



# *Ventura Countywide Stormwater Quality Management Program*

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## **Ventura Countywide Stormwater Monitoring Program 2005/06 Water Quality Monitoring Report July 2006**





# Ventura Countywide Stormwater Quality Monitoring Report Executive Summary

Pursuant to NPDES Permit No. CAS004002, the Ventura Countywide Stormwater Quality Management Program (Management Program) must submit a Stormwater Monitoring Report annually by July 15th summarizing results of water quality monitoring conducted during the wet season of the monitoring year. Consistent with this requirement the Ventura Countywide Stormwater Quality Management Program has prepared this Report to satisfy the permit requirements as well as to assess the effectiveness of the overall Stormwater Monitoring Program.

This report provides an investigation of stormwater program effectiveness, characterizes the surface water quality of Ventura County, and summarizes water quality data for monitoring conducted during the 2005/06 wet season. Analysis of samples collected at various monitoring sites throughout the watershed provides information to assess the impact of stormwater runoff and helps characterize the status of surface water quality for watersheds in Ventura County. The monitoring aids in the identification of pollutant sources as well as the evaluation of the Stormwater Monitoring Program's effectiveness. Evaluating the Stormwater Monitoring Program's effectiveness allows for changes to be made and continual improvement of the overall Program. This adaptive management strategy improves the quality and effectiveness of the Stormwater Monitoring Program and minimizes the impact of stormwater pollutant discharges throughout the watersheds.

For the 2005/06 wet season monitoring, several key points have been identified and are highlighted below.

- **This report presents and discusses the water quality monitoring data collected during four wet weather events monitored by the Ventura Countywide Stormwater Monitoring Program (Stormwater Monitoring Program).** The four wet weather events included monitoring at the Stormwater Monitoring Program's Land Use (Event 1), Receiving Water (Event 1), and Mass Emission (all events) sites. The remaining two dry weather events will be reported in the October 2006 Annual Report.
- **Sampling equipment was permanently installed at the new Ventura River NPDES Mass Emission Monitoring Station (ME-VR2) located at the Ojai Valley Sanitation District's Treatment Plant above the POTW outfall.** The extremely heavy rainfalls and correspondingly high flows observed in the Ventura River Watershed during January and February 2005 resulted in the need to relocate the original ME-VR Mass Emission station (located on Casitas Vista Road at Foster Park) to a new downstream location due to landslide activity and associated safety concerns at the ME-VR site. The new ME-VR2 Mass Emission site – located approximately one mile downstream of the historical ME-VR site – was first monitored using portable sampling equipment in May 2005. In September 2005, Ventura County Watershed Protection District (VCWPD) staff permanently installed a refrigerated sampler, flow meter, and tipping bucket rain gauge at the new ME-VR2 monitoring site. A digital cellular modem providing remote access to information compiled by all monitoring equipment was installed in June 2006. Due to the unique physical characteristics of the Ventura River at the ME-VR2 monitoring site, a new flow-rating table for this site was developed with assistance from the VCWPD Hydrology Section.
- **VCWPD employed the services of CRG Marine Laboratories, Inc., in order to achieve low detection limits for the majority of the water quality parameters evaluated by the Stormwater Monitoring Program.** As a means of improving the detection capability of various constituents found in the water quality samples collected by the VCWPD, the Stormwater Monitoring Program has again employed the services of CRG Marine Laboratories, Inc (CRG). CRG began analyzing the majority of the water quality parameters evaluated by the

Stormwater Monitoring Program at the beginning of the 2003/04 monitoring season. CRG is known for their ability to measure analytes at concentrations much lower than most water quality laboratories. During the current monitoring year, CRG was able to achieve detection limits for trace organic compounds (i.e., organics, PCBs, and pesticides) that are 100 – 1000 times lower than laboratories used in the past. This translates into a current achievable detection limit of 0.01 µg/L for an organic compound such as 1,4-Dichlorobenzene, whereas in years past the detection limit for this constituent was 10 µg/L. Additionally, CRG typically achieved detection limits for metals that are 10 times lower than historic levels for this class of constituent. Additional laboratories used by VCWPD also possess the ability to measure target analytes at very low levels.

- **VCWPD staff evaluated environmental and QA/QC water chemistry data using new 2005/2006 Data Quality Evaluation Plan and Data Quality Evaluation Standard Operating Procedures guidance documents.** The Stormwater Monitoring Program drafted two new guidance documents to help VCWPD staff accurately and consistently evaluate the water chemistry data collected by the Stormwater Monitoring Program. The new *2005/2006 Data Quality Evaluation Plan* (DQEP) describes the multiple step process used by VCWPD staff to identify errors, inconsistencies, or other problems potentially associated with Stormwater Monitoring Program data. Furthermore, the DQEP describes the various data quality objectives (DQOs) to which environmental and QA/QC data are compared as part of the Stormwater Monitoring Program's quality assurance/quality control program. The new *Data Quality Evaluation Standard Operating Procedures* document is a set of written instructions that describes both technical and administrative operational elements undertaken by the Stormwater Monitoring Program in carrying out its DQEP.
- **VCWPD used its water quality database to store and analyze stormwater quality data.** The Stormwater Monitoring Program has invested approximately \$150,000 in the past three years to develop a water quality database to further expedite, standardize, and enhance the Stormwater Monitoring Program's data management and data analysis activities. This monitoring season marks the first time that water quality data were received by the Stormwater Monitoring Program as electronic data deliverables (EDDs) due to a recent upgrade of the database that allows it to automatically import electronic data formatted in either Microsoft Excel® or Microsoft Access®. Key database attributes include automatic importation and cursory evaluation of electronically formatted data, semi-automated QA/QC evaluation, automated comparison of the Stormwater Monitoring Program's data to water quality objectives, and a wide array of hard copy and electronic data reporting features. The database has allowed the Stormwater Monitoring Program to improve its overall data management effort by providing staff with a robust data management tool for the storage, analysis, and reporting of stormwater monitoring data.
- **Acute toxicity of *Ceriodaphnia dubia* (water flea) was observed during one wet weather event at Receiving Water site W-3.** Acute toxicity tests using water flea were performed at all Land Use (A-1, I-2, R-1) and Receiving Water (W-3 and W-4) monitoring sites during the first October 2005 monitoring event (Event 1). A TU<sub>a</sub> > 1 (which demonstrates acute toxicity) was observed at the W-3 Receiving Water site. Although toxicity was detected a subsequent Toxicity Identification Evaluation (TIE) test was unable to identify the toxicant(s) because the toxicity had dissipated in the Receiving Water sample at the time the TIE was performed.
- **No chronic toxicity of *Strongylocentrotus purpuratus* (Purple Sea Urchin) was observed during two wet weather events at Mass Emission stations.** Chronic toxicity tests using purple sea urchin were conducted during the first two events at the three Mass Emission stations. Chronic toxicity (as determined by a TU<sub>c</sub> > 1.0) was not detected at any Mass Emission site.

- **Elevated pollutant concentrations were observed at all monitoring sites during one or more monitored wet weather storm events.** Constituent concentrations above Los Angeles Region Basin Plan, California Toxics Rule, and/or California Ocean Plan<sup>1</sup> water quality objectives were measured at the following monitoring sites:

#### Mass Emission Sites

<b>ME-CC</b>	<p><b>Bacteriological:</b> E. Coli, Enterococcus, Fecal Coliform, Total Coliform</p> <p><b>Metal:</b> Aluminum, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc</p> <p><b>Organic:</b> Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Bis(2-ethylhexyl)phthalate, Chrysene, total PAH compounds</p> <p><b>Pesticide:</b> 4,4'-DDD, 4,4'-DDE, total Chlordane compounds, total DDT compounds</p>
<b>ME-VR2</b>	<p><b>Anion:</b> Chloride</p> <p><b>Bacteriological:</b> E. Coli, Enterococcus, Fecal Coliform, Total Coliform</p> <p><b>Conventional:</b> Total Dissolved Solids</p> <p><b>Metal:</b> Aluminum, Chromium, Copper, Lead, Mercury, Nickel</p> <p><b>Organic:</b> Bis(2-ethylhexyl)phthalate, total PAH compounds</p>
<b>ME-SCR</b>	<p><b>Bacteriological:</b> E. Coli, Enterococcus, Fecal Coliform, Total Coliform</p> <p><b>Metal:</b> Aluminum, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc</p> <p><b>Organic:</b> Bis(2-ethylhexyl)phthalate, Chrysene, total PAH compounds</p>

#### Receiving Water Sites

<b>W-3</b>	<p><b>Bacteriological:</b> E. Coli, Enterococcus, Fecal Coliform, Total Coliform</p> <p><b>Conventional:</b> Total Dissolved Solids</p> <p><b>Metal:</b> Aluminum, Chromium, Copper, Lead, Mercury, Nickel, Zinc</p> <p><b>Organic:</b> total PAH compounds</p> <p><b>Pesticide:</b> 4,4'-DDD, 4,4'-DDE, total Chlordane compounds, total DDT compounds</p>
<b>W-4</b>	<p><b>Bacteriological:</b> E. Coli, Enterococcus, Fecal Coliform, Total Coliform</p> <p><b>Conventional:</b> Total Dissolved Solids</p> <p><b>Metal:</b> Aluminum, Chromium, Copper, Lead, Nickel, Zinc</p> <p><b>Nutrient:</b> Nitrate as N</p> <p><b>Organic:</b> Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Indeno(1,2,3-cd)pyrene, total PAH compounds</p> <p><b>Pesticide:</b> 4,4'-DDD, 4,4'-DDE, total Chlordane compounds, total DDT compounds</p>

Even though receiving water objectives are not directly applicable to constituent concentrations measured at Land Use monitoring stations, the Stormwater Monitoring Program performed comparisons between Land Use water quality data and Los Angeles Region Basin Plan, California Toxics Rule, and California Ocean Plan objectives as a means of identifying potential pollutants of concern.

<sup>1</sup> The Stormwater Management Program believes the comparison of stormwater runoff data to the California Ocean Plan is inappropriate based on the following applicability language contained in the plan:

“This plan is not applicable to discharges to enclosed bays and estuaries or inland waters, nor is it applicable to vessel wastes, or the control of dredged material.”

## Land Use Sites

**A-1**            **Bacteriological:** E. Coli, Enterococcus, Fecal Coliform, Total Coliform  
**Conventional:** Total Dissolved Solids  
**Metal:** Copper, Nickel  
**Nutrient:** Nitrate as N  
**Organic:** total PAH compounds  
**Pesticide:** 4,4'-DDD, 4,4'-DDE, total DDT compounds

The 2005/06 Annual Monitoring Report (due October 2006) will include results from the 2005/06 bioassessment, as well as water quality results from the Stormwater Monitoring Program's dry weather monitoring efforts.

# Ventura Countywide Stormwater Quality Monitoring Report July 2006

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# 1. Background

Pursuant to NPDES Permit No. CAS004002<sup>2</sup>, the Ventura Countywide Stormwater Quality Management Program must submit a Stormwater Monitoring Report, annually by July 15, and include the following:

- Status of implementation of the Stormwater Monitoring Program
- Results of the Stormwater Monitoring Program
- General interpretation of the results
- Tabular and graphical summaries of the monitoring data obtained during the previous years.

Consistent with this requirement, the Ventura Countywide Stormwater Quality Management Program (Management Program) has prepared this Report to address the permit requirements as well as to assess the effectiveness of the overall Management Program. The Ventura Countywide Stormwater Monitoring Program (Stormwater Monitoring Program), as originally proposed, is described in Chapter 9 of the Report of Waste Discharge submitted in February 1999. To facilitate the incorporation of information learned during implementation of the Management Program, increase the effectiveness of the Management Program, and streamline stormwater monitoring procedures, modifications to the Stormwater Monitoring Program have been implemented since 1999. As part of this adaptive management strategy, improvements to the *Mass Emission Stations Water Quality Monitoring Standard Operating Procedures (SOP) 2000-2005* were implemented in April 2003 to make them consistent with NPDES No. CAS004002, Order No. 00-108. The Stormwater Monitoring Program includes both stormwater management and scientific elements. The collection and analysis of stormwater samples across Ventura County and the analysis and interpretation of the resulting data are the central activities of the Stormwater Monitoring Program. The Stormwater Monitoring Program is currently conducted with the following four major objectives at its focus:

- Characterizing stormwater discharges from monitoring sites representative of different land uses: industrial, agricultural, and residential
- Establishing the impact of stormwater discharges on receiving waters by conducting receiving water quality, mass emission, and bioassessment monitoring
- Identifying pollutant sources based on analysis of monitoring data, inspection of businesses, and investigation of illicit discharges
- Defining stormwater program effectiveness using data collected before and after implementation of pollution prevention programs

This report provides an overview of stormwater program effectiveness and characterizes the surface water quality of Ventura County. Analysis of samples collected at various sites throughout the watershed gives an overall representation of the impact of stormwater discharges. The monitoring also aids in the identification of pollutant sources as well as the assessment of stormwater program effectiveness. Evaluating program effectiveness allows for changes to be made in the Stormwater Monitoring Program in order to resolve any problems that may exist. This adaptive management strategy improves stormwater monitoring program effectiveness and minimizes the impact of stormwater pollutant discharges on the watershed.

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<sup>2</sup> This Order expired July 27, 2005. However, in the absence of a State-issued new permit, the Ventura Countywide Stormwater Quality Management Program has elected to carry out the requirements of the Ventura County Storm Water Quality Management Plan under the expired Order pursuant to 40 CFR 122.6(d).

The pertinent parts of the Stormwater Monitoring Program include the following:

### **Land Use Site (Discharge Characterization) Monitoring**

Land use monitoring is designed to capture stormwater discharge from a specific type of land use. In the Stormwater Management Plan, sites are chosen to represent three land use types: agricultural, industrial, and residential.

Land use monitoring began during the 1992-93 monitoring season and is designed to characterize stormwater discharges from the three specific land uses noted above. During the 2005/06 monitoring season, samples from an October 2005 wet weather event were collected for water chemistry and aquatic toxicity at the agricultural (Wood Road, A-1) monitoring site. During the same wet weather event, only aquatic toxicity grab samples were collected at the Ortega Street (I-2) and Swan Street (R-1) Land Use sites because the Stormwater Monitoring Program had already satisfied its NPDES permit condition stating that these two Land Use sites must be monitored a minimum of three times per permit term with respect to the collection of water chemistry samples. However, the Stormwater Monitoring Program is still under a regulatory obligation to collect aquatic toxicity grab samples at these sites in order to amass baseline toxicity information related to land use discharges.

### **Receiving Water (Tributaries) Monitoring**

Receiving water monitoring is designed to characterize the quality of receiving waters rather than discharges to the receiving waters. This type of monitoring evaluates the water quality of smaller waterbodies tributary to main river systems. Monitoring smaller tributaries allows the Stormwater Monitoring Program to focus on smaller sub-basins of the watershed that are not impacted by discharges from wastewater treatment facilities. Monitoring a localized section of the watershed allows the Stormwater Monitoring Program to better examine the impact of stormwater on the watershed than mass emission monitoring (see discussion below). During the 2005/06 monitoring season, the Receiving Water sites La Vista (W-3) and Revolon Slough (W-4) were monitored once in October 2005 under wet weather conditions. Water chemistry and aquatic toxicity samples were collected at both sites. Receiving water monitoring at these sites was first implemented during the 1997-98 season and captures stormwater runoff from the Revolon Slough sub-basin.

### **Mass Emission Monitoring**

The purpose of mass emission monitoring is to identify pollutant loads to the ocean and identify long-term trends in pollutant concentrations. Mass Emission sites are located in the lower reaches of major watersheds. Through water quality monitoring at these sites, the Stormwater Monitoring Program can evaluate the cumulative effects of stormwater and other surface water discharges on beneficial uses in the watershed prior to discharge to the ocean. Both Mass Emission and Receiving Water stations allow for the measurement of water quality conditions in a surface water body, whereas Land Use monitoring stations permit the water quality characterization of discharges to surface waterbodies. Mass Emission monitoring stations allow for the measurement of water quality parameter concentrations resulting from discharges throughout an entire watershed. The Mass Emission drainage areas are much larger than the drainage areas associated with Receiving Water sites, and include other sources of discharge, such as wastewater treatment plants, non-point sources, and groundwater discharges.

Mass Emission stations are located in the three major Ventura County watersheds: Calleguas Creek (ME-CC), Ventura River (ME-VR2), and Santa Clara River (ME-SCR). Each Mass Emission station was monitored this season. Water quality samples from four wet weather events were collected for water chemistry at the Mass Emission sites, while aquatic toxicity samples were collected at each site during Events 1 (October 2005) and 2 (November 2005). As required by the permit, additional dry weather events are scheduled for later in the current monitoring season. Results from these dry weather monitoring events will be included in the October 2006 Annual Monitoring Report. Monitoring at the ME-CC station was initiated during the 2000/01 monitoring season, monitoring at the ME-SCR station was initiated during the 2001/02 monitoring season, and monitoring at the newly installed ME-VR2

station was initiated during the 2004/05 monitoring season after landslide activity at the original Ventura River Mass Emission station, ME-VR, precluded further sampling at that location.

### **Bioassessment Monitoring**

The Ventura County Stormwater Monitoring Program also includes the Bioassessment Monitoring Program. Biological assessments (bioassessments) of water resources integrate the effects of water quality over time and are capable of simultaneously evaluating multiple aspects of water and habitat quality. When integrated with physical and chemical assessments, bioassessments help to further define the effects of point and non-point source discharges of pollutants and provide a more appropriate means for evaluating impacts of non-chemical substances, such as sedimentation and habitat alteration. A work plan for in-stream bioassessment monitoring in the Ventura River watershed was developed and submitted in January 2001 to the Regional Water Quality Control Board (RWQCB) as part of the revised Stormwater Management Plan. For five years, starting in 2001, bioassessment monitoring has been conducted once a year in the fall to compile a baseline data set. The bioassessment monitoring for this reporting period occurred in September 2005, and included samples collected in main streams and tributaries. This year staff participated in the multiple collection method evaluation for low gradient streams conducted through the Southern California Coastal Water Research Program (SCCWRP) Stormwater Management Coalition (SMC) Bioassessment Workgroup and the California Department of Fish and Game. Bioassessment monitoring is conducted during the fall because it is the time period during which flows are most consistent and macroinvertebrates are most productive and diverse. The fall season provides a consistent, stable environment for sampling that allows for macroinvertebrate comparability from year to year. The bioassessment monitoring report will be part of the 2005-2006 Stormwater Quality Management Program Annual Monitoring Report due in October, 2006.

### **Report Contents**

This report discusses work conducted from July 2005 to June 2006 and includes precipitation and flow information and associated water quality data from four wet weather events monitored at the Stormwater Monitoring Program's Land Use (Event 1), Receiving Water (Event 1), and Mass Emission (all events) sites. Dry weather monitoring has been scheduled to be conducted in June and July, 2006. These dry weather water quality results, along with results from the Bioassessment Monitoring Program will be included in the October 2006 Annual Monitoring Report.

This monitoring report is organized into 8 sections. The first section provides the background and purpose of the Stormwater Monitoring Program. Section 2 includes a description of the monitoring sites. Section 3 discusses precipitation and flow conditions at the monitoring sites. Section 4 gives an overview of sample collection procedures and Section 5 provides tabular results of the sample analyses. Section 6 describes the quality assurance and control procedures employed by the Stormwater Monitoring Program. Section 7 discusses the water quality results and Section 8 summarizes mass loadings and comparisons to water quality objectives.

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## 2. Monitoring Site Locations and Descriptions

The locations of stormwater quality monitoring stations (including current and historical monitoring sites) are shown in Figure 1.



Figure 1: Ventura County Stormwater Monitoring Locations

Table 1 lists rain gauges and their corresponding gauge numbers used by the Stormwater Monitoring Program for recording precipitation that falls near NPDES stormwater monitoring sites.

Table 1: Rain Gauge Sites

<b>ALERT No.</b>	<b>Standard No.</b>	<b>Gauge</b>	<b>Assoc. Monitoring Site</b>
—	194	Camarillo-Adohr	ME-CC
2633	165	Ojai-Stewart Canyon	ME-VR2
110	222a	Ventura County Government Center	I-2, R-1
—	190	Somis-Bard	W-3
2660	171	Fillmore Fish Hatchery	ME-SCR
—	168	Oxnard Airport	A-1, W-4

Sites with multiple gauge numbers represent two different rain gauges located at the same location. The ALERT gauge transmits electronic data to the flood warning ALERT (Automated Local Evaluation in Real Time) system and measures precipitation with an accuracy of 0.04 inches. The standard gauge is a tipping bucket that measures rainfall with an accuracy of 0.01 inches. The more accurate tipping bucket

data are used for calculating rainfall totals unless they are unavailable. ALERT gauge numbers are typically 4 digits (i.e. 2633) while tipping bucket gauge numbers are 3 digits (i.e. 165), with the exception of the Ventura County Government Center (i.e., 222/110).

**Land Use Sites**

The Stormwater Monitoring Program includes three Land Use monitoring sites: Swan Street (R-1), Ortega Street (I-2), and Wood Road (A-1) as shown in Figure 1. Each station is identified by a code related to the primary land use in the monitored watershed: I for industrial, A for agricultural, and R for residential. The monitoring schedule for the Land Use sites is specified in the *Ventura Countywide Stormwater Monitoring Program: Standard Operating Procedures 2000-2005 Stormwater Monitoring*. During the 2005/06 monitoring season, all Land Use sites were monitored during one wet weather event (Event 1 – 10/17/05) for aquatic toxicity. Only aquatic toxicity grab samples were collected at the Ortega Street (I-2) and Swan Street (R-1) Land Use sites during Event 1 because the Stormwater Monitoring Program had already satisfied its NPDES permit condition which states that these two Land Use sites must be monitored a minimum of three times per permit term with respect to the collection of water chemistry samples. However, the Stormwater Monitoring Program is still under a regulatory obligation to collect aquatic toxicity grab samples at these sites in order to amass baseline toxicity information related to land use discharges. Water chemistry samples were collected at the agricultural (Wood Road, A-1) monitoring site during Event 1 as directed in the NPDES permit. Land Use station characteristics are summarized in Table 2.

**Table 2: Land Use Site Characteristics**

<b>Station Code</b>	<b>Year Installed</b>	<b>Location</b>	<b>Primary Land Use</b>	<b>Drainage Basin Area (acres)</b>	<b>Rain Gauge Location</b>
R-1	1992 (2003 Upgrade)	Swan Street and Macaw Avenue (City of San Buenaventura)	Residential	65	County Government Center
I-2	1992 (2003 Upgrade)	Ortega Street (City of San Buenaventura)	Industrial	189	County Government Center
A-1	1994 (2001 Upgrade)	Wood Road at Revolon Slough	Agricultural	350 (estimated)	Oxnard Airport

The Swan Street (R-1) site receives runoff from a relatively new (15 to 20 year old) residential neighborhood consisting of single-family dwellings, churches, parks, and a recreation center. The Ortega Street (I-2) site is located in an area of older manufacturing facilities, newer industrial parks, and a few undeveloped city lots. The associated drainage basin for (I-2) consists of diverse types of industrial facilities. The Wood Road (A-1) site receives drainage from the Oxnard Agricultural Plain and is comprised almost entirely of agricultural land (primarily row crops), including a small number of farm residences and ancillary farm facilities for equipment maintenance and storage. All three Land Use monitoring sites are equipped with automated monitoring equipment that collects composite water quality samples as time-paced composites. Sites R-1 and I-2 were upgraded in 2003 with new, portable refrigerated samplers and ISCO 4250 area velocity flow meters.

**Receiving Water (Tributaries) Characterization Sites**

Two Receiving Water stations are included among the Stormwater Monitoring Program’s characterization sites: La Vista (W-3) and Revolon Slough (W-4). The land use surrounding both Receiving Water sites is dominated by agriculture. The La Vista station is located in the upper Revolon Slough watershed, and the Revolon Slough station is located in the lower Revolon Slough Watershed at Wood Road as shown in Figure 1. Both Receiving Water sites were sampled during one wet weather event (Event 1 – 10/17/05) for water chemistry and aquatic toxicity during the current monitoring season. Composite water quality samples at sites W-3 and W-4 are collected as time-paced composites. Receiving Water site characteristics are summarized in Table 3.



**Table 3: Receiving Water Site Characteristics**

<b>Station Code</b>	<b>Year Installed</b>	<b>Location</b>	<b>Land Uses</b>	<b>Percent Developed</b>	<b>Watershed Area (acres)</b>	<b>Rain Gauge</b>
W-3	1997 (2003 Upgrade)	La Vista Avenue south of Center Road	Agricultural/ Open Space	<2%	752	Somis-Bard
W-4	2001 (2003 Upgrade)	Revolon Slough at Wood Road	Agricultural/ Mixed Use	20%	28,800	Oxnard Airport

**Mass Emission Sites**

Mass Emission monitoring was conducted in the Santa Clara River, Calleguas Creek, and Ventura River watersheds at the stations shown in Figure 1. Photographs of each Mass Emission monitoring location are presented in Figure 2 (Event 2, November 2005) and Figure 3 (Event 4, February 2006). The two sets of photos show the range of flows observed at the monitoring stations during the 2005/06 season. The site characteristics are summarized in Table 4. Both the ME-SCR and ME-VR2 stations are located in large watersheds possessing diverse inputs of runoff sources, which are dominated by agricultural and urban land uses.

**Table 4: Mass Emission Site Characteristics**

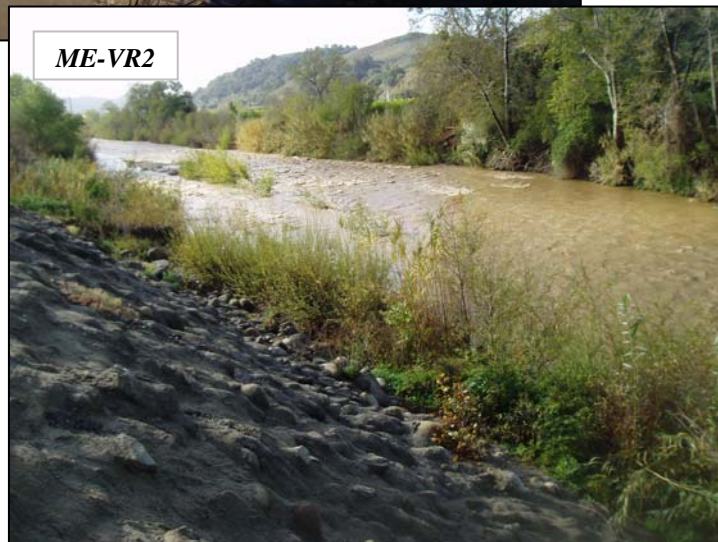
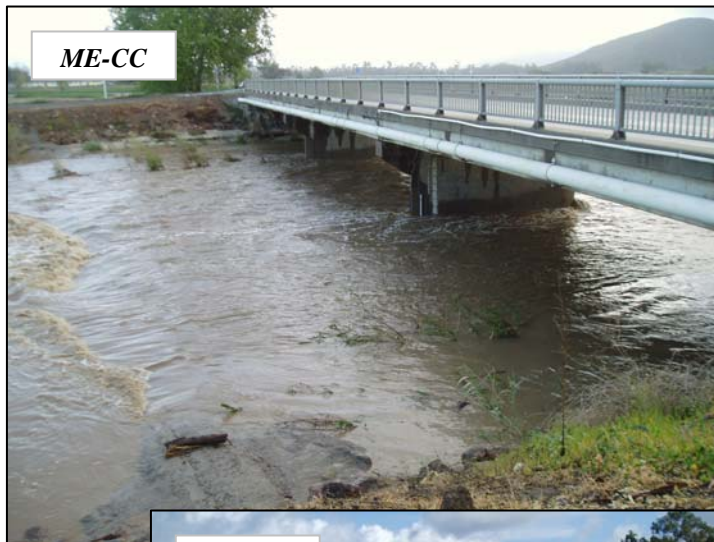
<b>Station Code</b>	<b>Location</b>	<b>Land Uses</b>	<b>Watershed Area (acres)</b>	<b>Rain Gauge</b>
ME-CC	Calleguas Creek – CSUCI north side of Hueneme Road, just east of Lewis Road at the CSUCI Bridge	Mixed Use	160,640	Camarillo-Adohr
ME-SCR	Santa Clara River – at Freeman Diversion Dam	Mixed Use	1,003,524	Fillmore Fish Hatchery
ME-VR2	Ventura River – Ojai Valley Sanitation District Treatment Plant (OVSDTP)	Mixed Use	134,490	Ojai-Stewart Canyon

The Mass Emission station ME-CC was installed and monitored for the first time during the 2000/01 monitoring season. The ME-SCR site was installed and first monitored during the 2001/02 season. The extremely heavy rainfalls and correspondingly high flows observed in the Ventura River Watershed during January and February 2005 resulted in landslides near the original ME-VR Mass Emission station (monitored since February 2001). Due to safety concerns associated with the landslide activity, the Ventura River Mass Emission site was moved downstream approximately one mile. The new ME-VR2 Mass Emission site (located at the Ojai Valley Sanitation District Treatment Plant, above the POTW outfall) was first monitored using portable sampling equipment in May 2005. A refrigerated sampler, flow meter, and tipping bucket rain gauge were permanently installed at the ME-VR2 site in September 2005 (see Figure 4).

ME-CC and ME-VR2 mass emission samples are collected using automated flow-proportional ISCO 6712 composite samplers. The ME-SCR station also uses an ISCO 6712FR sampler, but the sampler is programmed to collect composite samples on a time-paced basis due to the configuration of the sampling location. The ME-SCR station is located at a dam where water is diverted by United Water Conservation District for ground water infiltration. The diversion configuration poses challenges to the accurate measurement of flows at this location (as discussed in Section 3). Consequently, time-based composite samples are collected at this site rather than flow-proportional composite samples.



**Figure 2: Mass Emission Site Photos: ME-CC (Calleguas Creek), ME-SCR (Santa Clara River), and ME-VR2 (Ventura River) during low flows in November 2005 (Event 2)**



**Figure 3: Mass Emission Site Photos: ME-CC (Calleguas Creek), ME-SCR (Santa Clara River), and ME-VR2 (Ventura River) during higher flows in February 2006 (Event 4)**

The Mass Emission stations are also configured for remote access monitoring using state-of-the-art telemetry equipment. Additionally, rain gauges are located at all three Mass Emission sites, and the ME-VR2 and ME-SCR stations feature refrigerated sampling units. These refrigerated sampling units allow the Stormwater Monitoring Program to keep its water quality samples at a constant temperature throughout the duration of a monitoring event and thus comply with sample handling QA/QC objectives. The ME-CC station is monitored using a non-refrigerated, portable sampler which requires the constant icing of samples collected at the site in order to keep them at a temperature of 4° C.



**Figure 4: Newly installed ISCO 6712 refrigerated sampler, ISCO 4230 flowmeter, and steel enclosure at Mass Emission site ME-VR2 located at the Ojai Valley Sanitation District Treatment Plant**



### 3. Precipitation and Flow

Rainfall data compiled for the monitoring sites were obtained from six rain gauges. The data from the gauges associated with a particular monitoring site and events are identified in Figure 5 through Figure 10. With the exception of Land Use sites R-1 and I-2, each monitoring site is equipped with an automatic tipping bucket rain gauge. As mentioned previously, monitoring sites may have two different rain gauges, a tipping bucket and a standard gauge. All precipitation data presented herein are from tipping bucket measurements. As shown in Figure 1, these gauges are located nearby associated monitoring stations or within the tributary watershed. The Ventura County Watershed Protection District currently operates and maintains these gauges.

Historical average annual rainfall in the monitored area varies from 14 to 16 inches per year (based on data for the period between 1950 and 1989). The rainfall totals from October 2005 to May 2006 ranged from 13.0 inches at the Camarillo Sanitation Plant gauge (Station #194) to 22.29 inches at the Ojai-Stewart Canyon gauge (Station #165). The 2005-2006 rain year – as of June 1, 2006 – has produced slightly above normal precipitation totals throughout most of Ventura County. Daily precipitation during the 2005/2006 monitoring year and the corresponding monitored storm event dates are shown in Figure 5 through Figure 10. Dry weather monitoring conducted during the 2005/06 monitoring season will be discussed in the October 2006 Annual Monitoring Report. The monitoring events shown in the figures below are for wet weather (storm) conditions. The daily precipitation data from October 2005 through May 2006 used to generate these graphs are presented in Appendix A. The seasonal precipitation pattern at these sites is representative of the pattern throughout the monitoring area.

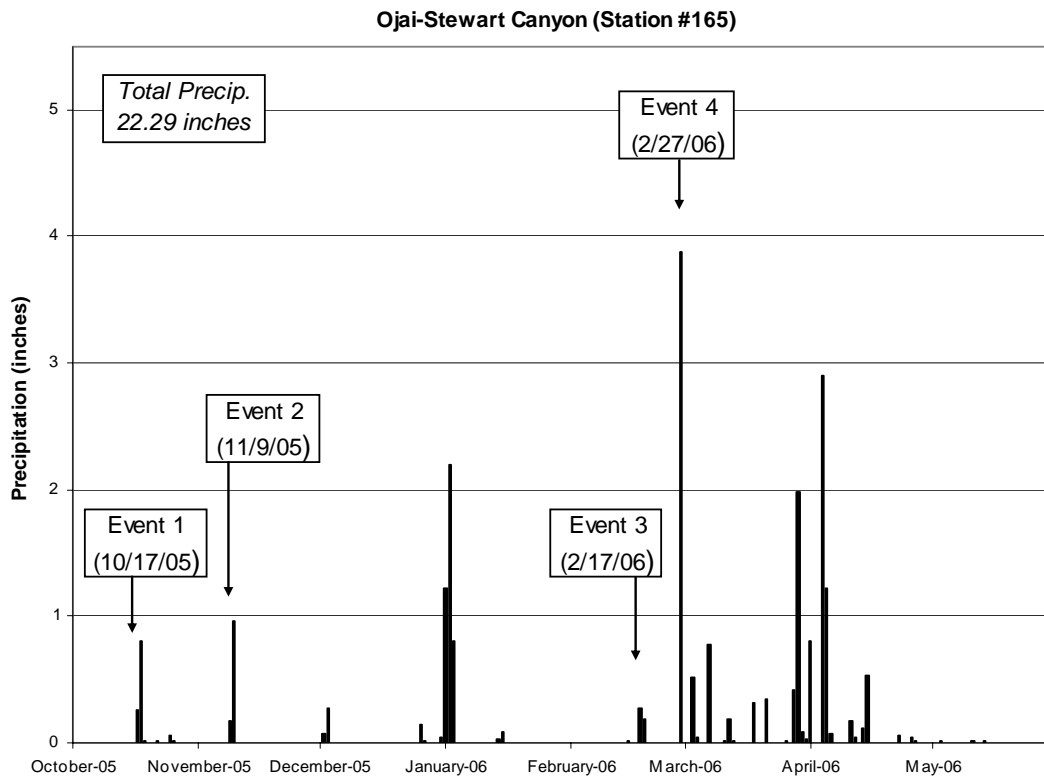
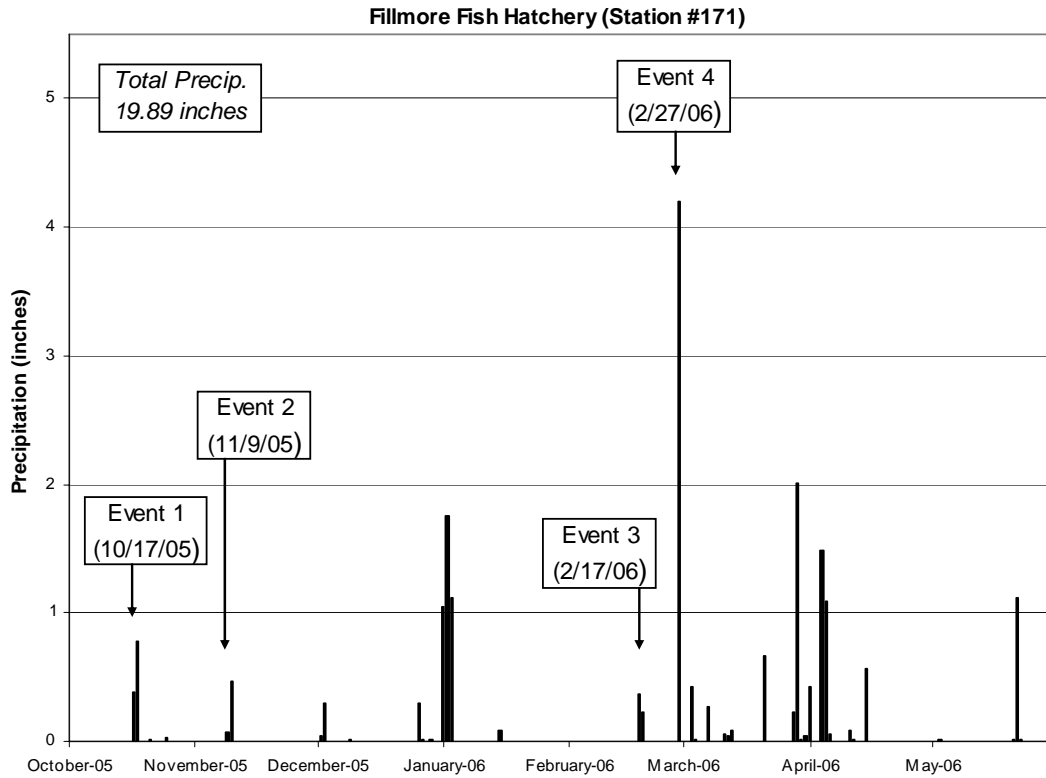
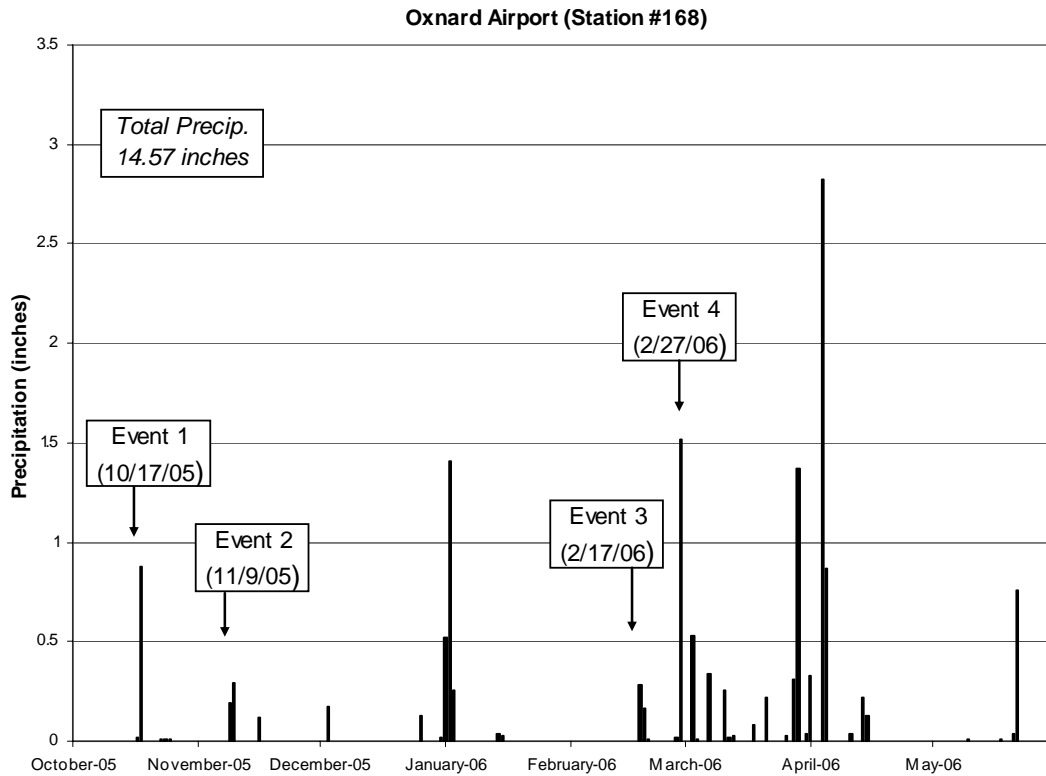


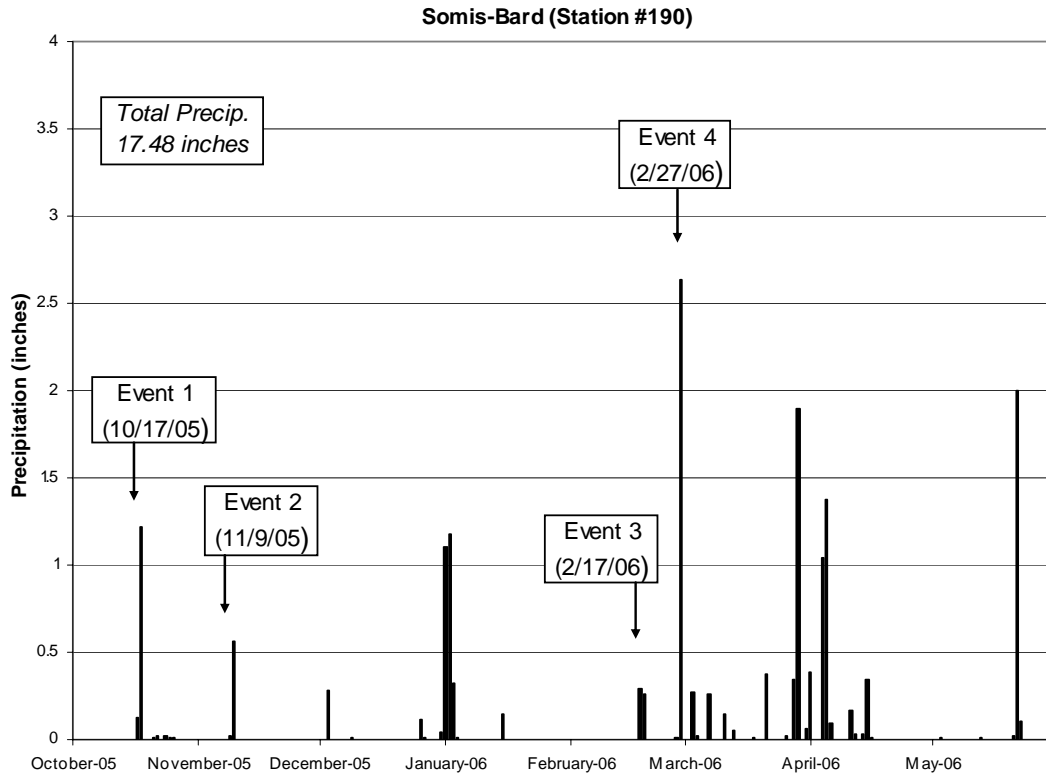
Figure 5: Ojai-Stewart Canyon Rain Gauge (ME-VR2 Monitoring Station)



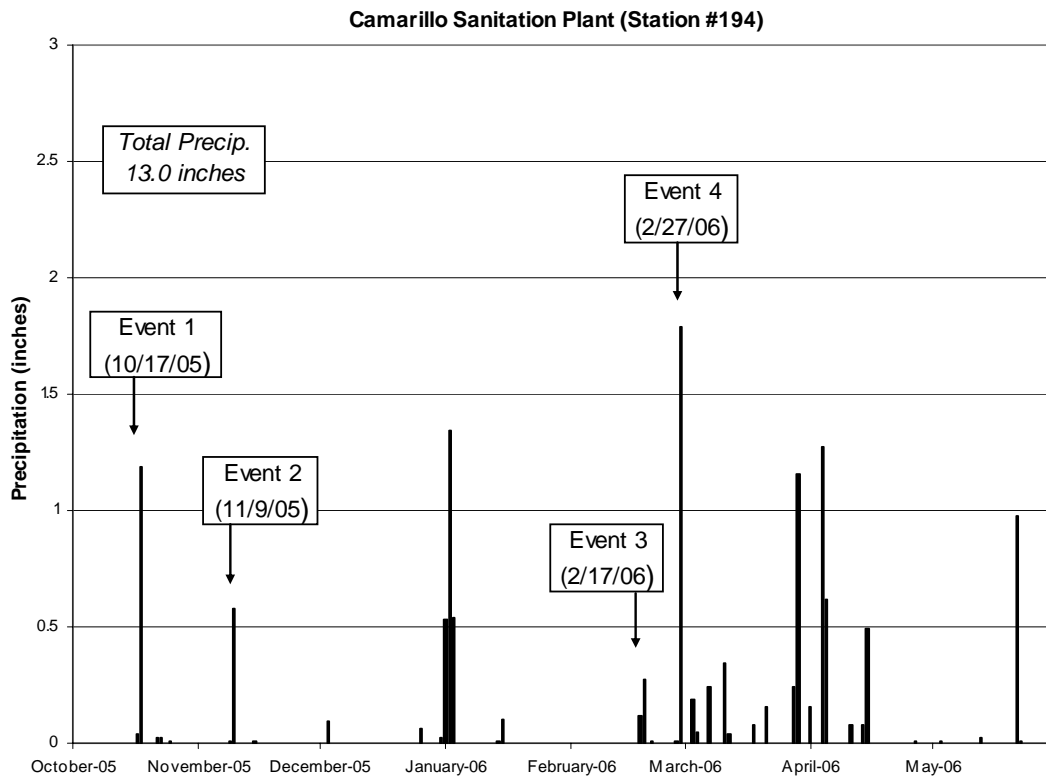
**Figure 6: Fillmore Fish Hatchery Rain Gauge (ME-SCR Monitoring Station)**



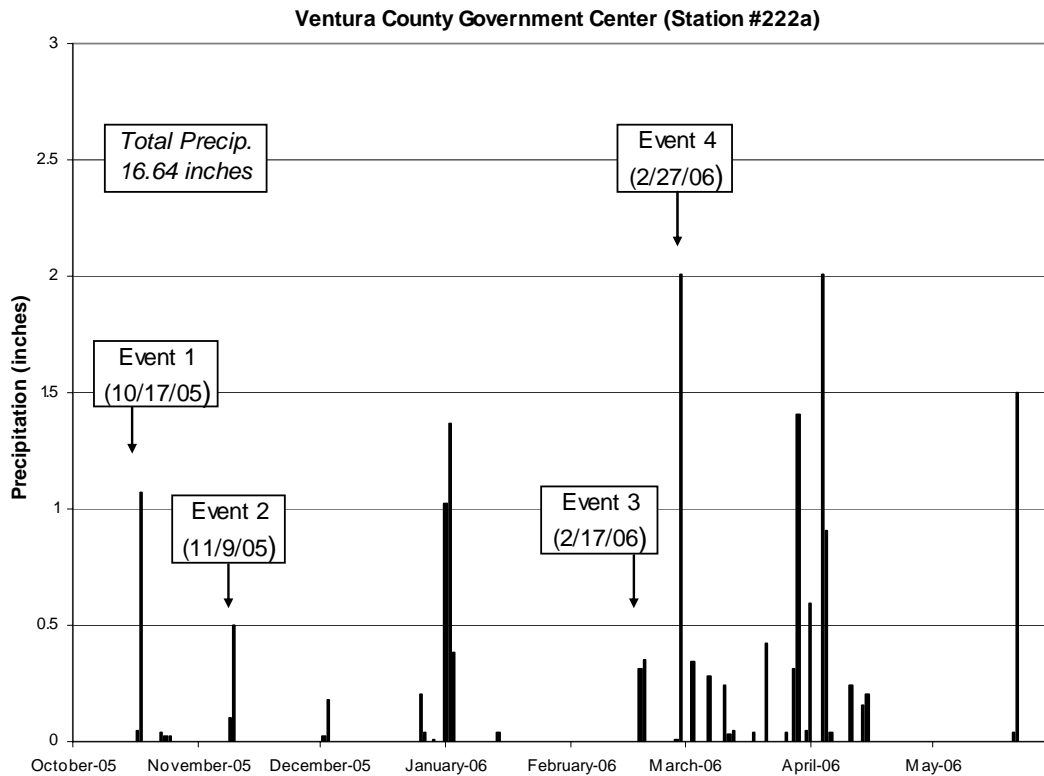
**Figure 7: Oxnard Airport Rain Gauge (W-4 and A-1 Monitoring Stations)**



**Figure 8: Somis-Bard Rain Gauge (W-3 Monitoring Station)**



**Figure 9: Camarillo-Adohr Rain Gauge (ME-CC Monitoring Station)**



**Figure 10: Ventura County Government Center Rain Gauge (R-1 and I-2 Monitoring Stations)**

**Flow Rates**

Flow rates were calculated at each of the Mass Emission sites to establish baseline conditions and load estimates. The automated composite sampling equipment collects information on flow rates (in cubic feet per second, CFS) and volumes (in cubic feet, CF) passing by the composite sampler during the monitoring period. Flowlink software, provided by Teledyne/ISCO, the manufacturer of the sampling equipment, allows the user to analyze the data collected by the sampling equipment to calculate flow rates and volumes over any designated time period. The output from this software was used to calculate average flow rates for the current monitoring events. Flowlink software also allows the generation of a composite graph showing an event hydrograph, sample collection times, and precipitation record for a particular monitoring event. These composite graphs were produced for each event monitored during the 2005/06 season and are presented in Appendix B.

The Stormwater Monitoring Program’s composite samples are made up of multiple sub-samples (aliquots) collected over a temporal range. Such temporal composite samples can be collected on a flow-proportional basis or time-paced basis. Flow-proportional composite samplers are programmed prior to the monitoring event to collect samples over certain flow volume increments. During flow-proportional sampling, samples are collected on a volumetric-flow interval basis, with a set aliquot volume collected at passage of each equal, pre-set flow volume. These flow volume increments are determined by predicting the duration of rainfall for a storm event and adjusting the sampler accordingly to collect samples during the course of the flow event that best represent the storm event (i.e., capture peak flow). Sample adjustment is based on the estimated volume of water passing by the monitoring station for a given size rain event. The estimate is based on 60 years of rainfall data and takes into account antecedent conditions. Time-paced composite samplers are also programmed according to the predicted duration of rainfall prior to a monitoring event. Under time-paced sampling, equal sample aliquot volumes are



collected at equal time intervals. Although composite samplers are automated, VCWPD staff actively monitor storm and flow conditions during each event in order to adaptively adjust the sampler to capture the best representation of storm flow.

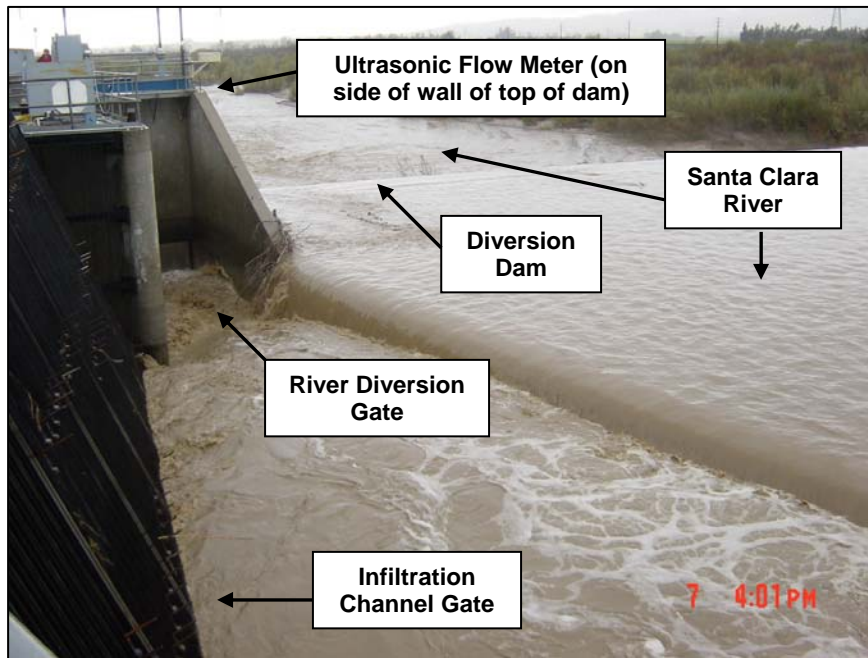
Flows at the Santa Clara River (ME-SCR) Mass Emission site are measured using two different meters, one for dry weather and one for wet weather sampling. The ME-SCR site is located on the Santa Clara River at the Freeman Diversion Dam which diverts water into infiltration ponds for groundwater recharge. The United Water Conservation District diverts water from the Santa Clara River during dry conditions for their infiltration facilities. An area velocity flow meter is installed inside the dry weather diversion channel downstream of the infiltration channel gate and is used for measuring dry weather flows (See Figure 11 and Figure 12). No water flows over the diversion dam during dry weather conditions. During wet weather, the Santa Clara River primarily flows through a river diversion gate, shown in Figure 12, in order to maintain connectivity between the diversion structure and the river. However, during higher wet weather flows, water flows through the river diversion gate and over the diversion dam itself. A flow gauge is presently installed at the top of the diversion dam for wet weather monitoring. There is no flow meter installed at the river diversion gate. VCWPD plans on installing a flow meter at the river diversion gate in the future in order to allow the collection of flow-proportional composite samples at the ME-SCR site. However, there are technical challenges involved in placing a non-intrusive flow meter (ultrasonic) at the river diversion gate due to equipment limitations and debris in the flow. Debris present in wet weather flows, such as trees, vegetation or sediment, could cause inaccurate flow readings and damage this type of meter. VCWPD is currently investigating the use of a radar or non-intrusive flow meter for measuring flow at this gate. These types of meters are capable of measuring open channel flows that contain debris. As mentioned previously, composite samples at ME-SCR are collected on a time-paced basis. Figures 11–13 show the configuration of the different flow channels at ME-SCR.



**Figure 11: ME-SCR Freeman Diversion Dam (Facing Upstream)**

Flow measurement in the infiltration channel during dry weather monitoring can also be problematic in that there is no fixed time schedule for diverting water from the river into the infiltration channel which makes it difficult to determine a daily average flow in the infiltration channel. The aforementioned challenges associated with measuring wet and dry weather flows preclude the complete measurement of

flows at ME-SCR at this time. However, the VCWPD is working to overcome these difficulties and develop methods for measuring all wet and dry weather flows at the ME-SCR site. Figures 12–14 show the river diversion gate, infiltration channel, and diversion dam at ME-SCR.



**Figure 12: ME-SCR Freeman Diversion Dam (Facing Downstream)**



**Figure 13: River Diversion Gate (Facing Downstream)**



**Figure 14: Infiltration Channel (Facing Upstream)**

Table 5 summarizes flow rates at the Mass Emission, Land Use, and Receiving Water stations for each of the wet weather monitoring events conducted in 2005/06. Event duration is defined as the number of hours elapsed between the first aliquot distributed into the first sample bottle collected through the last aliquot distributed into the last sample bottle collected by a composite sampler. Average flow is determined by averaging all available flow data over the event duration time period. Flow data listed in Table 5 are for wet weather events. It should be noted that all wet weather flows listed for ME-SCR in Table 5 do not include flow at the river diversion gate, and depending on the flow volume of a particular wet weather event, may represent only a fraction of the total wet weather flow.

**Table 5: Site Flow Data and Event Durations**

<b>Site ID</b>	<b>Event No.</b>	<b>Event Date<sup>A</sup></b>	<b>Average Flow (CFS)</b>	<b>Start Date, Time</b>	<b>End Date, Time</b>	<b>Event Duration</b>
<b>ME-CC</b>	1	10/17/2005	62.84	10/17/2005 0:01	10/17/2005 18:02	18:01:00
	2	11/9/2005	116.11	11/9/2005 0:01	11/10/2005 9:42	33:41:00
	3	2/17/2006	60.23	2/17/2006 17:50	2/21/2006 9:44	87:54:00
	4	2/27/2006	1114.88	2/27/2006 6:00	3/1/2006 1:28	43:28:00
<b>ME-VR2</b>	1	10/17/2005	10.44	10/17/2005 0:01	10/19/2005 10:59	58:58:00
	2	11/9/2005	23.00	11/9/2005 0:01	11/10/2005 10:31	34:30:00
	3	2/17/2006	21.22	2/17/2006 16:00	2/19/2006 12:12	44:12:00
	4	2/27/2006	263.82	2/27/2006 6:00	3/1/2006 7:17	49:17:00
<b>ME-SCR<sup>B</sup></b>	1	10/17/2005	0.15	10/17/2005 0:01	10/18/2005 14:26	38:25:00
	2	11/9/2005	0.04	11/9/2005 0:01	11/10/2005 0:01	24:00:00
	3	2/17/2006	C	2/17/2006 19:11	2/19/2006 18:41	47:30:00
	4	2/27/2006	541.31	2/27/2006 6:00	3/1/2006 9:45	51:45:00
<b>A-1</b>	1	10/17/2005	0.92	10/17/2005 0:01	10/18/2005 8:13	32:12:00
<b>I-2</b>	1	10/17/2005	D	10/17/2005 12:30	10/17/2005 12:30	N/A
<b>R-1</b>	1	10/17/2005	D	10/17/2005 11:30	10/17/2005 11:30	N/A
<b>W-3</b>	1	10/17/2005	1.55	10/17/2005 0:01	10/18/2005 13:59	37:58:00
<b>W-4</b>	1	10/17/2005	E	10/17/2005 0:01	10/18/2005 12:59	36:58:00

A. Event Date describes the date on which composite sampling began for a particular monitoring event.

B. During wet weather the Santa Clara River flows through the river diversion gate and over the diversion dam. Currently, there is no flow meter installed at the river diversion gate where a majority of the wet weather flow passes. It should be noted that until a flow meter is installed at the river diversion gate, these values only represent a portion of the total wet weather flow at ME-SCR (see Flow Rates section above for further information).

C. Event 3 (2/17/06) at the ME-SCR site produced insufficient flows to be measured by the flow meter located at the top of the diversion dam. Ostensibly, all flows produced during this event were redirected through the river diversion gate and into the infiltration channel.

D. Only aquatic toxicity grab samples were collected from Land Use sites I-1 and R-1 during Event 1 (10/17/05).

E. Flow measured at the W-4 site during Event 1 (10/17/05) was considered erroneous due to approximately one foot of sediment that has built up at the stream gauge since its installation. Sediment build up has produced a back water effect that prevents the accurate measurement of water levels and flow volumes in Revolon Slough. Due to these conditions, the VCWPD Hydrology Section has since moved the stream gauge 776A – Revolon Slough from Laguna Road upstream to Pleasant Valley Road.

## 4. Sample Collection

Sampling conducted by the Stormwater Monitoring Program during the 2005/06 monitoring season consisted of the capturing of the first flush storm event in Ventura County on October 17, 2005, followed by the monitoring of one early-season (November) and two mid-season (February) storms. Storm event sampling criteria contained in the NPDES permit specify that not more than 0.1 inch of rain shall occur during the 72 hours preceding a monitored event. Storms are selected for monitoring based on the antecedent conditions (72-hour dry period), fulfillment of the dry period, and predicted precipitation.

At the Calleguas Creek (ME-CC) and Ventura River (ME-VR2) sites automated composite samplers are programmed to collect flow-proportional samples based on water volume passing by the station during wet weather monitoring. The flow volume necessary to trigger sample collection is determined based on the predicted amount of precipitation over a specific period of time and the estimated volume of runoff from the watershed. These values are based on 60 years of historic precipitation data used to develop runoff tables included in the Standard Operating Procedures. Samples at ME-SCR are collected on a time-paced basis during wet weather monitoring because flow-proportional compositing is not possible due to the diversion of Santa Clara River water by the United Water Conservation District. The Stormwater Monitoring Program has installed a flow gauge in the diversion channel to monitor flow diverted to infiltration ponds during dry weather, as well as a flow meter on top of the Freeman Diversion Dam to measure flow during wet weather. Time-paced composite samples were collected at the Land Use (A-1) and Receiving Water (W-3, W-4) sites. Receiving Water site W-4 collects samples on a time interval basis because sample to volume (runoff) tables are not available. Only aquatic toxicity grab samples were collected at the Ortega Street (I-2) and Swan Street (R-1) Land Use sites during Event 1 (10/17/05) because the Stormwater Monitoring Program had already satisfied its NPDES permit condition stating that these two Land Use sites must be monitored a minimum of three times per permit term with respect to the collection of water chemistry samples. However, the Stormwater Monitoring Program is still under a regulatory obligation to collect aquatic toxicity grab samples at these sites in order to amass baseline toxicity information related to land use discharges.

The Santa Clara River (ME-SCR), Wood Road (A-1), and both Receiving Water (La Vista, W-3, and Revolon Slough, W-4) monitoring sites have hard line phone and electrical connections and refrigerated sampling units. The Ventura River (ME-VR2) site also possesses an electrical connection and refrigerated sampling unit, but communication with the sampling equipment is made possible via a cellular phone connection. The Calleguas Creek (ME-CC) station possesses a cellular phone connection and runs on solar/battery power. The Ortega Street (I-2) and Swan Street (R-1) Land Use sites do not possess phone or power connections, and utilize portable refrigerated samplers for sample collection. Automated data logging is available at all sites, while tipping bucket rain gauges are installed at all sites except for I-2 and R-1. Additionally, all sites except for I-2 and R-1 can be remotely accessed via telemetry, including the area velocity flow meter installed in the infiltration channel at ME-SCR.

The sampling methods and sample handling procedures used during the 2005/06 monitoring year are based on EPA Method 1669 and are described in the revised *Ventura Countywide Stormwater Monitoring Program: Water Quality Monitoring Standard Operating Procedures 2000-2005 Stormwater Monitoring* (LWA, 2001) – a document also referred to as the *Land Use and Receiving Water Guide*. The sampling methods and sample handling procedures employed at Mass Emission monitoring sites are also based on EPA Method 1669 and are described in *Ventura Countywide Stormwater Monitoring Program: Mass Emission Stations Water Quality Monitoring Standard Operating Procedures 2000-2005* (VCWPD, 2003) – a document also referred to as the *Mass Emission Guide*. The parameters required to be monitored by the Stormwater Monitoring Program are described as a part of NPDES Permit No. CAS004002 Section No. CL 7388. The Stormwater Monitoring Program produces an *event sample matrix* for each event prior to its monitoring as a means of documenting the specific environmental and QA/QC samples to be collected at any given monitoring site for a particular event, as well as the specific sample container to be used when collecting a certain sample. All event sample matrices associated with the 2005/06 monitoring season are presented in Appendix C.



At Mass Emission, Receiving Water, and Land Use sites, both composite and grab samples are collected. Composite samples are collected in glass containers and then delivered to the lab where they are split by pouring off with a tipper. When the splitting of a composite sample is performed, the composite sample is continually rocked in a sample-pouring stand to provide as much "non-invasive" mixing as possible. Sample splitting allows homogeneous aliquots of a single, large water sample to be divided into several smaller samples for the purpose of delivering these smaller volumes of water to individual analytical laboratories as necessary. The volume of sample collected depends upon the volume required by the lab to perform requested water quality and QA/QC analyses.



**Figure 15: Grab Sample Collection in the Ventura River using EPA Sampling Protocols**

In an effort to maintain quality control for the sampling program, the sampling crew, in cooperation with the analytical laboratories, has minimized the number of laboratories and sample bottles used for analysis. This has minimized bottle breakage, increased efficiency, and reduced the chances for contamination of the samples. Also, a dedicated monitoring team is used to provide consistent sample collection and handling. Remote access capability at all but two Land Use monitoring sites (I-2 and R-1) also provides data-on-demand which allows immediate onsite evaluation of stream conditions.

For constituents analyzed from samples required to be collected as “grabs”, samples are ideally taken at the peak runoff flow to provide the best estimate for an event mean concentration (EMC). In practice it is difficult to both predict the peak flow and to allocate manpower such that all sites are grab-sampled at the storm event peak flow. It should be noted that peak flow times vary for each monitoring station due to the size and inherent characteristics of the watershed in which the site is located. All grab and composite wet weather samples collected during the 2005/2006 monitoring season are considered best available estimates of storm EMCs. Table 6 summarizes the samples collected at each of the monitoring locations during the 2005/06 monitoring season’s wet weather events. As a means of documenting all preparatory, operational, observational, and concluding activities of a monitoring event, the Stormwater Monitoring Program produces an *event summary* for each monitoring event it conducts. These event summaries include, but are not limited to information related to event duration, predicted and actual precipitation, weather conditions, the programming of sampling equipment, equipment malfunctions, sample collection and handling, and sample tracking with respect to delivery to an analytical laboratory. All event summaries associated with the 2005/06 monitoring season are presented in Appendix D.

**Table 6: 2005/06 Monitoring Event Summary**

<i>Event Number</i>	<i>Event Date</i>	<i>A-1 Wood Road</i>	<i>I-2 Ortega Street</i>	<i>R-1 Swan Street</i>	<i>W-3 La Vista Avenue</i>	<i>W-4 Revolon Slough</i>	<i>ME-CC Calleguas Creek-CSUCI</i>	<i>ME-SCR Santa Clara River</i>	<i>ME-VR2 Ventura River-OVSDTP</i>
1	10/17/05	CGT	T	T	CGT	CGT	CGT	CGT	CGT
2	11/9/05	-	-	-	-	-	CGT	CGT	CGT
3	2/17/06	-	-	-	-	-	CG	CG	CG
4	2/27/06	-	-	-	-	-	CG	CG	CG

Notes:

"G" indicates that a grab sample was collected.

"T" indicates that toxicity samples were collected.

"C" indicates that a composite sample was collected.

"-" indicates that no sample was collected.

In addition to documenting the water quality samples scheduled for collection during an event through the generation of an event sample matrix, the Stormwater Monitoring Program also documents the actual samples it collects – and their date and time of collection – during the course of an event by completing a chain of custody (COC) form for each sampling event conducted at a monitoring site. The COC form not only documents sample collection, but also notifies an analytical laboratory that a particular sample should be analyzed for a certain constituent or group of constituents, oftentimes specifying the analytical method to be employed. Finally, the COC form acts as an evidentiary document noting how many samples were relinquished – and at what date and time – to a particular laboratory by the Stormwater Monitoring Program. All chain of custody forms associated with the 2005/06 monitoring season are presented in Appendix E.

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## 5. Analyses Performed

Stormwater Monitoring Program analyses include those for anions, bacteriologicals, conventionals, hydrocarbons, trace metals, nutrients, semi- and non-volatile organics, PCBs, various pesticides, including chlorinated and organophosphorus compounds, acute and chronic toxicity, and bioassessment. The following laboratories analyzed Stormwater Monitoring Program water quality samples during the 2005/06 monitoring season:

- CRG Marine Laboratories, Inc. of Torrance, CA performed all tests except for perchlorate, BOD, TOC, TKN, MTBE, Glyphosate, pesticides analyzed via EPA 8151A, bacteria, toxicity, and bioassessment;
- Calscience Environmental Laboratories, Inc. performed the following analyses: perchlorate, BOD, TOC, TKN (Events 1 and 2), MTBE, 2,4,5-T, 2,4,5-TP (Silvex), 2,4-D, 2,4-DB, Dalapon, Dicamba, Dichlorprop, Dinoseb, MCPA, and MCPPE;
- Ventura County Health Care Agency Laboratory performed bacteriological tests for E. coli, Enterococcus, and Total and Fecal Coliforms;
- Thomas Analytical Laboratory was used to perform Total Kjeldahl Nitrogen (TKN) analyses for Events 3 and 4;
- MWH Laboratories was used to perform Glyphosate analyses for Events 1 – 3;
- Weck Laboratories, Inc. was used to perform Glyphosate analyses for Event 4; and
- Aquatic Bioassay & Consulting Laboratories, Inc. performed all toxicity tests.

Analytical methods employed by all laboratories comply with those outlined in the permit. The analytical methods employed allow the laboratories to achieve the lowest possible detection limits.

The aquatic toxicity tests were conducted by Aquatic Bioassay & Consulting Laboratories, Inc. of Ventura, CA under the guidelines prescribed in *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms* (EPA 600/4-85/013). The toxicity tests included acute *Ceriodaphnia dubia* survival and chronic purple sea urchin (*Strongylocentrotus purpuratus*) fertilization bioassays. Aquatic Bioassay & Consulting also performs the macroinvertebrate bioassessment testing (including taxonomic identification and data analysis) and reporting in addition to aquatic toxicity bioassays.

Table 7 provides a complete listing of the constituents and associated analytical methods for all water quality analyses conducted by the Stormwater Monitoring Program during the 2005/06 monitoring year.

**Table 7: Constituents and Analytical Methods for Water Quality Analyses Conducted by the Stormwater Monitoring Program 2005/06**

<b>Classification</b>	<b>Constituent</b>	<b>Fraction</b>	<b>Method</b>	<b>Analytical Laboratory</b>
Anion Analyses	Bromide	n/a	SM 4500-Br	CRG
	Chloride	n/a	SM 4500-Cl E	CRG
	Perchlorate	n/a	EPA 314.0	Calscience
Bacteriological Analyses	E. Coli	n/a	MMO-MUG	VCHCA
	Enterococcus	n/a	Enterolert	VCHCA
	Fecal Coliform	n/a	SM 9221 E	VCHCA
	Total Coliform	n/a	MMO-MUG	VCHCA
Conventional Analyses	BOD	n/a	EPA 405.1	Calscience
	Conductivity	n/a	SM 2510	CRG
	Hardness as CaCO3	Total	SM 2340 B	CRG
	pH	n/a	EPA 150.1	CRG
	Total Dissolved Solids	n/a	SM 2540 C	CRG
	Total Organic Carbon	n/a	EPA 415.1	Calscience
	Total Suspended Solids	n/a	SM 2540 D	CRG
Turbidity	n/a	EPA 180.1	CRG	
Hydrocarbon Analyses	Oil and Grease	n/a	EPA 1664A	CRG
	TRPH	n/a	EPA 418.1 and EPA 1664	CRG
Metals Analyses	Aluminum	Dissolved	EPA 200.8m	CRG
	Aluminum	Total	EPA 200.8m	CRG
	Arsenic	Dissolved	EPA 200.8m	CRG
	Arsenic	Total	EPA 200.8m	CRG
	Cadmium	Dissolved	EPA 200.8m	CRG
	Cadmium	Total	EPA 200.8m	CRG
	Chromium	Dissolved	EPA 200.8m	CRG
	Chromium	Total	EPA 200.8m	CRG
	Chromium VI	Total	SM 3500-Cr	CRG
	Copper	Dissolved	EPA 200.8m	CRG
	Copper	Total	EPA 200.8m	CRG
	Lead	Dissolved	EPA 200.8m	CRG
	Lead	Total	EPA 200.8m	CRG
	Mercury	Dissolved	EPA 1631E	CRG
	Mercury	Total	EPA 1631E	CRG
	Nickel	Dissolved	EPA 200.8m	CRG
	Nickel	Total	EPA 200.8m	CRG
	Selenium	Dissolved	EPA 200.8m	CRG
	Selenium	Total	EPA 200.8m	CRG
	Silver	Dissolved	EPA 200.8m	CRG
	Silver	Total	EPA 200.8m	CRG
	Thallium	Dissolved	EPA 200.8m	CRG
Thallium	Total	EPA 200.8m	CRG	
Zinc	Dissolved	EPA 200.8m	CRG	
Zinc	Total	EPA 200.8m	CRG	

**Table 7 (Continued): Constituents and Analytical Methods for Water Quality Analyses Conducted by the Stormwater Monitoring Program 2005/06**

<b>Classification</b>	<b>Constituent</b>	<b>Fraction</b>	<b>Method</b>	<b>Analytical Laboratory</b>
Nutrient Analyses	Ammonia as N	n/a	SM 4500-NH3 F	CRG
	Nitrate as N	n/a	EPA 300.0	CRG
	Nitrite as N	n/a	EPA 300.0	CRG
	Orthophosphate as P (Diss)	n/a	EPA 300.0	CRG
	TKN	n/a	EPA 351.3 <sup>1</sup> and EPA 351.1 <sup>2</sup>	Calscience and TA
	Total Phosphorus	Dissolved	SM 4500-P C	CRG
	Total Phosphorus	Total	SM 4500-P C	CRG
Organic Analyses	1,2,4-Trichlorobenzene	n/a	EPA 625m	CRG
	1,2-Dichlorobenzene	n/a	EPA 625m	CRG
	1,3-Dichlorobenzene	n/a	EPA 625m	CRG
	1,4-Dichlorobenzene	n/a	EPA 625m	CRG
	1-Methylnaphthalene	n/a	EPA 625m	CRG
	1-Methylphenanthrene	n/a	EPA 625m	CRG
	2,3,5-Trimethylnaphthalene	n/a	EPA 625m	CRG
	2,4,6-Trichlorophenol	n/a	EPA 625m	CRG
	2,4-Dichlorophenol	n/a	EPA 625m	CRG
	2,4-Dimethylphenol	n/a	EPA 625m	CRG
	2,4-Dinitrophenol	n/a	EPA 625m	CRG
	2,4-Dinitrotoluene	n/a	EPA 625m	CRG
	2,6-Dimethylnaphthalene	n/a	EPA 625m	CRG
	2,6-Dinitrotoluene	n/a	EPA 625m	CRG
	2-Chloronaphthalene	n/a	EPA 625m	CRG
	2-Chlorophenol	n/a	EPA 625m	CRG
	2-Methyl-4,6-dinitrophenol	n/a	EPA 625m	CRG
	2-Methylnaphthalene	n/a	EPA 625m	CRG
	2-Nitrophenol	n/a	EPA 625m	CRG
	3,3'-Dichlorobenzidine	n/a	EPA 625m	CRG
	4-Bromophenyl phenyl ether	n/a	EPA 625m	CRG
	4-Chloro-3-methylphenol	n/a	EPA 625m	CRG
	4-Chlorophenyl phenyl ether	n/a	EPA 625m	CRG
	4-Nitrophenol	n/a	EPA 625m	CRG
	Acenaphthene	n/a	EPA 625m	CRG
	Acenaphthylene	n/a	EPA 625m	CRG
	Anthracene	n/a	EPA 625m	CRG
	Azobenzene	n/a	EPA 625m	CRG
	Benzidine	n/a	EPA 625m	CRG
	Benzo(a)anthracene	n/a	EPA 625m	CRG
	Benzo(a)pyrene	n/a	EPA 625m	CRG
	Benzo(b)fluoranthene	n/a	EPA 625m	CRG
	Benzo(e)pyrene	n/a	EPA 625m	CRG
Benzo(g,h,i)perylene	n/a	EPA 625m	CRG	
Benzo(k)fluoranthene	n/a	EPA 625m	CRG	
Biphenyl	n/a	EPA 625m	CRG	

**Table 7 (Continued): Constituents and Analytical Methods for Water Quality Analyses Conducted by the Stormwater Monitoring Program 2005/06**

<b>Classification</b>	<b>Constituent</b>	<b>Fraction</b>	<b>Method</b>	<b>Analytical Laboratory</b>
	Bis(2-chloroethoxy)methane	n/a	EPA 625m	CRG
	Bis(2-chloroethyl)ether	n/a	EPA 625m	CRG
	Bis(2-chloroisopropyl)ether	n/a	EPA 625m	CRG
	Bis(2-ethylhexyl)phthalate	n/a	EPA 625m	CRG
	Butyl benzyl phthalate	n/a	EPA 625m	CRG
	Chrysene	n/a	EPA 625m	CRG
	Dibenz(a,h)anthracene	n/a	EPA 625m	CRG
	Dibenzothiophene	n/a	EPA 625m	CRG
	Diethyl phthalate	n/a	EPA 625m	CRG
	Dimethyl phthalate	n/a	EPA 625m	CRG
	Di-n-butylphthalate	n/a	EPA 625m	CRG
	Di-n-octylphthalate	n/a	EPA 625m	CRG
	Fluoranthene	n/a	EPA 625m	CRG
	Fluorene	n/a	EPA 625m	CRG
	Hexachlorobenzene	n/a	EPA 625m	CRG
	Hexachlorobutadiene	n/a	EPA 625m	CRG
	Hexachlorocyclopentadiene	n/a	EPA 625m	CRG
	Hexachloroethane	n/a	EPA 625m	CRG
	Indeno(1,2,3-cd)pyrene	n/a	EPA 625m	CRG
	Isophorone	n/a	EPA 625m	CRG
	Methyl tert-butyl ether (MTBE)	n/a	EPA 8260B	Calscience
	Naphthalene	n/a	EPA 625m	CRG
	Nitrobenzene	n/a	EPA 625m	CRG
	N-Nitrosodimethylamine	n/a	EPA 625m	CRG
	N-Nitrosodi-N-propylamine	n/a	EPA 625m	CRG
	N-Nitrosodiphenylamine	n/a	EPA 625m	CRG
	Pentachlorophenol	n/a	EPA 625m	CRG
	Perylene	n/a	EPA 625m	CRG
	Phenanthrene	n/a	EPA 625m	CRG
	Phenol	n/a	EPA 625m	CRG
	Pyrene	n/a	EPA 625m	CRG
	Total Detectable PAHs	n/a	EPA 625m	CRG
PCB Analyses	Aroclor 1016	n/a	EPA 625m	CRG
	Aroclor 1221	n/a	EPA 625m	CRG
	Aroclor 1232	n/a	EPA 625m	CRG
	Aroclor 1242	n/a	EPA 625m	CRG
	Aroclor 1248	n/a	EPA 625m	CRG
	Aroclor 1254	n/a	EPA 625m	CRG
	Aroclor 1260	n/a	EPA 625m	CRG
	PCB 018	n/a	EPA 625m	CRG
	PCB 028	n/a	EPA 625m	CRG
	PCB 031	n/a	EPA 625m	CRG

**Table 7 (Continued): Constituents and Analytical Methods for Water Quality Analyses Conducted by the Stormwater Monitoring Program 2005/06**

<b>Classification</b>	<b>Constituent</b>	<b>Fraction</b>	<b>Method</b>	<b>Analytical Laboratory</b>
	PCB 033	n/a	EPA 625m	CRG
	PCB 037	n/a	EPA 625m	CRG
	PCB 044	n/a	EPA 625m	CRG
	PCB 049	n/a	EPA 625m	CRG
	PCB 052	n/a	EPA 625m	CRG
	PCB 066	n/a	EPA 625m	CRG
	PCB 070	n/a	EPA 625m	CRG
	PCB 074	n/a	EPA 625m	CRG
	PCB 077	n/a	EPA 625m	CRG
	PCB 081	n/a	EPA 625m	CRG
	PCB 087	n/a	EPA 625m	CRG
	PCB 095	n/a	EPA 625m	CRG
	PCB 097	n/a	EPA 625m	CRG
	PCB 099	n/a	EPA 625m	CRG
	PCB 101	n/a	EPA 625m	CRG
	PCB 105	n/a	EPA 625m	CRG
	PCB 110	n/a	EPA 625m	CRG
	PCB 114	n/a	EPA 625m	CRG
	PCB 118	n/a	EPA 625m	CRG
	PCB 119	n/a	EPA 625m	CRG
	PCB 123	n/a	EPA 625m	CRG
	PCB 126	n/a	EPA 625m	CRG
	PCB 128 + 167	n/a	EPA 625m	CRG
	PCB 138	n/a	EPA 625m	CRG
	PCB 141	n/a	EPA 625m	CRG
	PCB 149	n/a	EPA 625m	CRG
	PCB 151	n/a	EPA 625m	CRG
	PCB 153	n/a	EPA 625m	CRG
	PCB 156	n/a	EPA 625m	CRG
	PCB 157	n/a	EPA 625m	CRG
	PCB 158	n/a	EPA 625m	CRG
	PCB 168 + 132	n/a	EPA 625m	CRG
	PCB 169	n/a	EPA 625m	CRG
	PCB 170	n/a	EPA 625m	CRG
	PCB 177	n/a	EPA 625m	CRG
	PCB 180	n/a	EPA 625m	CRG
	PCB 183	n/a	EPA 625m	CRG
	PCB 187	n/a	EPA 625m	CRG
	PCB 189	n/a	EPA 625m	CRG
	PCB 194	n/a	EPA 625m	CRG
	PCB 200	n/a	EPA 625m	CRG
	PCB 201	n/a	EPA 625m	CRG
	PCB 206	n/a	EPA 625m	CRG
	Total Detectable PCBs	n/a	EPA 625m	CRG

**Table 7 (Continued): Constituents and Analytical Methods for Water Quality Analyses Conducted by the Stormwater Monitoring Program 2005/06**

<b>Classification</b>	<b>Constituent</b>	<b>Fraction</b>	<b>Method</b>	<b>Analytical Laboratory</b>
Pesticide Analyses	2,4,5-T	n/a	EPA 8151A	Calscience
	2,4,5-TP (Silvex)	n/a	EPA 8151A	Calscience
	2,4-D	n/a	EPA 8151A	Calscience
	2,4-DB	n/a	EPA 8151A	Calscience
	2,4'-DDD	n/a	EPA 625m	CRG
	2,4'-DDE	n/a	EPA 625m	CRG
	2,4'-DDT	n/a	EPA 625m	CRG
	4,4'-DDD	n/a	EPA 625m	CRG
	4,4'-DDE	n/a	EPA 625m	CRG
	4,4'-DDT	n/a	EPA 625m	CRG
	Aldrin	n/a	EPA 625m	CRG
	BHC-alpha	n/a	EPA 625m	CRG
	BHC-beta	n/a	EPA 625m	CRG
	BHC-delta	n/a	EPA 625m	CRG
	BHC-gamma (Lindane)	n/a	EPA 625m	CRG
	Bolstar	n/a	EPA 625m	CRG
	Chlordane-alpha	n/a	EPA 625m	CRG
	Chlordane-gamma	n/a	EPA 625m	CRG
	Chlorpyrifos	n/a	EPA 625m	CRG
	cis-Nonachlor	n/a	EPA 625m	CRG
	Dalapon	n/a	EPA 8151A	Calscience
	Demeton-O	n/a	EPA 625m	CRG
	Diazinon	n/a	EPA 625m	CRG
	Dicamba	n/a	EPA 8151A	Calscience
	Dichlorprop	n/a	EPA 8151A	Calscience
	Dichlorvos	n/a	EPA 625m	CRG
	Dieldrin	n/a	EPA 625m	CRG
	Dimethoate	n/a	EPA 625m	CRG
	Dinoseb	n/a	EPA 8151A	Calscience
	Disulfoton	n/a	EPA 625m	CRG
	Endosulfan sulfate	n/a	EPA 625m	CRG
	Endosulfan-I	n/a	EPA 625m	CRG
	Endosulfan-II	n/a	EPA 625m	CRG
	Endrin	n/a	EPA 625m	CRG
	Endrin aldehyde	n/a	EPA 625m	CRG
	Endrin ketone	n/a	EPA 625m	CRG
	Ethoprop	n/a	EPA 625m	CRG
	Fenclorophos (Rannel)	n/a	EPA 625m	CRG
	Fensulfotion	n/a	EPA 625m	CRG
	Fenthion	n/a	EPA 625m	CRG
Glyphosate	n/a	EPA 547	MWH and WL	
Heptachlor	n/a	EPA 625m	CRG	
Heptachlor epoxide	n/a	EPA 625m	CRG	

**Table 7 (Continued): Constituents and Analytical Methods for Water Quality Analyses Conducted by the Stormwater Monitoring Program 2005/06**

<b>Classification</b>	<b>Constituent</b>	<b>Fraction</b>	<b>Method</b>	<b>Analytical Laboratory</b>
Pesticide Analyses	Malathion	n/a	EPA 625m	CRG
	MCPA	n/a	EPA 8151A	Calscience
	MCPP	n/a	EPA 8151A	Calscience
	Merphos	n/a	EPA 625m	CRG
	Methoxychlor	n/a	EPA 625m	CRG
	Methyl parathion	n/a	EPA 625m	CRG
	Mevinphos	n/a	EPA 625m	CRG
	Mirex	n/a	EPA 625m	CRG
	Oxychlorane	n/a	EPA 625m	CRG
	Phorate	n/a	EPA 625m	CRG
	Tetrachlorovinphos (Stirofos)	n/a	EPA 625m	CRG
	Tokuthion	n/a	EPA 625m	CRG
	Total Detectable DDTs	n/a	EPA 625m	CRG
	Toxaphene	n/a	EPA 625m	CRG
	trans-Nonachlor	n/a	EPA 625m	CRG
Trichloronate	n/a	EPA 625m	CRG	

1. Calscience Environmental Laboratories, Inc. analyzed TKN via EPA method 351.3 for Events 1 and 2.
2. Thomas Analytical Laboratory analyzed TKN via EPA method 351.1 for Events 3 and 4.

**Land Use and Receiving Water Characterization Sites**

A summary of the composite and grab samples (including lab duplicates and matrix spike samples) collected and analyzed during the 2005/06 monitoring year for the Land Use and Receiving Water sites are shown in Table 8 and Table 9, respectively.

**Table 8: Environmental and QA/QC Samples Collected at Land Use Sites**

<b>Event</b>	<b>Event 1</b>		
<b>Monitoring Site</b>	<b>A-1</b>	<b>R-1</b>	<b>I-2</b>
<b>Date</b>	<b>10/17/2005</b>	<b>10/17/2005</b>	<b>10/17/2005</b>
<b>Composite Constituents</b>			
Bromide	✓ (LD)	—	—
Chloride	✓ (LD)	—	—
BOD <sup>1</sup>	✓ (LD)	—	—
Hardness as CaCO <sub>3</sub>	✓ (LD)	—	—
Total Dissolved Solids	✓ (LD)	—	—
Total Organic Carbon <sup>1</sup>	✓ (LD)	—	—
Total Suspended Solids	✓ (LD)	—	—
Turbidity	✓ (LD)	—	—
Metals, Total Recoverable	✓ (LD)	—	—
Metals, Dissolved	✓ (LD)	—	—
Chromium VI	✓ (LD)	—	—
Nitrate as N	✓ (LD)	—	—
Nitrite as N	✓ (LD)	—	—
Orthophosphate as P (Diss)	✓ (LD)	—	—
TKN <sup>1</sup>	✓ (LD)	—	—
Total Phosphorus, Total	✓ (LD)	—	—
Total Phosphorus, Dissolved	✓ (LD)	—	—
Organic – EPA 625m	✓ (LD)	—	—
PCB – EPA 625m	✓ (LD)	—	—
Pesticide – EPA 547 <sup>2</sup>	✓ (LD)	—	—
Pesticide – EPA 625m	✓ (LD)	—	—
Pesticide – EPA 8151A <sup>1</sup>	✓ (LD)	—	—
<b>Grab Constituents</b>			
Perchlorate <sup>1</sup>	✓ (LD)	—	—
Bacteriological <sup>3</sup>	✓ (LD)	—	—
pH/Conductivity	✓ (LD)	—	—
Hydrocarbons	✓ (LD)	—	—
Ammonia as N	✓ (LD, MS/MSD)	—	—
MTBE – EPA 8260B <sup>1</sup>	✓ (LD)	—	—
Aquatic Toxicity Bioassay <sup>4</sup>	✓	✓	✓

**Notes**

"✓" indicates that the analysis was performed on an environmental sample; "—" indicates that no sample was collected.

"LD" indicates that a laboratory duplicate analysis was performed.

"MS/MSD" indicates that a matrix spike/matrix spike duplicate analysis was performed.

Hydrocarbons include: Oil & Grease, TRPH; Metals include: Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag, Ti, & Zn.

Unless noted otherwise, all analyses performed by CRG Marine Laboratories, Inc.

1. Performed by Calscience Environmental Laboratories, Inc.

3. Performed by Ventura County HCA Laboratories

2. Performed by MWH Laboratories

4. Performed by Aquatic Bioassay & Consulting Labs, Inc.



**Table 9: Environmental and QA/QC Samples Collected at Receiving Water Sites**

<b>Event</b>	<b>Event 1</b>	
<b>Monitoring Site</b>	<b>W-3</b>	<b>W-4</b>
<b>Date</b>	<b>10/17/2005</b>	<b>10/17/2005</b>
<b>Composite Constituents</b>		
Bromide	✓	✓
Chloride	✓	✓
BOD <sup>1</sup>	✓	✓
Hardness as CaCO <sub>3</sub>	✓	✓
Total Dissolved Solids	✓	✓
Total Organic Carbon <sup>1</sup>	✓	✓
Total Suspended Solids	✓	✓
Turbidity	✓	✓
Metals, Total Recoverable	✓	✓
Metals, Dissolved	✓	✓
Chromium VI	✓	✓
Nitrate as N	✓	✓
Nitrite as N	✓	✓
Orthophosphate as P (Diss)	✓	✓
TKN <sup>1</sup>	✓	✓
Total Phosphorus, Total	✓	✓
Total Phosphorus, Dissolved	✓	✓
Organic – EPA 625m	✓	✓
PCB – EPA 625m	✓	✓
Pesticide – EPA 547 <sup>2</sup>	✓	✓
Pesticide – EPA 625m	✓	✓
Pesticide – EPA 8151A <sup>1</sup>	✓	✓
<b>Grab Constituents</b>		
Perchlorate <sup>1</sup>	✓	✓
Bacteriological <sup>3</sup>	✓	✓
pH/Conductivity	✓	✓
Hydrocarbons	✓	✓
Ammonia as N	✓	✓
MTBE – EPA 8260B <sup>1</sup>	✓	✓
Aquatic Toxicity Bioassay <sup>4</sup>	✓	✓

**Notes**

"✓" indicates that the analysis was performed on an environmental sample; "—" indicates that no sample was collected.

Hydrocarbons include: Oil & Grease, TRPH

Metals include: Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag, Tl, & Zn.

Unless noted otherwise, all analyses performed by CRG Marine Laboratories, Inc.

1. Performed by Calscience Environmental Laboratories, Inc.

2. Performed by MWH Laboratories

3. Performed by Ventura County HCA Laboratories

4. Performed by Aquatic Bioassay & Consulting Labs, Inc.

**Mass Emission Sites**

A summary of the composite and grab samples (including field blanks, field duplicates, lab duplicates, and matrix spike samples) collected and analyzed during the 2005/06 monitoring year at the Mass Emission monitoring sites are shown in Tables Table 10 through Table 12.

**Table 10: Environmental and QA/QC Samples Collected at Mass Emission Site ME-CC**

Event	ME-CC Calleguas Creek			
	Event 1	Event 2	Event 3	Event 4
Date	10/17/2005	11/9/2005	2/17/2006	2/27/2006
<b>Composite Constituents</b>				
Bromide	✓	✓	✓ (LD)	✓
Chloride	✓	✓	✓ (LD, MS/MSD)	✓
BOD <sup>1</sup>	✓	✓	✓	✓
Hardness as CaCO <sub>3</sub>	✓	✓	✓	✓
Total Dissolved Solids	✓	✓	✓ (LD)	✓
Total Organic Carbon <sup>1</sup>	✓ (MS/MSD)	✓	✓ (LD, MS/MSD)	✓
Total Suspended Solids	✓	✓	✓ (LD)	✓
Turbidity	✓	✓	✓	✓
Metals, Total Recoverable	✓ (MS/MSD)	✓ (FB)	✓ (LD, MS/MSD)	✓
Metals, Dissolved	✓	✓	✓ (LD, MS/MSD)	✓
Chromium VI	✓	✓	✓ (LD, MS/MSD)	✓ (MS/MSD)
Nitrate as N	✓ (MS/MSD)	✓	✓ (LD, MS/MSD)	✓
Nitrite as N	✓ (MS/MSD)	✓	✓ (LD, MS/MSD)	✓
Orthophosphate as P (Diss)	✓ (MS/MSD)	✓	✓ (LD, MS/MSD)	✓
TKN <sup>1,5</sup>	✓ <sup>1</sup>	✓ <sup>1</sup>	✓ (LD, MS/MSD) <sup>5</sup>	✓ <sup>5</sup>
Total Phosphorus, Total	✓	✓	✓ (LD, MS/MSD)	✓
Total Phosphorus, Dissolved	✓	✓	✓ (LD, MS/MSD)	✓
Organic – EPA 625m	✓ (MS/MSD)	✓ (FB)	✓ (LD, MS/MSD)	✓
PCB – EPA 625m	✓ (MS/MSD)	✓ (FB)	✓ (LD, MS/MSD)	✓
Pesticide – EPA 547 <sup>2,6</sup>	✓ <sup>2</sup>	✓ <sup>2</sup>	✓ (LD, MS/MSD) <sup>2</sup>	✓ <sup>6</sup>
Pesticide – EPA 625	✓ (MS/MSD)	✓ (FB)	✓ (LD, MS/MSD)	✓
Pesticide – EPA 8151A <sup>1</sup>	✓ (MS/MSD)	✓	✓ (MS/MSD)	✓
<b>Grab Constituents</b>				
Perchlorate <sup>1</sup>	✓	✓	✓	✓
Bacteriological <sup>3</sup>	✓	✓ (FB)	✓	✓
pH/Conductivity	✓	✓	✓ (LD)	✓
Hydrocarbons	✓	✓	✓	✓
Ammonia as N	✓	✓	✓ (LD, MS/MSD)	✓
Aquatic Toxicity Bioassay <sup>4</sup>	✓	✓	—	—

**Notes**

"✓" indicates that the analysis was performed on an environmental sample; "—" indicates that no sample was collected.

"FB" indicates that a field blank analysis was performed.

"LD" indicates that a laboratory duplicate analysis was performed.

"MS/MSD" indicates that a matrix spike/matrix spike duplicate analysis was performed.

Hydrocarbons include: Oil & Grease, TRPH

Metals include: Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag, Tl, & Zn.

Unless noted otherwise, all analyses performed by CRG Marine Laboratories, Inc.

1. Performed by Calscience Environmental Laboratories, Inc.

2. Performed by MWH Laboratories

3. Performed by Ventura County HCA Laboratories

4. Performed by Aquatic Bioassay & Consulting Labs, Inc.

5. Performed by Thomas Analytical Laboratory

6. Performed by Weck Laboratories, Inc.

**Table 11: Environmental and QA/QC Samples Collected at Mass Emission Site ME-VR2**

Event	ME-VR2 Ventura River			
	Event 1	Event 2	Event 3	Event 4
Date	10/17/2005	11/9/2005	2/17/2006	2/27/2006
<b>Composite Constituents</b>				
Bromide	✓ (FB)	✓ (FD)	✓	✓
Chloride	✓	✓ (FD)	✓	✓
BOD <sup>1</sup>	✓	✓ (FD, LD)	✓	✓
Hardness as CaCO <sub>3</sub>	✓ (FB)	✓ (FD)	✓	✓
Total Dissolved Solids	✓	✓ (FD)	✓	✓
Total Organic Carbon <sup>1</sup>	✓	✓ (FD)	✓	✓
Total Suspended Solids	✓	✓ (FD)	✓	✓
Turbidity	✓	✓ (FD, LD)	✓	✓
Metals, Total Recoverable	✓ (FB)	✓ (FD)	✓	✓ (MS/MSD)
Metals, Dissolved	✓	✓ (FD)	✓	✓
Chromium VI	✓	✓ (FD, MS/MSD)	✓	✓
Nitrate as N	✓	✓ (FD, MS/MSD)	✓	✓
Nitrite as N	✓	✓ (FD, MS/MSD)	✓	✓
Orthophosphate as P (Diss)	✓	✓ (FD, MS/MSD)	✓	✓
TKN <sup>1,5</sup>	✓ <sup>1</sup>	✓ (FD) <sup>1</sup>	✓ <sup>5</sup>	✓ (MS/MSD) <sup>5</sup>
Total Phosphorus, Total	✓	✓ (FD)	✓	✓
Total Phosphorus, Dissolved	✓	✓ (FD, MS/MSD)	✓	✓ (MS/MSD)
Organic – EPA 625m	✓ (FB)	✓ (FD)	✓	✓ (MS/MSD)
PCB – EPA 625m	✓ (FB)	✓ (FD)	✓	✓ (MS/MSD)
Pesticide – EPA 547 <sup>2,6</sup>	✓ <sup>2</sup>	✓ <sup>2</sup>	✓ <sup>2</sup>	✓ <sup>6</sup>
Pesticide – EPA 625m	✓ (FB)	✓ (FD)	✓	✓ (MS/MSD)
Pesticide – EPA 8151A <sup>1</sup>	✓	✓ (FD)	✓	✓
<b>Grab Constituents</b>				
Perchlorate <sup>1</sup>	✓	✓ (FD, MS/MSD)	✓ (MS/MSD)	✓
Bacteriological <sup>3</sup>	✓ (FB)	✓ (FD)	✓	✓
pH/Conductivity	✓	✓ (FD)	✓	✓
Hydrocarbons	✓	✓ (FD)	✓	✓
Ammonia as N	✓	✓ (FD, MS/MSD)	✓	✓
Aquatic Toxicity Bioassay <sup>4</sup>	✓	✓	—	—

**Notes**

"✓" indicates that the analysis was performed on an environmental sample; "—" indicates that no sample was collected.

"FB" indicates that a field blank analysis was performed.

"FD" indicates that a field duplicate analysis was performed.

"LD" indicates that a laboratory duplicate analysis was performed.

"MS/MSD" indicates that a matrix spike/matrix spike duplicate analysis was performed.

Hydrocarbons include: Oil & Grease, TRPH

Metals include: Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag, Tl, & Zn.

Unless noted otherwise, all analyses performed by CRG Marine Laboratories, Inc.

1. Performed by Calscience Environmental Laboratories, Inc.

2. Performed by MWH Laboratories

3. Performed by Ventura County HCA Laboratories

4. Performed by Aquatic Bioassay & Consulting Labs, Inc.

5. Performed by Thomas Analytical Laboratory

6. Performed by Weck Laboratories, Inc.

**Table 12: Environmental and QA/QC Samples Collected at Mass Emission Site ME-SCR**

Event	ME-SCR Santa Clara River			
	Event 1	Event 2	Event 3	Event 4
Date	10/17/2005	11/9/2005	2/17/2006	2/27/2006
<b>Composite Constituents</b>				
Bromide	✓	✓ (LD)	✓ (FB)	✓ (LD)
Chloride	✓	✓	✓	✓ (LD)
BOD <sup>1</sup>	✓	✓	✓	✓ (LD)
Hardness as CaCO <sub>3</sub>	✓	✓ (LD)	✓ (FB)	✓ (LD)
Total Dissolved Solids	✓	✓	✓	✓ (LD)
Total Organic Carbon <sup>1</sup>	✓	✓	✓	✓ (LD)
Total Suspended Solids	✓	✓	✓	✓ (LD)
Turbidity	✓	✓	✓ (LD)	✓ (LD)
Metals, Total Recoverable	✓	✓ (LD, MS/MSD)	✓ (FB)	✓ (LD)
Metals, Dissolved	✓	✓ (LD)	✓	✓ (LD)
Chromium VI	✓	R	✓	✓ (LD)
Nitrate as N	✓	✓	✓	✓ (LD)
Nitrite as N	✓	✓	✓	✓ (LD)
Orthophosphate as P	✓	✓	✓	✓ (LD)
TKN <sup>1,5</sup>	✓ <sup>1</sup>	✓ (LD) <sup>1</sup>	✓ <sup>5</sup>	✓ (LD) <sup>5</sup>
Total Phosphorus, Total	✓	✓	✓	✓ (LD)
Total Phosphorus, Dissolved	✓	✓	✓	✓ (LD)
Organic – EPA 625m	✓	✓ (LD, MS/MSD)	✓ (FB)	✓ (LD)
PCB – EPA 625m	✓	✓ (LD, MS/MSD)	✓ (FB)	✓ (LD)
Pesticide – EPA 547 <sup>2,6</sup>	✓ <sup>2</sup>	✓ <sup>2</sup>	✓ <sup>2</sup>	✓ (LD) <sup>6</sup>
Pesticide – EPA 625m	✓	✓ (LD, MS/MSD)	✓ (FB)	✓ (LD)
Pesticide – EPA 8151A <sup>1</sup>	✓	✓ (MS/MSD)	✓	✓ (LD)
<b>Grab Constituents</b>				
Perchlorate <sup>1</sup>	✓	✓	✓ (MS/MSD)	✓ (LD)
Bacteriological <sup>3</sup>	✓	✓	✓ (FB)	✓ (LD)
pH/Conductivity	✓	✓	✓	✓ (LD)
Hydrocarbons	✓	✓	✓	✓ (LD)
Ammonia as N	✓	✓	✓	✓ (LD)
Aquatic Toxicity Bioassay <sup>4</sup>	✓	✓	—	—

**Notes**

"✓" indicates that the analysis was performed on an environmental sample; "—" indicates that no sample was collected.

"FB" indicates that a field blank analysis was performed.

"LD" indicates that a laboratory duplicate analysis was performed.

"MS/MSD" indicates that a matrix spike/matrix spike duplicate analysis was performed.

Hydrocarbons include: Oil & Grease, TRPH

Metals include: Al, As, Cd, Cr, Cu, Pb, Ni, Se, Ag, Tl, & Zn.

Unless noted otherwise, all analyses performed by CRG Marine Laboratories, Inc.

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2. Performed by MWH Laboratories

3. Performed by Ventura County HCA Laboratories

4. Performed by Aquatic Bioassay & Consulting Labs, Inc.

5. Performed by Thomas Analytical Laboratory

6. Performed by Weck Laboratories, Inc.

Table 8 through Table 12 include information related to QA/QC samples scheduled for collection and analysis by the Stormwater Monitoring Program, as well as results from unsolicited QA/QC analyses provided by various analytical laboratories. Unsolicited QA/QC analyses received by the Stormwater Monitoring Program during the 2005/06 monitoring season took the forms of non-requested matrix spike and lab duplicate analyses provided by most laboratories. Since these additional QA/QC analyses

provide valuable information related to the laboratory's ability to accurately (matrix spike analyses) and precisely (lab duplicate analyses) evaluate water quality samples, they were included in the Stormwater Monitoring Program's database and considered along with all requested QA/QC analyses during the Stormwater Monitoring Program's QA/QC evaluation.

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## 6. Quality Assurance and Quality Control (QA/QC)

The following is a discussion of the results of the quality assurance and quality control (QA/QC) analysis performed on the 2005/06 stormwater quality monitoring data. The data were evaluated for overall sample integrity, holding time exceedances, contamination, accuracy, and precision using field- and lab-initiated QA/QC sample results according to the Stormwater Monitoring Program's 2005/06 *Data Quality Evaluation Plan* and *Data Quality Evaluation Standard Operating Procedures*. The Data Quality Evaluation Plan (DQEP) describes the process by which water chemistry data produced by the Stormwater Monitoring Program are evaluated. Data quality evaluation is a multiple step process used to identify errors, inconsistencies, or other problems potentially associated with Stormwater Monitoring Program data. The DQEP contains a detailed discussion of the technical review process, based on U.S. Environmental Protection Agency (EPA) guidance<sup>3</sup> and requirements set forth by the Stormwater Monitoring Program, used to evaluate water quality monitoring data. The DQEP provides a reference point from which a program-consistent quality assurance/quality control (QA/QC) evaluation can be performed by the Stormwater Monitoring Program. The Data Quality Evaluation Standard Operating Procedures (SOPs) document provides a set of written instructions that documents the process used by the Stormwater Monitoring Program to evaluate water quality data. The SOPs describe both technical and administrative operational elements undertaken by the Stormwater Monitoring Program in carrying out its DQEP. The SOPs act as a set of prescriptive instructions detailing in a step-by-step manner how District staff carry out the data evaluation and data quality objectives set forth in the DQEP. QA/QC sample results from the 2005/06 monitoring season are presented in Appendix G.

QA/QC sample collection and analysis relies upon QA/QC samples collected in the field (such as equipment blank, field blank, field duplicate, and matrix spike samples), as well as QA/QC samples prepared and analyzed by the analytical laboratory (i.e., lab-initiated samples, such as method blanks, filter blanks, and laboratory control spikes) performing the analysis. The actual chemical analysis of lab-initiated and field-initiated QA/QC samples is conducted in an identical manner as the analysis of field-collected environmental samples. After all analyses are complete, the results of the field-initiated and lab-initiated QA/QC sample results are compared to particular Data Quality Objectives (DQOs), also commonly referred to as QA/QC limits. These limits are typically established by the analytical laboratory based on EPA protocols and guidance. However, in some cases, the Stormwater Monitoring Program will set a particular DQO, such as the QA/QC limit for field duplicate results.

QA/QC sample results are evaluated in order to compare them to their appropriate QA/QC limits and identify those results that fall outside of these limits. This QA/QC evaluation occurs in two separate steps as the laboratory will review those results that fall outside of their QA/QC limits and typically label these results with some type of qualification or note. If a QA/QC sample result falls grossly outside of its associated QA/QC limit, and thus indicates that there is a major problem with the lab's instrumentation and/or analytical process, then the laboratory should re-run both the affected QA/QC and environmental samples as necessary. The second step in the QA/QC evaluation process occurs when the Stormwater Monitoring Program performs the overall sample integrity, holding time, contamination, accuracy, and precision checks mentioned above. This second evaluation step provides an opportunity to thoroughly review the Stormwater Monitoring Program's data to identify potential errors in a laboratory's reporting of analytical data and/or recognize any significant data quality issues that may need to be addressed.

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<sup>3</sup> U.S. Environmental Protection Agency. February 1994. *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*. EPA-540/R-94-013.

U.S. Environmental Protection Agency. December 1994. *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*. EPA-540/R-94-090.

U.S. Environmental Protection Agency. April 1995. *Guidance on the Documentation and Evaluation of Trace Metals Data Collected for Clean Water Act Compliance Monitoring*. EPA-821/B-95-002.

After this evaluation the Stormwater Monitoring Program is ready to qualify their environmental data as necessary based on the findings of the QA/QC assessment.

Environmental sample results are qualified in order to provide the user of the data with information regarding the quality of the data. Depending on the planned use of the data, qualifications may help to determine whether or not the data are appropriate for a given analysis. In general, data that are qualified with anything other than an “R” (meaning a rejected data point) are suitable for most analyses. However, the qualifications assigned to the data allow the user to assess the appropriateness of the data for a given use. The Stormwater Monitoring Program used its NDPEs Stormwater Quality Database to conduct a semi-automated QA/QC evaluation of the current season’s data contained in the database. The use of the database allows the Stormwater Monitoring Program to expedite and standardize the QA/QC evaluation of its monitoring data in conjunction with the use of the DQEP and SOPs. After reviewing the qualifications assigned to each qualified data point in the 2005/06 monitoring year data set, the environmental data are considered to be of high quality and sufficient for all future general uses. However, all data qualifiers should be reviewed and considered prior to the use of the data in a specific analysis or application. Environmental data from the 2005/06 monitoring season are presented in Appendix F.

This section provides a discussion of (1) the sample collection procedure for field-initiated QA/QC samples, (2) the QA/QC samples analyzed by the Stormwater Monitoring Program, along with remarks on QA/QC issues of significance observed during the 2005/06 season, and (3) a summary of the 2005/06 QA/QC sample results presented in Table 21 through Table 27 at the end of this section.

#### **Field-Initiated QA/QC Sample Collection**

Both environmental and field-initiated QA/QC samples are collected in the field using clean sampling techniques. To minimize the potential for contamination, CRG Marine Laboratories, Inc. cleans all bottles used for composite samples. Only new containers are used for grab sample collection, with the appropriate preservative added to grab bottles by CRG. Intake lines for the automated samplers are cleaned using nitric acid (30% dilution) and distilled water. A dedicated sampling crew is provided by VCWPD to ensure that consistent sample collection and handling techniques are followed during every monitoring event.

Field-initiated QA/QC samples include equipment blanks, field blanks, and field duplicates. Equipment blanks are typically prepared prior to the start of the monitoring season to check that tubing and strainers, and sample containers – especially composite bottles – aren’t sources of contamination for the Stormwater Monitoring Program’s environmental samples. Automated sampler intake lines (i.e., sample tubing) are cleaned using nitric acid (30% dilution; supplied by CRG) prior to equipment blank collection. Equipment blanks are collected by passing blank water through cleaned tubing and into brand new sample bottles. Equipment blanks are collected using clean techniques, prior to field sample collection, before the sampling equipment has been contaminated by environmental sample water or other sources. After collection, equipment blanks are submitted to the analytical laboratory and analyzed using the same methods as those employed for routine, environmental sample analysis. CRG supplied new, clean sample bottles and blank water for equipment blanks analyzed for total recoverable and dissolved metals (EPA 200.8m) and trace organic compounds (EPA 625m).

Field blanks are collected using the same techniques as used for environmental sample collection, but instead of sample water, blank water is poured into the sample bottle while in the field. CRG supplied sample bottles and blank water for all field blank analyses except for those associated with bacteriological analyses. In these instances, VCHCA provided sample bottles and blank water for bacteriological field blank analyses. For metals (EPA 200.8m) and trace organic compounds (including organics, PCBs, and pesticides), the blank water is de-ionized water. The de-ionized water is purified to 18 megOhm quality by CRG by passing it through de-ionized resin beads to remove ionic compounds, such as metals, and then through a carbon filter to remove trace organic compounds.



Duplicate samples – both field duplicates and lab duplicates – are collected in the field using the same techniques as used for all environmental sample collection. For composite samples a larger volume of water is collected during the monitoring event, and then the duplicates are split in the field (when generating a field duplicate) or in the lab (when generating a lab duplicate) while constantly mixing the contents of the composite containers to ensure the production of homogeneous duplicate samples. For grab samples two samples are collected side-by-side or in immediate succession into separate sample bottles when collecting an environmental sample and its field duplicate. Depending on the volume of water required to perform a particular analysis, a lab duplicate analysis of a grab sample may require the collection of a separate sample, or may be run on a single environmental sample.

### **QA/QC Sample Analysis and Issues of Significance**

The QA/QC evaluation process identifies isolated incidents of out-of-range QA/QC results, but more importantly, identifies potential trends in laboratory and sampling performance. An important and ongoing component of the QA/QC evaluation process is to identify, report, and correct these problems as they arise. The types of QA/QC analyses and evaluations of these results performed during the 2005/06 monitoring season are described below, along with identified QA/QC issues associated with a particular QA/QC sample type.

As a member of the Southern California Coastal Water Research Project's (SCCWRP) Stormwater Monitoring Coalition (SMC), VCWPD jointly sponsored the Stormwater Laboratory Intercalibration Study that was conducted by the SMC in 2003. Five analytical laboratories currently employed by the Stormwater Monitoring Program took part in the intercalibration study: CRG Marine Laboratories, Calscience Environmental Laboratories, MWH Laboratories, Weck Laboratories, and Aquatic Bioassay & Consulting Laboratories. The goal of the study was to establish performance-based guidelines for the analysis of stormwater samples through the setting of minimum standards for sensitivity, precision, and accuracy across different analytical laboratories so that individual data sets can be combined with estimated levels of confidence for making regional assessments of stormwater quality. The study's performance-based guidelines are considered key in achieving comparability across laboratories.

In brief, the intercalibration study focused on inter-laboratory comparability between a core group of 15 target analytes including total suspended solids, nutrients, and trace metals. The study set reporting levels for its target constituents that were sufficient to assess if environmental samples contained pollutant concentrations below relevant water quality objectives, such as the California Toxics Rule. The study's authors believed that reporting levels should be technologically achievable, but far enough below water quality objectives that observed exceedances cannot be attributable to methodological uncertainty. The study also set accuracy and precision DQOs for the analysis of stormwater matrices. Laboratory precision was based on the reproducibility of replicate sample analyses, while laboratory accuracy was judged via the analysis of spike environmental samples and reference materials. It is believed that the study's performance-based guidelines will be useful to stormwater programs in establishing specifications for work assignments or requests for proposals (RFPs) to conduct stormwater analyses. The intercalibration study and resulting guideline/protocols were documented in a Laboratory Guidance Manual for SMC member laboratories.

In April 2006, a new Laboratory Intercalibration Program agreement was signed by SCCWRP, three Regional Water Quality Control Boards, and six municipal parties, including the VCWPD, in order to fill three informational gaps left by the 2003 study. The goal of the new study is to complete three areas of missing information to make the Laboratory Guidance Manual an ongoing and effective document. The new Laboratory Intercalibration Program will include three steps: (1) repeat the laboratory intercalibration for TSS, nutrients, and trace metals; (2) initiate an intercalibration for organic constituents; and (3) create draft contract language for integration into stormwater monitoring programs. The study is expected to be completed in 2009.

Currently the Stormwater Monitoring Program uses generally established QA/QC limits and information provided by the laboratories to evaluate the QA/QC sample results. With regard to the 2005/06 monitoring season, it should be noted that all laboratories analyzing the 15 target analytes considered in

the intercalibration study were able to meet or go below the reporting levels set forth by the study. It is believed that the results of the Stormwater Laboratory Intercalibration Study, along with information gathered from the Stormwater Monitoring Program will help to refine QA/QC limits for the Ventura Countywide Stormwater Quality Management Program in the future.

### **Calculation of QA/QC Success Rates**

For each type of QA/QC analysis conducted, a percent success rate is calculated. The success rate is defined as the total number of QA/QC samples of a given type minus the number of samples that fall outside of QA/QC limits – that is, exceed the Stormwater Monitoring Program’s DQO for a particular QA/QC sample type – divided by the total number of samples, multiplied by 100%.

$$\text{Success Rate} = \left( \frac{TNS - NSO}{TNS} \right) * 100\%$$

where: TNS is the total number of QA/QC samples of a given type  
NSO is the number of QA/QC samples of a given type that fall outside of specific QA/QC limits

It should be noted that the QA/QC success rate calculated for a given QA/QC sample type may or may not be directly correlated to the number of environmental samples that ultimately require qualification by the Stormwater Monitoring Program due to a QA/QC sample result exceeding its DQO. For example, a detected concentration in a field blank sample may or may not result in the qualification of a *single* environmental sample, and a detected concentration in a method blank sample may or may not result in the qualification of *one or more* environmental samples. Furthermore, a matrix spike RPD result exceeding its DQO will always result in the qualification of the environmental sample collected at the same monitoring site as the matrix spike/matrix spike duplicate (MS/MSD) sample. Each of the following descriptions of QA/QC sample types evaluated by the Stormwater Monitoring Program includes a discussion of the particular QA/QC sample type’s DQO, its relationship to environmental samples (one-to-one or one-to-many), and the process by which it is determined if an out-of-control QA/QC sample result will result in the qualification of environmental data.

### **Equipment Blanks**

Equipment blanks, often referred to as pre-season blanks, are collected prior to the monitoring season to test for contamination in sample containers (e.g., jars, bottles, carboys, etc.) and sample equipment (e.g., intake lines, tubing, and strainers). The Stormwater Monitoring Program routinely analyzes pre-season *carboy blanks* by testing for contamination of these large glass bottles used to collect composite samples. The carboys are filled with laboratory-prepared blank water (acidified to pH < 2 for metals analyses) and allowed to stand for a minimum of 24 hours before analysis. Carboy blank analyses are performed to test for contamination of sample containers due to residues left from the manufacturing process (in the case of new carboys) or residues left from the cleaning process (in the case of cleaned, used carboys). Sampling equipment blanks – referred to as *tubing blanks* – are also routinely analyzed by the Stormwater Monitoring Program and consist of laboratory prepared blank water processed through sampler tubing to identify potential contamination of field-collected samples as a result of “dirty” tubing. Equipment blank “hits” or measured concentrations above the laboratory’s quantitation limit (RL, PQL, etc.) for a constituent are assessed and acted upon using the guidelines listed below:

1. The Stormwater Monitoring Program requests that the laboratory confirm the reported results against lab bench sheets or other original analytical instrument output. Any calculation or reporting errors should be corrected and reported by the laboratory in an amended laboratory report.
2. If the previous step does not identify improperly reported results, then the analytical laboratory should be asked to identify any possible sources of contamination in the laboratory.

3. If no laboratory contamination is identified, then a note should be made that documents that the equipment blank results indicate that the sample equipment may have introduced contamination into the blank samples.

When practical, remedial measures are initiated by the Stormwater Monitoring Program to replace or re-clean sampling equipment and re-analyze equipment blank samples in an effort to eliminate field contamination. No environmental samples are qualified by the Stormwater Monitoring Program based on the results of pre-season equipment blank analyses. Only the results of field-initiated and laboratory-initiated QA/QC samples associated with the environmental samples collected for any given monitoring event are used to qualify Stormwater Monitoring Program environmental samples.

**Equipment Blank Check** – The Stormwater Monitoring Program reviewed the results of its carboy and tubing blank analyses performed approximately two weeks (10/6/06) prior to monitoring of the first event (10/17/06) of the 2005/06 monitoring season. The results showed low-level, detected concentrations of five phthalate compounds (Bis(2-ethylhexyl)phthalate, Butyl benzyl phthalate, Diethyl phthalate, Dimethyl phthalate, and Di-n-butylphthalate) known by the Stormwater Monitoring Program to be regular laboratory contaminants of CRG Marine Laboratories, Inc. Additionally, a handful of metals (Aluminum, Copper, Nickel, and Zinc) and polynuclear aromatic hydrocarbons (1-Methylnaphthalene, 2-Methylnaphthalene, Biphenyl, and Naphthalene), as well as single examples of acid extractable (Phenol) and base/neutral extractable (1,2-Dichlorobenzene) compounds were found in detectable concentrations in equipment blanks. The Stormwater Monitoring Program confirmed with CRG Marine Laboratories, Inc., that these detected equipment blank concentrations were accurately reported and requested that all sampling equipment to be used in the upcoming monitoring season be re-cleaned by the laboratory. Instead of performing a second round of equipment blank analyses on the re-cleaned equipment, the Stormwater Monitoring Program chose to monitor potential sampling equipment contamination through a review of field blank and method blank results generated during the four wet weather monitoring events. With the exception of phthalate compound contamination, the field blank and method blank results from Events 1 – 4 showed no systemic contamination of those constituents detected in pre-season carboy and tubing blanks, thus providing evidence that rigorous re-cleaning of sampling equipment eliminated trace-level contamination observed in pre-season blanks. Carboy and tubing blank results are presented along with all other QA/QC data in Appendix G.

### **Field and Lab Duplicates**

When duplicates are analyzed, a sample is split into two separate sub-samples and analyzed independently of one another in the laboratory. Field duplicates are split by the sampling crew and provide a measure of the variability of field sampling techniques. Laboratory duplicates are split by the laboratory and provide information on the reproducibility of results by the lab.

The success of a duplicate analysis is measured by the relative percent difference (RPD) between the environmental sample result and the duplicate result. The RPD is calculated using the following equation:

$$RPD = \left( \frac{|ES - D|}{(ES + D)/2} \right) * 100\%$$

where: ES is the environmental sample result  
D is the duplicate sample result

**Field Duplicate Check** – This precision analysis checks the relative percent difference (RPD) between the measured concentration of an analyte in an environmental sample and the measured concentration of the same analyte in its associated field duplicate sample. Calculated RPD values greater than 30% (that also possess an absolute difference greater than or equal to their associated detection limit) are considered to exceed the Stormwater Monitoring Program's DQO for this QA/QC sample type. This QA/QC limit was set by the Stormwater Monitoring Program at 30% because the limit could be no more

restrictive than the QA/QC limit set for laboratory duplicates (see discussion below). Only 8 of 225 total field duplicates analyzed in 2005/06 fell outside of QA/QC limits, for an overall success rate of 96.4%. Field duplicate results are summarized in Table 13.

**Table 13: Field Duplicate Success Rates**

<b>Classification</b>	<b>Total Number</b>	<b>Number Outside DQO</b>	<b>Success Rate</b>
Anion	3	0	100%
Bacteriological	4	0	100%
Conventional	8	2	75%
Hydrocarbon	2	1	50%
Metal	25	1	96%
Nutrient	7	1	85.7%
Organic	66	3	95.5%
PCB	53	0	100%
Pesticide	57	0	100%

Field duplicate results were reviewed to determine if any reasons for observed success rates lower than 75% for some classes of constituents could be identified. In general, it is sometimes difficult to maintain a homogeneous mixture when splitting composite sample duplicates. Composite field duplicate samples were only collected at ME-VR2 during Event 2, and therefore no other data exist to determine if similar success rates could be observed at different monitoring sites during the same or a different monitoring event. It should be noted that differences in duplicate sample results are often observed when there is more solid material in one sample of the duplicate pair. When the splitting of a composite sample is performed, the composite sample is continually rocked in a sample pouring stand to provide as much "non-invasive" mixing as possible. However, the splitting process can still result in some variation in the solids content of duplicate samples.

Additionally, all field duplicates for the current monitoring season were collected under storm conditions. Water collected from storm events typically has higher concentrations of suspended solids than does water collected during dry weather events. As a result, the splitting of homogeneous duplicate samples could have been further encumbered due to the high solids content of these environmental samples. The lower success rates observed for conventionals and hydrocarbons (both less than 80%) were not considered significant enough to warrant follow-up investigation with the analyzing laboratories. However, all affected data were qualified as "estimated". It should be noted that success rates for metals and organics were close to 100%.

**Lab Duplicate Check** – This precision analysis checks the relative percent difference (RPD) between the original measured concentration of an analyte in a sample and a replicate measured concentration of the analyte in the same sample. The original and replicate analyses are the result of "sample splitting" by the laboratory. Calculated RPD values greater than 20 – 30% (depending on laboratory) are considered to exceed the Stormwater Monitoring Program's DQO for this QA/QC sample type. CRG Marine Laboratories, Inc. maintains a lab duplicate, RPD QA/QC limit of 30%, while all other laboratories (except the Ventura County Health Care Agency) employed by the Stormwater Monitoring Program set their lab duplicate, RPD QA/QC limit between 20 – 25%, depending on analytical method. The Ventura County Health Care Agency Laboratory does not maintain a QA/QC limit for lab duplicate analyses performed on bacteriological samples. In this instance, the Stormwater Monitoring Program log-transformed bacteriological sample results before calculating RPD values and comparing this to a QA/QC limit of 30%. Only 95 of 854 total lab duplicates analyzed during the current monitoring season fell outside of QA/QC limits, for an overall success rate of 88.9%. Lab duplicate results are summarized in Table 14.

**Table 14: Laboratory Duplicate Success Rates**

<b>Classification</b>	<b>Total Number</b>	<b>Number Outside DQO</b>	<b>Success Rate</b>
Anion	9	0	100%
Bacteriological	8	0	100%
Conventional	25	4	84%
Hydrocarbon	4	2	50%
Metal	98	27	72.4%
Nutrient	22	2	90.9%
Organic	265	57	78.5%
PCB	212	0	100%
Pesticide	211	3	98.6%

Lab duplicate results were reviewed to determine if any reasons for observed success rates lower than 90% for some classes of constituents could be identified. Placing a higher burden of success on lab duplicate analyses (90%) than field duplicate analyses (75%) is common due to the much higher variability inherent in the collection of field duplicate samples. Differences among the calculated RPD values of lab duplicate pairs can be attributed to both sample variation, stemming from the sample splitting described above, as well as analytical variation. The overall 88.9% success rate across all lab duplicate samples analyzed was impacted by lower-than-expected lab duplicate success rates observed during Event 4. The lower success rates observed during Event 4 for conventionals (50%), hydrocarbons (0%), metals (28%), and organics (65.2%) were considered significant enough to warrant follow-up contact with the analyzing laboratories to remind them of the importance of homogenous sample splitting. It should be noted that the splitting of homogenous samples could have been further encumbered by the high total suspended solids content of the environmental samples (see Mass Emission station water quality results presented in Table 36 through Table 38). Figure 16 shows a typical, turbid, wet weather sample collected at Mass Emission site ME-CC during February 2006. All affected environmental data were qualified as “estimated”. It should be noted that success rates for pesticides were very close to 100%.

### **Field Blanks**

Field blank analyses are performed to test for contamination of environmental samples by field sample collection activities. Field blanks use blank water that is assumed to be void of all constituents for which a given set of analyses are to be performed. Filtered and purified de-ionized water is used for metals and trace organics field blanks, while standard de-ionized water is used for all other field blanks. Any constituents detected in field blanks are considered to be sources of contamination in the field. Field blanks are “collected” by pouring water from a laboratory-provided bottle directly into a sample container using clean sampling techniques and without the use of any extraneous equipment. This minimizes the possibility of any contamination of the field blanks.

**Field Blank Check** – This contamination analysis checks for a “hit” or the detection of an analyte in a field blank. A detected field blank concentration is considered an exceedance of the Stormwater Monitoring Program’s DQO for this QA/QC sample type. Even though a detected concentration is an indication that contamination has occurred at some point during the field sampling or analytical process, it doesn’t necessarily result in the qualification of an environmental sample. If a detected field blank result is greater than 20% of the concentration measured in an environmental sample, then the field blank contamination would result in the qualification of a single environmental sample collected at the same monitoring site as the field blank sample. As shown in Table 15, the majority of field blanks posted a 100% success rate with the exception of a handful of Method 200.8m (Metals) and Method 625m (Organics) blanks having success rates between approximately 73 – 92%.



**Figure 16: Wet weather composite sample collected at Mass Emission Station ME-CC during February 2006 (Event 4) showing high suspended solids content**

Since the detection of an analyte in a field blank sample does not necessarily mean that the contamination impacts a particular environmental result, one must look further to determine if the environmental sample concentration is greater than five times the concentration measured in the detected field blank. Put another way, one must determine if the analyte concentration measured in the blank is greater than 20% of the analyte concentration measured in the associated environmental sample. Only if the blank contamination is greater than 20% of the measured environmental concentration would the environmental sample receive a qualification. For example, a dissolved zinc field blank hit of 0.2  $\mu\text{g/L}$  that is associated with an environmental sample with a measured concentration of 8.0  $\mu\text{g/L}$  would not result in the qualification of the environmental sample because its concentration is 40 times greater than that of the contamination measured in the field blank.

Field blank samples were collected at ME-VR2 (Event 1), ME-CC (Event 2), and ME-SCR (Event 3) during the 2005/06 monitoring season. Field contamination of Stormwater Monitoring Program environmental samples as evaluated through field blank analyses is minimal with only 26 hits out of 550 total field blank samples. This corresponds to an overall “non-detection” success rate of 95.3%; that is, no analyte was detected in 95.3% of the field blank samples. Only 14 of 550 total field blank samples analyzed in 2005/06 resulted in the qualification of environmental samples, for an overall success rate of 97.5%. Of the 14 field blanks showing contamination and having concentrations greater than 20% of that measured in their associated environmental samples, seven were from Event 1, three were from Event 2, and four were from Event 3. Mercury was detected in field blanks from all three monitoring events, while Copper and Lead were hits in an Event 1 blank and Zinc was found in field blanks from both Events 1 and 2. With regard to organics contamination, field blank analyses from all three monitoring events revealed detectable concentrations of phthalate compounds, while three polynuclear

aromatic hydrocarbons (PAHs) were detected in an Event 1 blank and 1,2-Dichlorobenzene was detected in an Event 3 blank. These 14 field blank detections were not considered indicative of any type of reoccurring contamination issue present during sample collection in the field. However, as discussed in the method blank section below, phthalate contamination in the laboratory appears to be an issue. The 14 affected environmental samples were qualified as “upper limit” due to field blank contamination.

**Table 15: Field Blank Success Rates**

<b>Event ID</b>	<b>Classification</b>	<b>Method</b>	<b>Total Number</b>	<b>Number Detected</b>	<b>Qualified Environ. Samples</b>	<b>Success Rate</b>
2005/06-1	Anion	SM 4500-Br	1	0	0	100%
	Bacteriological	Enterolert	1	0	0	100%
	Bacteriological	MMO-MUG	2	0	0	100%
	Bacteriological	SM 9221E	1	0	0	100%
	Conventional	SM 2340B	1	0	0	100%
	Metal	EPA 1631E	1	1	0	100%
	Metal	EPA 200.8m	11	3	1	72.7%
	Organic	EPA 625m	66	8	6	87.9%
	PCB	EPA 625m	53	0	0	100%
	Pesticide	EPA 625m	47	0	0	100%
2005/06-2	Bacteriological	Enterolert	1	0	0	100%
	Bacteriological	MMO-MUG	2	0	0	100%
	Bacteriological	SM 9221E	1	0	0	100%
	Metal	EPA 1631E	1	1	0	100%
	Metal	EPA 200.8m	11	1	0	100%
	Organic	EPA 625m	66	5	3	92.4%
	PCB	EPA 625m	53	0	0	100%
	Pesticide	EPA 625m	47	0	0	100%
2005/06-3	Anion	SM 4500-Br	1	0	0	100%
	Bacteriological	Enterolert	1	0	0	100%
	Bacteriological	MMO-MUG	2	0	0	100%
	Bacteriological	SM 9221E	1	0	0	100%
	Conventional	SM 2340B	1	0	0	100%
	Metal	EPA 1631E	1	1	0	100%
	Metal	EPA 200.8m	11	0	0	100%
	Organic	EPA 625m	66	6	4	90.9%
	PCB	EPA 625m	53	0	0	100%
	Pesticide	EPA 625m	47	0	0	100%

### **Method Blanks**

Method blanks are prepared by the laboratory using blank water, and then analyzed for every batch of environmental samples analyzed. A detected concentration or “hit” in a method blank is an indication of contamination in the analytical process; that is, contamination occurring somewhere in the laboratory. If the result for a single method blank is greater than the *method detection limit* (MDL), or if the average method blank concentration plus two standard deviations of three or more blanks is greater than the *reporting limit* (RL) for a particular analyte, then associated environmental sample results, depending on their measured concentrations, have the potential to be qualified.

**Method Blank Check** – This contamination analysis checks for “hits” or the detection of an analyte in a method blank. A detected method blank concentration is considered an exceedance of the Stormwater Monitoring Program’s DQO for this QA/QC sample type. Even though a detected concentration is an

indication that contamination has occurred during the analytical process, it doesn't necessarily result in the qualification of environmental samples. If a detected method blank value is greater than 20% of the concentration measured in associated environmental samples, then the method blank contamination would result in the qualification of one or more environmental samples analyzed in the same QA/QC batch as the out-of-control method blank. Table 16 below summarizes only those method blank results having less than 100% success rates. A summary of all method blanks analyzed during the 2005/06 monitoring season is presented in Appendix H. All method blanks except for those associated with organic compounds analyzed via EPA 625m posted a 100% success rate. On average, EPA 625m method blanks for all trace organic compounds (including PCBs and pesticides) analyzed by the Stormwater Monitoring Program posted a success rate of 97.3% across Events 1 – 4. Method blank success rates for individual 2005/06 monitoring events are shown in Table 16.

**Table 16: Method Blank Success Rates**

<i>Event ID</i>	<i>Classification</i>	<i>Method</i>	<i>Total Number</i>	<i>Number Detected</i>	<i>Qualified Environ. Samples</i>	<i>Success Rate<sup>1</sup></i>
2005/06-1	Organic	EPA 625m	66	5	19	92.4%
2005/06-2	Organic	EPA 625m	66	5	10	92.4%
2005/06-3	Organic	EPA 625m	66	5	11	92.4%
2005/06-4	Organic	EPA 625m	66	3	4	95.5%

1. Only method blanks having less than 100% success rates are summarized in this table. A summary of all method blanks analyzed during the 2005/06 monitoring season is presented in Appendix H.

Similar to field blanks, the detection of an analyte in a method blank sample does not necessarily mean that the contamination impacts environmental results. One must look further to determine if environmental sample concentrations are greater than five times the concentration measured in the detected method blank. Stated differently, one must determine if the analyte concentration measured in the blank is greater than 20% of the analyte concentration measured in the associated environmental samples. Only if the blank contamination is greater than 20% of the measured environmental concentration would the environmental sample receive a qualification. For example, a Butyl benzyl phthalate method blank hit of 0.02 µg/L would result in the qualification of all Butyl benzyl phthalate environmental samples with measured concentrations of less than 0.1 µg/L. A hypothetical environmental sample with a measured concentration of 0.7 µg/L would not be qualified because this concentration far overshadows the 0.02 µg/L contamination measured in the method blank.

The vast majority of method blanks run by the various analytical laboratories employed by the Stormwater Monitoring Program detected no analytes in the method blanks they analyzed. However, trace organic method blanks analyzed by CRG Marine Laboratories, Inc. using method EPA 625m did show contamination. Specifically, five phthalate compounds (Bis(2-ethylhexyl)phthalate, Butyl benzyl phthalate, Diethyl phthalate, Dimethyl phthalate, and Di-n-butylphthalate) were detected in each EPA 625m base/neutral extractable compound method blank analyzed by CRG during the course of monitoring Events 1 – 4. It should be noted that all five phthalate compounds were also detected by CRG in tubing and carboy pre-season equipment blanks. In total, phthalate compounds were detected in pre-season equipment blanks, field blanks, method blanks, and environmental samples. Phthalate contamination is common in analytical laboratories and is most often associated with exposure to plastic materials. CRG Marine Laboratories, Inc., the laboratory performing EPA 625m analyses for the Stormwater Monitoring Program, maintains that all measures have been taken to avoid sample contact with plastics. CRG's low detection limits (MDL = 0.005 µg/L for the detected phthalates) also lend themselves to the identification of constituents that would not be detected by laboratories having higher detection limits. The relatively high detected concentration of phthalates in environmental samples also indicates that these constituents are indeed present in the environment as well. In response to the observed phthalate contamination issue, all affected data (44 of 75 total samples associated with the five phthalate compounds) were qualified as "upper limit" due to method blank contamination.



**Matrix Spikes and Matrix Spike Duplicates**

A matrix spike (MS) is an environmental sample that is spiked by the laboratory with a known amount of the constituent being analyzed. Once the analysis is run, the analysis results are compared to the spike amount to determine how much of the spike was detected through the analytical process. The amount of the spike recovered is described as the “percent recovery” of the target analyte. A matrix spike duplicate (MSD) is a duplicate of this analysis that checks whether or not the lab is able to duplicate the results of the initial matrix spike analysis. These analyses help to confirm that the laboratory’s instrumentation and procedures are accurate and compliant with typical laboratory performance standards.

For both matrix spikes and matrix spike duplicates, lower and upper limits are placed on the recovery of the spike by the laboratory performing the analysis. Once percent recoveries are available for both matrix spike and matrix spike duplicate analyses, a relative percent difference can be calculated for the two results. Table 17 below summarizes the matrix spike recovery and matrix spike RPD qualification limits (QA/QC limits) established by the laboratories employed by the Stormwater Monitoring Program. Unless specifically identified in EPA analytical guidance for a particular method, QA/QC limits are usually developed by laboratories using the average percent recovery for an analyte and setting lower and upper limits at two or three standard deviations below and above the average recovery, respectively. Trace organic compound matrix spike recovery rates vary widely among these constituents, and therefore no single recovery acceptance range (i.e., 70 – 130%) can be used for these analytes. Instead, each constituent’s recovery is compared to a unique constituent-specific acceptance range.

**Table 17: Matrix Spike Qualification Limits**

<b>Classification or Constituent</b>	<b>MS Percent Recovery Limits</b>		<b>MS RPD Percent Limit</b>
	<b>Lower Limit</b>	<b>Upper Limit</b>	<b>Maximum RPD</b>
Anion (Calscience)	80%	120%	15%
Anion (CRG)	70%	130%	30%
Conventional	70%	130%	25%
Aluminum*	50%	140%	30%
Arsenic*	65%	135%	30%
Cadmium*	60%	140%	30%
Chromium*	70%	130%	30%
Chromium VI	70%	130%	30%
Copper*	70%	130%	30%
Lead*	65%	135%	30%
Mercury*	60%	140%	30%
Nickel*	70%	130%	30%
Selenium*	40%	160%	30%
Silver*	50%	155%	30%
Thallium*	70%	130%	30%
Zinc*	50%	150%	30%
Nutrient	70%	130%	30%
TKN	80%	120%	20%
Organic EPA 625m	variable	variable	30%
PCB EPA 625m*	65%	135%	30%
EPA 547	82%	115%	20%
Pesticide EPA 625m	variable	variable	30%
Pesticide EPA 8151A	30%	130%	30%

RPD = Relative Percent Difference

\*Lower and Upper Limits vary – widest possible range presented.

**Matrix Spike Recovery Check** – This accuracy analysis verifies that secondary spike analyses (such as matrix spike recovery analyses) performed by the laboratory show that the laboratory’s instrumentation and procedures are accurate and compliant with typical laboratory performance standards. Matrix spike recovery values (for both MS and MSD analyses) outside of laboratory-determined QA/QC ranges (set with lower and upper limits) are considered to exceed the Stormwater Monitoring Program’s DQO for this QA/QC sample type.

Matrix spike recovery success rates ranged from 95.2% (Event 3, EPA 625m organics) to 100% for the majority of matrix spike recovery analyses performed. A summary of success rates for matrix spike recovery samples analyzed during the 2005/06 monitoring season is presented in Appendix I. No particular classifications of constituents or analytical methods appear to be more prone to recovery problems than any other classification or method. Likewise, particular monitoring sites showed no tendency toward recovery problems. Recoveries below the lower QA/QC limit or above the upper QA/QC limit are generally attributed to matrix interference. Matrix interference occurs when substances contained in the sample water, or *matrix*, interfere with the ability of the laboratory instrumentation to accurately detect a compound being analyzed. Stormwater matrices tend to be “dirtier” than other matrices and are prone to contain substances that cause matrix interference. Matrix spike recoveries above their upper limit resulted in two Event 1 environmental samples being qualified as “high biased” due to matrix interference. Matrix spike recoveries below their lower limits resulted in three Event 3 environmental samples being qualified as “low biased” due to matrix interference.

**Matrix Spike RPD Check** – This precision analysis checks the relative percent difference (RPD) between two related matrix spike recovery results. RPD values greater than 20 – 30% (depending on constituent and analytical method) are considered to exceed the Stormwater Monitoring Program’s DQO for this QA/QC sample type.

Matrix spike relative percent difference (RPD) success rates ranged from 50% (Event 3, SM 4500 P-C analyzing for Total Phosphorus) to 100% for the vast majority of matrix spike RPD analyses performed. A summary of success rates for matrix spike RPD values calculated during the 2005/06 monitoring season is presented in Appendix J. Matrix spike RPD values calculated from EPA 625m trace organic compound (organics, PCBs, and pesticides) matrix spike recoveries posted an average success rate of 97.5% across Events 1 – 4, whereas the matrix spike RPD success rate for SM 4500 P-C (Total Phosphorus) was 75% over the same averaging period. All other analytical methods showed 100% success in meeting the DQO for a matrix spike RPD evaluation. In general, the greater the matrix interference in individual matrix spike recoveries, especially if one recovery leans low and the other lean high, the greater their relative percent difference. Calculated matrix spike RPD values in excess of their associated QA/QC limit resulted in 14 affected environmental samples being qualified as “estimated”.

### **Surrogate Spikes**

Surrogate spikes are compounds added to all trace organics samples by the laboratory to check the efficiency of the organics extraction process when testing samples using gas chromatography (GC) or gas chromatography-mass spectroscopy (GC/MS) analytical methods. Surrogates are compounds that are chemically and analytically similar to the compounds (“target analytes”) for which the analysis is being performed. They are added to both laboratory blank water and environmental samples undergoing analyses for trace organic compounds. The success of a particular sample extraction is based on the amount of the surrogate compound that is recovered through the analytical process. The amount of the spike recovered is described as the “percent recovery”. Different analytical methods, as well as individual constituents analyzed by those methods, possess different QA/QC limits for the recovery of surrogates. Table 18 summarizes the lower and upper QA/QC limits for the recovery of surrogate compounds via three analytical methods used to measure trace organic compounds by the Stormwater Monitoring Program. Limits displayed in the table represent the lowest and highest possible recoveries for a particular analytical method.

**Table 18: Surrogate Spike Recovery Limits**

<b>Analytical Method</b>	<b>Surrogate Recovery Limits</b>	
	<b>Lower Limit</b>	<b>Upper Limit</b>
EPA 8151A	0%	123%
EPA 8260B*	74%	146%
EPA 625m*	6%	162%

\*Lower and Upper Limits vary – widest possible range presented.

Results coming from the analysis of surrogate compounds are not used to directly qualify environmental samples when a surrogate result is found to fall outside of its associated QA/QC limits. Instead, surrogate results are used to elucidate trends in a laboratory’s analysis of organic constituents. High and low surrogate recoveries can inform the laboratory that a particular analytical process is out of control or moving toward that state, and prompt the laboratory to take corrective measures as necessary. For the current monitoring season, the surrogate method blank success rate for all trace organic analytical methods was 100%, while the surrogate field blank success rate for analytical method EPA 625m was 97%. Surrogate matrix spike recovery success rates were all 100%. Surrogate environmental recovery results – evaluated in conjunction with matrix spike recovery results – showed a 100% success rate. Surrogate recoveries outside of QA/QC limits were only associated with method EPA 625m surrogate field blank recoveries, but did not show any discernable pattern with regard to associated monitoring event.

### **Laboratory Control Spikes**

Laboratory control spike (LCS) analyses are used to test the accuracy of the entire laboratory analytical process. These primary spike analyses are performed by the laboratory to certify that the instrumentation and laboratory procedures are accurate and compliant with typical laboratory performance. LCS recovery samples can also be run in duplicate similar to matrix spike duplicate analyses. LCS samples are standards prepared internally by the laboratory using a known amount of analyte. A laboratory can also purchase pre-prepared standards called standard reference material (SRM) or certified reference material (CRM). Regardless of how the standard is prepared, it is run through the entire analytical process as if it was an environmental sample. Since the standard contains a known amount of a compound, the results of the analysis can be compared to the expected result and a percent recovery calculated. LCS recoveries are reviewed to determine if the percent recovery is within control limits provided by the laboratory. If a LCS recovery is below the lower QA/QC acceptance limit for a constituent, then an environmental sample is qualified as “low biased”. If a LCS recovery is above the upper QA/QC acceptance limit for a constituent, then an environmental sample is qualified as “high biased”. In the absence of matrix spike recovery data for a particular monitoring site, a LCS result outside of QA/QC limits would lead to the qualification of all environmental data from the same analytical batch as the out-of-control LCS recovery. However, in instances where in-control matrix spike recovery results exist for an analyte, these matrix spike recovery results would “trump” LCS recovery results. An environmental sample associated with in-control matrix spike results would not be qualified as either “low biased” or “high biased” due to poor LCS recovery. Table 19 shows the lower and upper LCS recovery limits associated with those constituents for which laboratory control spike analyses were performed during the current monitoring season.

**Laboratory Control Spike Check** – This accuracy analysis verifies that primary spike analyses, such as LCS, SRM, and CRM recovery analyses, performed by a laboratory show that the lab’s instrumentation and procedures are accurate and compliant with typical laboratory performance standards. LCS, SRM, and CRM recovery values outside of laboratory-determined ranges are considered to exceed the Stormwater Monitoring Program’s DQO for this QA/QC sample type.

The success rate of all laboratory control spike recoveries (including LCS and LCS duplicate recoveries) analyzed in the 2005/06 monitoring season is 100%. No environmental samples were biased either low or high due to LCS recoveries, and therefore no environmental samples were qualified based on this

particular QA/QC evaluation. A summary of success rates for LCS recovery analyses performed during the 2005/06 monitoring season is presented in Appendix K.

**Table 19: Laboratory Control Spike Recovery Limits**

<b>Classification</b>	<b>Constituent(s)</b>	<b>LCS Recovery Limits</b>	
		<b>Lower Limit</b>	<b>Upper Limit</b>
Anion	Chloride	70	130
Anion	Perchlorate	85	115
Conventional	Total Dissolved Solids	70	130
Conventional	Total Organic Carbon	80	120
Hydrocarbon	Oil and Grease	70	130
Hydrocarbon	TRPH	70	130
Metal	Al, Cr, Cu, Pb, Hg, Ni, Ag, Tl, Zn	75	125
Metal	Arsenic	65	135
Metal	Cadmium	60	140
Metal	Chromium VI	70	130
Metal	Selenium	40	160
Nutrient	Ammonia as N, Nitrate as N, Nitrite as N, Orthophosphate as P (Diss), and Total Phosphorus	70	130
Nutrient	TKN	80	120
Organic	Methyl tert-butyl ether (MTBE)	82	118
Pesticide	2,4,5-T	30	130
Pesticide	2,4-D	30	130
Pesticide	2,4-DB	30	130
Pesticide	Glyphosate	71	137

\*Lower and Upper Limits vary – widest possible range presented.

**Laboratory Control Spike RPD Check** – This precision analysis checks the relative percent difference (RPD) between two related laboratory control spikes (LCS), standard reference material (SRM), or certified reference material (CRM) recovery analyses. RPD values greater than 10 – 30% (depending on constituent and analytical method) are considered to exceed the Stormwater Monitoring Program’s DQO for this QA/QC sample type.

Only a single calculated LCS RPD value out of a total of 75 calculated values exceeded the DQO for a LCS RPD evaluation. A LCS RPD result calculated from two TRPH LCS recoveries exceeded its 30% maximum QA limit. To this end, three TRPH environmental samples from Event 3 were qualified at “estimated”. A summary of success rates for LCS RPD values calculated during the 2005/06 monitoring season is presented in Appendix L.

**Holding Time Exceedances**

The large majority of analytical methods used to analyze water quality samples specify a certain time period in which an analysis must be performed in order to ensure confidence in the result provided from the analysis. A sample that remains unanalyzed for too long a period of time sometimes shows analytical results different from those that would have been observed had the sample been analyzed earlier in time. This difference is due to the breakdown, transformation, and/or dissipation of substances in the sample over time. A holding time can be either the time between sample collection and sample preparation (the preparation holding time limit) or between the sample preparation and sample analysis (the analysis holding time limit). If a particular sample doesn’t require any pre-analysis preparation, then the analysis holding time is the time between sample collection and sample analysis.

**Holding Time Exceedance Check** – This analysis determines the elapses time between sample collection and sample analysis, the elapsed time between sample collection and sample preparation, and the elapsed time between sample preparation and sample analysis. These elapsed times are then compared to holding time values (typically provided in EPA guidance for analytical methods) to determine if a holding time exceedance has occurred. Elapsed times greater than specified holding time limits are considered to exceed the Stormwater Monitoring Program’s DQO for this QA/QC sample type.

All holding times were met by laboratories during the current monitoring season. Samples evaluated for holding time exceedances during the 2005/06 monitoring season are presented in Appendix M.

**Data Qualification Codes**

As discussed above, the Stormwater Monitoring Program’s QA/QC evaluation process looked for and found various environmental and QA/QC sample results that fell outside of particular data quality objectives or QA/QC limits. In some instances these exceedances of QA/QC limits resulted in the qualification of affected environmental data. Data are literally qualified by attaching specific qualification codes used by the Stormwater Monitoring Program to individual data points as necessary. The various qualification codes assigned to environmental data during the current monitoring season are presented in Table 20.

**Table 20: Program Data Qualification Codes**

<b>Qualification Code</b>	<b>Qualification Description</b>
EST-FD	Result is considered "estimated" due to field duplicate DQO exceedance.
EST-HT	Result is considered "estimated" due to holding time limit exceedance.
EST-LCSRPD	Result is considered "estimated" due to laboratory control spike, RPD DQO exceedance.
EST-LD	Result is considered "estimated" due to laboratory duplicate DQO exceedance.
EST-MSRPD	Result is considered "estimated" due to matrix spike, RPD DQO exceedance.
HB-MSR	Result is considered "high biased" due to a matrix spike recovery greater than the established upper limit for the analyte. Both matrix spike and matrix spike duplicate results can exceed the upper limit due to matrix interference and therefore result in qualification of environmental data.
LB-MSR	Result is considered "low biased" due to a matrix spike recovery less than the established lower limit for the analyte. Both matrix spike and matrix spike duplicate results can fall below the lower limit due to matrix interference and therefore result in qualification of environmental data.
UL-FB	Result is considered an "upper limit" of its true concentration due to field blank DQO exceedance (i.e., field blank contamination).
UL-FLTRB	Result is considered an "upper limit" of its true concentration due to filter blank DQO exceedance (i.e., filter blank contamination).
UL-MB	Result is considered an "upper limit" of its true concentration due to method blank DQO exceedance (i.e., method blank contamination).
EST*	Result is estimated; numeric value below the RL and above the MDL.

\*The EST qualification code is assigned by the analytical laboratory that analyzed the sample, not by the Program.

The codes listed in Table 20 appear in the “Qualifier” data field included in Appendix F that presents all environmental sample results generated by the Stormwater Monitoring Program during the 2005/06 monitoring season. It should be noted that with the exception of holding time exceedances for field

blank and field duplicate results, the Stormwater Monitoring Program does not assign qualifications to QA/QC samples. Appendix G presents all QA/QC results generated by the Stormwater Monitoring Program during the 2005/06 monitoring season.

In summary, a total of 3666 environmental samples (including 228 field duplicate results) were analyzed during the first four events in the 2005/06 monitoring season. Field duplicate analyses are considered to be surrogates of environmental analyses and are therefore included in the calculation of environmental sample totals. The Stormwater Monitoring Program's QA/QC evaluation process identified 173 environmental samples in need of qualification. An additional 56 environmental results were reported as "estimated" by the laboratory upon completion of its sample analysis. In total, there were 229 qualified environmental samples from the current monitoring season, which translates into the Stormwater Monitoring Program achieving a 93.8% success rate in meeting program data quality objectives. Additionally, five QA/QC data records were rejected from the current monitoring season's data set. All five rejected records were matrix spike results (for Bis(2-ethylhexyl)phthalate and Total Aluminum) from Event 4 that were insufficiently spiked by the laboratory due to the parameter concentration in the sample exceeding the spike concentration. As a matter of course, insufficiently spiked matrix spike samples are removed from the Stormwater Monitoring Program's QA/QC data set as they cannot be used to evaluate target analyte recovery. Overall, the four wet weather events monitored during the current season produced a high quality data set in terms of the low percentage of qualified data, as well as the low reporting levels achieved by all laboratories analyzing the Stormwater Monitoring Program's water quality samples. Table 21 through Table 27 present the success rates observed for each QA/QC evaluation performed by the Stormwater Monitoring Program during the 2005/06 monitoring season on a classification-by-classification basis.

**Table 21: QA/QC Success Rates for Anions**

<b>QA/QC Sample Type</b>	<b>Total Number</b>	<b>Number Successful</b>	<b>Success Rate</b>
Holding Time (HT)*	50	50	100%
Method Blank (MB)	13	13	100%
Field Blank (FB)	2	2	100%
Laboratory Control Spike (LCS)	9	9	100%
Laboratory Control Spike Duplicate (LCSD)	9	9	100%
Laboratory Control Spike, RPD (LSCRPD)	9	9	100%
Matrix Spike (MS)	4	4	100%
Matrix Spike Duplicate (MSD)	4	4	100%
Matrix Spike, RPD (MSRPD)	4	4	100%
Laboratory Duplicate (LD)	9	9	100%
Field Duplicate (FD)	3	3	100%

\*Holding Time is not a specific type of QA/QC sample, rather a specific QA/QA evaluation performed by the Stormwater Monitoring Program.

**Table 22: QA/QC Success Rates for Bacteriologicals**

<b>QA/QC Sample Type</b>	<b>Total Number</b>	<b>Number Successful</b>	<b>Success Rate</b>
Holding Time (HT)*	76	76	100%
Field Blank (FB)	12	12	100%
Laboratory Duplicate (LD)	8	8	100%
Field Duplicate (FD)	4	4	100%

\*Holding Time is not a specific type of QA/QC sample, rather a specific QA/QA evaluation performed by the Stormwater Monitoring Program.

**Table 23: QA/QC Success Rates for Conventionals**

<b>QA/QC Sample Type</b>	<b>Total Number</b>	<b>Number Successful</b>	<b>Success Rate</b>
Holding Time (HT)*	130	130	100%
Method Blank (MB)	28	28	100%
Field Blank (FB)	2	2	100%
Laboratory Control Spike (LSC)	8	8	100%
Laboratory Control Spike Duplicate (LCSD)	5	5	100%
Laboratory Control Spike, RPD (LCSRPD)	5	5	100%
Matrix Spike (MS)	2	2	100%
Matrix Spike Duplicate (MSD)	2	2	100%
Matrix Spike, RPD (MSRPD)	2	2	100%
Laboratory Duplicate (LD)	25	21	84%
Field Duplicate (FD)	8	6	75%

\*Holding Time is not a specific type of QA/QC sample, rather a specific QA/QA evaluation performed by the Stormwater Monitoring Program.

**Table 24: QA/QC Success Rates for Hydrocarbons**

<b>QA/QC Sample Type</b>	<b>Total Number</b>	<b>Number Successful</b>	<b>Success Rate</b>
Holding Time (HT)*	32	32	100%
Method Blank (MB)	8	8	100%
Laboratory Control Spike (LSC)	8	8	100%
Laboratory Control Spike Duplicate (LCSD)	8	8	100%
Laboratory Control Spike, RPD (LCSRPD)	8	8	100%
Laboratory Duplicate (LD)	4	2	50%
Field Duplicate (FD)	2	1	50%

\*Holding Time is not a specific type of QA/QC sample, rather a specific QA/QA evaluation performed by the Stormwater Monitoring Program.

**Table 25: QA/QC Success Rates for Nutrients**

<b>QA/QC Sample Type</b>	<b>Total Number</b>	<b>Number Successful</b>	<b>Success Rate</b>
Holding Time (HT)*	112	112	100%
Method Blank (MB)	28	28	100%
Laboratory Control Spike (LCS)	26	26	100%
Laboratory Control Spike Duplicate (LCSD)	24	24	100%
Laboratory Control Spike, RPD (LCSRPD)	24	24	100%
Matrix Spike (MS)	17	17	100%
Matrix Spike Duplicate (MSD)	17	17	100%
Matrix Spike, RPD (MS RPD)	17	16	94.1%
Laboratory Duplicate (LD)	22	20	90.9%
Field Duplicate (FD)	7	6	85.7%

\*Holding Time is not a specific type of QA/QC sample, rather a specific QA/QA evaluation performed by the Stormwater Monitoring Program.

**Table 26: QA/QC Success Rates for Metals**

<b>QA/QC Sample Type</b>	<b>Total Number</b>	<b>Number Successful</b>	<b>Success Rate</b>
Holding Time (HT)*	436	436	100%
Method Blank (MB)	88	88	100%
Field Blank (FB)	36	35	97.2%
Laboratory Control Spike (LCS)	16	16	100%
Laboratory Control Spike Duplicate (LCSD)	16	16	100%
Laboratory Control Spike, RPD (LCSRPD)	16	16	100%
Matrix Spike (MS)	61	61	100%
Matrix Spike Duplicate (MSD)	61	61	100%
Matrix Spike, RPD (MSRPD)	61	61	100%
Laboratory Duplicate (LD)	98	71	72.4%
Field Duplicate (FD)	25	24	96%

\*Holding Time is not a specific type of QA/QC sample, rather a specific QA/QA evaluation performed by the Stormwater Monitoring Program.



**Table 27: QA/QC Success Rates for Trace Organic Compounds**

<i>Method</i>	<i>QA/QC Sample Type</i>	<i>Total Number</i>	<i>Number Successful</i>	<i>Success Rate</i>
EPA 547	Holding Time (HT)*	15	15	100%
	Method Blank (MB)	6	6	100%
	Laboratory Control Spike (LCS)	6	6	100%
	Matrix Spike (MS)	1	1	100%
	Matrix Spike Duplicate (MSD)	1	1	100%
	Matrix Spike, RPD (MSRPD)	1	1	100%
	Laboratory Duplicate (LD)	3	3	100%
EPA 625m	Holding Time (HT)*	3211	3211	100%
	Method Blank (MB)	664	646	97.3%
	Surrogate Method Blank (SMB)	55	55	100%
	Field Blank (FB)	498	485	97.4%
	Surrogate Field Blank (SFB)	33	32	97%
	Matrix Spike (MS)	523	515	98.5%
	Matrix Spike Duplicate (MSD)	522	520	99.6%
	Matrix Spike, RPD (MSRPD)	522	509	97.5%
	Surrogate Matrix Spike (SMS)	44	44	100%
	Surrogate Matrix Spike Duplicate (SMSD)	44	44	100%
	Environmental Sample Surrogates (ESS)	176	176	100%
	Laboratory Duplicate (LD)	664	604	91%
	Field Duplicate (FD)	166	163	98.2%
	EPA 8151A	Holding Time (HT)*	160	160
Method Blank (MB)		40	40	100%
Surrogate Method Blank (SMB)		4	4	100%
Laboratory Control Spike (LCS)		12	12	100%
Laboratory Control Spike Duplicate (LCSD)		12	12	100%
Laboratory Control Spike, RPD (LCSRPD)		12	12	100%
Matrix Spike (MS)		9	9	100%
Matrix Spike Duplicate (MSD)		9	9	100%
Matrix Spike, RPD (MSRPD)		9	9	100%
Environmental Sample Surrogates (ESS)		16	16	100%
Laboratory Duplicate (LD)		20	20	100%
Field Duplicate (FD)		10	10	100%
EPA 8260B	Holding Time (HT)*	3	3	100%
	Method Blank (MB)	1	1	100%
	Surrogate Method Blank (SMB)	4	4	100%
	Laboratory Control Spike (LCS)	1	1	100%
	Laboratory Control Spike Duplicate (LCSD)	1	1	100%
	Laboratory Control Spike, RPD (LCSRPD)	1	1	100%
	Environmental Sample Surrogates (ESS)	12	12	100%
	Laboratory Duplicate (LD)	1	1	100%

\*Holding Time is not a specific type of QA/QC sample, rather a specific QA/QA evaluation performed by the Stormwater Monitoring Program.

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## 7. Water Quality Results

This section provides a brief description of the Stormwater Monitoring Program's NPDES Stormwater Quality Database, as well as presents the 2005/06 monitoring results from the Land Use, Receiving Water, and Mass Emission monitoring locations. All environmental sample results, as exported from the NPDES Stormwater Quality Database, are included in Appendix F. As mentioned earlier, these data include qualifiers that were assigned to them based on the outcome of the QA/QC data evaluation process described in Section 6.

### NPDES Stormwater Quality Database

The Stormwater Monitoring Program manages all of its water chemistry environmental and QA/QC data in its NPDES Stormwater Quality Database (Database). Over the past three years, VCWPD has invested approximately \$150,000 to develop and upgrade a water quality database (built using Microsoft Access XP Version 2002) to further expedite, standardize, and enhance the Stormwater Monitoring Program's data management and data analysis activities. Monitoring results for the 2005/06 monitoring year were reported by laboratories in the forms of electronic data deliverables (EDDs) and hard copy laboratory reports. This monitoring season marks the first time that water quality data were received by the Stormwater Monitoring Program as EDDs due to a recent upgrade of the Database that allows it to automatically import electronic data formatted in either Microsoft Excel worksheets or Microsoft Access data tables. As a means of facilitating the proper compilation and formatting of EDDs by laboratories, the Stormwater Monitoring Program produced the *NPDES Stormwater Water Quality Database Data Reporting Protocols* guidance document. This document was distributed to all laboratories providing electronically formatted water chemistry data to the Stormwater Monitoring Program in order to provide these laboratories with appropriate EDD formatting and data population guidance. VCWPD staff automatically imported, as well as hand entered data into the Database and checked the data for accuracy and completeness using the Stormwater Monitoring Program's new *Data Quality Evaluation Standard Operating Procedures* guidance document. The Database includes the following features employed by the Stormwater Monitoring Program to manage and evaluate its water chemistry data:

- Automatic importation and cursory evaluation of electronically formatted data
- Key data entry screens for single and multiple record data entry for data reported in hard copy form
- Data viewing/editing screens for the detailed evaluation of newly entered data
- Semi-automated QA/QC evaluation
- Data querying screens
- Automated comparison of the Stormwater Monitoring Program's data to water quality objectives (Basin Plan, Ocean Plan, California Toxics Rule).

The database has allowed the Stormwater Monitoring Program to improve its overall data management effort by providing staff with a robust data management tool for the storage, analysis, and reporting of monitoring data. On a routine basis the reference information used by the Database to carry out its various functions is reviewed to confirm that it is accurate and up-to-date. During the current monitoring season, the California Ocean Plan reference table was updated to include the addition of Enterococcus and Fecal Coliform objectives included in the revised 2005 California Ocean plan. Additionally, the Database's reference table of site-specific Basin Plan objectives was updated to include appropriate site-specific objectives for the new ME-VR2 Mass Emission site. The new station's specific location on the Ventura River features water quality objectives slightly different from those of the upstream reach where the original ME-VR site was located.

There are plans to expand the database beyond the capabilities listed above. Future upgrades to the database will eventually include (1) the ability to perform complex statistical analyses such as trend analysis, (2) the means to store the Stormwater Monitoring Program's aquatic toxicity and bioassessment data, and (3) the capability to export electronic data in specific data formats for the purpose of sharing data with other agencies. The addition of these features to the water quality database will provide

additional tools to the Stormwater Monitoring Program that will improve data management and analysis in an effort to enhance the effectiveness of the overall program.

**Monitoring Results**

Land Use, Receiving Water, and Mass Emission water quality results for the 2005/06 monitoring year were generated from the collection and analysis of composite and grab samples. Results are reported as the concentrations measured from either flow-proportional or time-paced composite samples, or from single grab samples. As mentioned earlier, only samples collected from the ME-CC and ME-VR2 stations are collected as flow-proportional composite samples; all other composites are collected as time-paced samples. In either case, the results can be interpreted as the best available estimate of the event mean concentrations (EMC) for the given storm event.

The following constituents were collected as grab samples, with all other constituents analyzed from composite samples:

- Perchlorate
- E. coli
- Enterococcus
- Fecal Coliform
- Total Coliform
- Conductivity
- pH
- Oil and Grease
- TRPH
- Ammonia-Nitrogen
- MTBE (Land Use and Receiving Water Stations)
- Aquatic Toxicity

**Receiving Water and Land Use Site Results**

Water quality results for the 2005/06 monitoring season from the Land Use and Receiving Water stations are presented in Table 28 through Table 35.

**Table 28: Anion, Conventional, Hydrocarbon, and Nutrient Results from Agricultural Land Use Site A-1**

<i>Classification</i>	<i>Constituent</i>	<i>Fraction</i>	<i>Units</i>	<i>A-1</i>
				<i>Event 1 10/17/05</i>
Anion	Bromide	n/a	mg/L	10
Anion	Chloride	n/a	mg/L	26.6
Anion	Perchlorate	n/a	µg/L	< 2
Conventional	BOD	n/a	mg/L	6.8
Conventional	Conductivity	n/a	µmhos/cm	1030
Conventional	Hardness as CaCO3	Total	mg/L	1420
Conventional	pH	n/a	pH Units	7.86
Conventional	Total Dissolved Solids	n/a	mg/L	3158
Conventional	Total Organic Carbon	n/a	mg/L	14
Conventional	Total Suspended Solids	n/a	mg/L	136
Conventional	Turbidity	n/a	NTU	113
Hydrocarbon	Oil and Grease	n/a	mg/L	< 1
Hydrocarbon	TRPH	n/a	mg/L	< 0.01
Nutrient	Ammonia as N	n/a	mg/L	0.5
Nutrient	Nitrate as N	n/a	mg/L	48.7
Nutrient	Nitrite as N	n/a	mg/L	0.36
Nutrient	Orthophosphate as P	n/a	mg/L	0.26
Nutrient	TKN	n/a	mg/L	2.1
Nutrient	Total Phosphorus	Dissolved	mg/L	0.31
Nutrient	Total Phosphorus	Total	mg/L	0.50

\*See Appendix F for a description of the data qualifier(s) associated with this sample result.  
 "<" – Constituent not detected above specified detection limit.

**Table 29: Anion, Conventional, Hydrocarbon, and Nutrient Results from Receiving Water Sites W-3 and W-4**

Classification	Constituent	Fraction	Units	W-3	W-4
				Event 1 10/17/05	Event 1 10/17/05
Anion	Bromide	n/a	mg/L	1.56	2.08
Anion	Chloride	n/a	mg/L	32.6	22.6
Anion	Perchlorate	n/a	µg/L	< 2	< 2
Conventional	BOD	n/a	mg/L	26	5.9
Conventional	Conductivity	n/a	µmhos/cm	376	1960
Conventional	Hardness as CaCO <sub>3</sub>	Total	mg/L	297	776
Conventional	pH	n/a	pH Units	7.98	7.6
Conventional	Total Dissolved Solids	n/a	mg/L	881	1624
Conventional	Total Organic Carbon	n/a	mg/L	25	13
Conventional	Total Suspended Solids	n/a	mg/L	3180	2640
Conventional	Turbidity	n/a	NTU	6111	422
Hydrocarbon	Oil and Grease	n/a	mg/L	< 1	< 1
Hydrocarbon	TRPH	n/a	mg/L	< 0.01	< 0.01
Nutrient	Ammonia as N	n/a	mg/L	0.29	1.05
Nutrient	Nitrate as N	n/a	mg/L	4.51	22.4
Nutrient	Nitrite as N	n/a	mg/L	0.24	0.25
Nutrient	Orthophosphate as P	Total	mg/L	0.51	0.25
Nutrient	TKN	n/a	mg/L	10	12
Nutrient	Total Phosphorus	Dissolved	mg/L	0.47	0.25
Nutrient	Total Phosphorus	Total	mg/L	0.58	0.38

\*See Appendix F for a description of the data qualifier(s) associated with this sample result.

"<" – Constituent not detected above specified detection limit.

**Table 30: Metals Results from Agricultural Land Use Site A-1**

<i>Constituent</i>	<i>Fraction</i>	<i>Units</i>	<i>A-1</i>
			<i>Event 1 10/17/05</i>
Aluminum	Total	µg/L	929 *
Arsenic	Total	µg/L	5.55
Cadmium	Total	µg/L	1.23 *
Chromium	Total	µg/L	5.49 *
Chromium VI	Total	µg/L	< 5
Copper	Total	µg/L	15.9 *
Lead	Total	µg/L	2.56 *
Mercury	Total	ng/L	13.4
Nickel	Total	µg/L	26.4
Selenium	Total	µg/L	15.7
Silver	Total	µg/L	< 0.1
Thallium	Total	µg/L	< 0.1
Zinc	Total	µg/L	37.6 *
Aluminum	Dissolved	µg/L	5.31 *
Arsenic	Dissolved	µg/L	5.29
Cadmium	Dissolved	µg/L	1.22
Chromium	Dissolved	µg/L	4.14
Copper	Dissolved	µg/L	13
Lead	Dissolved	µg/L	0.27
Mercury	Dissolved	ng/L	10.1
Nickel	Dissolved	µg/L	24.3
Selenium	Dissolved	µg/L	16.3
Silver	Dissolved	µg/L	< 0.1
Thallium	Dissolved	µg/L	< 0.1
Zinc	Dissolved	µg/L	21.5

\*See Appendix F for a description of the data qualifier(s) associated with this sample result.

"<" – Constituent not detected above specified detection limit.

**Table 31: Metals Results from Receiving Water Sites W-3 and W-4**

Constituent	Fraction	Units	W-3	W-4
			Event 1 10/17/05	Event 1 10/17/05
Aluminum	Total	µg/L	28600	8850
Arsenic	Total	µg/L	6.45	7.12
Cadmium	Total	µg/L	3.4	1.79
Chromium	Total	µg/L	45.6	17.4
Chromium VI	Total	µg/L	50	< 5
Copper	Total	µg/L	170	34.1
Lead	Total	µg/L	50.3	17.6
Mercury	Total	ng/L	129	43
Nickel	Total	µg/L	77.6	24.4
Selenium	Total	µg/L	8.72	11.4
Silver	Total	µg/L	< 0.1	< 0.1
Thallium	Total	µg/L	0.28 *	0.17 *
Zinc	Total	µg/L	302	115
Aluminum	Dissolved	µg/L	20	9.76
Arsenic	Dissolved	µg/L	3.09	3.71
Cadmium	Dissolved	µg/L	< 0.1	0.22
Chromium	Dissolved	µg/L	0.48 *	0.39 *
Copper	Dissolved	µg/L	21.2	4.62
Lead	Dissolved	µg/L	0.14	0.06 *
Mercury	Dissolved	ng/L	13	6.5
Nickel	Dissolved	µg/L	5.31	4.92
Selenium	Dissolved	µg/L	8.12	11.4
Silver	Dissolved	µg/L	< 0.1	< 0.1
Thallium	Dissolved	µg/L	< 0.1	< 0.1
Zinc	Dissolved	µg/L	4.49	6.53

\*See Appendix F for a description of the data qualifier(s) associated with this sample result.

"<" – Constituent not detected above specified detection limit.

**Table 32: Detected Trace Organic Results from Agricultural Land Use Site A-1**

<i>Classification</i>	<i>Method</i>	<i>Constituent</i>	<i>Units</i>	<i>A-1</i>
				<i>Event 1 10/17/05</i>
Organic	EPA 625m	1-Methylnaphthalene	µg/L	0.0022 *
Organic	EPA 625m	1-Methylphenanthrene	µg/L	< 0.001
Organic	EPA 625m	2-Methylnaphthalene	µg/L	0.0095
Organic	EPA 625m	Acenaphthene	µg/L	< 0.001
Organic	EPA 625m	Benzo(b)fluoranthene	µg/L	0.0096 *
Organic	EPA 625m	Benzo(k)fluoranthene	µg/L	0.0051
Organic	EPA 625m	Bis(2-ethylhexyl)phthalate	µg/L	0.298 *
Organic	EPA 625m	Butyl benzyl phthalate	µg/L	0.0255 *
Organic	EPA 625m	Chrysene	µg/L	0.0166
Organic	EPA 625m	Diethyl phthalate	µg/L	0.385 *
Organic	EPA 625m	Dimethyl phthalate	µg/L	0.13 *
Organic	EPA 625m	Di-n-butylphthalate	µg/L	0.0711 *
Organic	EPA 625m	Fluoranthene	µg/L	0.0188
Organic	EPA 625m	Fluorene	µg/L	< 0.001
Organic	EPA 625m	Naphthalene	µg/L	0.0123
Organic	EPA 625m	Pentachlorophenol	µg/L	0.62
Organic	EPA 625m	Phenanthrene	µg/L	0.0182
Organic	EPA 625m	Pyrene	µg/L	0.0172
Pesticide	EPA 625m	2,4'-DDD	µg/L	0.0131
Pesticide	EPA 625m	2,4'-DDE	µg/L	0.004 *
Pesticide	EPA 625m	2,4'-DDT	µg/L	0.0188 *
Pesticide	EPA 625m	4,4'-DDD	µg/L	0.049
Pesticide	EPA 625m	4,4'-DDE	µg/L	0.197
Pesticide	EPA 625m	4,4'-DDT	µg/L	0.069
Pesticide	EPA 625m	Chlorpyrifos	µg/L	0.0211 *
Pesticide	EPA 625m	Ethoprop	µg/L	< 0.01
Pesticide	EPA 547	Glyphosate	µg/L	63

\*See Appendix F for a description of the data qualifier(s) associated with this sample result.

"<" – Constituent not detected above specified detection limit.



**Table 33: Detected Trace Organic Results from Receiving Water Sites W-3 and W-4**

Classification	Method	Constituent	Units	W-3	W-4
				Event 1 10/17/05	Event 1 10/17/05
Organic	EPA 625m	1-Methylnaphthalene	µg/L	0.0141	0.0111
Organic	EPA 625m	2-Methylnaphthalene	µg/L	0.0144	0.0266
Organic	EPA 625m	Acenaphthene	µg/L	< 0.001	< 0.001
Organic	EPA 625m	Bis(2-ethylhexyl)phthalate	µg/L	0.411	1.85
Organic	EPA 625m	Butyl benzyl phthalate	µg/L	0.0267 *	0.187
Organic	EPA 625m	Diethyl phthalate	µg/L	0.227 *	0.505
Organic	EPA 625m	Dimethyl phthalate	µg/L	0.139 *	0.178 *
Organic	EPA 625m	Di-n-butylphthalate	µg/L	0.0967 *	0.124 *
Organic	EPA 625m	Di-n-octylphthalate	µg/L	< 0.005	0.142
Organic	EPA 625m	Fluoranthene	µg/L	0.0435	0.15
Organic	EPA 625m	Naphthalene	µg/L	0.0303	0.026
Organic	EPA 625m	Phenanthrene	µg/L	0.0727	0.0936
Organic	EPA 625m	Phenol	µg/L	0.837	< 0.1
Organic	EPA 625m	Pyrene	µg/L	0.0391	0.135
Pesticide	EPA 625m	2,4'-DDD	µg/L	0.0293	0.0909
Pesticide	EPA 625m	2,4'-DDT	µg/L	0.0538	< 0.001
Pesticide	EPA 625m	4,4'-DDD	µg/L	0.114	0.3
Pesticide	EPA 625m	4,4'-DDE	µg/L	0.742	1.45
Pesticide	EPA 625m	4,4'-DDT	µg/L	0.1575	< 0.001
Pesticide	EPA 625m	Chlorpyrifos	µg/L	0.415	0.219
Pesticide	EPA 547	Glyphosate	µg/L	60.7 *	19.9 *

\*See Appendix F for a description of the data qualifier(s) associated with this sample result.

"<" – Constituent not detected above specified detection limit.

**Table 34: Bacteriological Results from Agricultural Land Use Site A-1**

Constituent	Units	A-1
		Event 1 10/17/05
E. Coli	MPN/100 mL	4611
Enterococcus	MPN/100 mL	165200
Fecal Coliform	MPN/100 mL	5000
Total Coliform	MPN/100 mL	2481000

**Table 35: Bacteriological Results from Receiving Water Sites W-3 and W-4**

Constituent	Units	W-3	W-4
		Event 1 10/17/05	Event 1 10/17/05
E. Coli	MPN/100 mL	32550	3873
Enterococcus	MPN/100 mL	59100	20500
Fecal Coliform	MPN/100 mL	50000	2400
Total Coliform	MPN/100 mL	120330	1986300

**Mass Emission Site Results**

Water quality results for the 2005/06 monitoring season from the Mass Emission stations are presented in Table 36 through Table 47.

**Table 36: Anion, Conventional, Hydrocarbon, and Nutrient Results from Mass Emission Site ME-CC**

<b>Classifi- cation</b>	<b>Constituent</b>	<b>Fraction</b>	<b>Units</b>	<b>Event 1 10/17/05</b>	<b>Event 2 11/9/05</b>	<b>Event 3 2/17/06</b>	<b>Event 4 2/27/06</b>
Anion	Bromide	n/a	mg/L	0.42	0.7	0.6	0.3
Anion	Chloride	n/a	mg/L	62.8	95.1	125	41.2
Anion	Perchlorate	n/a	µg/L	< 2	< 2	< 2	< 2
Conventional	BOD	n/a	mg/L	1.4	9.2	30	1000
Conventional	Conductivity	n/a	µmhos /m	1390	900	1100	400
Conventional	Hardness as CaCO <sub>3</sub>	Total	mg/L	206	275	340	185
Conventional	pH	n/a	pH Units	7.63	7.7	7.8	7.8
Conventional	Total Dissolved Solids	n/a	mg/L	535	626	758	420
Conventional	Total Organic Carbon	n/a	mg/L	14	12	19	390
Conventional	Total Suspended Solids	n/a	mg/L	293	200	38.5	1940
Conventional	Turbidity	n/a	NTU	558	146	20.4	1930
Hydrocarbon	Oil & Grease	n/a	mg/L	1.4 *	< 1	< 1	2.1
Hydrocarbon	TRPH	n/a	mg/L	< 0.01	1.29	< 0.1 *	< 0.01
Nutrient	Ammonia as N	n/a	mg/L	0.42	0.16	0.28	0.1
Nutrient	Nitrate as N	n/a	mg/L	6.73	7.89	7.65	2.76
Nutrient	Nitrite as N	n/a	mg/L	0.209	0.12	0.46	0.3
Nutrient	Orthophosphate as P (Diss)	n/a	mg/L	0.974	1.21	1.52	0.55
Nutrient	TKN	n/a	mg/L	2.8	2.1	0.58	1.46
Nutrient	Total Phosphorus	Diss.	mg/L	1.07	1.28	1.11 *	1.98
Nutrient	Total Phosphorus	Total	mg/L	1.06	1.7	1.47	1.9

\*See Appendix F for a description of the data qualifier(s) associated with this sample result.  
 "<" - Constituent not detected above specified detection limit.

**Table 37: Anion, Conventional, Hydrocarbon, and Nutrient Results from Mass Emission Site ME-VR2**

<b>Classification</b>	<b>Constituent</b>	<b>Fraction</b>	<b>Units</b>	<b>Event 1 10/17/05</b>	<b>Event 2 11/9/05</b>	<b>Event 3 2/17/06</b>	<b>Event 4 2/27/06</b>
Anion	Bromide	n/a	mg/L	0.394	0.72	0.9	0.6
Anion	Chloride	n/a	mg/L	48.8	50.7	66.5	40.7
Anion	Perchlorate	n/a	µg/L	< 2	< 2	< 2	< 2
Conventional	BOD	n/a	mg/L	3.7	40 *	31	3.6
Conventional	Conductivity	n/a	µmhos/ m	1010	900	1300	900
Conventional	Hardness as CaCO <sub>3</sub>	Total	mg/L	383	392	514	267
Conventional	pH	n/a	pH Units	8.19	8.4	8.2	7.8
Conventional	Total Dissolved Solids	n/a	mg/L	783	862	1004	648
Conventional	Total Organic Carbon	n/a	mg/L	7.5	40	16	9.7
Conventional	Total Suspended Solids	n/a	mg/L	< 0.5	15.3	17	1030
Conventional	Turbidity	n/a	NTU	< 1	26.9 *	8.1	1340
Hydrocarbon	Oil & Grease	n/a	mg/L	< 1	< 1	< 1	1.7
Hydrocarbon	TRPH	n/a	mg/L	< 0.01	0.52 *	< 0.1 *	1.7
Nutrient	Ammonia as N	n/a	mg/L	0.03 *	0.01 *	< 0.01	0.15
Nutrient	Nitrate as N	n/a	mg/L	0.451	0.85	1.34	0.97
Nutrient	Nitrite as N	n/a	mg/L	0.144	0.04 *	2.39	0.28
Nutrient	Orthophosphate as P (Diss)	n/a	mg/L	0.182	0.296 *	< 0.0075	0.15
Nutrient	TKN	n/a	mg/L	0.7	6	0.84	1.13
Nutrient	Total Phosphorus	Diss.	mg/L	0.155	0.759	0.06	0.59
Nutrient	Total Phosphorus	Total	mg/L	0.158	0.871	0.155	0.551

\*See Appendix F for a description of the data qualifier(s) associated with this sample result.

"<" – Constituent not detected above specified detection limit.

**Table 38: Anion, Conventional, Hydrocarbon, and Nutrient Results from Mass Emission Site ME-SCR**

<b>Classification</b>	<b>Constituent</b>	<b>Fraction</b>	<b>Units</b>	<b>Event 1 10/17/05</b>	<b>Event 2 11/9/05</b>	<b>Event 3 2/17/06</b>	<b>Event 4 2/27/06</b>
Anion	Bromide	n/a	mg/L	0.383	0.67	0.4	0.3
Anion	Chloride	n/a	mg/L	23.5	41.9	48.9	25.2
Anion	Perchlorate	n/a	µg/L	< 2	< 2	< 2	< 2
Conventional	BOD	n/a	mg/L	7.6	69	56	36
Conventional	Conductivity	n/a	µmhos /m	1400	1500	1500	1000
Conventional	Hardness as CaCO <sub>3</sub>	Total	mg/L	522	544	571	547 *
Conventional	pH	n/a	pH Units	8.25	8.2	8.3	7.7
Conventional	Total Dissolved Solids	n/a	mg/L	1112	1060	1088	708
Conventional	Total Organic Carbon	n/a	mg/L	6.5	35	4.9	35 *
Conventional	Total Suspended Solids	n/a	mg/L	648	1120	410	2530 *
Conventional	Turbidity	n/a	NTU	465	401	75.9	4260 *
Hydrocarbon	Oil & Grease	n/a	mg/L	< 1	< 1	< 1	1 *
Hydrocarbon	TRPH	n/a	mg/L	< 0.01	1.04	< 0.1 *	1.7 *
Nutrient	Ammonia as N	n/a	mg/L	0.1	0.06	0.06	0.25 *
Nutrient	Nitrate as N	n/a	mg/L	1.69	1.88	2.35	1.93
Nutrient	Nitrite as N	n/a	mg/L	0.164	0.03 *	0.27	0.28
Nutrient	Orthophosphate as P (Diss)	n/a	mg/L	0.208	0.075	0.22	0.18
Nutrient	TKN	n/a	mg/L	2.1	1.8	0.11	0.08 *
Nutrient	Total Phosphorus	Diss.	mg/L	0.155	0.201	0.16	1.18
Nutrient	Total Phosphorus	Total	mg/L	0.201	0.911	0.34	1.13

\*See Appendix F for a description of the data qualifier(s) associated with this sample result.

"<" – Constituent not detected above specified detection limit.

**Table 39: Metals Results from Mass Emission Site ME-CC**

<b>Constituent</b>	<b>Fraction</b>	<b>Units</b>	<b>Event 1 10/17/05</b>	<b>Event 2 11/9/05</b>	<b>Event 3 2/17/06</b>	<b>Event 4 2/27/06</b>
Aluminum	Total	µg/L	1480	4300	5720	12200
Arsenic	Total	µg/L	4.52	5.99	4.61	6.49
Cadmium	Total	µg/L	0.88	4.58	1.56	4.32
Chromium	Total	µg/L	4.14	13.8	23.8	26.2
Chromium VI	Total	µg/L	5 *	< 5	< 5	6 *
Copper	Total	µg/L	13.6	22.3	21.9	59.1
Lead	Total	µg/L	11.7	6.62	5.7	16.1
Mercury	Total	ng/L	23.2	37.2	36.88	79.6
Nickel	Total	µg/L	13.5	27.8	28.4	56.5
Selenium	Total	µg/L	2.15	3.88	3.26	1.28
Silver	Total	µg/L	< 0.1	< 0.1	< 0.1	< 0.1
Thallium	Total	µg/L	< 0.1	< 0.1	< 0.1	< 0.1
Zinc	Total	µg/L	64.3	65.1	72	168
Aluminum	Dissolved	µg/L	34	12.3	3.53 *	737
Arsenic	Dissolved	µg/L	3.84	3.28	3.07	4.31
Cadmium	Dissolved	µg/L	0.2 *	0.45	0.53	2.47
Chromium	Dissolved	µg/L	0.55	0.52	0.75	2.93
Copper	Dissolved	µg/L	5.01	4.71	4.13	13.8
Lead	Dissolved	µg/L	0.39	0.07 *	0.11 *	2.86
Mercury	Dissolved	ng/L	9.1	8.3	2.53	3.9
Nickel	Dissolved	µg/L	5.7	5.04	4.69	12.5
Selenium	Dissolved	µg/L	2.06	2.84	3.38	1.08
Silver	Dissolved	µg/L	< 0.1	< 0.1	< 0.1	< 0.1
Thallium	Dissolved	µg/L	< 0.1	< 0.1	< 0.1	< 0.1
Zinc	Dissolved	µg/L	15.1	14.5	16.1	63

\*See Appendix F for a description of the data qualifier(s) associated with this sample result.

"<" – Constituent not detected above specified detection limit.

**Table 40: Metals Results from Mass Emission Site ME-VR2**

<b>Constituent</b>	<b>Fraction</b>	<b>Units</b>	<b>Event 1 10/17/05</b>	<b>Event 2 11/9/05</b>	<b>Event 3 2/17/06</b>	<b>Event 4 2/27/06</b>
Aluminum	Total	µg/L	22.5	151	1713	10100
Arsenic	Total	µg/L	1.34	3.65	2.24	2.35
Cadmium	Total	µg/L	< 0.1	0.58	1.09	2.38
Chromium	Total	µg/L	0.3 *	0.67	4.34	16.9
Chromium VI	Total	µg/L	< 5	< 5	< 5	53
Copper	Total	µg/L	1.85	8.25	7.82	26.8
Lead	Total	µg/L	0.12 *	0.28 *	2.77	9.77
Mercury	Total	ng/L	9.7	17.7	29.28	64.9
Nickel	Total	µg/L	3.02	5.66	10.8	43.8
Selenium	Total	µg/L	3.56	5.54	6.34	2.29
Silver	Total	µg/L	< 0.1	< 0.1	< 0.1	< 0.1
Thallium	Total	µg/L	< 0.1	< 0.1	< 0.1	< 0.1
Zinc	Total	µg/L	6.43	7.21	31.9	79.4
Aluminum	Dissolved	µg/L	1.93 *	9.32	2.06 *	769
Arsenic	Dissolved	µg/L	1.29	3.85	1.14	1.03
Cadmium	Dissolved	µg/L	0.15 *	0.62	0.94	2.25
Chromium	Dissolved	µg/L	0.21 *	0.44 *	0.54	0.76
Copper	Dissolved	µg/L	1.94	7.26	2.88	7.07
Lead	Dissolved	µg/L	< 0.05	< 0.05	< 0.05	1.56
Mercury	Dissolved	ng/L	6.5	7.93	2.45	5.9
Nickel	Dissolved	µg/L	3.17	5.5	3.42	10.3
Selenium	Dissolved	µg/L	3.63	6.53	7.46	2.87
Silver	Dissolved	µg/L	< 0.1	< 0.1	< 0.1	< 0.1
Thallium	Dissolved	µg/L	< 0.1	< 0.1	< 0.1	< 0.1
Zinc	Dissolved	µg/L	6.66	6.3	3.86	17.3

\*See Appendix F for a description of the data qualifier(s) associated with this sample result.

"<" – Constituent not detected above specified detection limit.

**Table 41: Metals Results from Mass Emission Site ME-SCR**

<b>Constituent</b>	<b>Fraction</b>	<b>Units</b>	<b>Event 1 10/17/05</b>	<b>Event 2 11/9/05</b>	<b>Event 3 2/17/06</b>	<b>Event 4 2/27/06</b>
Aluminum	Total	µg/L	8580	12060	8390	43600 *
Arsenic	Total	µg/L	5.92	7.14	5.05	10.8 *
Cadmium	Total	µg/L	2.15	3.28	1.83	14.8 *
Chromium	Total	µg/L	17.1	20.1	13.1	43.6 *
Chromium VI	Total	µg/L	< 5	< 5	< 5	41 *
Copper	Total	µg/L	21.7	38	18	149 *
Lead	Total	µg/L	7.89	11.6	6.93	35.7 *
Mercury	Total	ng/L	54.5	87.5	36.67	174
Nickel	Total	µg/L	27.7	40.2	23.5	161 *
Selenium	Total	µg/L	6.7	5.9	5.84	5.8 *
Silver	Total	µg/L	< 0.1	< 0.1	< 0.1	< 0.1
Thallium	Total	µg/L	0.25 *	0.27 *	0.2 *	0.26 *
Zinc	Total	µg/L	67.5	96.4	64.1	341 *
Aluminum	Dissolved	µg/L	9.16	8.42	2.19 *	2950 *
Arsenic	Dissolved	µg/L	1.75	1.54	1.1	4.91 *
Cadmium	Dissolved	µg/L	0.35	0.58	0.77	7.96 *
Chromium	Dissolved	µg/L	0.19 *	0.3 *	0.4 *	2.14 *
Copper	Dissolved	µg/L	2.74	2	2.11	18.1
Lead	Dissolved	µg/L	< 0.05	< 0.05	< 0.05	1.79 *
Mercury	Dissolved	ng/L	7.8	6.89	1.54	3.6
Nickel	Dissolved	µg/L	3.05	2.51	2.11	32 *
Selenium	Dissolved	µg/L	6.39	5.51	6.05	4.3 *
Silver	Dissolved	µg/L	< 0.1	< 0.1	< 0.1	< 0.1
Thallium	Dissolved	µg/L	< 0.1	< 0.1	< 0.1	< 0.1
Zinc	Dissolved	µg/L	4.39	4.95 *	2.13	63.9 *

\*See Appendix F for a description of the data qualifier(s) associated with this sample result.

"<" – Constituent not detected above specified detection limit.

**Table 42: Detected Trace Organic Results from Mass Emission Site ME-CC**

<i>Constituent</i>	<i>Event 1 10/17/05</i>	<i>Event 2 11/9/05</i>	<i>Event 3 2/17/06</i>	<i>Event 4 2/27/06</i>
<b>EPA 625m Organics ~ µg/L</b>				
1-Methylnaphthalene	0.002 *	0.0139	0.0045 *	0.0071
1-Methylphenanthrene	0.0077	< 0.001	< 0.001	0.0095
2,3,5-Trimethylnaphthalene	0.0056	< 0.001	< 0.001	< 0.001
2,6-Dimethylnaphthalene	0.0106	0.0106	0.0057 *	0.0106
2-Methylnaphthalene	0.0099	0.0396	0.0135 *	0.0117
Acenaphthylene	< 0.001	< 0.001	< 0.001	0.0025 *
Anthracene	0.0081	< 0.001	< 0.001	0.0124
Benzo(a)anthracene	0.0148	0.0154	< 0.001 *	0.0495
Benzo(a)pyrene	0.0226	0.0232	< 0.001 *	0.0665
Benzo(b)fluoranthene	0.0472 *	0.0403	< 0.001 *	0.0708
Benzo(e)pyrene	0.037	0.0477	0.0061 *	0.633
Benzo(g,h,i)perylene	0.0367	0.0299	< 0.001 *	0.0537
Benzo(k)fluoranthene	0.028	0.0198	< 0.001 *	0.0724
Biphenyl	0.0037 *	0.0053	0.0027 *	0.0083
Bis(2-chloroisopropyl)ether	< 0.05	< 0.05	< 0.05	< 0.05
Bis(2-ethylhexyl)phthalate	1.02 *	1.99	0.521 *	6.3
Butyl benzyl phthalate	0.219	0.108	0.0642 *	0.305
Chrysene	0.0607	0.0652	0.0026 *	0.0894
Dibenz(a,h)anthracene	< 0.001	< 0.001	< 0.001 *	0.0093
Dibenzothiophene	0.0317	0.014	< 0.001	0.0134
Diethyl phthalate	0.578	0.163 *	2.58	1.73
Dimethyl phthalate	0.124 *	0.145 *	0.31 *	0.125
Di-n-butylphthalate	0.122 *	0.0946 *	0.141 *	0.187
Di-n-octylphthalate	0.0495	0.0596	< 0.005	0.242
Fluoranthene	0.0601	0.0304	0.0058 *	0.101
Fluorene	0.0074	< 0.001	< 0.001	0.0051
Indeno(1,2,3-cd)pyrene	0.0337	0.0188	< 0.001 *	0.0487
Naphthalene	0.0077	0.172	0.0342	0.0385
Pentachlorophenol	0.106	< 0.05	< 0.05 *	< 0.05
Perylene	0.0081	0.0413	< 0.001 *	0.0373
Phenanthrene	0.036	0.0177	0.0064 *	0.0476
Phenol	0.753	0.597	0.118 *	< 0.1
Pyrene	0.0467	0.0332	0.0032 *	0.103
<b>EPA 547 Pesticide ~ µg/L</b>				
Glyphosate	19.1 *	< 30	< 6	< 5
<b>EPA 625m Pesticides ~ µg/L</b>				
4,4'-DDD	0.0328	< 0.001	< 0.001	0.0205
4,4'-DDE	0.136	0.069	< 0.001	0.0891
4,4'-DDT	< 0.001	< 0.001	< 0.001	0.0113
Chlordane-alpha	< 0.001	< 0.001	< 0.001	< 0.0028 *
Chlordane-gamma	< 0.001	< 0.001	< 0.001	0.0024 *
Chlorpyrifos	0.0135	0.0423	< 0.005	0.231
Diazinon	0.0588	0.0431	< 0.005	0.124
Malathion	0.237	0.26	< 0.005	< 0.005
trans-Nonachlor	< 0.001	< 0.001	< 0.001	0.0053
<b>Results from remaining EPA Methods 8151A are non-detect.</b>				

\*See Appendix F for a description of the data qualifier(s) associated with this sample result.

"<" – Constituent not detected above specified detection limit.



**Table 43: Detected Trace Organic Results from Mass Emission Site ME-VR2**

<i>Constituent</i>	<i>Event 1 10/17/05</i>	<i>Event 2 11/9/05</i>	<i>Event 3 2/17/06</i>	<i>Event 4 2/27/06</i>
<b><i>EPA 625m Organics ~ µg/L</i></b>				
1-Methylnaphthalene	0.0091	0.0087	0.0113	0.0471
1-Methylphenanthrene	< 0.001	< 0.001	< 0.001	0.0407
2,3,5-Trimethylnaphthalene	< 0.001	< 0.001	< 0.001	0.0262
2,4-Dichlorophenol	< 0.05	< 0.05	0.0528 *	< 0.05
2,6-Dimethylnaphthalene	< 0.001	< 0.001	< 0.001	0.0512
2-Methylnaphthalene	0.0237	0.0204	0.023	0.0617
Benzo(a)anthracene	< 0.001	< 0.001	< 0.001	0.008
Benzo(a)pyrene	< 0.001	< 0.001	< 0.001	0.0078
Benzo(b)fluoranthene	< 0.001	< 0.001	< 0.001	0.0159
Benzo(e)pyrene	< 0.001	< 0.001	< 0.001	0.0196
Benzo(g,h,i)perylene	< 0.001	< 0.001	< 0.001	0.0075
Benzo(k)fluoranthene	< 0.001	< 0.001	< 0.001	0.0083
Biphenyl	< 0.001	0.002 *	0.0042 *	0.0178
Bis(2-ethylhexyl)phthalate	0.868 *	3.08 *	1.67	6.48
Butyl benzyl phthalate	0.0118 *	< 0.005 *	0.0429 *	< 0.005
Chrysene	< 0.001	< 0.001	< 0.001	0.0445
Dibenzothiophene	< 0.001	< 0.001	< 0.001	0.0068
Diethyl phthalate	0.753	0.499	1.29	0.318 *
Dimethyl phthalate	0.153 *	0.135 *	0.254 *	0.0293
Di-n-butylphthalate	0.0876 *	0.0419 *	0.116 *	0.0346 *
Fluoranthene	< 0.001	0.0051 *	< 0.001	0.023
Fluorene	< 0.001	< 0.001	< 0.001	0.0071
Naphthalene	0.138	0.0983	0.122	0.0338
Perylene	< 0.001	< 0.001	< 0.001	0.0286
Phenanthrene	0.0032 *	< 0.001	< 0.001	0.0898
Phenol	11.9	6.48	13.5	< 0.1
Pyrene	0.0013 *	0.0038 *	< 0.001	0.0219
<b><i>EPA 625m Pesticides ~ µg/L</i></b>				
Malathion	0.0437	< 0.005	< 0.005	< 0.005
Results from remaining EPA Methods 547 and 8151A are non-detect.				

\*See Appendix F for a description of the data qualifier(s) associated with this sample result.

"<" – Constituent not detected above specified detection limit.

**Table 44: Detected Trace Organic Results from Mass Emission Site ME-SCR**

<b>Constituent</b>	<b>Event 1 10/17/05</b>	<b>Event 2 11/9/05</b>	<b>Event 3 2/17/06</b>	<b>Event 4 2/27/06</b>
<b>EPA 625m Organics ~ µg/L</b>				
1-Methylnaphthalene	0.004	0.0057	0.0139	0.0854 *
1-Methylphenanthrene	0.0143	0.0044 *	0.0052	0.0429 *
2,3,5-Trimethylnaphthalene	0.0078	< 0.001 *	< 0.001	0.0371 *
2,4-Dichlorophenol	< 0.05	< 0.05	0.0555 *	< 0.05
2,6-Dimethylnaphthalene	0.016	0.0063 *	0.0115	0.0868 *
2-Methylnaphthalene	0.0075	0.0073	0.0087	0.107 *
Benzo(a)anthracene	0.0063	< 0.001	< 0.001	0.0151 *
Benzo(a)pyrene	0.0075	< 0.001	< 0.001	0.0133 *
Benzo(b)fluoranthene	0.0094	< 0.001 *	< 0.001	0.0233 *
Benzo(e)pyrene	0.0143	< 0.001	< 0.001	0.0238 *
Benzo(g,h,i)perylene	0.0108	0.004 *	< 0.001	0.0151 *
Benzo(k)fluoranthene	0.0052	< 0.001	< 0.001	0.0143 *
Biphenyl	< 0.001	0.0038 *	< 0.001	0.0358 *
Bis(2-ethylhexyl)phthalate	0.865	0.747 *	2.21	4.95
Butyl benzyl phthalate	0.0204 *	0.018 *	0.0317 *	0.0426 *
Chrysene	0.0369	0.0074 *	< 0.001	0.0576 *
Dibenzothiophene	< 0.001	< 0.001	< 0.001	0.0214 *
Diethyl phthalate	0.36 *	0.105 *	0.346 *	0.182 *
Dimethyl phthalate	0.137 *	0.1 *	0.181 *	0.0185
Di-n-butylphthalate	0.0741 *	0.0509 *	0.101 *	0.0464 *
Fluoranthene	0.0113	0.0033 *	0.0047 *	0.0253 *
Fluorene	< 0.001	< 0.001	< 0.001	0.0129 *
Naphthalene	0.0189	0.0205	0.015	0.0716 *
Perylene	0.0922	0.0779*	0.0885	0.151 *
Phenanthrene	0.0168	0.0087*	0.0083	0.114 *
Phenol	0.595	0.441	0.516	< 0.1
Pyrene	0.0233	0.0044 *	0.0082	0.0376 *
<b>EPA 625m Pesticides ~ µg/L</b>				
Malathion	0.226	0.658	0.386	< 0.005
<b>Results from remaining EPA Methods 547 and 8151A are non-detect.</b>				

\*See Appendix F for a description of the data qualifier(s) associated with this sample result.

"<" – Constituent not detected above specified detection limit.

**Table 45: Bacteriological Results from Mass Emission Site ME-CC**

<b>Constituent ~ MPN/100 mL</b>	<b>Event 1 10/17/05</b>	<b>Event 2 11/9/05</b>	<b>Event 3 2/17/06</b>	<b>Event 4 2/27/06</b>
E. Coli	12033	9208	1313	10462
Enterococcus	43300	16520	2005	19200
Fecal Coliform	50000	16000	1700	30000
Total Coliform	5475000	770100	198630	344800

**Table 46: Bacteriological Results from Mass Emission Site ME-VR2**

<b>Constituent ~ MPN/100 mL</b>	<b>Event 1 10/17/05</b>	<b>Event 2 11/9/05</b>	<b>Event 3 2/17/06</b>	<b>Event 4 2/27/06</b>
E. Coli	2613	327	74	11199
Enterococcus	12980	207	111	10910
Fecal Coliform	5000	130	50	17000
Total Coliform	104620	3076	3448	241920

**Table 47: Bacteriological Results from Mass Emission Site ME-SCR**

<b>Constituent ~ MPN/100 mL</b>	<b>Event 1 10/17/05</b>	<b>Event 2 11/9/05</b>	<b>Event 3 2/17/06</b>	<b>Event 4 2/27/06</b>
E. Coli	256	1722	122	5794
Enterococcus	288	1298	453	14450
Fecal Coliform	900	9000	110	5000
Total Coliform	34480	198630	12997	686700

### **Aquatic Toxicity Results**

Samples for acute and chronic aquatic toxicity testing were collected during two wet weather events (October and November) in 2005. Results for acute and chronic toxicity tests for samples collected at the Land Use, Receiving Water, and Mass Emission monitoring stations are summarized in Table 48 and Table 49.

### **Acute Toxicity**

Acute toxicity testing was performed using *Ceriodaphnia dubia* as the test species. Results for acute toxicity are reported as the LC50, which is the concentration of sample that produces death in 50% of test organisms exposed. Since the concentration of pollutants is unknown in environmental samples, concentration is measured as a dilution percentage of the original sample, with 100% equal to the undiluted sample. An LC50 concentration, or dilution percentage, reported as less than 100% indicates that the undiluted sample caused >50% mortality to exposed test organisms and required dilution to achieve LC50. An LC50 dilution result of greater than 100% indicates that the sample would have to be more concentrated than it was at the time of sample collection to achieve the LC50. Results are also reported in units of TUa<sup>4</sup>, which the analyzing laboratory calculated using the following equation from the California Ocean Plan<sup>5</sup>:

$$TUa = \frac{\log(100-S)}{1.7}$$

where: S = percent survival in 100% sample. If S > 99, TUa shall be reported as zero.

<sup>4</sup> Historically, acute toxicity has been calculated using the following equation: TUa = 100/LC50

<sup>5</sup> California Ocean Plan. State Water Resources Control Board. 2005.

Acute toxicity (as demonstrated by a TUa >1.0) was observed at Receiving Water site W-3 for the sample collected during Event 1 (grab sample date – 10/18/05) as shown in Table 48. In accordance with permit requirements, a TIE was initiated for this sample. The toxicity testing laboratory, Aquatic Bioassay & Consulting Laboratories, Inc. (ABC), was unable to identify the toxicant(s) because the toxicity dissipated in the sample by the time the TIE was initiated.

**Table 48: Acute Toxicity Results from Land Use and Receiving Water Sites**

Station	Sample Date	Percent Survival in 100% Sample	Acute <i>Ceriodaphnia</i> Survival	
			LC50 – Dilution %	TUa
A-1	10/18/05	90	>100%	0.59
I-2	10/18/05	100	>100%	0.00
R-1	10/18/05	85	>100%	0.69
W-3	10/18/05	10	55.56%	2.00
W-4	10/18/05	80	>100%	0.77

**Chronic Toxicity**

Chronic toxicity tests were performed using the Purple Sea Urchin (*Strongylocentrotus purpuratus*) as the test species; results are summarized in Table 49.

Results are reported in several ways: the IC50 is the sample concentration, or dilution percentage, at which an inhibitory response – in this case, lack of fertilization – is observed in 50% of the exposed test organisms. The NOEC is the concentration of sample at which there exists no observable effect on test organisms. An IC50 dilution or NOEC dilution reported as greater than 100% indicates that the sample would have to be more concentrated than it was at the time of sample collection to achieve the indicated effect. Results are also reported in units of TUC, which is calculated as 100 divided by the NOEC.

**Table 49: Chronic Toxicity Results from Mass Emission Sites**

Station	Sample Date	Chronic Purple Sea Urchin Fertilization Bioassay		
		IC50 Dilution	NOEC Dilution	TUC
ME-CC	10/18/05	>100%	100%	1.00
ME-CC	11/09/05	>100%	100%	1.00
ME-SCR	10/18/05	>100%	100%	1.00
ME-SCR	11/09/05	>100%	100%	1.00
ME-VR2	10/18/05	>100%	100%	1.00
ME-VR2	11/09/05	>100%	100%	1.00

The NPDES permit specifies that a TIE must be initiated if two consecutive wet weather samples (or a single dry weather sample) exhibit toxicity; however, a numeric trigger for chronic toxicity is not specified in the permit. For the purposes of the Stormwater Monitoring Program, a numeric chronic toxicity trigger of >1.0 TUC was selected. Chronic toxicity (defined herein as a TUC >1.0) was not detected in any wet-weather samples collected at Mass Emission stations in 2005. ABC Laboratory’s toxicity testing reports from the 2005/06 monitoring season are provided in Appendix F.

Dry weather monitoring for chronic toxicity is scheduled to be conducted later in the current monitoring season, and results from those tests will be reported in the October 2006 Annual Monitoring Report.

## 8. Data Analysis and Discussion

This section summarizes the estimated mass loadings from the ME-CC and ME-VR2 Mass Emission stations and provides a comparison of the Stormwater Monitoring Program's 2005/06 data to water quality objectives. The purpose of stormwater monitoring is to characterize water quality conditions that can be used to assess water quality improvements and to help direct the efforts of the Stormwater Management Program. Mass loadings were calculated to track conditions in the watershed. Analysis of the data is needed in order to provide a comparison with water quality objectives and assist in the identification of any pollutants or sources that may be problematic in the watershed. The applicability of relevant water quality objectives is discussed in detail later in this section.

### Mass Loadings

Mass loadings were estimated for constituents detected at the ME-CC and ME-VR2 Mass Emission sites during 2005/06 monitoring season. Mass loadings could not be calculated at the ME-SCR station because total wet weather flow could not be accurately measured, as discussed in Section 3. To recap, the Santa Clara River flows through two possible routes during wet weather conditions. One route is through the river diversion gate structure where the majority of wet weather flow passes. The other route is over the diversion dam, a situation which occurs only during high flows generated by large storm events. At the moment, wet weather flow can only be measured at the diversion dam because there is no flow meter installed at the river diversion gate. There are technical challenges involved with measuring flow at the river diversion gate since floating debris and sediment can interfere with flow measurement. VCWPD is currently investigating flow meters capable of measuring flow in the diversion gate structure under these conditions.

Mass loads were calculated by using the average flow (measured in cubic feet per second, CFS) estimated over the duration of a monitoring event and the concentrations of detected constituents. Event duration is defined as the number of hours elapsed between the first aliquot distributed into the first sample bottle collected through the last aliquot distributed into the last sample bottle collected by a composite sampler. Storm events monitored during 2005/06 at the ME-CC and ME-VR2 stations lasted from less than 24 hours (Event 1 at ME-CC) to just under 88 hours (Event 3 at ME-CC). Based on the average flow rate for an event, loadings were calculated in lbs/event to allow for comparisons between sites as well as between events (see example below). These mass loading estimates are presented in Table 50 and Table 51.

### Example Mass Loading Calculation

A mass loading calculation is shown below for an Event 1 Total Copper concentration measured at ME-CC (Event Duration = 18 hours 1 minute = 18.02 hours).

#### Total Copper Concentration

13.6 µg/L or 0.0136 mg/L (Table 39)

#### Average Flow Rate for Monitoring Event

62.84 CFS (Table 5)

62.84 CFS x 7.48 gal/CF x 3.785 liters/gal = 1779 liters/sec

#### Load = Concentration x Volume

1779 liters/sec x 0.0136 mg/L = 24.19 mg/sec

24.19 mg/sec x 60 sec/min x 60 min/hr x 18.02 hr/event x 1 kg/10<sup>6</sup> mg = 1.57 kg/event

1.57 kg/event x 2.2 lb/kg = <b>3.5 lbs/event</b>
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**Table 50: ME-CC Estimated Mass Loadings**

<b>Classification</b>	<b>Constituent</b>	<b>Event 1 10/17/05 18.02 hours (lbs/event)</b>	<b>Event 2 11/9/05 33.68 hours (lbs/event)</b>	<b>Event 3 2/17/06 87.90 hours (lbs/event)</b>	<b>Event 4 2/27/06 43.47 hours (lbs/event)</b>
Anion	Bromide	107	614	712	3260
Anion	Chloride	15900	83400	148000	448000
Conventional	BOD	355	8070	35600	1.09E+07
Conventional	Hardness as CaCO <sub>3</sub> – Total	136000	549000	900000	4560000
Conventional	Total Dissolved Solids	3550	10500	22600	4240000
Conventional	Total Organic Carbon	74400	175000	45700	2.11E+07
Conventional	Total Suspended Solids	355	ND	ND	22800
Hydrocarbon	Oil and Grease	ND	1130	ND	ND
Hydrocarbon	TRPH	107	614	712	3260
Metal	Aluminum – Total	376	3770	6790	133000
Metal	Arsenic – Total	1.1	5.3	5.5	70.5
Metal	Cadmium – Total	0.22	4.0	1.9	46.9
Metal	Chromium – Total	1.1	12.1	28.3	285
Metal	Chromium VI – Total	1.3	ND	ND	65.2
Metal	Copper – Total	3.5	19.6	26	642
Metal	Lead – Total	3.0	5.8	6.8	175
Metal	Mercury – Total	0.006	0.03	0.04	0.87
Metal	Nickel – Total	3.4	24.4	33.7	614
Metal	Selenium – Total	0.55	3.4	3.9	13.9
Metal	Zinc – Total	16.3	57.1	85.5	1830
Nutrient	Ammonia as N	107	140	332	1090
Nutrient	Nitrate as N	1709	6918	9080	30000
Nutrient	Nitrite as N	53.1	105	546	3260
Nutrient	Orthophosphate as P (Diss)	247	1061	1800	5980
Nutrient	TKN	711	1841	689	15800
Nutrient	Total Phosphorus – Total	269	1491	1750	20600
Organic	1-Methylnaphthalene	5.00E-04	0.01	0.005	0.08
Organic	1-Methylphenanthrene	0.002	ND	ND	0.10
Organic	2,3,5-Trimethylnaphthalene	0.001	ND	ND	ND
Organic	2,6-Dimethylnaphthalene	0.003	0.009	0.007	0.12
Organic	2-Methylnaphthalene	0.003	0.03	0.02	0.13
Organic	Acenaphthene	ND	ND	ND	0.03
Organic	Anthracene	0.002	ND	ND	0.13
Organic	Benzo(a)anthracene	0.004	0.01	ND	0.54
Organic	Benzo(a)pyrene	0.006	0.02	ND	0.72
Organic	Benzo(b)fluoranthene	0.01	0.04	ND	0.77
Organic	Benzo(e)pyrene	0.01	0.04	0.007	6.9
Organic	Benzo(g,h,i)perylene	0.01	0.03	ND	0.58
Organic	Benzo(k)fluoranthene	0.01	0.02	ND	0.79
Organic	Biphenyl	9.00E-04	0.005	0.003	0.09

ND – Constituent not detected, and therefore no estimated mass loading was calculated.

**Table 50 (Continued): ME-CC Estimated Mass Loadings**

<b>Classifi- cation</b>	<b>Constituent</b>	<b>Event 1 10/17/05 18.02 hours (lbs/event)</b>	<b>Event 2 11/9/05 33.68 hours (lbs/event)</b>	<b>Event 3 2/17/06 87.90 hours (lbs/event)</b>	<b>Event 4 2/27/06 43.47 hours (lbs/event)</b>
Organic	Bis(2-ethylhexyl)phthalate	2.8	4.2	1.3	561
Organic	Butyl benzyl phthalate	0.14	0.49	0.02	20.1
Organic	Chrysene	0.02	0.06	0.003	0.97
Organic	Dibenz(a,h)anthracene	ND	ND	ND	0.10
Organic	Dibenzothiophene	0.01	0.01	ND	0.15
Organic	Diethyl phthalate	0.15	0.14	3.1	18.8
Organic	Dimethyl phthalate	0.03	0.13	0.37	1.4
Organic	Di-n-butylphthalate	0.03	0.08	0.17	2.0
Organic	Di-n-octylphthalate	0.01	0.05	ND	2.6
Organic	Fluoranthene	0.02	0.03	0.007	1.1
Organic	Fluorene	0.002	ND	ND	0.06
Organic	Indeno(1,2,3-cd)pyrene	0.01	0.02	ND	0.53
Organic	Naphthalene	0.002	0.15	0.04	0.42
Organic	Pentachlorophenol	0.03	ND	ND	ND
Organic	Perylene	0.002	0.04	ND	0.41
Organic	Phenanthrene	0.01	0.02	0.008	0.52
Organic	Phenol	0.19	0.52	0.14	ND
Organic	Pyrene	0.01	0.03	0.004	1.1
Pesticide	4,4'-DDD	0.01	ND	ND	0.22
Pesticide	4,4'-DDE	0.03	0.06	ND	0.97
Pesticide	4,4'-DDT	ND	ND	ND	0.12
Pesticide	Chlordane-alpha	ND	ND	ND	0.03
Pesticide	Chlordane-gamma	ND	ND	ND	0.03
Pesticide	Chlorpyrifos	0.003	0.04	ND	2.5
Pesticide	Diazinon	0.01	0.04	ND	1.3
Pesticide	Glyphosate	4.8	ND	ND	ND
Pesticide	Malathion	0.06	0.23	ND	ND
Pesticide	trans-Nonachlor	ND	ND	ND	0.06

ND – Constituent not detected, and therefore no estimated mass loading was calculated.

**Table 51: ME-VR2 Estimated Mass Loadings**

<b>Classification</b>	<b>Constituent</b>	<b>Event 1 10/17/05 58.97 hours (lbs/event)</b>	<b>Event 2 11/9/05 34.50 hours (lbs/event)</b>	<b>Event 3 2/17/06 44.20 hours (lbs/event)</b>	<b>Event 4 2/27/06 49.28 hours (lbs/event)</b>
Anion	Bromide	54.4	128	189	1750
Anion	Chloride	6737	9020	14000	119000
Conventional	BOD	510.8	7120	6520	10500
Conventional	Hardness as CaCO <sub>3</sub> – Total	108000	153000	211000	1890000
Conventional	Total Dissolved Solids	1040	7120	3360	28300
Conventional	Total Organic Carbon	ND	2720	3580	3000000
Conventional	Total Suspended Solids	ND	ND	ND	4960
Hydrocarbon	Oil and Grease	ND	92.5	ND	4960
Hydrocarbon	TRPH	54.4	128	189	1750
Metal	Aluminum – Total	3.1	26.9	360	29400
Metal	Arsenic – Total	0.18	0.65	0.47	6.9
Metal	Cadmium – Total	ND	0.1	0.23	6.9
Metal	Chromium – Total	0.04	0.12	0.91	46.3
Metal	Chromium VI – Total	ND	ND	ND	155
Metal	Copper – Total	0.26	1.5	1.6	78.1
Metal	Lead – Total	0.02	0.05	0.58	28.5
Metal	Mercury – Total	0.001	0.003	0.006	0.19
Metal	Nickel – Total	0.42	1.0	2.3	128
Metal	Selenium – Total	0.49	0.99	1.3	6.7
Metal	Zinc – Total	0.89	1.3	6.7	231
Nutrient	Ammonia as N	4.1	1.8	ND	437
Nutrient	Nitrate as N	62.3	151	282	2830
Nutrient	Nitrite as N	19.9	7.1	503	816
Nutrient	Orthophosphate as P (Diss)	25.1	52.7	ND	237
Nutrient	TKN	96.6	1070	177	3290
Organic	1-Methylnaphthalene	0.001	0.002	0.002	0.14
Organic	1-Methylphenanthrene	ND	ND	ND	0.12
Organic	2,3,5-Trimethylnaphthalene	ND	ND	ND	0.08
Organic	2,6-Dimethylnaphthalene	ND	ND	0.01	0.15
Organic	2-Methylnaphthalene	0.003	0.004	0.005	0.18
Organic	Benzo(a)anthracene	ND	ND	ND	0.02
Organic	Benzo(a)pyrene	ND	ND	ND	0.02
Organic	Benzo(b)fluoranthene	ND	ND	ND	0.05
Organic	Benzo(e)pyrene	ND	ND	ND	0.06
Organic	Benzo(g,h,i)perylene	ND	ND	ND	0.02
Organic	Benzo(k)fluoranthene	ND	ND	ND	0.02
Organic	Biphenyl	ND	4.00E-04	9.00E-04	0.05
Organic	Bis(2-ethylhexyl)phthalate	0.12	0.55	0.35	18.9
Organic	Butyl benzyl phthalate	0.002	ND	0.009	ND

ND – Constituent not detected, and therefore no estimated mass loading was calculated.



**Table 51 (Continued): ME-VR2 Estimated Mass Loadings**

Classification	Constituent	Event 1 10/17/05 58.97 hours (lbs/event)	Event 2 11/9/05 34.50 hours (lbs/event)	Event 3 2/17/06 44.20 hours (lbs/event)	Event 4 2/27/06 49.28 hours (lbs/event)
Organic	Chrysene	ND	ND	ND	0.13
Organic	Dibenzothiophene	ND	ND	ND	0.02
Organic	Diethyl phthalate	0.10	0.09	0.27	0.93
Organic	Dimethyl phthalate	0.02	0.02	0.05	0.09
Organic	Di-n-butylphthalate	0.01	0.007	0.02	0.10
Organic	Fluoranthene	ND	9.00E-04	ND	0.07
Organic	Fluorene	ND	ND	ND	0.02
Organic	Naphthalene	0.02	0.02	0.03	0.10
Organic	Perylene	ND	ND	ND	0.08
Organic	Phenanthrene	4.00E-04	ND	ND	0.26
Organic	Phenol	1.6	1.2	2.8	ND
Organic	Pyrene	2.00E-04	7.00E-04	ND	0.06
Pesticide	Malathion	0.006	ND	ND	ND

ND – Constituent not detected, and therefore no estimated mass loading was calculated.

### **Water Quality Objective Comparisons**

Pursuant to Part 2.C of the Countywide NPDES Permit the co-permittees are required to determine whether discharges from their municipal separate storm sewer system are causing or contributing to an exceedance of water quality standards. This determination is impacted by a number of factors including: duration of the storm event, averaging periods, mixing zones, representative samples, impacted beneficial uses, etc. Currently, neither USEPA nor the State has established procedures for making this type of determination. In spite of these limitations the co-permittees have conducted a preliminary assessment of receiving water and discharge monitoring data to identify potential water quality issues.

There are several steps involved in analyzing data to assess water quality improvements. The first step involves comparing analytical results from Mass Emission and Receiving Water stations to the applicable surface water quality objectives established in the Los Angeles Region 4 Basin Plan (Basin Plan) and the California Toxics Rule (CTR). Each plan includes a discussion of the applicability of their objectives based on the type of water (freshwater or saltwater) and the beneficial uses that are being protected. For the purposes of this analysis, all of the water quality objectives were evaluated.

Water quality parameter results from the Mass Emission and Receiving Water stations were compared to both surface water quality objectives (as defined in the Basin Plan and CTR) and ocean water quality objectives (as defined in the California Ocean Plan). The Stormwater Management Program believes the comparison of Mass Emission and Receiving Water data to the California Ocean Plan<sup>6</sup> is inappropriate based on the following applicability language contained in the plan:

“This plan is not applicable to discharges to enclosed bays and estuaries or inland waters, nor is it applicable to vessel wastes, or the control of dredged material.”

Correspondence between the Stormwater Management Program and the Regional Board on the applicability of the California Ocean Plan for comparison of inland stormwater discharges to ocean water quality objectives, as well as several other issues, is presented in Appendix O.

<sup>6</sup> California Ocean Plan. State Water Resources Control Board. 2005.

The VCWPD, as lead co-permittee of the Stormwater Monitoring Program, is an active executive committee member of the Southern California Coastal Water Research Program (SCCWRP). One of SCCWRP's primary goals is to develop, participate in, and coordinate programs to understand ecological systems in Southern California coastal waters and to document relationships between these systems and human activities. VCWPD provides financial support to SCCWRP, as well as participates in a variety of management and technical subcommittees. Through these associations with SCCWRP, the VCWPD supports an organization that develops and coordinates model monitoring programs (stormwater and POTW) that seek to better understand the impact of inland discharges to ocean waters.

Since the Stormwater Monitoring Program's monitoring sites are representative of larger drainage areas, the comparison of water quality data from Mass Emission and Receiving Water stations to water quality objectives will identify pollutants that may pose a problem to the overall watershed. More specifically, water quality data from the three Mass Emission sites are representative of water quality conditions in the three major watersheds (Calleguas Creek, Santa Clara River, and Ventura River) in Ventura County. The second step in analyzing data to assess water quality in Ventura County includes comparing Land Use data to these same objectives. The third step involves comparing Land Use water quality objective exceedances to Receiving Water and Mass Emission exceedances. Land Use sites are representative of drainage areas that are specific to either one of three land use types: residential, agricultural or industrial. These sites also allow the Stormwater Monitoring Program to identify the possible sources of problematic constituents based on the land use (i.e. agriculture, residential, industrial sources).

Based on the analysis, a list of potentially problematic constituents, or pollutants of concern (POCs), can be identified. The beneficial uses potentially impacted by the receiving water exceedances of these POCs can be identified and the impacts of stormwater discharges can be assessed. In summary, the water quality objective comparison is composed of the following four steps:

- Compare Mass Emission and Receiving Water data with water quality objectives
- Compare Land Use discharge data with water quality objectives
- Compare Land Use water quality objective exceedances to Receiving Water and Mass Emission exceedances
- Identify potentially problematic constituents

#### **Mass Emission and Receiving Water Analysis**

The 2005/06 monitoring data from the Mass Emission and Receiving Water stations were analyzed and compared to the water quality objectives to determine the frequency of exceedances of objectives and identify potential pollutants of concern.

The most appropriate standards for comparison to stormwater (i.e., wet weather) discharges are short-term acute freshwater objectives. Stormwater events usually occur over the span of a few hours to a day. As a result, exposure to the concentrations above the objectives only occurs for a short period of time. For this reason, longer term objectives (i.e., chronic exposure objectives) may not be as applicable for wet events. Acute criteria better reflect the short-term event exposure experienced by organisms during precipitation runoff events. Additionally, freshwater objectives are the most appropriate because the monitoring stations discharge to inland, freshwater receiving waters. As noted previously, direct comparison of inland water quality data to objectives designed to protect the ocean waters only provides insight into identifying potential water quality issues, not necessarily in accessing water quality compliance with ocean water quality standards.

For this analysis of wet weather (storm) data, the Basin Plan objectives, the acute, freshwater objectives in the California Toxics Rule (CTR), and the 2005 California Ocean Plan (Ocean Plan) daily maximum objectives were used. For some constituents, the California Toxics Rule does not contain acute objectives. In these cases, the California Toxics Rule Human Health (Organisms Only) objectives were used in the wet weather comparison. The CTR Human Health (Organisms Only) objectives were used here because these constituents have no other objectives for comparison. These objectives were used even though they are based on long-term risks to human health that cannot be directly correlated to

stormwater discharges. CTR chronic criteria were not used for wet weather analyses because acute criteria better reflect the short-term storm event exposure experienced by organisms, as compared to the long-term exposure considered by chronic criteria. With respect to the Ocean Plan, a 30-day Average objective (for protection of human health) was used when a Daily Maximum objective was not provided for a particular constituent. Objectives in the CTR for metals are calculated based on the hardness of the water. This analysis used the hardness value measured at a particular site during a particular monitoring event for calculating a certain metals objective, except when the measured hardness was greater than 400 mg/L. The CTR sets a hardness cap of 400 mg/L for calculating the objectives, so any measured hardness value above 400 mg/L was set equal to 400 mg/L for the purposes of the calculation.

The elevated mass loadings calculated for Mass Emission stations ME-CC (see Table 50) and ME-VR2 (see Table 51) during Event 4 are the result of (1) large average flows (see Table 5) calculated for this event, relative to those calculated for Events 1 – 3, and (2) the elevated concentration of most constituents (especially total suspended solids, metals, organics, and pesticides) measured in the water quality samples collected at these sites during Event 4. The elevated constituent concentrations were likely produced by a flushing of watersheds and the scouring of streambeds and adjacent riparian habitat that occurred as a result of the higher flows observed during Event 4. The net result of these flushing and scouring effects can be seen in the increased number of water quality objective exceedances observed during Event 4 at the Mass Emission sites as compared to the exceedances reported during Events 1–3 at these stations. Table 52 through Table 56 present water quality objective exceedances at Mass Emission and Receiving Water stations based on an analysis of the 2005/06 wet weather stormwater monitoring data.

**Table 52: Water Quality Objective Exceedances at Mass Emission Site ME-CC**

<b>Classification</b>	<b>Constituent (in µg/L except where noted)</b>	<b>Event 1 10/17/05 Result</b>	<b>Event 2 11/9/05 Result</b>	<b>Event 3 2/17/06 Result</b>	<b>Event 4 2/27/06 Result</b>	<b>Basin Plan Objtv</b>	<b>CTR FW Acute Objtv</b>	<b>Ocean Plan Daily Max Objtv</b>
Bacterio-logical	E. Coli (MPN/100 mL)	12033	9208	1313	10462	235		
Bacterio-logical	Enterococcus (MPN/100 mL)	43300	16520	2005	19200			104
Bacterio-logical	Fecal Coliform (MPN/100 mL)	50000	16000	1700	30000	400		400
Bacterio-logical	Total Coliform (MPN/100 mL)	5475000	770100	198630	344800			10000
Metal	Aluminum – Total	1480	4300	5720	12200	1000		
Metal	Cadmium – Total		4.58		4.32			4
Metal	Chromium – Total		13.8	23.8	26.2			8
Metal	Copper – Total	13.6	22.3	21.9	59.1			12
Metal	Lead – Total	11.7			16.1			8
Metal	Mercury – Total				0.0796		0.051^	
Metal	Nickel – Total		27.8	28.4	56.5			20
Metal	Zinc – Total				168			80
Organic	Benzo(a)-anthracene				0.0495		0.049^	
Organic	Benzo(a)-pyrene				0.0665		0.049^	
Organic	Benzo(b)-fluoranthene				0.0708		0.049^	
Organic	Benzo(k)-fluoranthene				0.0724		0.049^	
Organic	Bis(2-ethyl-hexyl)phthalate				6.3	4	5.9^	3.5
Organic	Chrysene	0.0607	0.0652		0.0894		0.049^	
Organic	PAHs	0.3419	0.2635		0.6309			0.0088
Pesticide	4,4'-DDD	0.0328			0.0205		0.00084^	
Pesticide	4,4'-DDE	0.136	0.069		0.0891		0.00059^	
Pesticide	Chlordane compounds				0.0105			0.000023
Pesticide	DDTs	0.1688	0.069		0.1209			0.00017

Blank cells denote no exceedance of a water quality objective.

“^” – CTR Human Health objective for consumption of organisms only.

**Table 53: Water Quality Objectives Exceedances at Mass Emission Site ME-VR2**

<b>Classifi- cation</b>	<b>Constituent (in µg/L except where noted)</b>	<b>Event 1 10/17/05 Result</b>	<b>Event 2 11/9/05 Result</b>	<b>Event 3 2/17/06 Result</b>	<b>Event 4 2/27/06 Result</b>	<b>Basin Plan Objtv</b>	<b>CTR FW Acute Objtv</b>	<b>Ocean Plan Daily Max Objtv</b>
Anion	Chloride (mg/L)			66.5		60		
Bacterio- logical	E. Coli (MPN/100 mL)	2613	327		11199	235		
Bacterio- logical	Enterococcus (MPN/100 mL)	12980	207	111	10910			104
Bacterio- logical	Fecal Coliform (MPN/100 mL)	5000			17000	400		400
Bacterio- logical	Total Coliform (MPN/100 mL)	104620			241920			10000
Conven- tional	Total Dissolved Solids (mg/L)			1004		1000		
Metal	Aluminum – Total			1713	10100	1000		
Metal	Chromium – Total				16.9	50		8
Metal	Copper – Total				26.8			12
Metal	Lead – Total				9.77			8
Metal	Mercury – Total				0.0649		0.051^	
Metal	Nickel – Total				43.8			20
Organic	Bis(2-ethyl- hexyl)phthalate				6.48	4	5.9^	3.5
Organic	PAHs				0.2108			0.0088

Blank cells denote no exceedance of a water quality objective.

^^ - CTR Human Health objective for consumption of organisms only.

**Table 54: Water Quality Objective Exceedances at Mass Emission Site ME-SCR**

<b>Classification</b>	<b>Constituent (in µg/L except where noted)</b>	<b>Event 1 10/17/05 Result</b>	<b>Event 2 11/9/05 Result</b>	<b>Event 3 2/17/06 Result</b>	<b>Event 4 2/27/06 Result</b>	<b>Basin Plan Objtv</b>	<b>CTR FW Acute Objtv</b>	<b>Ocean Plan Daily Max Objtv</b>
Bacteriological	E. Coli (MPN/100 mL)	256	1722		5794	235		
Bacteriological	Enterococcus (MPN/100 mL)	288	1298	453	14450			104
Bacteriological	Fecal Coliform (MPN/100 mL)	900	9000		5000	400		400
Bacteriological	Total Coliform (MPN/100 mL)	34480	198630	12997	686700			10000
Metal	Aluminum – Total	8580	12060	8390	43600	1000		
Metal	Cadmium – Total				14.8	5		4
Metal	Chromium – Total	17.1	20.1	13.1	43.6			8
Metal	Copper – Total	21.7	38	18	149			12
Metal	Lead – Total		11.6		35.7			8
Metal	Mercury – Total	0.0545	0.0875		0.174		0.051^	0.16
Metal	Nickel – Total	27.7	40.2	23.5	161	100		20
Metal	Zinc – Total		96.4		341			80
Organic	Bis(2-ethylhexyl)phthalate				4.95	4		3.5
Organic	Chrysene				0.0576		0.049^	
Organic	PAHs	0.1162	0.0245	0.0165	0.3032			0.0088

Blank cells denote no exceedance of a water quality objective.

“^” – CTR Human Health objective for consumption of organisms only.

**Table 55: Water Quality Objective Exceedances for Receiving Water Site W-3**

<b>Classification</b>	<b>Constituent (in µg/L except where noted)</b>	<b>Event 1 10/17/05 Result</b>	<b>Basin Plan Objective</b>	<b>CTR FW Acute Objective</b>	<b>Ocean Plan Daily Max Objective</b>
Bacteriological	E. Coli (MPN/100 mL)	32550	235		
Bacteriological	Enterococcus (MPN/100 mL)	59100			104
Bacteriological	Fecal Coliform (MPN/100 mL)	50000	400		400
Bacteriological	Total Coliform (MPN/100 mL)	120330			10000
Conventional	Total Dissolved Solids (mg/L)	881	500		
Metal	Aluminum – Total	28600	1000		
Metal	Chromium – Total	45.6			8
Metal	Copper - Total	170			12
Metal	Lead – Total	50.3			8
Metal	Mercury – Total	0.129		0.051^	
Metal	Nickel – Total	77.6			20
Metal	Zinc – Total	302			80
Organic	PAH compounds	0.2782			0.0088
Pesticide	4,4'-DDD	0.114		0.00084^	
Pesticide	4,4'-DDE	0.742		0.00059^	
Pesticide	Chlordane compounds	0.0178			0.000023
Pesticide	DDTs	1.1108			0.00017

Blank cells denote no exceedance of a water quality objective.

“^” – CTR Human Health objective for consumption of organisms only.

**Table 56: Water Quality Objective Exceedances for Receiving Water Site W-4**

<b>Classification</b>	<b>Constituent (in µg/L except where noted)</b>	<b>Event 1 10/17/05 Result</b>	<b>Basin Plan Objective</b>	<b>CTR FW Acute Objective</b>	<b>Ocean Plan Daily Max Objective</b>
Bacteriological	E. Coli (MPN/100 mL)	3873	235		
Bacteriological	Enterococcus (MPN/100 mL)	20500			104
Bacteriological	Fecal Coliform (MPN/100 mL)	2400	400		400
Bacteriological	Total Coliform (MPN/100 mL)	1986300			10000
Conventional	Total Dissolved Solids (mg/L)	16240	500		
Metal	Aluminum – Total	8850	1000		
Metal	Chromium – Total	17.4			8
Metal	Copper - Total	34.1			12
Metal	Lead – Total	17.6			8
Metal	Nickel – Total	24.4			20
Metal	Zinc – Total	115			80
Nutrient	Nitrate as N (mg/L)	22.4	10		
Organic	Benzo(a)pyrene	0.056		0.049^	
Organic	Benzo(b)fluoranthene	0.115		0.049^	
Organic	Benzo(k)fluoranthene	0.0713		0.049^	
Organic	Chrysene	0.162		0.049^	
Organic	Indeno(1,2,3-cd)pyrene	0.0673		0.049^	
Organic	PAH compounds	0.868			0.0088
Pesticide	4,4'-DDD	0.3		0.00084^	
Pesticide	4,4'-DDE	1.45		0.00059^	
Pesticide	Chlordane compounds	0.0573			0.000023
Pesticide	DDTs	1.8565			0.00017

Blank cells denote no exceedance of a water quality objective.

^ - CTR Human Health objective for consumption of organisms only.

### **Land Use Discharge Analysis**

In order to assess whether or not discharges from the stormwater system are contributing to the exceedances of objectives identified in the receiving waters, Land User discharge data were analyzed in the same manner as the Mass Emission and Receiving Water data.

The 2005/06 monitoring data from the Agricultural Land Use station A-1 were compared to the Basin Plan, California Toxics Rule, and California Ocean Plan objectives previously described. Although the Stormwater Monitoring Program's Land Use stations are not always located in each of the watersheds for which Receiving Water samples are collected, the sites were chosen to provide representative data to be used to describe the water quality of discharges from urban and agricultural areas in Ventura County. As a result, for this analysis, the Land Use objective exceedances are compared to the receiving water objectives exceedances in all watersheds even if they are not specifically located in that watershed. This comparison allows the Stormwater Monitoring Program to determine whether certain land use types may be contributing to the objectives exceedances in receiving waters.

Table 57 presents water quality objective exceedances at agricultural Land Use site A-1 based on an analysis of the wet weather stormwater monitoring data collected there during Event 1.

**Table 57: Water Quality Objective Exceedances at Agricultural Land Use Site A-1**

<b>Classification</b>	<b>Constituent (in µg/L except where noted)</b>	<b>Event 1 10/17/05 Result</b>	<b>Basin Plan Objective</b>	<b>CTR FW Acute Objective</b>	<b>Ocean Plan Daily Max Objective</b>
Bacteriological	E. Coli (MPN/100 mL)	4611	235		
Bacteriological	Enterococcus (MPN/100 mL)	165200			104
Bacteriological	Fecal Coliform (MPN/100 mL)	5000	400		400
Bacteriological	Total Coliform (MPN/100 mL)	2481000			10000
Conventional	Total Dissolved Solids (mg/L)	3158	500		
Metal	Copper - Total	15.9			12
Metal	Nickel - Total	26.4			20
Nutrient	Nitrate as N (mg/L)	48.7	10		
Organic	PAH compounds	0.0917			0.0088
Pesticide	4,4'-DDD	0.049		0.00084^	
Pesticide	4,4'-DDE	0.197		0.00059^	
Pesticide	DDT compounds	0.3509			0.00017

Blank cells denote no exceedance of a water quality objective.

^ - CTR Human Health objective for consumption of organisms only.

### **Potential Problematic Constituents**

A review of Table 52 through Table 57 provides the following observations with respect to potential problematic constituents measured in wet weather runoff.

#### **Bacteriological**

All Receiving Water and Mass Emission sites recorded concentrations greater than water quality objectives for E. Coli, Enterococcus, Fecal Coliform, and Total Coliform. Likewise, runoff from the A-1 agricultural Land Use site exceeded bacteriological objectives for these same four bacteria. It should be noted that the inclusion of new Enterococcus (104 MPN/100 mL) and Fecal Coliform (400 MPN/100 mL) objectives in the revised 2005 California Ocean Plan resulted in the recording of these two parameters as existing at concentrations above their respective Ocean Plan objective at all monitoring locations. Consistent with previous pollutant of concern identification efforts by the Ventura Countywide Stormwater Quality Program (presented most recently in the 2002/03 Annual Monitoring Report) bacteria pose a potential problem for water quality protection and warrant special consideration by the Program (see Pollutant of Concern Assessment below).

#### **Conventionals**

Mass Emission station ME-VR2, Receiving Water sites W-3 and W-4, and the agricultural Land Use site A-1 showed total dissolved solids concentrations during wet weather events above Basin Plan objectives. Total dissolved solids was included in the Stormwater Monitoring Program's 2002/03 Pollutant of Concern (POC) Prioritization List, but was not ultimately included in the top-ranked POC list contained in the 2002/-3 Annual Monitoring Report. The Stormwater Monitoring Program will continue to evaluate total dissolved solids at its monitoring sites as a means of augmenting its database and tracking site-specific and seasonal trends in observed Basin Plan exceedances for this water quality parameter.

#### **Metals**

All Mass Emission and Receiving Water sites monitoring during wet weather events showed concentrations of total aluminum in excess of Basin Plan water quality objectives. The one Land Use site monitoring this season, A-1, did not show any such exceedance. This is the third year that aluminum has been monitored by the Stormwater Monitoring Program, and the third time that a comparison to



Basin Plan objectives has revealed exceedances for total aluminum. It should be noted that aluminum is found as a ubiquitous natural element in sediments throughout Ventura County geology. Mass Emission stations ME-CC and ME-SCR also recorded concentrations of cadmium, chromium, copper, lead, mercury, nickel, and zinc (all total fractions) above water quality objectives. Chromium, copper, lead, mercury, and nickel (all total fractions) were observed above water quality objectives as Mass Emission site ME-VR2. Both Receiving Water sites exhibited exceedances for chromium, copper, lead, nickel, and zinc (all total fractions) above water quality standards, while the La Vista (W-3) site also posted a CTR exceedance for total mercury. Total copper and nickel concentrations measured at the agricultural Land Use site A-1 exceeded their respective Ocean Plan Daily Maximum objectives.

The Basin Plan total aluminum exceedances notwithstanding, it should be noted that most metals exceedances observed during 2005/06 wet weather events were for metals concentrations above Ocean Plan objectives, with the exception of CTR mercury exceedances, and some Basin Plan exceedances observed at Mass Emission stations during the elevated flows of Event 4 in February 2006. It is reasonable to posit that the higher flows generated by the larger February 27, 2006, rainfall event were responsible for streambed and riparian habitat scouring that produced elevated concentrations of metals in water quality samples collected from Mass Emission sites during Event 4. Consistent with the most recent POC analysis (see 2002/03 Annual Monitoring Report), the runoff contributions of copper, lead, and zinc will need to be analyzed by the Stormwater Management Program in more detail via trend analyses, source identification, and potential source control measures (see Pollutant of Concern Assessment below).

### **Nutrients**

Water quality objective exceedances were recorded for nitrate at one Receiving Water site, W-4, and the Agricultural Land Use station, A-1. Given that these Basin Plan exceedances appear to be an issue more pertinent to agriculture, the Stormwater Monitoring Program will continue to monitor for nutrients at these sites to augment the database. Consistent with the most recent POC analysis (see 2002/03 Annual Monitoring Report), the runoff contributions of nitrogen compounds will need to be analyzed by the Stormwater Management Program in more detail via trend analyses, source identification, and potential source control measures (see Pollutant of Concern Assessment below).

### **Organics**

Organic compound exceedances observed during 2005/06 wet weather events were limited to the phthalate compound, Bis(2-ethylhexyl)phthalate, and various polynuclear aromatic hydrocarbons (PAHs). All Mass Emission monitoring stations recorded exceedances of the Ocean Plan objective for Bis(2-ethylhexyl)phthalate (3.5 µg/L), and often also exceeded the Basin Plan (4 µg/L) and CTR Human Health objectives (5.9 µg/L) for this constituent. No exceedances of Bis(2-ethylhexyl)phthalate were observed at either Receiving Water site (W-3 and W-4) or the agricultural Land Use site, A-1. As mentioned in Section 6, phthalate compounds originating from plastics are present in the environment at relatively high concentrations. The use of low detection limits achieved by the analytical laboratory employed by the Stormwater Monitoring Program to analyze for trace organics has resulted in the measurement of phthalate compounds at all monitoring stations in recent years.

All monitoring sites recorded concentrations of polynuclear aromatic hydrocarbons (PAHs) above the Ocean Plan's objective for PAH compounds<sup>7</sup>. Additionally, Mass Emission stations ME-CC and ME-SCR and the Receiving Water site W-4 exhibited one or more PAH compound (see Footnote 1 for list of constituents) concentrations in excess of CTR Human Health water quality objectives. The presence of individual PAH compounds above CTR objectives at particular monitoring sites are listed as follows:

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<sup>7</sup> The California Ocean Plan requires that the concentrations of the following individual PAH constituents be summed when comparing discharge concentrations to the Ocean Plan's 0.0088 µg/L PAH objective: Acenaphthylene, Anthracene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenz(a,h)anthracene, Fluorene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene.

- Benzo(a)anthracene: ME-CC
- Benzo(a)pyrene: ME-CC, W-4
- Benzo(b)fluoranthene: ME-CC, W-4
- Benzo(k)fluoranthene: ME-CC, W-4
- Chrysene: ME-CC, ME-SCR, W-4
- Indeno(1,2,3-cd)pyrene: W-4

PAHs are found in the combustion products of wood, coal, and internal combustion engines, and are ubiquitous in the environment. Wildfires that burned in the region in recent years could also have served as a source of PAH compounds that were measured in water quality samples. With reference to both phthalates and PAHs, the CTR Human Health criteria for which these exceedances were observed were based on long-term exposure human health protection. Comparing short-term discharges with the human health criterion is only useful as a screening tool and not for assessing the impact of the stormwater discharge on the waterbody and compliance with water quality standards.

### **Pesticides**

Pesticide exceedances observed during 2005/06 wet weather events were limited to Chlordane-related compounds<sup>8</sup> and two DDT-related compounds: 4,4'-DDD and 4,4'-DDE. The Ocean Plan's Chlordane objective was exceeded at the ME-CC station during Event 4 and at the Receiving Water sites, W-3 and W-4, during Event 1. All monitoring stations except for the Mass Emission sites ME-VR 2 and ME-SCR showed an exceedance of the Ocean Plan's DDT compound<sup>9</sup> objective. The two DDT-related compounds for which CTR Human Health exceedances were recorded at all monitoring sites possessing detectable DDT concentrations were the legacy pesticides 4,4'-DDD and 4,4'-DDE. These legacy pesticides are associated with Ventura County's extensive farming history. These compounds are currently being addressed in the Calleguas Creek watershed through the implementation of the Calleguas Creek Watershed OC Pesticides and PCBs Total Maximum Daily Load (TMDL), adopted by the Los Angeles Regional Water Quality Control Board in July 2005. The Ventura Countywide co-permittees located in the Calleguas Creek watershed were actively involved in the TMDL development and are participating in its implementation. Legacy pesticides, such as DDT and Chlordane compounds, will be further monitored over the course of the TMDL's implementation phase, and if high concentration areas (i.e., "hotspots") of these pesticides are identified, special studies will be implemented to address these hotspots.

### **Pollutant of Concern Assessment**

On an annual basis it is important for the co-permittees to review the monitoring data generated by the Stormwater Monitoring Program as a means to evaluate the effectiveness of the existing Stormwater Management Program and to help direct future efforts and resources to the appropriate problematic water quality issues. During August 2005 the co-permittees conducted a limited review of the Stormwater Monitoring Program's historic data set (1993 – 2004) at Receiving Water sites W-3 and W-4 and Land Use sites I-2 and R-1 to determine whether discernable trends in the concentrations of the constituents contained in the 2003 POC list can be identified. The trend analysis used statistical summary results to identify POCs with sufficient data to ascertain potential trends in concentrations measured at Receiving Water and Land Use sites. POCs were selected for the trend analysis based on two criteria:

<sup>8</sup> The California Ocean Plan requires that the concentrations of the following individual Chlordane-related compounds be summed when comparing discharge concentrations to the Ocean Plan's 0.00023 µg/L Chlordane objective: alpha-Chlordane, alpha-Chlordene, alpha-Nonachlor, Chlordane, gamma-Chlordane, gamma-Chlordene, gamma-Nonachlor, and Oxychlordane.

<sup>9</sup> The California Ocean Plan requires that the concentrations of the following individual DDT-related compounds be summed when comparing discharge concentrations to the Ocean Plan's 0.00017 µg/L DDT objective: 2,4'-DDD, 2,4'-DDE, 2,4'-DDT, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT.

- Pollutant was sampled at least 10 times, and
- Pollutant concentration was detected at least 20% of the time

Based on these criteria, the following pollutants were selected for trend analysis:

- Nutrients: Ammonia As N, Nitrate as N, and TKN
- Metals: Copper, Lead, and Zinc
- Pesticides: 4,4'-DDE
- Bacteria: Total Coliform

Of the 48 individual trend analyses conducted, only 11 analyses resulted in the finding of a statistically significant trend in a pollutant concentration. The remaining 37 analyses did not show statistical significance at the 95% confidence level ( $p < 0.05$ ), and therefore revealed no distinguishable trend in a pollutant concentration at a particular monitoring site over the study period (1993 – 2004). POCs with a statistically significant trend at any of the four sites are summarized in Table 58. A review of the results reveals very small increases or decreases in the trends that were found statistically significant. Furthermore, the low  $R^2$  values indicate that these trends are statistically weak and therefore should be regarded cautiously. Dissolved lead and zinc at Land Use site W-3 show the most significant decreasing trend with  $R^2$  values of 0.851 and 0.792, respectively. However, the observed decrease for these two metals is minor (see slope). Additionally, the trend analysis was unable to discern a trend for 4,4'-DDE, and the organophosphorus pesticide, Chlorpyrifos, which was included in the original 2003 POC list was not amenable to a trend analysis due to insufficient detected data. The technical memorandum describing the trend analysis, review of relevant TMDLs, list of potential sources of POCs, and list of current management practices employed by the Stormwater Management Program will be provided in the October 2006 Annual Monitoring Report.

**Table 58: 2005 Pollutant of Concern Trend Analysis**

<i>SITE</i>	<i>POC</i>	<i>NO. OF OBSERVATIONS</i>	<i>% DETECTED DATA</i>	<i>R<sup>2</sup></i>	<i>SLOPE</i>	<i>TREND</i>
R1	Lead, Total	27	100	0.251	- 6.44 e-9	Decrease
I2	Ammonia as N	24	79.2	0.172	+ 3.81 e-9	<b>Increase</b>
I2	Copper, Total	26	100	0.162	+ 3.15 e-9	<b>Increase</b>
I2	Lead, Dissolved	22	72.7	0.386	- 9.28 e-9	Decrease
I2	Total Coliform	17	100	0.301	+ 6.91 e-9	<b>Increase</b>
W3	Lead, Dissolved	16	81.3	0.851	- 2.44 e-8	Decrease
W3	Zinc, Dissolved	16	93.8	0.792	- 1.28 e-8	Decrease
W4	Copper, Total	12	100	0.372	- 6.37 e-9	Decrease
W4	Lead, Dissolved	12	66.7	0.497	- 1.72 e-8	Decrease
W4	TKN	12	100	0.433	- 7.26 e-9	Decrease
W4	Zinc, Total	12	100	0.392	- 6.78 e-9	Decrease

### Conclusions

This report summarizes the first four events of the 2005/06 monitoring season in which the Stormwater Monitoring Program successfully collected and analyzed water quality samples from four wet weather storm events. The Stormwater Monitoring Program subsequently conducted a thorough QA/QC evaluation of the environmental and QA/QC results generated from its analysis of water quality samples and found the resultant data set to have achieved a 93.8% success rate in meeting program data quality objectives. Overall, the four wet weather events monitored during the current season produced a high quality data set in terms of the low percentage of qualified data, as well as the low reporting levels achieved by all laboratories analyzing the Stormwater Monitoring Program's water quality samples. Two additional dry weather monitoring events remain to be conducted in 2006 by the Stormwater

Monitoring Program. Water quality samples collected from these dry events will be analyzed and their data evaluated in the same manner as the wet weather samples described in this report. The results of the Stormwater Monitoring Program's dry weather monitoring activities will be presented in the October 2006 Annual Monitoring Report along with the present wet weather monitoring results.