.

2.1.1 Land Use Monitoring Sites

The following is a description of the locations selected to monitor runoff from land-use specific drainage areas. Figures 2-7 through 2-14 show the location and drainage area of each monitoring station along with a description of its land use and 1990 population.

Santa Monica Pier Storm Drain Monitoring Station (S08)

The Santa Monica Pier Storm Drain Monitoring Station monitors runoff from land use that is predominantly commercial. The monitoring site is located near the intersection of Appian Way and Moss Avenue in Santa Monica. This storm drain discharges below the Santa Monica Pier. The Santa Monica Mall and Third Street Promenade dominate this watershed. The remaining land uses include: commercial office buildings, small shops, restaurants, hotels, and high density apartments. S08 was not operational for the 1999-2000 storm season.

Sawpit Creek Monitoring Station (S11)

The Sawpit Creek Monitoring Station is located in the Los Angeles River Watershed in the City of Monrovia. The monitoring station is in Sawpit Creek, downstream of Monrovia Creek. Sawpit Creek is a natural watercourse at this location. The overall watershed land use is predominantly vacant.

Project 620 Monitoring Station (S18)

The Project 620 Monitoring Station is located in the Los Angeles River Watershed in the City of Glendale. The monitoring station is at the intersection of Glenwood Road and Cleveland Avenue. The overall watershed land use is predominantly high density residential.

Dominguez Channel Monitoring Station (S23)

The Dominguez Channel Monitoring Station is located within the Dominguez Channel/ Los Angeles Harbor Watershed in Lennox, near Los Angeles International Airport (LAX). The monitoring station is near the intersection of 116th Street and Isis Avenue. The overall watershed land use is predominantly transportation, and includes areas of LAX and Interstate 105.

Project 1202 Monitoring Station (S24)

The Project 1202 Monitoring Station is located in the Dominguez Channel/Los Angeles Harbor Watershed in the City of Carson. The monitoring station is near the intersection of Wilmington Avenue and 220th Street. The overall watershed land use is predominantly industrial.

Project 474 Monitoring Station (S25)

The Project 474 Monitoring Station is located in the Los Angeles River Watershed in the Northridge section of the City of Los Angeles. The monitoring station is located along Lindley Avenue, one block south of Nordhoff Street. The station monitors runoff from the California State University of Northridge. The land use of the drainage area is primarily education.

Project 404 Monitoring Station (S26)

The Project 404 Monitoring Station is located within the Los Angeles River Watershed in the City of Arcadia. The monitoring station is located along Duarte Road, between Holly Avenue and La Cadena Avenue. The land use of the drainage area is primarily multi-family residential.

Project 156 Monitoring Station (S27)

The Project 156 Monitoring Station is located within the Los Angeles Watershed in the City of Glendale. The monitoring station is located along Wilson Avenue, near the intersection of Concord Street and Wilson Avenue. The land use of the drainage area is classified as mixed residential.

2.1.2 Critical Source Monitoring Sites

The general locations of the critical source monitoring sites are shown in Figure 2-15. For purposes of anonymity, the agreement reached with each of the businesses prohibits us from revealing the exact locations. Sites C01, C02, and C03 are the control sites for the wholesale trade (auto dismantlers); T01, T02, and T03 are the sites where Best Management Practices (BMPs) will be installed for the wholesale trade industry. Similarly, C04, C05, and C06 are the control sites for automotive repair, while T04, T05, and T06 are the BMP sites for the automotive repair industry. Sites C07, C08, and C09 are the control sites for fabricated metal products; T07, T08, and T09 are the BMP sites for the fabricated metal products industry. Sites C10, C11, and C12 are the control sites for motor freight companies; T10, T11A, T11B, T12A, T12B, and T12C are the BMP sites for the motor freight companies. Sites C13, C14, and C15 are the control sites for the auto dealers; T13, T14, and T15 are the BMP sites for the auto dealers.

the Pacific Ocean in Los Angeles County. At the site, the river is a concrete lined trapezoidal channel.

Coyote Creek Monitoring Station (S13)

The Coyote Creek Monitoring Station is located at the existing ACOE stream gage station (Stream Gage No. F354-R) below Spring Street in the lower San Gabriel River watershed. The site assists in determining mass loading for the San Gabriel River watershed. At this location, the upstream tributary area is 150 square miles (extending into Orange County). The sampling site was chosen to avoid backwater effects from the San Gabriel River. Coyote Creek, at the gauging station, is a concrete lined trapezoidal channel. The Coyote Creek sampling location has been an active stream gauging station since 1963.

San Gabriel River Monitoring Station (S14)

The San Gabriel River Monitoring Station is located at an historic stream gage station (Stream Gage No. F263C-R), below San Gabriel River Parkway in Pico Rivera. At this location the upstream tributary area is 450 square miles. The San Gabriel River, at the gauging station, is a grouted rock-concrete stabilizer along the western levee and a natural section on the eastern side. Flow measurement and water sampling are conducted in the grouted rock area along the western levee of the river. The length of the concrete stabilizer is nearly 70 feet. The San Gabriel River sampling location has been an active stream gauging station since 1968.

Dominguez Channel Monitoring Station (S28)

The Dominguez Channel Monitoring Station is located at Dominguez Channel and Artesia Boulevard in the City of Torrance. At this location, which was chosen to avoid tidal influence, the upstream tributary area is 33 square miles. The portion of the river where the monitoring site is located is a concrete-lined rectangular channel.

GOALS AND OBJECTIVES

The goal of the Los Angeles County Monitoring Program is to provide technical data and information to support effective watershed stormwater quality management programs in Los Angeles County. Specific objectives of the Program, as outlined in the Municipal Permit, are:

- tracking water quality status, pollutant trends and pollutant loads, and identifying pollutants of concern;
- monitoring and assessing pollutant loads from specific land uses and watershed areas;
- identifying, monitoring, and assessing significant water quality problems related to stormwater discharges within the watershed;
- identifying sources of pollutants in stormwater runoff;
- identifying and eliminating illicit discharges;
- evaluating the effectiveness of management programs, including pollutant reductions achieved by implementation of Best Management Practices; and
- assessing the impacts of stormwater runoff on receiving waters.

The 2000-2001 Monitoring Program was designed to address these objectives through the implementation of three elements: land use station monitoring, mass emission station monitoring, and critical source/BMP monitoring. The County also is addressing illicit discharges through an inspection program.

LAND USE AND MASS EMISSION STATION MONITORING

Stations and Equipment

Land use stations are defined as relatively small catchments (0.1 to over 5 square miles) that have one predominant land use. The objectives of land use monitoring are to evaluate possible effects of land use on water quality, to evaluate the relative importance of land uses as pollution sources; and to provide data that can be used, along with data from mass emission stations, to project watershed pollutant loads. Data were obtained from seven land use stations during the 2000-2001 storm season: one vacant, one single family high density residential, one multiple family residential, one mixed residential, one light industrial, one transportation, and one educational. Land use stations were equipped with automatic water samplers and stage (water depth) recorders so that flow composite samples could be obtained. Grab samples were not required from land use stations.

In contrast to land use stations, mass emission stations monitor relatively large (100 to 1000 square miles) mixed land use watersheds. Runoff from five mass emissions monitoring stations was sampled during the 2000-2001 storm season. These stations cumulatively represented a total of 1619 square miles of drainage area. The Permit requires mass emission monitoring of four major drainage areas, namely: Ballona Creek, Malibu Creek, Los Angeles River, and San Gabriel River. The purpose of the mass emission monitoring is to support stormwater load estimates and to provide a basis for long term water quality trend analysis. Therefore, the monitoring stations are located as close as practical to where the creeks and rivers enter the ocean. Mass emission stations are equipped with automated water samplers and stage recorders to collect composite stormwater samples during storm events. Grab samples were also taken at these stations in accordance with the Municipal Permit. Composite samples only were collected from one additional mass emission station (Coyote Creek) to support loadings analyses for the San Gabriel River watershed. At least six storms were sampled at all the mass emission stations during the 2000-2001 storm season, satisfying the required five storm events per station minimum under the 1996 Permit.

Hydrologic Conditions and Sampling Success

Twelve storms were sampled during the season, compared to 13 last season.

Water Quality Chemical Analysis

Monitoring in Los Angeles County in 2000-2001 was performed in compliance with the Municipal Permit issued in July 1996 which requires a broad suite of chemical analyses, including solids, minerals, bacteria, metals, organics, and nutrients. The Los Angeles County Department of Agricultural Commissioner/Weights and Measures, Environmental Toxicology Laboratory provided the water quality laboratory and related services to the Department of Public Works. The laboratory implemented a Quality Assurance/Quality Control program to ensure that the analyses conducted are scientifically valid, defensible, and of known precision and accuracy.

Water Quality Results (Mass Emission Study)

- Malibu Creek had noticeably higher median concentrations of both total and dissolved phosphorus, while the San Gabriel River has the highest median concentration of nitrate.
- The median total dissolved solids concentration in Malibu Creek is more than twice that of any other mass emission site.
- Both total and fecal coliforms exhibited higher medians in the Los Angeles River. Ballona Creek had the greatest range of results for both total and fecal coliforms as well as fecal enterococcus, while the Los Angeles River had the greatest variability for fecal streptococcus results.
- Concentrations were similar among stations for a given metal. In other words, no station appeared to be "cleaner" or "dirtier" than any other with respect to metals.
- There were several individual exceedances of water quality objectives, either of the California Toxics Rule or of the Ocean Plan (or of both), for metals; and in fact, total aluminum, total copper, dissolved copper, and total zinc each had at least one seasonal mean or median exceed an objective.

Water Quality Results (Land Use Study)

- Runoff from the vacant catchment had high pH (8.0) and high alkalinity (median of 180 mg/l), while runoff from the light industrial, transportation, mixed residential, and high density residential stations had lower median pH values (6.9, 6.8, 6.8, and 6.8 respectively) and lower median alkalinity concentrations (26, 21, 26, and 23 mg/l respectively). The educational and multiple family residential stations fell in between these two extremes with median pH values of 7.1 and 7.3 respectively, and median alkalinities of 31 and 48 mg/l respectively.

- Median hardness concentrations are similar to the alkalinity pattern: high (200 mg/l) at the vacant station; low in the transportation (30 mg/l), mixed residential (40 mg/l), and high density residential stations (20 mg/l); and in between (55, 60, and 75 mg/l) at the educational, light industrial, and multiple family residential stations.
- TSS results overlapped substantially among the different land uses; however, the light industrial station had the highest median for TSS (199 mg/l) being more than twice as high as the next highest median (84 mg/l for transportation).
- Total and dissolved copper concentrations overlapped among the different land uses, however, the dissolved copper median for the transportation station (31.6 µg/l) was more than twice as high as the next highest median (9.0 µg/l for mixed residential). Dissolved copper generally exceeds the 3.1 µg/l California Toxics Rule guideline while both mean and median concentrations of total copper exceed the Ocean Plan guideline in the transportation, light industrial, educational high density single family residential, and mixed residential stations.
- Total lead results are fairly consistent among land uses.
- Dissolved and total zinc exhibit similar patterns; there is substantial overlap among the different land uses although the mean and median for the light industrial station is highest in each case.

Water Quality Results (Critical Source/BMP Monitoring Study)

- Total and dissolved copper medians at the fabricated metal control sites (218 µg/l and 97 µg/l, respectively) were an order of magnitude higher than those at the motor freight sites (3 and 9 µg/l respectively).
- The highest concentrations of total and dissolved lead occurred at the fabricated metal control sites (medians of 109 µg/l and 42 µg/l, respectively) while there were "no meaningful" median values for the motor freight sites.
- The highest dissolved zinc concentration was observed at the auto repair test sites (median of 229 µg/l) as compared with the auto repair control sites (median of 56 µg/l). Total zinc had a median of 299 µg/l at the fabricated metal test sites and a median of 95 µg/l at the auto repair control sites.
- Dissolved nickel had a median of 18 µg/l at the fabricated metal control sites, and the median of dissolved nickel was not meaningful at the motor freight sites.

RECOMMENDATIONS

The Permit states that if a given constituent is not detected in at least 25% of the samples taken in ten consecutive storm events then that constituent may qualify for removal from the analytical suite for the associated station. For both mass emission and land use stations several constituents met this criterion. It is recommended that these constituents be removed from the analytical suite for the associated stations.

The Permit allows the discontinuation of monitoring at a land use station for specific constituents once the event mean concentration (EMC) is derived at the 25% error rate. As mutually agreed upon with the RWQCB, it was decided to use the mean standard error as a substitute for error rate (Swamikannu, 1999). Eighty-nine station-constituent combinations met the criterion and it is recommended that monitoring be discontinued for these constituents at the associated stations.

To characterize the quality of stormwater runoff in Los Angeles County, a combination of single land use sites and large area mass emissions sites have been selected for monitoring.

2.1 SITE SELECTION

2.1.1 Mass Emission Site Selection

The Department of Public Works monitored four major drainage areas near their outfalls to the ocean. Four of the mass emission monitoring stations installed under the original 1990 Permit were retained under the 1996 Permit; specifically the Los Angeles River, San Gabriel River, Ballona Creek, and Malibu Creek. The Coyote Creek mass emission station, which was required under the 1990 Permit but not under the 1996 Permit, was also monitored during the 2000-2001 season. This station was retained in the program to provide data for the calculation of mass loading in the San Gabriel River watershed. The five mass emission monitoring stations were used to collect water quality data from over 1619 square miles and have produced the data used to calculate total loading to the ocean from these watersheds.

For mass emission sites, the Permit requires sampling a minimum of five events per station per year. These sampling events may be either dry weather or wet weather events.

2.1.2 Land Use Site Selection

The following is a brief summary of the land use site selection process completed between the spring and fall of 1996. The complete methods and results of this study are provided in *Evaluation of Land Use Monitoring Stations* (Woodward-Clyde and Psomas and Associates, 1996).

An initial list of 104 land use types based on the Southern California Association of Governments (SCAG) database was sorted into 37 categories. Of these, the top 12 urban uses based on total area were chosen for a field survey. The survey was performed to identify characteristics that would assist in the aggregation or subdivision of the 12 top land use categories. For each of the 12 land uses, 8 representative areas no larger than a city block were selected for the field survey during the spring of 1996. One issue investigated in the field surveys was whether the age of a development of high density single family residential areas warranted additional monitoring sites. However, the survey indicated that there were no apparent differences between the five different age categories for high density single-family residential land use so this land use was considered one category.

A loading model for all land uses was applied for four constituents (copper, phosphorus, COD, and TSS). The model used local and regional field-derived estimates of imperviousness and water quality. For each constituent, the land use categories were ranked by total loading. A marginal benefit analysis was applied to the ranked land uses to determine the most important for monitoring. The top land use types that ranked above or equal to the land use with the maximum marginal benefit were identified for monitoring. They were:

- Vacant
- High Density Single Family Residential (HDSFR)
- Light Industrial

- Transportation
- Retail/Commercial
- Multifamily Residential
- Educational Facilities

The first 5 of the 7 land use types listed above (Vacant, High Density Single Family Residential, Light Industrial, Transportation, and Retail/Commercial) were already being monitored under the 1990 Municipal Permit. To comply with the terms of the 1996 Permit, one site for each of these land uses was retained for continued sampling; the remaining sites were dismantled. New stations to monitor the last two land use types, Multifamily Residential and Educational Facilities, were installed in February 1997 and were operational for the 1997-98, 1998-99, 1999-2000, and 2000-2001 storm seasons.

In addition to the pollutant loading analysis, land uses were also ranked by total area within each of the six major Los Angeles County watershed management areas. Four land use types not already on the list were then identified as having significant area in one or more of the watersheds (i.e., ranking in the top five land uses), as follows:

- Heavy Industrial
- Rural Residential
- Utility Facilities
- Mixed Residential

On the basis of this analysis, one mixed residential land use station was installed in October 1997 and was operational for the 1997-98, 1998-99, 1999-2000, and 2000-2001 storm seasons; seven land use monitoring stations were operational during the 2000-2001 season. The retail/commercial sampling site on Pier Drain in Santa Monica (S08) was dismantled and not in used in either the 1999-2000 or 2000-2001 season, with prior approval from the RWQCB, to accommodate construction by the City of Santa Monica of its stormwater treatment plant.

2.1.3 Critical Source Site Selection

The following is a brief summary of the Critical Source selection process undertaken to identify industrial and/or commercial critical source categories/types to be monitored. Each selected critical source type is to be monitored for a minimum of two years, the first year without BMPs, and subsequent years with BMPs. The complete site selection methods and results of this study are provided in *Critical Source Selection and Monitoring Report* (Woodward-Clyde, 1997).

Similar to the land use monitoring evaluation process, the County undertook a five-step process to identify and prioritize a list of critical industries within the county that may contribute significant pollutants to stormwater runoff. Standard Industrial Classification (SIC) codes played a major role in the selection process. Once selected, appropriate sites would be monitored over a minimum two-year period for the duration of the permit to measure runoff quality with and without remedial cleanup actions. These remedial actions are referred to as Best Management Practices, or BMPs.

The first step was to develop an initial list of candidate industries. This list contained industries both included and excluded under the State's General Industrial Activities Stormwater permit process. Initial candidate selection was based on prevalence in the county and the extent of outdoor activities. The resulting list yielded a group of 30 candidate industries ranked by the number of facilities.

The next step involved developing a set of criteria to prioritize the list. A number of empirical factors were used to assign levels of significance to each SIC category. Loading (Q) would be addressed by the number of sources at a site and the likelihood of release. Imperviousness (R) of a site would be represented by the percent of paved area. Pollutant toxicity (T) would be denoted by the number of toxic pollutants and the inherent toxicity of the mix. An exposure factor (E) signifies if activities are exposed to rainfall. And finally, number (N) would represent the total number of sites in the county. Each variable would be assigned a qualitative number from 1 to 10, with 10 representing the worst condition. The pollutant potential (P) used to rank the results would thus be the product of all the factors, or

$$P = Q \times R \times T \times E \times N$$

Based on this ranking scheme, some "critical source" industries are selected to be monitored as follows:

- Wholesale Trade (scrap and auto dismantling)
- Automotive Repair/Parking
- Fabricated Metal Products
- Motor Freight
- Automobile Dealers
- Chemical Manufacturing
- Electric/Gas/Sanitary
- Miscellaneous Manufacturing.

A literature search was simultaneously conducted to identify what "critical source" industries, if any, have already been analyzed. The search revealed that similar stormwater studies had yet to be performed.

After the identification and prioritization, the Department then had the task of finding six companies out of the selected critical source industries to enlist for monitoring runoff from five storms during the 1996-97 storm season. However, all six companies could not be enlisted until the end of that storm season, too late for the collection of runoff data. In 1997-98, twelve companies from two industries, automobile repair and auto dismantling, were enlisted. In the 1998-99 storm season, six companies from the metal fabrication industry were added. In the 1999-2000 storm season, nine of the eighteen companies from the automotive repair, auto dismantling, and metal fabrication industries were fitted with BMPs at the Department's expense. The remaining nine companies remained as control sites in order to evaluate BMP effectiveness. Twelve companies from two industries, motor freight and automobile dealerships were added to the monitoring program in the 1999-2000 storm season.

Of the twelve companies from the motor freight and automobile dealership industries, six were fitted with BMPs in the 2000-2001 storm season. The remaining six companies remained as control sites for evaluating BMP effectiveness. In addition, 13 companies from three industries, chemical manufacturing, industrial machinery manufacturing, rubber/miscellaneous plastics manufacturing were added to the monitoring program in the 2000-2001 storm season. Sampling will continue into the sixth year of monitoring until the eight critical source industries and remedial BMPs are tested and evaluated.

2.2 LOCATION AND DRAINAGE AREA DESCRIPTIONS

Figure 2-1 is an overview of the study area with all mass emission and land use monitoring sites shown. Table 2-1 also indicates the dominant land use associated with each monitoring site and the total drainage area.

2.2.1 Mass Emission Monitoring Sites

Provided below is a description of the four mass emission stations required by the 1996 Municipal Permit (Ballona Creek, Malibu Creek, Los Angeles River, and San Gabriel River) and one additional mass emission station (Coyote Creek) which is not specifically required. Figures 2-2 through 2-6 show the location of each monitoring station along with a description of its land use and 1990 population.

Ballona Creek Monitoring Station (S01)

The Ballona Creek monitoring station is located at the existing stream gage station (Stream Gage No. F38C-R) between Sawtelle Boulevard and Sepulveda Boulevard in the City of Los Angeles. At this location, which was chosen to avoid tidal influences, the upstream tributary watershed of Ballona Creek is 88.8 square miles. The entire Ballona Creek Watershed is 211.6 square miles. At the gauging station, Ballona Creek is a concrete lined trapezoidal channel.

Malibu Creek Monitoring Station (S02)

The Malibu Creek monitoring station is located at the existing stream gage station (Stream Gage No. F130-9-R) near Malibu Canyon Road, south of Piuma Road. At this location, the tributary watershed to Malibu Creek is 104.9 square miles. The entire Malibu Creek Watershed is 202.9 square miles.

Los Angeles River Monitoring Station (S10)

The Los Angeles River Monitoring Station is located at the existing stream gage station (Stream Gage No. F319-R) between Willow Street and Wardlow Road in the City of Long Beach. At this location, which was chosen to avoid tidal influences, the total upstream tributary drainage area for the Los Angeles River is 822.5 square miles. This river is the largest watershed outlet to the Pacific Ocean in Los Angeles County. At the site, the river is a concrete lined trapezoidal channel.

San Gabriel River Monitoring Station (S14)

The San Gabriel River Monitoring Station is located at an historic stream gage station (Stream Gage No. F263C-R), below San Gabriel River Parkway in Pico Rivera. At this location the upstream tributary area is 450.6 square miles. The San Gabriel River, at the gauging station, is a grouted rock-concrete stabilizer along the western levee and a natural section on the eastern side. Flow measurement and water sampling are conducted in the grouted rock area along the western levee of the river. The length of the concrete stabilizer is nearly 70 feet. The San Gabriel River sampling location has been an active stream gauging station since 1968.

Coyote Creek Monitoring Station (S13)

The Coyote Creek Monitoring Station is located at the existing ACOE stream gage station (Stream Gage No. F354-R) below Spring Street in the lower San Gabriel River watershed. Although this site is not required for monitoring per the NPDES Permit, the site was added to assist in determining mass loading for the San Gabriel River watershed. At this location, the upstream tributary area is 148.6 square miles (extending into Orange County). The sampling site was chosen to avoid backwater effects from the San Gabriel River. Coyote Creek, at the gauging station, is a concrete lined trapezoidal channel. The Coyote Creek sampling location has been an active stream gauging station since 1963.

2.2.2 Land Use Monitoring Sites

The following is a description of the locations selected to monitor runoff from land-use specific drainage areas. Figures 2-7 through 2-13 show the location and drainage area of each monitoring station along with a description of its land use and 1990 population.

Sawpit Creek Monitoring Station (S11)

The Sawpit Creek Monitoring Station is located in the Los Angeles River Watershed in the City of Monrovia. The monitoring station is in Sawpit Creek, downstream of Monrovia Creek. Sawpit Creek is a natural watercourse at this location. The overall watershed land use is predominantly vacant.

Project 620 Monitoring Station (S18)

The Project 620 Monitoring Station is located in the Los Angeles River Watershed in the City of Glendale. The monitoring station is at the intersection of Glenwood Road and Cleveland Avenue. The overall watershed land use is predominantly high density residential.

Dominguez Channel Monitoring Station (S23)

The Dominguez Channel Monitoring Station is located within the Dominguez Channel/ Los Angeles Harbor Watershed in Lennox, near Los Angeles International Airport (LAX). The monitoring station is near the intersection of 116th Street and Isis Avenue. The overall watershed land use is predominantly transportation, and includes areas of LAX and Interstate 105.

Project 1202 Monitoring Station (S24)

The Project 1202 Monitoring Station is located in the Dominguez Channel/Los Angeles Harbor Watershed in the City of Carson. The monitoring station is near the intersection of Wilmington Avenue and 220th Street. The overall watershed land use is predominantly industrial.

Project 474 Monitoring Station (S25)

The Project 474 Monitoring Station is located in the Los Angeles River Watershed in the Northridge section of the City of Los Angeles. The monitoring station is located along Lindley Avenue, one block south of Nordhoff Street. The station monitors runoff from the California State University of Northridge. The land use of the drainage area is primarily education.

Project 404 Monitoring Station (S26)

The Project 404 Monitoring Station is located within the Los Angeles River Watershed in the City of Arcadia. The monitoring station is located along Duarte Road, between Holly Avenue and La Cadena Avenue. The land use of the drainage area is primarily multi-family residential.

Project 156 Monitoring Station (S27)

The Project 156 Monitoring Station is located within the Los Angeles Watershed in the City of Glendale. The monitoring station is located along Wilson Avenue, near the intersection of Concord Street and Wilson Avenue. The land use of the drainage area is classified as mixed residential.

2.2.3 Critical Source Monitoring Sites

The general locations of the critical source monitoring sites are shown in Figure 2-14. For purposes of anonymity, the agreement reached with each of the businesses prohibits us from revealing the exact locations.

Sites C01, C02, and C03 are the control sites for the wholesale trade (auto dismantlers); T01, T02, and T03 are the sites where Best Management Practices (BMPs) have been installed for the wholesale trade industry. Similarly, C04, C05, and C06 are the control sites for automotive repair, while T04, T05, and T06 are the sites where the BMPs were installed for the automotive repair industry. Sites C07, C08, and C09 are the control sites for fabricated metal products industry; T07, T08, and T09 are the sites where BMPs were installed for the fabricated metal products industry. Sites C10, C11, and C12 are the control sites for motor freight companies; T10, T11, and T12 are the sites where the BMPs were installed for the motor freight companies. Sites C13, C14, and C15 are the control sites for auto dealership industry; T13, T14, and T15 are the sites where the BMPs were installed for the auto dealership industry.

During the 2000-2001 season, three new industries were added as follows: C16 and C17 are the control sites for chemical manufacturing industry; T16 and T17 are the BMPs sites for the chemical manufacturing industry. Sites C19 and C20 are the control sites for the industrial machinery manufacturing companies, while T19 and T20 are the BMPs sites for the industrial machinery manufacturing companies. Sites C22 and C23 are the control sites for the rubber and miscellaneous plastics industry; T22, T23 and T24 are the BMPs sites for the rubber and miscellaneous plastics industry.

This section describes the field and laboratory methods used to conduct the Monitoring Program, which includes precipitation and flow monitoring, stormwater sampling, and laboratory analyses.

3.1 PRECIPITATION AND FLOW MEASUREMENT

3.1.1 Precipitation Monitoring

For every monitoring station, a minimum of one automatic tipping bucket (intensity measuring) rain gage is located nearby or within the tributary watershed. Large watersheds may require multiple rain gages to accurately characterize the rainfall. The Los Angeles County Department of Public Works operates various automatic rain gages throughout the county. Existing gages near the monitored watersheds are also utilized in calculating stormwater runoff and are essential to develop runoff characteristics for these watersheds.

3.1.2 Flow Monitoring

Flow monitoring equipment is needed to trigger the automated samplers because the Monitoring Program requires flow-weighted composites for many constituents. Flows are determined from measurements of water elevation as described below.

The water elevation in a storm drain is measured by the stage monitoring equipment, and the flow rate is derived from a previously established rating table for the site or calculated with an equation such as Manning's. The Los Angeles County Department of Public Works uses rating tables generated from analysis of storm drain cross sections and upstream/downstream flow characteristics. The rating tables are modified if it is demonstrated in the field through stream velocity measurements that calculated table values are incorrect. Previous stormwater flow measurement efforts indicates that all stations will require multiple storm events to gather the data necessary for calibration of the measurement devices.

The automatic samplers utilize pressure transducers as the stage measurement device. However, pressure transducers are only accurate as flow measurement devices in open channel flow regimes. Therefore, for stations monitoring flows in underground storm drains, efforts were made to select drains that do not surcharge (flow under pressure) during events smaller than a 10-year storm event.

3.2 STORMWATER SAMPLING

3.2.1 Sample Collection Methods

Grab and composite sample collection methods, defined below, were used during the 2000-2001 storm season.

- **Grab Sample** - a discrete, individual sample taken within a short period of time, usually less than 15 minutes. This method is used to collect samples for constituents that have very short holding times and specific collection or preservation needs. For example, samples for coliforms are taken directly into a sterile container to avoid non-resident bacterial contamination.

- **Composite Sample** - a mixed or combined sample created by combining a series of discrete samples (aliquots) of specific volume, collected at specific flow-volume intervals. Composite sampling is ideally conducted over the duration of the storm event.

During a storm event, grab samples were collected during the initial portion of the storm (on the rising limb of the hydrograph) and taken directly to the laboratory.

Flow composite storm samples were obtained using an automated sampler to collect samples at flow-paced intervals. Samples collected at each station were combined in the laboratory to create a single flow-weighted sample for analysis.

During the storm season, the sampler was programmed to start automatically when the water level in the channel or storm drain exceeded the maximum annual dry weather stage. A sample was collected each time a set volume of water had passed the monitoring point (this volume is referred to as the pacing volume or trigger volume). The sample was stored in glass containers within the refrigerated sampler. A minimum of eight liters of sample was required to conduct the necessary laboratory analyses for all the constituents. The automated sampler was deactivated by field personnel when the water level in the channel or storm drain fell to about 120 percent of the observed maximum annual dry weather flow stage.

Samples were retrieved from the automated samplers as soon as possible to meet laboratory analysis holding time requirements. As samples were collected, rainfall and runoff data were logged and stored for transfer to the office.

3.2.2 Field Quality Assurance/Quality Control Plan

Properly performed monitoring station set up, water sample collection, sample transport, and laboratory analyses are vital to the collection of accurate data. Quality Assurance/Quality Control (QA/QC) is an essential component of the monitoring program.

Evaluation of Analytes and QA/QC Specifications for Monitoring Program (Woodward-Clyde, 1996a) describes the procedures used for bottle labeling, chain-of-custody tracking, sampler equipment checkout and setup, sample collection, field blanks to assess field contamination, field duplicate samples, and transportation to the laboratory.

An important part of the QA/QC Plan is the continued education of all field personnel. Field personnel were adequately trained from the onset and informed about new information on stormwater sampling techniques on a continuing basis. Field personnel also evaluate the field activities required by the QA/QC Plan, and the Plan is updated if necessary.

Bottle Preparation

For each monitoring station, a minimum of three sets of bottles was available so that up to two complete bottle change-outs could be made for each storm event. Bottle labels contained the following information:

- LADPW Sample ID Number
- Station Number
- Station Name

- Sample Type (Grab or Composite)
- Laboratory Analysis Requested
- Date
- Time
- Preservative
- Temperature
- Sampler's Name

Bottles were cleaned at the laboratory prior to use, then they were labeled and stored in sets. Each station was provided with the same number, types, and volumes of bottles for each rotation unless special grab samples were required. Clean composite sample bottles were placed in the automated sampler when samples were collected. This practice ensured readiness for the next storm event. All bottles currently not in use were stored and later transported in plastic ice chests. Composite sample bottles were limited to a maximum of 2-1/2 gallons each, to ensure ease of handling.

Chain-of-Custody Procedure

Chain-of-custody forms were completed to ensure and document sample integrity. These procedures establish a written record which tracks sample possession from collection through analysis.

Field Setup Procedures

All field sampling locations were fixed sites, with the sampler placed on a public road or flood control right-of-way. After sample collection, field staff prepared the sampler for collection of the next set of samples either in storm mode or in dry weather mode. Inspection of visible hoses and cables was performed to ensure proper working conditions according to the site design. Inspection of the strainer, pressure transducer, and auxiliary pump was performed during daylight hours in non-storm conditions.

The automated sampler was checked at the beginning of the storm (during grab sample collection) to ensure proper working condition and to see if flow composite samples were being collected properly. Dry weather collection techniques were similar, with grab and 24-hour composite samples being collected.

Bottles were collected after each event and packed with ice and foam insulation inside individually marked ice chests. Chain-of-custody forms were completed by field staff before transportation of the samples to the laboratory. Under no circumstance were samples removed from the ice chest during transportation from the field to the laboratory.

Travel Blanks and Field Duplicates

Potential field contamination was assessed through analysis of travel blanks and duplicate grab samples. Field travel blanks were collected for each monitoring station during every sampling event to quantify post sampling contamination. The monitoring program also included field duplicates to assess the precision of laboratory results. A field duplicate, the origin of which was unknown to the laboratory, was collected for each sampling event. This methodology for assessing post sampling contamination and laboratory testing procedures provided data to measure the precision and accuracy of the laboratory results.

3.2.3 Sampling Frequency

During the 2000-2001 storm season, the Permit required the Department to sample up to 200 "station events" for the land use sites. A station event is defined as collection of one sample at one station. The Municipal Permit specifies sampling at mass emission stations to total five events per year during dry weather, storm, or a combination of both.

3.3 LABORATORY ANALYSES

The Department of Agricultural Commissioner/Weights and Measures (ACWM) Environmental Toxicology Laboratory provides water quality laboratory and related services to the LACDPW. The ACWM lab is state certified to perform the water quality analyses contracted by LACDPW. The ACWM Lab maintains a laboratory analysis program that includes Quality Assurance and Quality Control protocols consistent with the objectives of the monitoring program required by the Permit (Section 3.3.3).

3.3.1 Possible Constituents of Concern

Possible constituents of concern for each element of the Monitoring Program are specified in the Municipal Permit. The constituents of concern for land use station monitoring are:

- Total Suspended Solids
- Total Nitrogen
- Total Phosphorus
- Cadmium
- Chromium
- Copper
- Lead
- Mercury
- Nickel
- Selenium
- Silver
- Zinc
- Chlordane
- Chlorpyrifos
- Diazinon
- Malathion
- Simazine
- Total DDT
- Total PAHs
- Total PCBs

Constituents of concern for mass emission monitoring include those listed above plus:

- Bacteria
- Total Phenols
- TPH
- Oil and Grease
- Cyanide

3.3.2 Analytical Suite and Analytical Methods

The suite of analytes and associated detection limits for samples collected at the land use stations and mass emission stations are specified in the Municipal Permit. Constituents of concern for derivation of event mean concentrations are also specified by the Permit. All the laboratory methods used for analysis of the stormwater samples are approved by the California Department of Health Services and are in conformance with USEPA approved methods.

Table 3-1 shows all the constituents monitored during the 2000-2001 season at the mass emissions and land use stations, including constituents analyzed with composite or grab samples. The table lists the method number, the detecting limit, the data quality objectives, and other relevant information for each constituent. The table also shows which constituents were monitored at the land use sites versus the mass emission sites. It should be noted that detection limits of many semi-volatile organic compounds (SVOCs) were lowered, including all PAHs, for the land use and mass emission studies at the request of the Los Angeles Regional Water Quality Control Board.

Analyses of constituents in samples collected for the Critical Source/BMP Monitoring Study were performed using the methods and reporting limits given in Table 3-2.

The laboratory made an effort to provide the lowest detection limits attainable without compromising the reliability of the data. "Detection limit" (DL) is defined by the USEPA as "the concentration above which we are 99% confident that the analyte is present at a concentration greater than zero" (40 CFR Part 136 Appendix B). For this project the laboratory made some allowance for interference in the analysis due to the complex nature of the sample matrix by performing a DL study using a water sample collected from a channel during dry weather. These 'matrix specific' DLs are the reported DLs in the data tables. Data below the DL are reported as zero. The Practical Quantitation Limit (PQL) is the concentration above which the analyte can be accurately quantified. Reported PQLs were developed by the laboratory during the analysis of stormwater runoff samples using professional judgment to account for matrix interferences. Data that fall between the DL and PQL are reported by the laboratory at the apparent concentrations. When reviewing these data it should be noted that the concentrations below the PQL are estimated.

3.3.3 Quality Assurance and Quality Control

The primary objective of the laboratory quality assurance/quality control program is to ensure that the analyses are scientifically valid, defensible, and of known precision and accuracy. The ACWM laboratory maintains quality assurance/quality control procedures (as described in their Quality Assurance Manual) in accordance with requirements of the California Department of Health Services. The ACWM laboratory standard operation procedures include method validation, equipment calibration, preventive maintenance, data validation procedures, assessment of accuracy and precision, corrective actions, and performance and system audits. The QA/QC review and data validation for the 2000-2001 monitoring data was conducted by ACWM Lab, and the QA/QC documentation is available within the ACWM Lab files. The validated data as provided by the ACWM Lab were used for data analysis and interpretation with no further QA/QC review.

4.1 HYDROLOGY: PRECIPITATION AND FLOW

Total annual rainfall during the 2000-2001 storm season in LA County was just below normal. The long term average annual rainfall at Station # 716, Ducommun Street in downtown Los Angeles is about 15.60 inches. For water year (WY) 2000-2001 the total rainfall from October 2000 through May 2001 was about 15.09 inches.

Figures 4-1a and 4-1b show the rainfall pattern for WY 2000-2001 compared to the long term pattern of rainfall. About 78% of the annual total fell during the month of January. This is reflected by the timing of the storms that were monitored. Seven of the 12 storms monitored occurred in January and February. The months of November and December were practically dry this season while February had more than twice the amount of rainfall compared to the long term average for that month.

Table 4-1 summarizes the hydrologic and meteorologic conditions of each station-event monitored this season. Table 4-2 summarizes total precipitation and runoff volume for each station on a seasonal basis from 1994 through 2001. These data will help define hydrologic and water quality trends after subsequent years of data are compiled. A collection of 2000-2001 season hydrographs for each storm event from the monitored sites and rainfall contour maps is included in Appendix A. Each hydrograph includes the time of grab sample collection when applicable, the time of the first and last composite sample aliquot collection, the number of aliquots per composite, the sample volume interval, and the percent of storm sampled.

Also included in Appendix A are contour maps of total rainfall for the 2000-2001 storm season. The dates given as "Storm Event Date" are the dates each storm began.

4.2 STORMWATER QUALITY

A summary of the composite and grab samples taken during the 2000-2001 season is included as Table 4-3.

4.2.1 Determination of Constituents of Concern for Analysis

The County analyzes for some 209 individual water quality constituents, the results of which are included in Appendix B. But while the Municipal Stormwater permit lists 25 of them as constituents of concern, some constituents were not detected or were detected at levels below a number of common water quality guidelines. Therefore, a comparison was made between mass emission water quality results and the water quality objectives outlined in the Ocean Plan, Basin Plan, and California Toxics Rule. If either the mean or median concentration of a constituent from mass emission sampling exceeded the objective, it was selected for further analysis. The 2000-2001 mass emission results were compared with the standards in Table 4-4a, while information about each site is included in Table 4-4b. A comparison was made of the 1994-2001 water quality concentrations, and 17 pollutants were identified (see Table 4-4c). A complete description of the comparison study is included in *Los Angeles County 1994-2000 Integrated Stormwater Monitoring Report* (Los Angeles County Department of Public Works). Thirteen additional constituents (total suspended solids, diazinon, chlorpyrifos, total coliform, fecal coliform, fecal streptococcus, fecal enterococcus, dissolved phosphorus, total phosphorus, ammonia nitrogen, nitrate nitrogen, nitrite nitrogen and TKN, which may have not exceeded standards or did not have standards defined) were also included. The constituents used for analysis are:

- Total Aluminum
- Dissolved Cadmium
- Dissolved Copper
- Total Copper
- Dissolved Nickel
- Total Nickel
- Dissolved Lead
- Total Lead
- Total Mercury
- Dissolved Zinc
- Total Zinc
- Total Suspended Solids
- Total Dissolved Solids
- Total Kjeldalh Nitrogen
- Ammonia
- Cyanide
- Turbidity
- Diazinon
- Chlorpyrifos
- Dissolved Phosphorus
- Total Phosphorus
- Total Coliform
- Fecal Coliform
- Fecal Streptococcus
- Fecal Enterococcus
- Bis(2-ethylhexyl)phthalate
- Phenanthrene
- Pyrene
- Nitrate
- Nitrite

The above 30 constituents of concern were used in developing the percentile distribution (box and whisker) graphs, bacteria count trend analysis, and pollutant loading estimations.

There are no numerical effluent standards that apply to stormwater pollution. Current federal and state numeric effluent standards apply only to "point source pollution," such as sanitary sewage, industrial and commercial discharges to the ocean, and other waterbodies. Water quality standards described in the 1995 Los Angeles Region Basin Plan or the 1997 California Ocean Plan do not apply to stormwater runoff, and any exceedance of values should not indicate violation or noncompliance with the plans. The 2000 California Toxics Rule is, strictly speaking, applicable to industrial and sewage treatment plant point-source discharges, but not to stormwater runoff discharges, which do not have any effluent limits. Furthermore, a direct comparison of the sampling results with the Ocean Plan standards cannot be made since the results presented in the tables are detected values before dilution, a factor allowed by the Ocean Plan. At the same time, however, it should be noted that new stormwater permits are including the narrative guidelines and limitations prescribed in the local Basin Plans.

4.2.2 Mass Emission Element

The NPDES Municipal Stormwater Permit mandates that the County monitor the quality of its stormwater discharges and create various programs for managing and improving stormwater runoff quality. The permit specifically requires the County to assess the pollutant loading from all six of its Watershed Management Areas following the 2000-2001 storm season.

4.2.2.1 GIS Model

To assist in implementing this requirement, the Department developed a GIS application called the Pollutant Loading Model.

The Pollutant Loading application computes total pollutant loading for selected pollutants originating in user-defined watersheds or political boundaries. It draws upon many existing data sources, such as predetermined drainage subbasins, land use, historical and event rainfall data, water quality monitoring station results, and multiple underlying geographic data including political boundaries, natural boundaries, census tracts, forest boundaries, streets, and drains.

Assumptions and Limitations

- An imperviousness value used for the calculations is associated with 104 different land use categories.
- The 104 SCAG land use categories have been aggregated into 34 categories covering 100% of the County.
- Water quality data collected from 8 different land use monitoring stations yields Event Mean Concentration (EMC) values. The remaining land use categories (34-8 = 26) use assumed EMC values based on their association with the 8 monitored land use types.
- All polygons of the same land use type are assumed to have the same EMC value regardless of their spatial location within the county.
- Annual pollutant loadings use previously calculated seasonal EMCs for their calculation.
- Rainfall grid cell sizes are 500 feet by 500 feet. Rainfall depth does not vary within the grid cell.
- The model does not account for variation over time in soil permeability which influences surface runoff in undeveloped watersheds. In other words, a given coefficient of discharge for a particular land use type will not change regardless of previous soil conditions (saturated soil versus dry soil)

The model does not take into account possible degradation or adsorption of the pollutant as it is transported downstream. These results therefore should not be taken as absolute; rather, they should be used for unmonitored watersheds or smaller portions of monitored watersheds for comparative purposes only.

4.2.2.2 Mass Emission Water Quality

This section provides a description of wet-weather results generated during the 2000-2001 monitoring season (Figures 4-2a through 4-2u). The figures present several panels, one for each parameter, with a series of box and whisker plots, one for each constituent. This box and whisker presentation of the data provides information on the distribution and variability of each data set. It shows the median, mean, 25 and 75 percentiles, 10 and 90 percentiles, as well as the 5 and 95 percentiles. Common water quality objectives for each parameter are also provided where available.

The criteria and conventions used in generation of these statistics are as follows:

- Only datasets that had at least 20% "detections" (positive result, with value above the method detection limit), and at least three "detections", were included;
- For data sets that met the selection criteria, if a parameter was a "non-detect", i.e., under the method detection limit, it was included in the dataset as half the method detection limit.

Thus, absence of a plot for a specific station for a given parameter may indicate that the dataset did not meet the selection criteria. However, in some situations it may indicate lack of data (due to logistical constraints related to sampling activities). The reader is referred to Table 4-3 for data inventory information.

All data for mass emission stations are presented in Appendix B.

- Malibu Creek had noticeably higher median concentrations of both total and dissolved phosphorus, while the San Gabriel River has the highest median concentration of nitrate.
- The median total dissolved solids concentration in Malibu Creek is more than twice that of any other mass emission sites.
- Both total and fecal coliforms exhibited higher medians in the Los Angeles River. Ballona Creek had the greatest range of results for both total and fecal coliforms as well as fecal enterococcus, while the Los Angeles River had the greatest variablilty for fecal streptococcus results. Please see Table 4-5 and Figures 4-3a through 4-3d for bacteria counts from 1994-2001.
- Concentrations were similar among stations for a given metal. In other words, no station appeared to be "cleaner" or "dirtier" than any other with respect to metals.
- There were several individual exceedances of water quality objectives, either of the California Toxics Rule or of the Ocean Plan (or of both), for metals; and in fact, total aluminum, total copper, dissolved copper, and total zinc each had at least one seasonal mean or median exceed an objective.

The Permit states that if a given constituent is not detected in at least 25% of the samples taken in ten consecutive storm events at a given station then that constituent may qualify for removal from the analytical suite for the associated station. Several mass emission stations meet this criterion and are summarized in Table 4-6. It is recommended that these constituents be removed from the analytical suite for the associated stations.

4.2.2.3 Loadings for Constituents of Concern for 2000-2001 Storm Season

Derivation of Event Mean Concentrations

Section B.4 of Attachment C of the Municipal Stormwater Permit (CAS614001) requires the County to "perform a loads assessment analysis for each of the six Watershed Management Areas to determine pollutant loads entering the ocean from receiving waters in the county . . . using the collected monitoring data from the land use and mass emission stations . . . and employing the USEPA simplified model". The work plan for this assessment, submitted to the Regional Board on November 6, 1997, was described in detail in *Monitoring Task Report No. 2* (Woodward-Clyde, December 9, 1996b). Loads from monitored mass emission watersheds have been calculated from observed mass emission mean concentrations and runoff volumes. Loads from unmonitored watersheds have been estimated using the GIS loading model with mean concentrations derived from the land use monitoring program. Following is a brief explanation of how event mean concentrations were calculated.

The event mean concentration is based on flow-weighted composited samples. Numerous data sets were created comprised of laboratory results from each monitoring station for a given season. Data were screened and analyzed to determine the quality and amount of data present. The following criteria were applied:

- at least 20% of the sample results were detected concentrations;
- there were at least 3 detected sample concentrations.

If the set of data did not meet these criteria, it was not used to calculate an event mean concentration. If sufficient data existed to conduct the statistical analysis, two methods were followed to address non-detects.

Initially, the Hazen robust method was used to calculate land use EMCs. The robust method uses a combination of regression and probability analysis to determine the "assumed" concentration to assign to samples with concentrations below the method detection limit. The "assumed" concentration is the point along a probability distribution regression line (derived from detected data) where true concentrations of non-detected data have the highest probability of residing. Each non-detect result was assigned the value of the detection limit and ranked along with the other detected results in the data set. The cumulative frequency data were plotted on a logarithmic plot and a straight line regression was fitted to the points. The mean, m, and variance, σ^2, of the natural logarithm of each point of the data set were used to calculate the event mean concentration. The event mean concentration, which the loading model multiplies by the volume of the event runoff to develop total loading, is defined as follows:

Event Mean Concentration= $\exp(m + 0.5\sigma^2)$.

In order to reduce analysis time, another method, which has been successfully implemented by other agencies, was also used to calculate EMCs for the mass emission water quality data. That second method assigned a value of half the detection limit to each non-detect result. The resulting data set of concentrations was analyzed as described above to develop the mass emission EMCs. A comparison of the two methods showed that differences between EMCs developed from the same data set were insignificant in most cases; therefore, the second method assumed a valid approach.

The calculated EMCs are summarized in Table 4-7 for specific land uses. These EMCs were used to estimate loadings for several watersheds.

The loadings calculated for the monitored watersheds are summarized in Tables 4-8a through 4-8e and Figures 4-4a through 4-10.

The locations of unmonitored watersheds are shown in Figures 4-11 through 4-13. The loadings calculated for the unmonitored watersheds are summarized in Tables 4-9a through 4-9c and Figures 4-14 through 4-16.

4.2.3 Land Use Element

The land use element monitoring results for the 2000-2001 season are summarized in Table 4-10. This table includes the number of samples analyzed and the percentage of samples that had detectable concentrations, as well as summary statistics (the mean, median, and coefficient of variation (CV)). Box and whisker plots for several constituents are included as Figures 4-17a through 4-17v for the 2000-2001 season. This "box-and whisker" presentation of the data provides information on the distribution and variability of each data set. It shows the median, mean, 25 and 75 percentiles, 10 and 90 percentiles, as well as the 5 and 95 percentiles. Common water quality objectives for each parameter are also provided where available.

The criteria and conventions used in generation of these statistics are as follows:

- Only datasets that had at least 20% "detections" (positive result, with value above the method detection limit), and at least three "detections", were included;
- For data sets that met the selection criteria, if a parameter was a "non-detect", i.e., under the method detection limit, it was included in the dataset as half the method detection limit.

All data for land use monitoring stations are presented in Appendix B.

Thus, absence of a plot for a specific station for a given parameter may indicate that the dataset did not meet the selection criteria. However, in some situations it may indicate lack of data (due to logistical constraints related to sampling activities). The reader is referred to Table 4-3 and to the summary tables for data inventory information.

The median pH values were visibly different between catchment types, and this trend is also reflected in the median concentrations of bicarbonate. Runoff from the vacant catchment had high pH (8.0) and high alkalinity (median of 180 mg/l), while runoff from the light industrial, transportation, mixed residential, and high density residential stations had lower median pH values (6.9, 6.8, 6.8, and 6.8 respectively) and lower median alkalinity concentrations (26, 21, 26, and 23 mg/l respectively). The educational and multiple family residential stations fell in between these two extremes with median pH values of 7.1 and 7.3 respectively, and median alkalinities of 31 and 48 mg/l respectively.

Hardness is also an important variable of water quality because it diminishes the potential of dissolved metals to cause toxicity to aquatic life. Median hardness concentrations are similar to the alkalinity pattern: high (200 mg/l) at the vacant station; low in the transportation (30 mg/l), mixed residential (40 mg/l), and high density residential stations (20 mg/l); and in between (55, 60, and 75 mg/l) at the educational, light industrial, and multiple family residential stations.

Total suspended solids (TSS) measurements reflect the amount of sediment in the water. Sediment is a constituent of concern because of the potential to adversely affect the aquatic habitat and also cause sediment accumulation that ultimately may require dredging. Sediment also may be a carrier of other chemicals that have a tendency to adsorb to particulate matter. TSS results overlapped substantially among the different land uses; however, the light industrial station had the highest median for TSS (199 mg/l) being more than twice as high as the next highest median (84 mg/l for transportation).

Metals in stormwater runoff can be of concern because some metals are toxic to aquatic organisms and some can bio-accumulate in the tissues of aquatic organisms (e.g., fish and clams) and be a human health concern. Total and dissolved copper concentrations overlapped among the different land uses, however, the dissolved copper median for the transportation station (31.6 µg/l) was more than twice as high as the next highest median (9.0 µg/l for mixed residential). Dissolved copper generally exceeds the 3.1 µg/l California Toxics Rule guideline while both mean and median concentrations of total copper exceed the Ocean Plan guideline in the transportation, light industrial, educational high density single family residential, and mixed residential stations. Total lead results are fairly consistent among land uses. Dissolved and total zinc exhibit similar patterns; there is substantial overlap among the different land uses although the mean and median for the light industrial station is highest in each case. All data for land use monitoring stations are presented in Appendix B.

The Permit states that if a given constituent is not detected in at least 25% of the samples taken in ten consecutive storm events at a given station then that constituent may qualify for removal from the analytical suite for the associated station. Several land use stations meet this criterion and are summarized in Table 4-11. It is recommended that these constituents be removed from the analytical suite for the associated stations.

The Permit allows the discontinuation of monitoring at a land use station for specific constituents once the event mean concentration (EMC) is derived at the 25% error rate. We used the mean standard error as a substitute for error rate as mutually agreed upon with the RWQCB (Swamikannu, 1999).

The constituents evaluated include:

- PAHs
- Chlordane
- Cadmium
- Copper
- Nickel
- Lead
- Chromium
- Silver
- Zinc
- Selenium
- Mercury
- Total Nitrogen
- Total Phosphorus
- TSS
- Diazinon
- Chlorpyrifos
- Malathion
- Simazine
- Total DDTs
- Total PCBs

We first identified 114 station-constituent combinations which had at least 10 detected samples and no more than 20% non-detected samples. Non-detects were replaced with half of the corresponding detection limit. Then, we performed the Shapiro-Wilk Normality Test at 5% significance level on each station-constituent to determine whether the concentrations were normally or lognormally distributed (Gibbons 1994, USEPA 1995). If the p-value of the normality test in raw scale of the constituent's concentration was greater than 0.05, such station-constituent was concluded to be normally distributed. Similarly, if the p-value of the normality test in log-transformed scale was greater than 0.05, it was concluded to be lognormally distributed. If a station-constituent was determined to be both normally and lognormally distributed (the p-values for both tests for normality were greater than 0.05), we assigned such station-constituent with a normal distribution. Similarly, if a station-constituent was neither normally nor lognormally distributed based on the normality tests (both p-values less than 0.05), we assumed that it had a normal distribution.

Based on the probability distribution determined above, we calculated the mean standard error as follows:

$$\text{Mean Standard Error} = \frac{\text{Standard Error}}{\text{Mean}} = \frac{\text{Standard Deviation} / \sqrt{\text{Sample Size}}}{\text{Mean}}$$

For those station-constituents with a normal distribution, the sample mean and standard deviation were used in the above formula. However, for station-constituents with a lognormal distribution, the mean and standard deviation were estimated as follows (Gilbert 1987):

$$\text{Mean, } \hat{\mu} = e^{(\bar{y} + \frac{s_y^2}{2})}$$

$$\text{Standard Error, } s(\hat{\mu}) = \sqrt{e^{(2\bar{y} + \frac{s_y^2}{n})}\left[\left(1 - \frac{2s_y^2}{n}\right)^{-\frac{(n-1)}{2}} \cdot e^{(\frac{s_y^2}{n})} - \left(1 - \frac{s_y^2}{n}\right)^{-(n-1)}\right]}$$

where $\bar{y}$ and s_y^2 are the arithmetic mean and variance of the log-transforme d values

n is the sample size

All results of this analysis are summarized in Table 4-12. Of 114 station-constituents under investigation, 25 of them had an EMC with a mean standard error higher than 25%. In other words, there were 25 station-constituents which had a standard error (standard deviation of the mean) larger than 25% of their corresponding mean concentrations. These station-constituents must continue to be monitored under the current Permit. The remaining 89 station-constituent combinations met the criteria and it is recommended that monitoring be discontinued for these constituents at the associated stations.

4.2.4 Critical Source Element

The following is a discussion of the results of the 2000-2001 critical source study results summarized in Table 4-13. This table includes the number of samples analyzed and the percentage of samples that had detectable concentrations, as well as summary statistics (the mean, median, and coefficient of variation (CV)). Box and whisker plots for several constituents are included as Figures 4-18a through 4-18q for the 2000-2001 season. This "box and whisker" presentation of the data provides information on the distribution and variability of each data set. It shows the median, mean, 25 and 75 percentiles, 10 and 90 percentiles, as well as the 5 and 95 percentiles. Common water quality objectives for each parameter are also provided where available. This was the second year BMPs were installed under the Critical Source Monitoring Program.

Note there are no numerical effluent standards that apply to stormwater pollution. Current federal and state standards apply only to "point source pollution," such as sanitary sewage, industrial and commercial discharges to the ocean and other water bodies. Water quality standards described in the 1995 Los Angeles Region Basin Plan or the 1997 California Ocean Plan do not apply to stormwater runoff, and any exceedance of values should not indicate violation or noncompliance with the plans. The Toxic Rule is, strictly speaking, applicable to industrial and sewage treatment plant point-source discharges, but not to stormwater runoff discharges, which do not have any effluent limits. The Ocean Plan objectives apply to "instantaneous" grab samples. Furthermore, a direct comparison of the sampling results with the Ocean Plan standards is not directly applicable since the results presented in the tables are detected values before dilution, a factor allowed by the Ocean Plan. At the same time, however, it should be noted that new stormwater permits are including the narrative guidelines and limitations prescribed in the local Basin Plans.

The chemical constituents whose means were above the objectives of the Ocean Plan, Basin Plan, or California Toxics Rule are discussed below and are as follows:

- Bis(2-ethylhexyl)phthalate (a semi-volatile organic)
- Dissolved copper
- Total copper
- Total lead
- Dissolved nickel
- Dissolved zinc
- Total zinc

The testing methods for the critical source program are outlined in Section 3.

A comparison of control to test sites for the motor freight companies reveals the following.

- Median oil and grease concentrations were higher at the test sites (5.50 mg/l) than the control sites (1.80 mg/l).
- Median bacterial counts for all bacterial types examined were lower at the test sites than the control sites.

Sample sizes for the oil and grease samples as well as the bacterial samples were significantly higher (n=12 to n=21) than for the other analyses discussed (n=3). Therefore, caution must be used in applying the following observations.

- Median suspended solids concentrations were higher at the test sites (147 mg/l) than the control sites (73 mg/l).
- Median zinc concentrations, both total and dissolved, were higher at the test sites (245 and 178 mg/l ,respectively) than the control sites (157 and 110 mg/l, respectively).
- Median total aluminum concentrations were lower at the test sites (318 mg/l) than the control sites (635 mg/l).
- Median iron concentrations, both total and dissolved, were lower at the test sites (270 and 200 mg/l, respectively) than the control sites (920 and 320 mg/l, respectively).

A comparison of control to test sites for the auto dealers reveals the following.

- Median oil and grease concentrations were lower at the test sites (1.45 mg/l) than the control sites (3.7 mg/l).

- Median bacterial counts for all bacterial types examined were higher at the test sites than the control sites.

Sample sizes for the oil and grease samples as well as the bacterial samples were significantly higher (n=8 to n=16) than for the other analyses discussed (n=2 to n=3). Therefore, caution must be used in applying the following observations.

- Median suspended solids concentrations were lower at the test sites (46.5 mg/l) than the control sites (125 mg/l).
- Median zinc concentrations, both total and dissolved, were lower at the test sites (85.7 and 54.7 mg/l, respectively) than the control sites (150 and 133 mg/l, respectively).
- Median iron concentrations, both total and dissolved, were higher at the test sites (240 and 110 mg/l, respectively) than the control sites (110 and 50 mg/l, respectively).

The 2000-2001 season was the first year for which BMPs were implemented at the test sites for the motor freight and automobile dealership industries. Motor freight and automobile dealership industries had both active test and control sites this season for the first time. A list of initial BMPs purchased is included as Table 4-14. Individual business owners were encouraged throughout the storm season to use the BMPs at all times, although LACDPW had no control over this action on the part of the owners.

This report describes the results of the 2000-2001 Monitoring Program that was conducted in compliance with the Program's NPDES Municipal Stormwater Permit No. CAS614004. Elements of the Monitoring Program consisted of land use station monitoring, mass emission station monitoring, and the Critical Source/BMP Monitoring Study. The following are the principal conclusions and recommendations from this work.

5.1 OBJECTIVES ACHIEVED IN 2000-2001

The land use monitoring was conducted at seven stations and included flow composite sample data collected during 71 station events through April 7, 2001. The mass emission monitoring was conducted at 5 stations and consisted of 37 station events. Some grab sample data were also obtained at the mass emission stations. Generally, sampling activities were conducted according to plan, and attempts were made to capture as many storms as possible.

Monitoring at the land use stations and mass emission stations included a broad constituent suite including bacteria, metals, organics, major ions, and nutrients. The laboratory analytical efforts achieved detection limits (DL) as required by the Permit for all constituents, and achieved DLs that were lower than Permit requirements for many analytes, particularly for constituents of concern. Lower DLs are beneficial for two reasons: 1) to increase the probability of detection of potentially harmful substances at the concentrations of concern, and 2) to enhance the information value of the data by improving the quality of the data sets and allowing for more rigorous statistical analyses and data interpretation techniques. Thus, the major objective of runoff characterization at mass emission and land use catchments was achieved.

5.2 MASS EMISSION PROGRAM CONCLUSIONS

- Malibu Creek had noticeably higher median concentrations of both total and dissolved phosphorus, while the San Gabriel River has the highest median concentration of nitrate.
- The median total dissolved solids concentration in Malibu Creek is more than twice that of any other mass emission sites.
- Both total and fecal coliforms exhibited higher medians in the Los Angeles River. Ballona Creek had the greatest range of results for both total and fecal coliforms as well as fecal enterococcus. While the Los Angeles River had the greatest variability for fecal streptococcus results
- Concentrations were similar among stations for a given metal. In other words, no station appeared to be "cleaner" or "dirtier" than any other with respect to metals.
- There were several individual exceedances of water quality objectives, either of the California Toxics Rule or of the Ocean Plan (or of both), for metals; and in fact, total aluminum, total copper, dissolved copper, and total zinc each had at least one seasonal mean or median exceed an objective.

5.3 LAND USE PROGRAM CONCLUSIONS

- Runoff from the vacant catchment had high pH (8.0) and high alkalinity (median of 180 mg/l), while runoff from the light industrial, transportation, mixed residential, and high density residential stations had lower median pH values (6.9, 6.8, 6.8, and 6.8 respectively) and lower median alkalinity concentrations (26, 21, 26, and 23 mg/l respectively). The educational and multiple family residential stations fell in between these two extremes with median pH values of 7.1 and 7.3 respectively, and median alkalinities of 31 and 48 mg/l respectively.

- Median hardness concentrations are similar to the alkalinity pattern: high (200 mg/l) at the vacant station; low in the transportation (30 mg/l), mixed residential (40 mg/l), and high density residential stations (20 mg/l); and in between (55, 60, and 75 mg/l) at the educational, light industrial, and multiple family residential stations.
- TSS results overlapped substantially among the different land uses; however, the light industrial station had the highest median for TSS (199 mg/l) being more than twice as high as the next highest median (84 mg/l for transportation).
- Total and dissolved copper concentrations overlapped among the different land uses, however, the dissolved copper median for the transportation station (31.6 µg/l) was more than twice as high as the next highest median (9.0 µg/l for mixed residential). Dissolved copper generally exceeds the 3.1 µg/l California Toxics Rule guideline while both mean and median concentrations of total copper exceed the Ocean Plan guideline in the transportation, light industrial, educational high density single family residential, and mixed residential stations.
- Total lead results are fairly consistent among land uses.
- Dissolved and total zinc exhibit similar patterns; there is substantial overlap among the different land uses although the mean and median for the light industrial station is highest in each case.

5.4 CRITICAL SOURCE PROGRAM CONCLUSIONS

A comparison of control to test sites for the motor freight companies reveals the following.

- Median oil and grease concentrations were higher at the test sites (5.50 mg/l) than the control sites (1.80 mg/l).
- Median bacterial counts for all bacterial types examined were lower at the test sites than the control sites.

A comparison of control to test sites for the auto dealers reveals the following.

- Median oil and grease concentrations were lower at the test sites (1.45 mg/l) than the control sites (3.7 mg/l).
- Median bacterial counts for all bacterial types examined were higher at the test sites than the control sites.

5.5 RECOMMENDATIONS

The Permit allows the discontinuation of monitoring at a land use station for specific constituents once the event mean concentration (EMC) is derived at the 25% error rate. We used the mean standard error as a substitute for error rate as mutually agreed upon with the RWQCB (Swamikannu, 1999).

Of 114 station-constituents under investigation, 25 of them had an EMC with a mean standard error higher than 25%. In other words, there were 25 station-constituents which had a standard error (standard deviation of the mean) larger than 25% of their corresponding mean concentrations. These station-constituents must continue to be monitored under the current Permit. The remaining 89 station-constituent combinations met the criterion and it is recommended that monitoring be discontinued for these constituents at the associated stations.

SL-2

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COUNTY OF LOS ANGELES

DEPARTMENT OF PUBLIC WORKS

"To Enrich Lives Through Effective and Caring Service"

JAMES A. NOYES, Director

900 SOUTH FREMONT AVENUE
ALHAMBRA, CALIFORNIA 91803-1331
Telephone: (626) 458-5100
www.ladpw.org

ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1460
ALHAMBRA, CALIFORNIA 91802-1460

May 12, 2004

IN REPLY PLEASE REFER TO FILE: WM-9
B498

Mr. Craig J. Wilson
Chief, TMDL Listing Unit
Division of Water Quality
State Water Resources Control Board
P.O. Box 100
Sacramento, CA 95812-0100

Dear Mr. Wilson:

**SOLICITATION OF WATER QUALITY DATA AND INFORMATION
2004 CLEAN WATER ACT SECTION 303(d) LIST**

We appreciate the opportunity to submit numeric data and information regarding water quality conditions in surface waters within the County of Los Angeles. As noted in your letter dated April 30, 2004, Public Works will reference only the data generated since May 15, 2001. The information collected by Public Works is compiled in Annual Storm Water Quality Monitoring Reports that are submitted to the Los Angeles Regional Water Quality Control Board as mandated by our National Pollutant Discharge Elimination System (NPDES) Municipal Storm Water Permit. Relevant information is found in the 2000-2001, 2001-2002, and 2002-2003 Monitoring Reports. Adobe Acrobat formatted versions of these reports are available at the following website:

http://ladpw.org/wmd/NPDES/report_directory.cfm

The information contained within the reports includes monitoring data collected at mass emission sites at or near the ocean or County boundary outfalls of major watersheds in the County such as the Los Angeles, San Gabriel, and Santa Clara Rivers, Malibu and Ballona Creeks, and Dominguez Channel. There is also data collected from major tributaries to Los Angeles River and from Coyote Creek, a major tributary to the San Gabriel River.

If you have any questions, please contact Mr. Fred Gonzalez, Civil Engineer, Water Quality Section, at (626) 458-5948.

Very truly yours,

JAMES A. NOYES
Director of Public Works

Rod Kubomoto

ROD H. KUBOMOTO
Assistant Deputy Director
Watershed Management Division

FG:sw
C:\MyFiles\NPDES\GonzalezF\1.doc

From: Craig J. Wilson
To: Melenee Emanuel; Tim Stevens
Date: 5/13/04 10:04AM
Subject: Fwd: FW: Solicitation of Water Quality Data and Information 2004 Clean Water Act Section 303(d) List

For the record.

>>> "Woods, Susan" <SWOODS@ladpw.org> Thursday, May 13, 2004 >>>

> Per Rod Kubomoto, please find attached the PDF file on the above. Also,
> this document is being mailed by the U.S. Post Service today.
>
> Thank you,
>
>
> <<solicitationpdf.pdf>>
>
> Susan Woods
> County of Los Angeles
> Department of Public Works
> Watershed Management Division
> Water Quality Section
> Phone: (626) 458-4369 (M-Th 7:30 a.m. - 6 p.m.)
> Fax: (626) 458-3534
> E-mail: swoods@ladpw.org
> <<Woods, Susan.vcf>>

CC: Ken Harris

Table B-5. Summary of Results for the 1999-2000 Routine Monitoring at San Gabriel River

STATION NO.					S14	S14	S14	S14	S14	S14	S14	S14	S14	S14	S14	S14
STATION NAME					San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River
STORM NO.					9900-01	9900-02	9900-03	9900-04	9900-05	9900-06	9900-07	9900-08	9900-09	9900-10	9900-11	9900-12
DATE					11/8/99	12/31/99	1/25/00	1/30/00	2/10/00	2/12/00	2/16/00	2/20/00	2/23/00	2/27/00	3/5/00	3/8/00
	Sample Type	EPA Method	DL	Units												
Conventional																
Cyanide	Grab	A335.2	0.01	mg/l			0		0	0	0	0	0	0	0	0
TPH as Diesel	Grab	A418.1	1	mg/l												
TPH as Gas	Grab	A418.1	1	mg/l												
Oil and Grease	Grab	A413.1	1	mg/l			3.3		0	1	2.1	1	0	0	2.3	3.7
Total Phenols	Grab	A420.1	0.1	mg/l			0		0	0	0	0	0	0	0	0
Indicator Bacteria																
Total Coliform	Grab		20	MPN/100ml			30000		280000	220000	170000	300000	500000	170000	300000	300000
Fecal Coliform	Grab		20	MPN/100ml			800		17000	50000	90000	170000	7000	2700	28000	300000
Fecal Streptococcus	Grab		20	MPN/100ml			3500		90000	160000	50000	22000	110000	11000	130000	130000
General																
Ammonia	Comp	A350.3	0.1	mg/l			0	0	0	0	0	0	0	0	0.116	0
Calcium	Comp	A215.2	1	mg/l			26.1	40.1	40.1	35.3	32.1	27.3	25.3	64.1	23.7	51.3
Magnesium	Comp	C3500MgD	1	mg/l			7.29	17	14.6	9.72	7.78	6.61	7	17	6.32	6.81
Potassium	Comp	A258.1	1	mg/l			5.51	2.81	5.16	5.46	4.55	3.74	3.75	8.04	3.59	6.68
Sodium	Comp	A273.1	1	mg/l			30	70.6	51.4	38.3	28.9	20.7	17.1	62.8	15.5	44.8
Bicarbonate	Comp	A310.1	2	mg/l			76.3	124	97	84.1	69.8	59.5	59.5	137	53	113
Carbonate	Comp	A310.1	2	mg/l			0	0	0	0	0	0	0	0	0	0
Chloride	Comp	B429	2	mg/l			33.6	91.3	40.9	37.2	33.2	24.6	18.4	66.6	22.7	65.7
Fluoride	Comp	B429	0.1	mg/l			0.26	0.22	0.23	0.19	0.16	0.15	0.12	0.39	0.1	0.24
Nitrate	Comp	B429	0.1	mg/l			9.04	4.73	6.48	6.54	7.46	5.03	4.6	13.5	5.71	8.91
Sulfate	Comp	B429	0.1	mg/l			50.2	73.6	77	57.9	54.1	46.9	39.6	113	36.9	92.6
Alkalinity	Comp	A310.1	4	mg/l			62.5	102	79.5	68.9	57.2	48.8	48.8	112	43.5	92.2
~~Hardness~~	~~Comp~~	~~A130.2~~	~~2~~	~~mg/l~~			~~95~~	~~170~~	~~160~~	~~128~~	~~112~~	~~95.2~~	~~192~~	~~230~~	~~85~~	~~198~~
Dissolved Phosphorus	Comp	A365.2	0.05	mg/l			0.29	0.19	0.18	0.22	0.088	0.157	0.226	0.148	0.289	0.457
Total Phosphorus	Comp	A365.2	0.05	mg/l			0.31	0.21	0.23	0.29	0.218	0.184	0.242	0.173	0.314	0.469
COD	Comp	A410.4	5	mg/l			56.8	22.7	55.7	56.6	35.5	10.7	29.1	108.1	0	22.19
pH	Comp	A150.1	na				7.13	7.68	7.47	7.3	7.32	7.22	7.18	7.5	6.93	6.86
NH3-N	Comp	A350.3	0.1	mg/l			0	0	0	0	0	0	0	0	0	0
Nitrate-N	Comp	C4110B	0.1	mg/l			2.04	1.07	1.46	1.48	1.68	1.14	1.04	3.05	1.29	2.01
Nitrite-N	Comp	C4110B	0.1	mg/l			0.213	0.466	0.198	0.295	0.228	0.14	0.125	0.393	0.128	0.609
Kjeldahl-N	Comp	A351.4	0.1	mg/l			2.82	1.65	0.768	0.968	0.866	1.14	1.5	2.32	1.288	1.254
Specific Conductance	Comp	A120.1	1	umhos/cm			380	622	525	416	360	303	271	760	269	642
Total Dissolved Solids	Comp	A160.1	2	mg/l			210	362	310	252	206	194	150	456	148	382
Turbidity	Comp	A180.1	0.1	NTU			54.8	6.18	52.5	41.2	88.4	157	279	35.1	109	57.6
Suspended Solids	Comp	A160.2	2	mg/l			84	17	95	59	105	220	384	53	215	108
Volatile Suspended Solids	Comp	160.4	1	mg/l			26	10	33	26	44	24	36	16	23	15
MBAS	Comp	A425.1	0.05	mg/l			0.077	0.068	0	0	0.051	0	0	0.058	0	0
Total Organic Carbon	Comp	A415.1	1	mg/l			8.8	7.3	6.4	5.6	4.7	5.5	6.7	9.6	7	8.4
BOD	Comp	A405.1	2	mg/l			15.69	31.84	18.3	14.8	4	6	7	8	7	11
Metals																
Dissolved Aluminum	Comp	A202.2	1000	ug/l			0	0	124	0	174	278	676	0	468	0
Total Aluminum	Comp	A202.2	1000	ug/l			365	216	183	238	313	673	716	128	686	494
Dissolved Antimony	Comp	A204.2	5	ug/l			0	0	0	0	0	0	0	0	0	0
Total Antimony	Comp	A204.2	5	ug/l			0	0	0	0	0	0	0	0	0	0
Dissolved Arsenic	Comp	A206.2	5	ug/l			0	0	0	0	0	0	0	0	0	0
Total Arsenic	Comp	A206.2	5	ug/l			0	0	0	0	0	0	0	0	0	0
Dissolved Barium	Comp	A208.2	10	ug/l			53.8	76.3	73.1	71.6	44.6	31.3	42.9	67.8	26.8	19.4
Total Barium	Comp	A208.2	10	ug/l			65.8	87.4	85.2	73.3	48.7	31.5	42.9	67.8	44.3	19.4
Dissolved Beryllium	Comp	A210.2	1	ug/l			0	0	0	0	0	0	0	0	0	0
Total Beryllium	Comp	A210.2	1	ug/l			0	0	0	0	0	0	0	0	0	0
Dissolved Boron	Comp	A212.3	100	ug/l			0	209	0	0	127	145	0	119	0	136
Total Boron	Comp	A212.3	100	ug/l			145	209	127	122	195	147	0	128	0	152
Dissolved Cadmium	Comp	A213.2	1	ug/l			0	0	0	0	0	0	0	0	0	0
Total Cadmium	Comp	A213.2	1	ug/l			0	0	0	0	0	0	0	0	0	0
Dissolved Chromium	Comp	A218.2	5	ug/l			0	0	0	0	0	0	0	0	0	0
Total Chromium	Comp	A218.2	5	ug/l			0	0	0	0	0	0	0	0	0	0

Table B-5. Summary of Results for the 1999-2000 Routine Monitoring at San Gabriel River

STATION NO.					S14	S14	S14	S14	S14	S14	S14	S14	S14	S14	S14	S14
STATION NAME					San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River
STORM NO.					9900-01	9900-02	9900-03	9900-04	9900-05	9900-06	9900-07	9900-08	9900-09	9900-10	9900-11	9900-12
DATE					11/8/99	12/31/99	1/25/00	1/30/00	2/10/00	2/12/00	2/16/00	2/20/00	2/23/00	2/27/00	3/5/00	3/8/00
	Sample Type	EPA Method	DL	Units												
Metals (cont.)																
Dissolved Chromium +6	Comp		10	ug/l			0	0	0	0	0	0	0	0	0	0
Total Chromium +6	Comp		10	ug/l			0	0	0	0	0	0	0	0	0	0
Dissolved Copper	Comp	A220.1	5	ug/l			5.2	0	0	0	0	0	0	0	0	0
Total Copper	Comp	A220.1	5	ug/l			8.3	0	6.4	8.2	6.1	9.6	7.7	12.6	5.2	7.2
Dissolved Iron	Comp	A236.1	100	ug/l			170	0	0	0	0	1350	490	160	370	0
Total Iron	Comp	A236.1	100	ug/l			690	270	0	350	1070	1850	700	190	430	210
Dissolved Lead	Comp	A239.2	5	ug/l			0	0	0	0	0	0	0	0	0	0
Total Lead	Comp	A239.2	5	ug/l			6.1	0	0	0	0	0	0	0	0	0
Dissolved Manganese	Comp	A243.1	100	ug/l			0	0	0	0	0	0	0	0	0	0
Total Manganese	Comp	A243.1	100	ug/l			0	0	0	0	0	0	0	0	0	0
Dissolved Mercury	Comp	A245.1	1	ug/l			0	0	0	0	0	0	0	0	0	0
Total Mercury	Comp	A245.1	1	ug/l			0	0	0	0	0	0	0	0	0	0
Dissolved Nickel	Comp	A249.2	5	ug/l			0	0	0	0	0	0	0	0	0	0
Total Nickel	Comp	A249.2	5	ug/l			6.4	0	20.3	0	0	0	0	0	0	0
Dissolved Selenium	Comp	A270.2	5	ug/l			0	0	0	0	0	0	0	0	0	0
Total Selenium	Comp	A270.2	5	ug/l			0	0	0	0	0	0	0	0	0	0
Dissolved Silver	Comp	A272.2	1	ug/l			0	0	0	0	0	0	0	0	0	0
Total Silver	Comp	A272.2	1	ug/l			0	0	0	0	0	0	0	0	0	0
Dissolved Thallium	Comp	A279.2	5	ug/l			0	0	0	0	0	0	0	0	0	0
Total Thallium	Comp	A279.2	5	ug/l			0	0	0	0	0	0	0	0	0	0
Dissolved Zinc	Comp	A289.1	50	ug/l			0	0	0	0	0	0	0	0	0	0
Total Zinc	Comp	A289.1	50	ug/l			0	0	0	0	0	0	0	0	0	0
Semi-Volatiles Organics																
Bis(2-ethylhexyl)phthalate	Comp	625M	3	ug/l												
All other SVOCs	Comp	625M	0.5 - 5.0	ug/l												
Pesticides																
Diazinon	Comp	8141SOP	0.01	ug/l			0.08	0	0	0	0.05	0	0.024	0	0	0.1
Chlorpyrifos	Comp	8141SOP	0.05	ug/l			0	0	0	0	0	0	0	0	0	0
Carbofuran	Comp	531.1	5	ug/l			0	0	0	0	0	0	0	0	0	0
2,4-D	Comp	515.1	10	ug/l												
2,4,5-TP	Comp	515.1	1	ug/l												
Bentazon	Comp	515.1	2	ug/l												
Glyphosate	Comp	547	25	ug/l			0	0	0	0	0	0	0	0	0	0

Note:
1). blank cell indicates sample was not analyzed
2). 0 inidicated level below detection limit

WEATHER CONDITION					Wet			Dry	
STATION NO.					S14	S14	S14	S14	S14
STATION NAME					San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River
EVENT NO.					0304-01	0304-02	0304-03	0304-01	0304-02
DATE					10/31/2003	12/25/2003	1/1/2004	10/28/2003	37999
	Sample Type	EPA Method	PQL	Units					
Conventional									
Oil and Grease	Grab	EPA413.1	1	mg/L	0	0	0	0	3.3
Total Phenols	Grab	EPA420.1	0.1	mg/L	0	0	0	0	0
Cyanide	Grab	EPA335.2	0.01	mg/L	0.012	0.022	0.015	0.023	0
pH	Comp	SM4500H B	0-14		8.17	7.68	7.64	7.49	7.92
Dissolved Oxygen	Grab	SM4500O G	1	mg/L	9.56	9.02	10.68	8.52	10.38
Indicator Bacteria									
Total Coliform	Grab	SM9230B	20	MPN/100ml	30000	170000	3000	30000	13000
Fecal Coliform	Grab	SM9230B	20	MPN/100ml	500	130000.00	270	110.00	500.00
Ratio Fecal Coliform/Total Coliform					0.02	0.76	0.09	0.00	0.04
Fecal Streptococcus	Grab	SM9230B	20	MPN/100ml	1300	22000	1300	700	300
Fecal Enterococcus	Grab	SM9230B		MPN/100ml	1300	17000	800	700	170
General									
Chloride	Comp	EPA300.0	2	mg/L	153	123	132	147	111
Fluoride	Comp	EPA300.0	0.1	mg/L	0.32	0.17	0.17	0.23	0.11
Nitrate	Comp	EPA300.0	0.1	mg/L	24.6	32.4	36.3	31.5	10.3
Sulfate	Comp	EPA300.0	0.1	mg/L	191	186	174	132	121
Alkalinity	Comp	EPA310.1	4	mg/L	140.8	169	152	112	107
Hardness	Comp	EPA130.2	2	mg/L	260	320	305	210	195
COD	9i	EPA410.4	10	mg/L	103.5	45.3	44.5	40.7	31.7
TPH	Grab	EPA418.1	1	mg/L	0	0	0	0	0
Specific Conductance	Comp	EPA120.1	1	umhos/cm	1116	1167	1107	1008	733
Total Dissolved Solids	Comp	EPA160.1	2	mg/L	706	716	682	594	450
Turbidity	Comp	EPA180.1	0.1	NTU	0.55	30	1.16	0.5	0.2
Total Suspended Solids	Comp	EPA160.2	2	mg/L	10	29	80	6	23
Volatile Suspended Solids	Comp	EPA160.4	1	mg/L	4	10	14	2	11
MBAS	Comp	EPA425.1	0.05	mg/L	0.061	0.052	0.07	0.054	0.05
Total Organic Carbon	Comp	EPA415.1	1	mg/L	8.69	5.49	5.81	6.75	5.42
BOD	Comp	SM5210B	2	mg/L	16.7	5.87	14.8	3.4	3.93
Nutrients									
Dissolved Phosphorus	Comp	EPA365.3	0.05	mg/L	0.09	0.54	0.35	0.13	0.09
Total Phosphorus	Comp	EPA365.3	0.05	mg/L	0.11	0.65	0.38	0.14	0.11
NH3-N	Comp	EPA350.3	0.1	mg/L	0.00	0.00	0.00	0.00	0.00
Nitrate-N	Comp	SM4110B	0.5	mg/L	5.55	7.32	8.20	7.11	2.33
Nitrite-N	Comp	SM4110B	0.03	mg/L	0.76	0.48	0.44	1.93	0.37
Kjeldahl-N	Comp	EPA351.4	0.1	mg/L	0.95	1.71	0.77	0.64	0.17
Metals									
Dissolved Aluminum	Comp	EPA200.8	100	ug/l	0	0	0	0	0
Total Aluminum	Comp	EPA200.8	100	ug/l	198	258	178	0	0
Dissolved Antimony	Comp	EPA200.8	5	ug/l	0.529	0	0.6	0	0
Total Antimony	Comp	EPA200.8	5	ug/l	0.529	0	0.74	0	0.88
Dissolved Arsenic	Comp	EPA200.8	5	ug/l	0	1.52	1.44	1.01	1.67
Total Arsenic	Comp	EPA200.8	5	ug/l	1.05	1.58	1.55	1.01	1.88
Dissolved Berylium	Comp	EPA200.8	1	ug/l	0	0	0	0	0
Total Beryllium	Comp	EPA200.8	1	ug/l	0	0	0	0	0
Dissolved Cadmium	Comp	EPA200.8	1	ug/l	0	0	0	0	0
Total Cadmium	Comp	EPA200.8	1	ug/l	0	0	0	0	0
Dissolved Chromium	Comp	EPA200.8	5	ug/l	0.807	1.19	3.81	5.93	0
Total Chromium	Comp	EPA200.8	5	ug/l	0.807	4.76	4.74	14.6	0.86
Dissolved Chromium +6	Comp	EPA200.8	10	ug/l	0	0	0	0	0
Total Chromium +6	Comp	EPA200.8	10	ug/l	0	0	0	0	0
Dissolved Copper	Comp	EPA200.8	5	ug/l	2.21	4.3	5.95	4.96	4.86
Total Copper	Comp	EPA200.8	5	ug/l	12.5	16	10.5	13.9	10.7
Dissolved Iron	Comp	EPA200.8	100	ug/l	0	115	102	0	0
Total Iron	Comp	EPA200.8	100	ug/l	160	423	320	150	0
Dissolved Lead	Comp	EPA200.8	5	ug/l	0	0.92	1.46	0	0
Total Lead	Comp	EPA200.8	5	ug/l	3.34	1.72	2.14	1.04	0.72
Dissolved Mercury	Comp	EPA200.8	1	ug/l	0	0	0	0	0
Total Mercury	Comp	EPA200.8	1	ug/l	0	0	0.234	0	0
Dissolved Nickel	Comp	EPA200.8	5	ug/l	3.7	4.97	5.62	4.61	3.47
Total Nickel	Comp	EPA200.8	5	ug/l	7.52	6.36	6.66	5.37	3.62
Dissolved Selenium	Comp	EPA200.8	5	ug/l	2.52	2.3	2.18	1.55	1.54
Total Selenium	Comp	EPA200.8	5	ug/l	2.69	2.39	2.58	1.55	1.65
Dissolved Silver	Comp	EPA200.8	1	ug/l	0	0	0	0	0
Total Silver	Comp	EPA200.8	1	ug/l	0	0	0	0	0
Dissolved Thallium	Comp	EPA200.8	5	ug/l	0	0	0	0	0
Total Thallium	Comp	EPA200.8	5	ug/l	0	0	0	0	0
Dissolved Zinc	Comp	EPA200.8	50	ug/l	26.9	46	42	36.8	13
Total Zinc	Comp	EPA200.8	50	ug/l	64.5	61	67	36.8	33

WEATHER CONDITION					Wet			Dry	
STATION NO.					S14	S14	S14	S14	S14
STATION NAME					San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River
EVENT NO.					0304-01	0304-02	0304-03	0304-01	0304-02
DATE					10/31/2003	12/25/2003	1/1/2004	10/28/2003	37999
	Sample Type	EPA Method	PQL	Units					
Semi-Volatiles Organics (EPA 625)									
2- Chlorophenol	Comp	EPA625	2	ug/l	0	0	0	0	0
2,4-dichlorophenol	Comp	EPA625	2	ug/l	0	0	0	0	0
2,4-dimethylphenol	Comp	EPA625	2	ug/l	0	0	0	0	0
2,4-dinitrophenol	Comp	EPA625	3	ug/l	0	0	0	0	0
2-nitrophenol	Comp	EPA625	3	ug/l	0	0	0	0	0
4-nitrophenol	Comp	EPA625	3	ug/l	0	0	0	0	0
4-chloro_3_methylphenol	Comp	EPA625	3	ug/l	0	0	0	0	0
Pentachlorophenol	Comp	EPA625	2	ug/l	0	0	0	0	0
Phenol	Comp	EPA625	1	ug/l	0	0	0	0	0
2,4,6-trichlophenol	Comp	EPA625	1	ug/l	0	2.9	2.1	0	0
Base/Neutral									
Acenaphthene	Comp	EPA625	0.05	ug/l	0	0	0	0	0
Acenaphthylene	Comp	EPA625	0.05	ug/l	0	0	0	0	0
Anthracene	Comp	EPA625	0.05	ug/l	0	0	0	0	0
Benzidine	Comp	EPA625	3	ug/l	0	0	0	0	0
1,2 Benzanthracene	Comp	EPA625	0.1	ug/l	0	0	0	0	0
Benzo(a)pyrene	Comp	EPA625	0.1	ug/l	0	0	0	0	0
Benzo(k)flouranthene	Comp	EPA625	0.1	ug/l	0	0	0	0	0
Bis(2-Chloroethoxy) methane	Comp	EPA625	0.1	ug/l	0	0	0	0	0
Bis(2-Chloroisopropyl) ether	Comp	EPA625	1	ug/l	0	0	0	0	0
Bis(2-Chloroethyl) ether	Comp	EPA625	0.1	ug/l	0	0	0	0	0
Bis(2-Ethylhexl) phthalate	Comp	EPA625	1	ug/l	42.4	43.4	19.8	18.7	0
4-Bromophenyl phenyl ether	Comp	EPA625	1	ug/l	0	0	0	0	0
Butyl benzyl phthalate	Comp	EPA625	0.3	ug/l	0	0	0	0	0
2-Chloronaphthalene	Comp	EPA625	0.1	ug/l	0	0	0	0	0
4-Chlorophenyl phenyl ether	Comp	EPA625	0.1	ug/l	0	0	0	0	0
Chrysene	Comp	EPA625	0.1	ug/l	0	0	0	0	0
Dibenzo(a,h)anthracene	Comp	EPA625	0.1	ug/l	0	0	0	0	0
1,3-Dichlorobenzene	Comp	EPA625	0.05	ug/l	0	0	0	0	0
1,4-Dichlorobenzene	Comp	EPA625	0.05	ug/l	0	0	0	0	0
1,2-Dichlorobenzene	Comp	EPA625	0.05	ug/l	0	0	0	0	0
3,3-Dichlorobenzidine	Comp	EPA625	3	ug/l	0	0	0	0	0
Diethyl phthalate	Comp	EPA625	0.5	ug/l	9.5	1.7	1.9	0	0
Dimethyl phthalate	Comp	EPA625	0.5	ug/l	1	0	0	3.1	0
di-n-Butyl phthalate	Comp	EPA625	1	ug/l	0	0	0	7.2	0
2,4-Dinitrotoluene	Comp	EPA625	0.05	ug/l	0	0	0	0	0
2,6-Dinitrotoluene	Comp	EPA625	0.05	ug/l	0	0	0	0	0
4,6 Dinitro-2-methylphenol	Comp	EPA625	3	ug/l	0	0	0	0	0
1,2-Diphenylhydrazine	Comp	EPA625	3	ug/l	0	0	0	0	0
di-n-Octyl phthalate	Comp	EPA625	1	ug/l	0	0	0	0	0
Fluoranthene	Comp	EPA625	0.1	ug/l	0	0	0	0	0
Fluorene	Comp	EPA625	0.1	ug/l	0	0	0	0	0
Hexachlorobenzene	Comp	EPA625	0.5	ug/l	0	0	0	0	0
Hexachlorobutadiene	Comp	EPA625	1	ug/l	0	0	0	0	0
Hexachloro-cyclopentadiene	Comp	EPA625	3	ug/l	0	0	0	0	0
Hexachloroethane	Comp	EPA625	1	ug/l	0	0	0	0	0
Indeno(1,2,3-cd)pyrene	Comp	EPA625	0.1	ug/l	0	0	0	0	0
Isophorone	Comp	EPA625	0.05	ug/l	0	0	0	0	0
Naphthalene	Comp	EPA625	0.05	ug/l	0	0	0	0	0
Nitrobenzene	Comp	EPA625	0.05	ug/l	0	0	0	0	0
N-Nitroso-dimethyl amine	Comp	EPA625	0.3	ug/l	0	0	0	0	0
N-Nitroso-diphenyl amine	Comp	EPA625	0.3	ug/l	0	0	0	0	0
N-Nitroso-di-n-propyl amine	Comp	EPA625	0.3	ug/l	0	0	0	0	0
Phenanthrene	Comp	EPA625	0.05	ug/l	0	0	0	0	0
Pyrene	Comp	EPA625	0.05	ug/l	0	0	0	0	0
1,2,4-Trichlorobenzene	Comp	EPA625	0.5	ug/l	0	0	0	0	0
Chlorinated Pesticides									
Aldrin	Comp	EPA625	0.05	ug/l	0	0	0	0	0
alpha-BHC	Comp	EPA625	0.05	ug/l	0	0	0	0	0
beta-BHC	Comp	EPA625	0.05	ug/l	0	0	0	0	0
delta-BHC	Comp	EPA625	0.05	ug/l	0	0	0	0	0
gamma-BHC (lindane)	Comp	EPA625	0.05	ug/l	0	0	0	0	0
alpha-chlordane	Comp	EPA625	0.05	ug/l	0	0	0	0	0
gamma-chlordane	Comp	EPA625	0.05	ug/l	0	0	0	0	0
4,4'-DDD	Comp	EPA625	0.1	ug/l	0	0	0	0	0
4,4'-DDE	Comp	EPA625	0.1	ug/l	0	0	0	0	0
4,4'-DDT	Comp	EPA625	0.1	ug/l	0	0	0	0	0
Dieldrin	Comp	EPA625	0.1	ug/l	0	0	0	0	0

Table C-7. Summary of Results for 1998-1999 Routine Monitoring at San Gabriel River

STATION NO.					S14	S14	S14	S14	S14	S14	S14	S14	S14
STATION NAME					San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River
STORM NO.							9899-01	9899-02	9899-03	9899-04		9899-05	9899-06
DATE SAMPLED					10/14/98	10/22/98	11/8/98	11/28/98	12/1/98	12/6/98	1/12/99	1/21/99	1/25/99
DATE DELIVERED					10/14/98	10/22/98	11/9/98	11/28/98	12/1/98	12/8/98	1/12/99	1/21/99	1/25/99
	EPA Method	DL	Units	Sample Type	Dry	Dry					Dry		
Conventional													
Cyanide	A335.2	0.01	mg/l	Grab			0.03	0.01	0		0		0.033
TPH	A418.1	1.0	mg/l	Grab			0	0	0		0		0
Oil and Grease	A413.1	1.0	mg/l	Grab			0	0	0		0		0
Total Phenols	A420.1	0.1	mg/l	Grab			0.144	0	0		0		0
Glyphosate	547	25.0	ug/l	Comp.	0	0	66			0	0	0	33
Indicator Bacteria													
Total Coliform	C9221B	20.0	MPN/100ml	Grab			2200000	240000	0		9000		160000
Fecal Coliform	C9221C	20.0	MPN/100ml	Grab			90000	90000	0		2200		2400
Fecal Streptococcus	C9230B	20.0	MPN/100ml	Grab			160000	130000	0		500		17000
Fecal Enterococcus	C9230B	20.0	MPN/100ml	Grab									
General													
Ammonia	A350.3	0.1	mg/l	Comp.	0	0	4.16			0.524	0	0	4.57
Calcium	A215.2	1.0	mg/l	Comp.	104	108	60.9			24	100	72.1	49.7
Magnesium	C3500MgD	1.0	mg/l	Comp.	27.2	26.7	19			4.86	23.3	23.3	14.6
Potassium	A258.1	1.0	mg/l	Comp.	6	6.02	8.74			2.87	5.8	8.52	6.16
Sodium	A273.1	1.0	mg/l	Comp.	82.2	80.4	71.2			17.9	77.6	92.7	48.4
Bicarbonate	A310.1	2.0	mg/l	Comp.	211	212	144			41.3	203	178	117
Carbonate	A310.1	2.0	mg/l	Comp.	0	0	0			0	6.36	0	0
Chloride	B429	2.0	mg/l	Comp.	101	100	103			15.4	103	97	55.1
Fluoride	B429	0.1	mg/l	Comp.	0.28	0.262	0.36			0.151	0.319	0.375	0.3
Nitrate	B429	0.1	mg/l	Comp.	2.03	2.7	14.4			2.3	4.55	9.66	8.73
Sulfate	B429	0.1	mg/l	Comp.	193	200	157			24.3	177	150	79.1
Alkalinity	A310.1	4.0	mg/l	Comp.	211	212	144			41.3	209	178	117
Hardness	A130.2	2.0	mg/l	Comp.	372	380	230			80	346	276	184
Dissolved Phosphorus	A365.2	0.05	mg/l	Comp.	0.18	0.14	0.77			0.19	0.22	0.51	0.37
Total Phosphorus	A365.2	0.05	mg/l	Comp.	0.19	0.17	0.97			0.22	0.23	0.58	0.42
COD	A410.4	5.0	mg/l	Comp.	0	134	91			57.8	57.3	66.7	81.6
pH	A150.1	14.0		Comp.	9.29	8.29	7.99			7.14	8.4	8.08	7.84
NH3-N	A350.3	0.1	mg/l	Comp.	0	0	3.44			0.433	0	0	3.78
Nitrate-N	C4110B	0.1	mg/l	Comp.	0.45878	0.61	3.25			0.519	1.03	2.18	1.97
Nitrite-N	C4110B	0.1	mg/l	Comp.	0	0	0.816			0.231	0.167	0.894	0.472
Kjeldahl-N	A351.4	0.1	mg/l	Comp.	0.86	0.72	6.32			3.92	0.972	5.76	6.02
Specific Conductance	A120.1	1.0	umhos/cm	Comp.	1220	1220	1010			240	1105	1005	629
Total Dissolved Solids	A160.1	2.0	mg/l	Comp.	704	724	592			150	664	630	386
Turbidity	A180.1	0.1	NTU	Comp.	3.6	3.38	105			127	6.96	26.1	26.3
Suspended Solids	A160.2	2.0	mg/l	Comp.	10	9	329			272	17	59	46
Vol.Sus.Solids	160.4	1.0	mg/l	Comp.	5	4	50			68	10	20	12
MBAS	A425.1	0.05	mg/l	Comp.	0.052	0.076	0.36			0.111	0	0.094	0.086
Total Organic Carbon	A415.1	1.0	mg/l	Comp.	3.077	3.029	14.94			2.1	3.4	6.66	7.2
BOD	A405.1	2.0	mg/l	Comp.	11	6	29			12	17	106	110
Metals													
Dissolved Aluminum	A202.2	1000	ug/l	Comp	0	0	124			145	0	0	0
Total Aluminum	A202.2	1000	ug/l	Comp	250	440	365			318	0	552	281
Dissolved Antimony	A204.2	5.0	ug/l	Comp	0	0	0			0	0	0	0
Total Antimony	A204.2	5.0	ug/l	Comp	0	0	0			0	0	0	0
Dissolved Arsenic	A206.2	5.0	ug/l	Comp	0	0	0			0	0	0	0
Total Arsenic	A206.2	5.0	ug/l	Comp	0	0	0			0	0	0	0
Dissolved Barium	A208.2	10.0	ug/l	Comp	49.8	105	46.5			0	79.7	19.4	67.9
Total Barium	A208.2	10.0	ug/l	Comp	49.8	118	56.3			0	79.7	19.4	80.9
Dissolved Beryllium	A210.2	1.0	ug/l	Comp	0	0	0			0	0	0	0
Total Beryllium	A210.2	1.0	ug/l	Comp	0	0	0			0	0	0	0
Dissolved Boron	A212.3	100.0	ug/l	Comp	380	358	460			117	315	300	238
Total Boron	A212.3	100.0	ug/l	Comp	506	437	560			168	437	387	307
Dissolved Cadmium	A213.2	1.0	ug/l	Comp	0	0	0			0	0	0	0
Total Cadmium	A213.2	1.0	ug/l	Comp	0	0	0			0	0	0	0
Dissolved Chromium	A218.2	5.0	ug/l	Comp	0	0	0			0	0	0	0
Metals (cont.)													

Table C-7. Summary of Results for 1998-1999 Routine Monitoring at San Gabriel River

STATION NO.					S14	S14	S14	S14	S14	S14	S14	S14	S14
STATION NAME					San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River
STORM NO.							9899-01	9899-02	9899-03	9899-04		9899-05	9899-06
DATE SAMPLED					10/14/98	10/22/98	11/8/98	11/28/98	12/1/98	12/6/98	1/12/99	1/21/99	1/25/99
DATE DELIVERED					10/14/98	10/22/98	11/9/98	11/28/98	12/1/98	12/8/98	1/12/99	1/21/99	1/25/99
	EPA Method	DL	Units	Sample Type	Dry	Dry					Dry		
Total Chromium	A218.2	5.0	ug/l	Comp	0	0	0			0	0	0	0
Dissolved Chromium +6		10.0	ug/l	Comp	0	0	0			0	0	0	0
Total Chromium +6		10.0	ug/l	Comp	0	0	0			0	0	0	0
Dissolved Copper	A220.1	5.0	ug/l	Comp	0	0	0			0	0	9.3	0
Total Copper	A220.1	5.0	ug/l	Comp	0	5.6	13.1			6.9	7.4	9.3	8.2
Dissolved Iron	A236.1	100.0	ug/l	Comp	0	0	0			185	0	0	0
Total Iron	A236.1	100.0	ug/l	Comp	397	321	260			531	143	104	174
Dissolved Lead	A239.2	5.0	ug/l	Comp	0	0	0			0	0	0	0
Total Lead	A239.2	5.0	ug/l	Comp	0	0	0			0	0	0	0
Dissolved Manganese	A243.1	100.0	ug/l	Comp	0	0	0			0	271	0	0
Total Manganese	A243.1	100.0	ug/l	Comp	139	177	0			0	276	0	0
Dissolved Mercury	A245.1	1.0	ug/l	Comp	0	0	0			0	0	0	0
Total Mercury	A245.1	1.0	ug/l	Comp	0	0	0			0	0	0	0
Dissolved Nickel	A249.2	5.0	ug/l	Comp	0	0	0			0	0	0	0
Nickel	A249.2	5.0	ug/l	Comp	9.1	6.8	6			0	0	0	0
Dissloved Selenium	A270.2	5.0	ug/l	Comp	0	0	0			0	0	0	0
Total Selenium	A270.2	5.0	ug/l	Comp	0	13.6	0			10.5	0	0	0
Dissolved Silver	A272.2	1.0	ug/l	Comp	0	0	0			0	0	0	0
Total Silver	A272.2	1.0	ug/l	Comp	0	0	0			0	0	0	0
Dissolved Thallium	A279.2	5.0	ug/l	Comp	0	0	0			0	0	0	0
Total Thallium	A279.2	5.0	ug/l	Comp	0	0	0			0	0	0	0
Dissolved Zinc	A289.1	50.0	ug/l	Comp	0	0	57			0	0	0	0
Total Zinc	A289.1	50.0	ug/l	Comp	0	54	75			51	0	0	0
Semi-Volatiles Organics													
Bis(2-ethylhexyl)phthalate	625	3.0	ug/l	Comp	64	5.2	3.1	0	0				
4-Chloro-3-methylphenol	625	3.0	ug/l	Comp	0	0	0	0	0				
2-Chlorophenol	625	2.0	ug/l	Comp	0	0	0	0	0				
All other SVOCs	625	0.5-5.0	ug/l	Comp	0	0	0	0	0				
Pesticides													
Organochlorine Pesticides & PCBs	D608	0.05-1.0	ug/l	Comp	0	0	0						
Diazinon	8141 SOP	0.01	ug/l	Comp	0	0	0			0	0	0	0
Thiobencarb	507	1.0	ug/l	Comp	0	0	0			0	0	0	0
Chlorpyrifos	8141 SOP	0.05	ug/l	Comp	0	0	0			0	0	0	0
Pesticides	507	1.0-2.0	ug/l	Comp	0	0	0			0	0	0	0

Note:
1). blank cell indicates sample was not analyzed
2). 0 inidicated level below detection limit

Table C-7. Summary of Results for 1998-1999 Routine Monitoring at San Gabriel River

STATION NO.					S14	S14	S14	S14	S14	S14	S14	S14	S14
STATION NAME					San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River
STORM NO.					9899-07	9899-08	9899-09	9899-11	9899-12	9899-12	9899-13	9899-14	9899-15
DATE SAMPLED					1/31/99	2/6/99	2/9/99	3/15/99	3/20/99	3/20/99	3/25/99	4/6/99	4/8/99
DATE DELIVERED					1/31/99	2/7/99	2/9/99	3/15/99	3/20/99	3/20/99	3/25/99	4/6/99	4/8/99
	EPA Method	DL	Units	Sample Type									
Conventional													
Cyanide	A335.2	0.01	mg/l	Grab	0		0.03	0	0.018	0	0.01	0.01	0.017
TPH	A418.1	1.0	mg/l	Grab	0		1	0	0	0	0	0	0
Oil and Grease	A413.1	1.0	mg/l	Grab	0		0	2.8	2.5	1.4	1	0	0
Total Phenols	A420.1	0.1	mg/l	Grab	0		0	0	0	0	0	0	0
Glyphosate	547	25.0	ug/l	Comp.	0	0	0	0		0	0	0	0
Indicator Bacteria													
Total Coliform	C9221B	20.0	MPN/100ml	Grab	90000		240000	300000	170000	17000	24000	7000	240000
Fecal Coliform	C9221C	20.0	MPN/100ml	Grab	800		2300	300000	1400	1100	230	170	1100
Fecal Streptococcus	C9230B	20.0	MPN/100ml	Grab	3000		28000	160000	300	300	220	1400	1400
Fecal Enterococcus	C9230B	20.0	MPN/100ml	Grab				90000	300	300	220	1400	700
General													
Ammonia	A350.3	0.1	mg/l	Comp.	0	0	0.845	1.67	7.74		0.123	0	0
Calcium	A215.2	1.0	mg/l	Comp.	76.2	71.3	71.3	34.5	72.1		74.1	48.1	60.1
Magnesium	C3500MgD	1.0	mg/l	Comp.	21.9	19	26.3	9.72	20.7		25.5	14.1	19.4
Potassium	A258.1	1.0	mg/l	Comp.	5.32	6.6	4.9	4.46	9.42		8.49	4.9	6.14
Sodium	A273.1	1.0	mg/l	Comp.	63.6	64.6	42.4	31.8	91.2		86.4	40.4	52.8
Bicarbonate	A310.1	2.0	mg/l	Comp.	165	167	148	65.7	172		145	84.8	108
Carbonate	A310.1	2.0	mg/l	Comp.	0	0	0	0	0		0	0	0
Chloride	B429	2.0	mg/l	Comp.	85.8	88	69.4	29.2	123		127	56.9	76
Fluoride	B429	0.1	mg/l	Comp.	0.276	0.31	0.287	0.16	0.37		0.36	0.19	0.27
Nitrate	B429	0.1	mg/l	Comp.	8.98	7.18	8.92	6	9.73		13.6	19.5	7.3
Sulfate	B429	0.1	mg/l	Comp.	149	126	125	46.7	151		147	79	105
Alkalinity	A310.1	4.0	mg/l	Comp.	165	167	148	65.7	172		145	84.8	108
Hardness	A130.2	2.0	mg/l	Comp.	280	256	286	126	265		290	178	230
Dissolved Phosphorus	A365.2	0.05	mg/l	Comp.	0.29	0.6	0.64	0.215	0.78		0.63	0.421	0.277
Total Phosphorus	A365.2	0.05	mg/l	Comp.	0.33	0.67	0.68	0.215	0.89		0.69	0.449	0.369
COD	A410.4	5.0	mg/l	Comp.	49	42.4	30.8	116	151		44.8	42	42.4
pH	A150.1	14.0		Comp.	7.05	8.03	7.82	7.32	8.03		7.54	7.79	7.96
NH3-N	A350.3	0.1	mg/l	Comp.	0	0	0.698	1.38	6.4		0.102	0	0
Nitrate-N	C4110B	0.1	mg/l	Comp.	2.03	1.62	2.01	1.35	2.2		3.07	4.403	1.65
Nitrite-N	C4110B	0.1	mg/l	Comp.	0.587	0.489	0.42	0.183	1.19		1.2	0	0.575
Kjeldahl-N	A351.4	0.1	mg/l	Comp.	1.26	4.56	5.14	2.32	8.44		0.792	1.59	3.54
Specific Conductance	A120.1	1.0	umhos/cm	Comp.	950	870	756	379	972		1008	591	682
Total Dissolved Solids	A160.1	2.0	mg/l	Comp.	580	524	424	226	664		672	354	456
Turbidity	A180.1	0.1	NTU	Comp.	18	37.9	54.3	28.3	5.17		26.8	61.7	5.79
Suspended Solids	A160.2	2.0	mg/l	Comp.	23	92	84	26	12		17	82	6
Vol.Sus.Solids	160.4	1.0	mg/l	Comp.	12	9	11	22	6		8	11	1
MBAS	A425.1	0.05	mg/l	Comp.	0.222	0.055	0	0	0		0.214	0	0
Total Organic Carbon	A415.1	1.0	mg/l	Comp.	6.8			7.55	6.4		5.2	5.8	5.7
BOD	A405.1	2.0	mg/l	Comp.	73.4			33.78	0		0	65.6	65.4
Metals													
Dissolved Aluminum	A202.2	1000	ug/l	Comp	0	0	0	0	0		0	0	0
Total Aluminum	A202.2	1000	ug/l	Comp	203.5	126	341	128	0		271	156	146
Dissolved Antimony	A204.2	5.0	ug/l	Comp	0	0	0.	0	0		0	0	0
Total Antimony	A204.2	5.0	ug/l	Comp	0	0	0	0	0		0	0	0
Dissolved Arsenic	A206.2	5.0	ug/l	Comp	0	0	0	0	0		0	0	0
Total Arsenic	A206.2	5.0	ug/l	Comp	0	0	0	0	0		0	0	0
Dissolved Barium	A208.2	10.0	ug/l	Comp	77.2	84.4	65.6	18.4	68.2		75.4	46.3	58.8
Total Barium	A208.2	10.0	ug/l	Comp	83.2	88.2	65.6	18.4	104		89.7	51.2	58.8
Dissolved Beryllium	A210.2	1.0	ug/l	Comp	0	0	0	0	0		0	0	0
Total Beryllium	A210.2	1.0	ug/l	Comp	0	0	0	0	0		0	0	0
Dissolved Boron	A212.3	100.0	ug/l	Comp	409	422	186	145	354		374	263	283
Total Boron	A212.3	100.0	ug/l	Comp	562	605	387	266	354		423	313	303
Dissolved Cadmium	A213.2	1.0	ug/l	Comp	0	0	0	0	0		0	0	1.1
Total Cadmium	A213.2	1.0	ug/l	Comp	0	0	0	0	0		0	0	1.2
Dissolved Chromium	A218.2	5.0	ug/l	Comp	0	0	0	0	0		0	0	0

Metals (cont.)

Table C-7. Summary of Results for 1998-1999 Routine Monitoring at San Gabriel River

STATION NO.					S14	S14	S14	S14	S14	S14	S14	S14	S14
STATION NAME					San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River	San Gabriel River
STORM NO.					9899-07	9899-08	9899-09	9899-11	9899-12	9899-12	9899-13	9899-14	9899-15
DATE SAMPLED					1/31/99	2/6/99	2/9/99	3/15/99	3/20/99	3/20/99	3/25/99	4/6/99	4/8/99
DATE DELIVERED					1/31/99	2/7/99	2/9/99	3/15/99	3/20/99	3/20/99	3/25/99	4/6/99	4/8/99
	EPA Method	DL	Units	Sample Type									
Total Chromium	A218.2	5.0	ug/l	Comp	0	0	0	0	0		5	0	0
Dissolved Chromium +6		10.0	ug/l	Comp	0	0	0	0	0		0	0	0
Total Chromium +6		10.0	ug/l	Comp	0	0	0	0	0		0	0	0
Dissolved Copper	A220.1	5.0	ug/l	Comp	0	0	0	0	0		0	0	0
Total Copper	A220.1	5.0	ug/l	Comp	5.6	5.1	6.3	8.4	6.7		6.3	10.3	0
Dissolved Iron	A236.1	100.0	ug/l	Comp	0	0	0	0	0		114	0	0
Total Iron	A236.1	100.0	ug/l	Comp	206	185	408	0	0		459	125	0
Dissolved Lead	A239.2	5.0	ug/l	Comp	0	0	0	0	0		0	0	0
Total Lead	A239.2	5.0	ug/l	Comp	0	0	0	0	0		0	0	0
Dissolved Manganese	A243.1	100.0	ug/l	Comp	0	0	0	0	0		0	0	0
Total Manganese	A243.1	100.0	ug/l	Comp	0	0	0	0	0		141	0	0
Dissolved Mercury	A245.1	1.0	ug/l	Comp	0	0	0	0	0		0	0	0
Total Mercury	A245.1	1.0	ug/l	Comp	0	0	0	0	0		0	0	0
Dissolved Nickel	A249.2	5.0	ug/l	Comp	0	0	0	0	0		0	0	0
Nickel	A249.2	5.0	ug/l	Comp	0	0	0	0	0		8.51	0	0
Dissloved Selenium	A270.2	5.0	ug/l	Comp	0	0	0	0	0		0	0	0
Total Selenium	A270.2	5.0	ug/l	Comp	0	0	0	0	0		0	0	0
Dissolved Silver	A272.2	1.0	ug/l	Comp	0	0	0	0	0		0	0	0
Total Silver	A272.2	1.0	ug/l	Comp	0	0	0	0	0		0	0	0
Dissolved Thallium	A279.2	5.0	ug/l	Comp	0	0	0	0	0		0	0	0
Total Thallium	A279.2	5.0	ug/l	Comp	0	0	0	0	0		0	0	0
Dissolved Zinc	A289.1	50.0	ug/l	Comp	0	0	50	0	0		0	0	0
Total Zinc	A289.1	50.0	ug/l	Comp	51	56	83	0	0		83	59	0
Semi-Volatiles Organics													
Bis(2-ethylhexyl)phthalate	625	3.0	ug/l	Comp									
4-Chloro-3-methylphenol	625	3.0	ug/l	Comp									
2-Chlorophenol	625	2.0	ug/l	Comp									
All other SVOCs	625	0.5-5.0	ug/l	Comp									
Pesticides													
Organochlorine Pesticides & PCBs	D608	0.05-1.0	ug/l	Comp									
Diazinon	8141 SOP	0.01	ug/l	Comp	0	0	0	0.075	0.21		0	0	0
Thiobencarb	507	1.0	ug/l	Comp	0	0	0	0	0		0	0	0
Chlorpyrifos	8141 SOP	0.05	ug/l	Comp	0	0	0	0	0		0	0	0
Pesticides	507	1.0-2.0	ug/l	Comp	0	0	0	0	0		0	0	0

Note:
1). blank cell indicates sample was not analyzed
2). 0 inidicated level below detection limit

Table C-7. Summary of Results for 1998-1999 Routine Monitoring at San Gabriel River

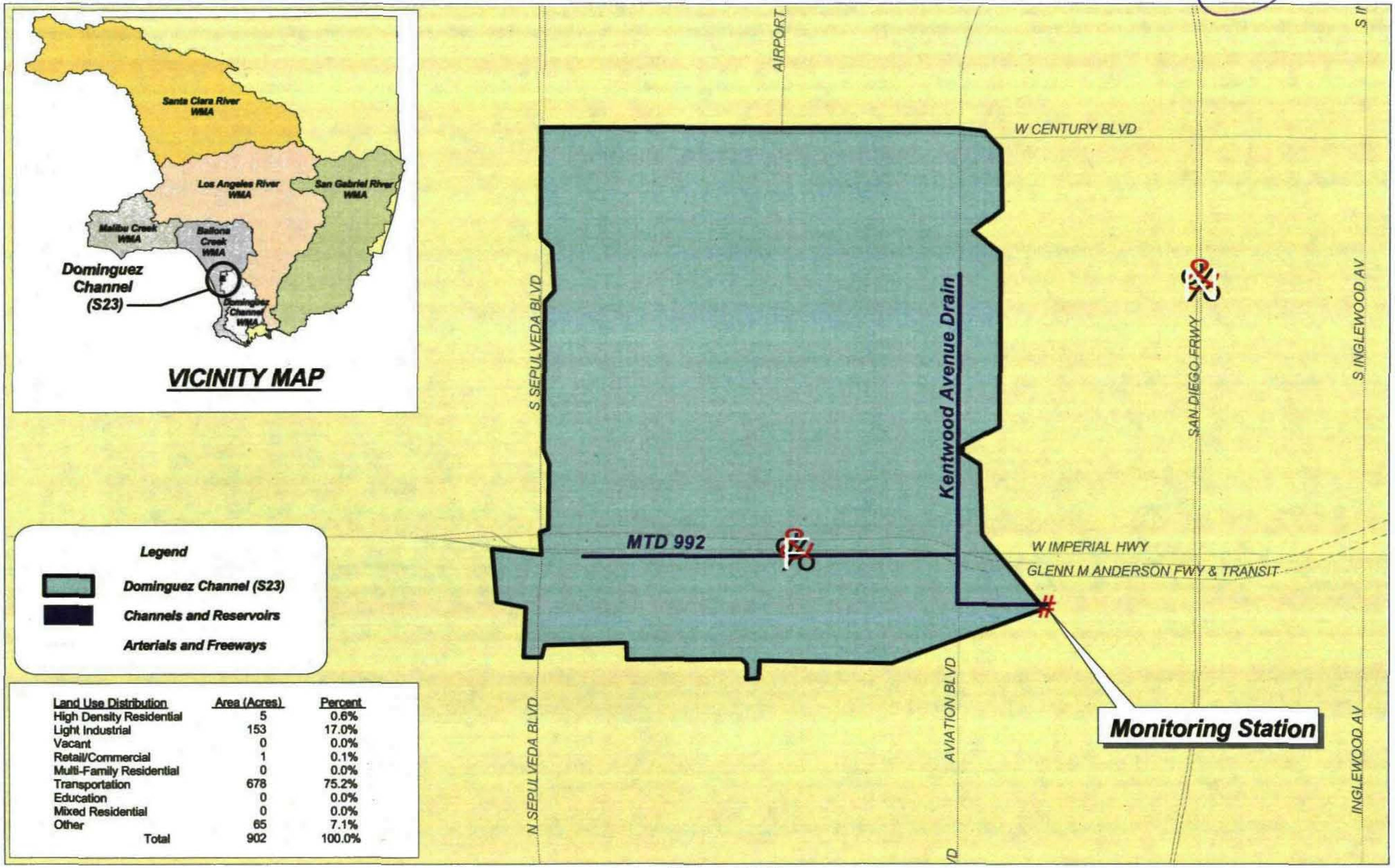
	EPA Method	DL	Units	Sample Type	
STATION NO.					S14
STATION NAME					San Gabriel River
STORM NO.					9899-16
DATE SAMPLED					4/11/99
DATE DELIVERED					4/11/99
Conventional					
Cyanide	A335.2	0.01	mg/l	Grab	0.27
TPH	A418.1	1.0	mg/l	Grab	0
Oil and Grease	A413.1	1.0	mg/l	Grab	0
Total Phenols	A420.1	0.1	mg/l	Grab	0
Glyphosate	547	25.0	ug/l	Comp.	0
Indicator Bacteria					
Total Coliform	C9221B	20.0	MPN/100ml	Grab	240000
Fecal Coliform	C9221C	20.0	MPN/100ml	Grab	1400
Fecal Streptococcus	C9230B	20.0	MPN/100ml	Grab	5000
Fecal Enterococcus	C9230B	20.0	MPN/100ml	Grab	1400
General					
Ammonia	*A350.3*	*0.1*	*mg/l*	*Comp.*	*0*
Calcium	A215.2	1.0	mg/l	Comp.	12.8
Magnesium	C3500MgD	1.0	mg/l	Comp.	7.29
Potassium	A258.1	1.0	mg/l	Comp.	4.49
Sodium	A273.1	1.0	mg/l	Comp.	24.8
Bicarbonate	A310.1	2.0	mg/l	Comp.	53
Carbonate	*A310.1*	*2.0*	*mg/l*	*Comp.*	*0*
Chloride	B429	2.0	mg/l	Comp.	26
Fluoride	B429	0.1	mg/l	Comp.	0.11
Nitrate	B429	0.1	mg/l	Comp.	4.16
Sulfate	B429	0.1	mg/l	Comp.	33.8
Alkalinity	A310.1	4.0	mg/l	Comp.	53
~~Hardness~~	~~A130.2~~	~~2.0~~	~~mg/l~~	~~Comp.~~	~~110~~
Dissolved Phosphorus	A365.2	0.05	mg/l	Comp.	0.125
Total Phosphorus	A365.2	0.05	mg/l	Comp.	0.191
COD	A410.4	5.0	mg/l	Comp.	25.4
pH	A150.1	14.0		Comp.	7.46
NH3-N	A350.3	0.1	mg/l	Comp.	0
Nitrate-N	*C4110B*	*0.1*	*mg/l*	*Comp.*	*0.939*
Nitrite-N	C4110B	0.1	mg/l	Comp.	0.335
Kjeldahl-N	A351.4	0.1	mg/l	Comp.	0.636
Specific Conductance	A120.1	1.0	umhos/cm	Comp.	318
Total Dissolved Solids	A160.1	2.0	mg/l	Comp.	190
Turbidity	A180.1	0.1	NTU	Comp.	21.5
Suspended Solids	A160.2	2.0	mg/l	Comp.	8
Vol.Sus.Solids	160.4	1.0	mg/l	Comp.	2
MBAS	A425.1	0.05	mg/l	Comp.	0
Total Organic Carbon	A415.1	1.0	mg/l	Comp.	4.2
BOD	A405.1	2.0	mg/l	Comp.	7.42
Metals					
Dissolved Aluminum	A202.2	1000	ug/l	Comp	0
Total Aluminum	A202.2	1000	ug/l	Comp	127
Dissolved Antimony	A204.2	5.0	ug/l	Comp	0
Total Antimony	A204.2	5.0	ug/l	Comp	0
Dissolved Arsenic	A206.2	5.0	ug/l	Comp	0
Total Arsenic	A206.2	5.0	ug/l	Comp	0
Dissolved Barium	*A208.2*	*10.0*	*ug/l*	*Comp*	*17.7*
Total Barium	A208.2	10.0	ug/l	Comp	17.7
Dissolved Beryllium	A210.2	1.0	ug/l	Comp	0
Total Beryllium	A210.2	1.0	ug/l	Comp	0
Dissolved Boron	A212.3	100.0	ug/l	Comp	161
Total Boron	A212.3	100.0	ug/l	Comp	242
Dissolved Cadmium	*A213.2*	*1.0*	*ug/l*	*Comp*	*0*
Total Cadmium	A213.2	1.0	ug/l	Comp	0
Dissolved Chromium	A218.2	5.0	ug/l	Comp	0
Metals (cont.)					

Table C-7. Summary of Results for 1998-1999 Routine Monitoring at San Gabriel River

STATION NO.					S14
STATION NAME					San Gabriel River
STORM NO.					9899-16
DATE SAMPLED					4/11/99
DATE DELIVERED					4/11/99
	EPA Method	DL	Units	Sample Type	
Total Chromium	A218.2	5.0	ug/l	Comp	0
Dissolved Chromium +6		10.0	ug/l	Comp	0
Total Chromium +6		10.0	ug/l	Comp	0
~~Dissolved Copper~~	~~A220.1~~	~~5.0~~	~~ug/l~~	~~Comp~~	~~0~~
Total Copper	A220.1	5.0	ug/l	Comp	6.3
Dissolved Iron	A236.1	100.0	ug/l	Comp	0
Total Iron	A236.1	100.0	ug/l	Comp	142
Dissolved Lead	A239.2	5.0	ug/l	Comp	0
Total Lead	A239.2	5.0	ug/l	Comp	0
Dissolved Manganese	A243.1	100.0	ug/l	Comp	0
Total Manganese	A243.1	100.0	ug/l	Comp	0
Dissolved Mercury	A245.1	1.0	ug/l	Comp	0
Total Mercury	A245.1	1.0	ug/l	Comp	0
Dissolved Nickel	A249.2	5.0	ug/l	Comp	0
Nickel	A249.2	5.0	ug/l	Comp	0
Dissloved Selenium	A270.2	5.0	ug/l	Comp	0
Total Selenium	A270.2	5.0	ug/l	Comp	0
Dissolved Silver	A272.2	1.0	ug/l	Comp	0
Total Silver	A272.2	1.0	ug/l	Comp	0
Dissolved Thallium	A279.2	5.0	ug/l	Comp	0
Total Thallium	A279.2	5.0	ug/l	Comp	0
Dissolved Zinc	A289.1	50.0	ug/l	Comp	54
Total Zinc	A289.1	50.0	ug/l	Comp	68
Semi-Volatiles Organics					
Bis(2-ethylhexyl)phthalate	625	3.0	ug/l	Comp	
4-Chloro-3-methylphenol	625	3.0	ug/l	Comp	
2-Chlorophenol	625	2.0	ug/l	Comp	
All other SVOCs	625	0.5-5.0	ug/l	Comp	
Pesticides					
Organochlorine Pesticides & PCBs	D608	0.05-1.0	ug/l	Comp	
Diazinon	8141 SOP	0.01	ug/l	Comp	0
Thiobencarb	507	1.0	ug/l	Comp	0
Chlorpyrifos	8141 SOP	0.05	ug/l	Comp	0
Pesticides	507	1.0-2.0	ug/l	Comp	0

Note:
1). blank cell indicates sample was not analyzed
2). 0 inidicated level below detection limit

1116



Land Use Distribution	Area (Acres)	Percent
High Density Residential	5	0.6%
Light Industrial	153	17.0%
Vacant	0	0.0%
Retail/Commercial	1	0.1%
Multi-Family Residential	0	0.0%
Transportation	678	75.2%
Education	0	0.0%
Mixed Residential	0	0.0%
Other	65	7.1%
Total	902	100.0%

Figure 2-9

DOMINGUEZ CHANNEL (S23)
at 116th St.
Unincorporated L.A. County
(Transportation Land Use Monitoring Site)
1990 Population = 2,000

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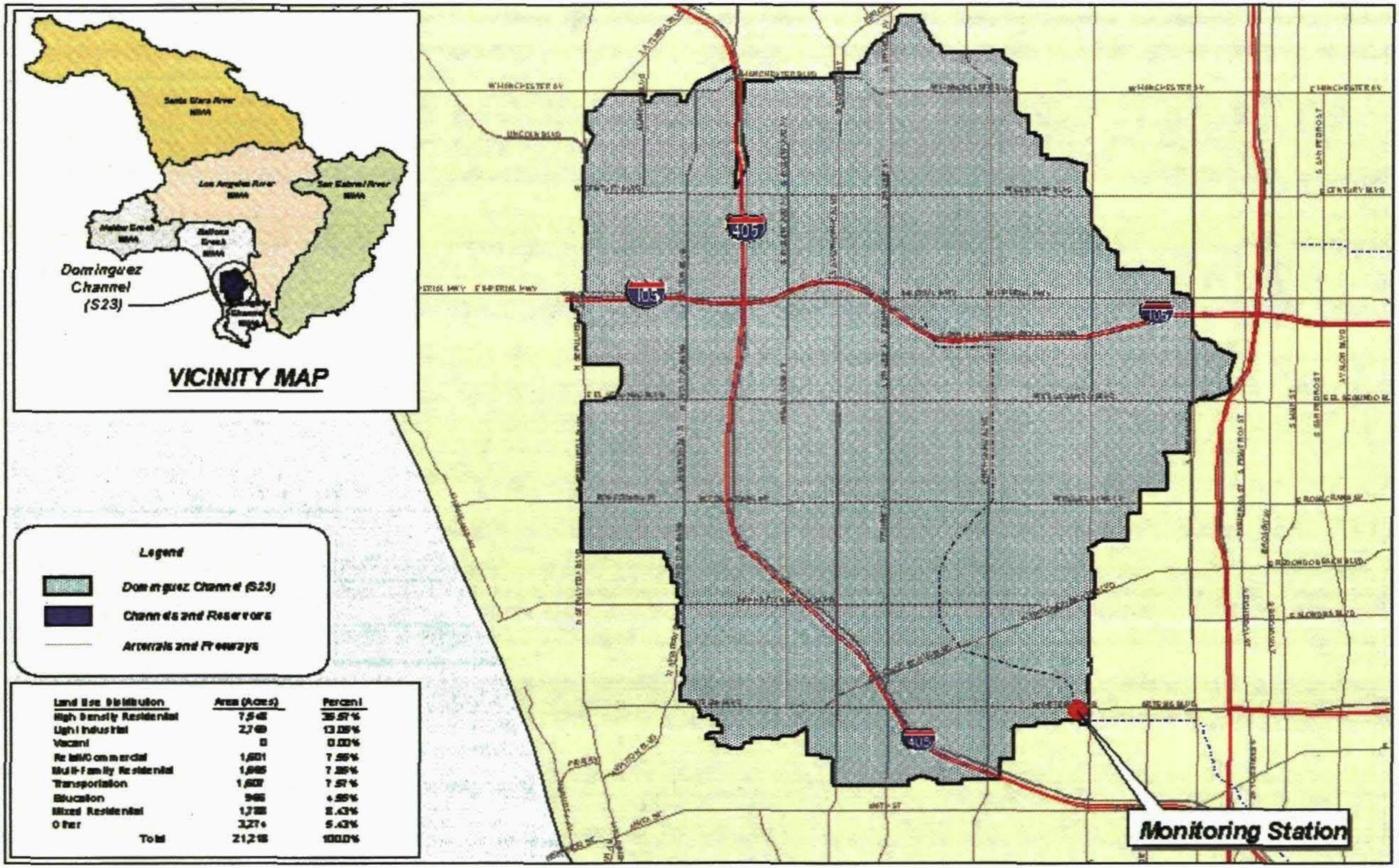

Land Use Distribution	Area (Acres)	Percent
High Density Residential	7,548	35.57%
Light Industrial	2,769	13.05%
Vacant	0	0.00%
Retail/Commercial	1,601	7.55%
Multi-Family Residential	1,665	7.85%
Transportation	1,607	7.57%
Education	966	4.55%
Mixed Residential	1,788	8.43%
Other	3,274	5.43%
Total	21,218	100.0%

Figure 2-7

DOMINGUEZ CHANNEL (S28)

at Artesia Blvd.

Torrance

(Mass Emission Monitoring Site)

N W E S

12 Miles