Ventura Countywide Stormwater Quality Management Program

Ventura Countywide Stormwater Monitoring Program
2008/09 Water Quality Monitoring Report
July 2009




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 and providing a general interpretation of the available results from water quality monitoring conducted during the monitoring year. Consistent with this requirement the Management Program has prepared this Report to satisfy the permit requirements and 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 available water quality data for monitoring conducted during the 2008/09 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 2008/09 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 three wet weather events monitored by the Ventura Countywide Stormwater Monitoring Program (Stormwater Monitoring Program).** The three 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 fourth wet weather event and two dry weather events will be reported in the October 2009 Annual Report.

- **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. 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 the *Data Quality Evaluation Plan* and *Data Quality Evaluation Standard Operating Procedures* guidance documents.** The *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 *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 $200,000 in the past six years to develop a water quality database to further expedite, standardize, and enhance the Stormwater Monitoring Program's data management and data analysis activities. 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* was observed at Receiving Water sites W-3 (La Vista) and W-4 (Revolon Slough) for the samples collected during Event 1.** The permit requires that a TIE Baseline test be initiated for each sample with a TUa >1.0. This test was performed, but by the time the testing was initiated much of the toxicity had dissipated; therefore, no further TIE testing was undertaken.

- **No chronic toxicity of *Strongylocentrotus purpuratus* (Purple Sea Urchin) was observed at any of the Mass Emission stations.**

- **Toxaphene concentrations exceeded applicable water quality objectives at multiple locations on one or more occasions.** These exceedances mark the first time that this insecticide has ever been detected in Ventura County.

- **No samples (water chemistry or aquatic toxicity) were collected for the Ortega Street (I-2) and Swan Street (R-1) Land Use sites.** In previous years, the Stormwater Monitoring Program 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. Beginning last year (2007/08), the Stormwater Monitoring Program felt that it had obtained enough data to fulfill its regulatory obligation to collect aquatic toxicity grab samples at these sites in order to amass baseline toxicity information related to land use discharges.

- **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[1] water quality objectives were measured at the following monitoring sites:

<u>**Mass Emission Sites**</u>

ME-CC — **Bacteriological:** *E. coli*, Enterococcus, Fecal Coliform, Total Coliform
Metal: Aluminum, Chromium, Copper, Lead, Nickel, Zinc
Organic: Bis(2-ethylhexyl)phthalate, Total PAH Compounds
Pesticide: 4,4'-DDD, 4,4'-DDE, Total Chlordane Compounds, Total DDT Compounds Toxaphene

ME-VR2 — **Bacteriological:** *E. coli*, Enterococcus, Fecal Coliform, Total Coliform

ME-SCR — **Bacteriological:** *E. coli*, Enterococcus, Fecal Coliform, Total Coliform
Metal: Aluminum, Chromium, Copper, Lead, Mercury, Nickel,
Organic: Bis(2-ethylhexyl)phthalate, Total PAH Compounds
Pesticide: Toxaphene

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[1] 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." (California Ocean Plan. State Water Resources Control Board. 2005.)

Receiving Water Sites

W-3 **Bacteriological:** *E. coli*, Enterococcus, Total Coliform
Metal: Aluminum, Copper, Lead, Zinc
Organic: Total PAH Compounds
Pesticide: 4,4'-DDD, 4,4'-DDE, Total DDT Compounds, Toxaphene

W-4 **Bacteriological:** *E. coli*, Enterococcus, Fecal Coliform, Total Coliform
Conventional: Total Dissolved Solids
Metal: Aluminum, Copper
Nutrient: Nitrate as N
Organic: Total PAH Compounds
Pesticide: 4,4'-DDD, 4,4'-DDE, Total Chlordane compounds, Total DDT Compounds, Toxaphene

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.

Land Use Sites

A-1 **Bacteriological:** *E. coli*, Enterococcus, Fecal Coliform, Total Coliform
Conventional: Total Dissolved Solids
Metal: Aluminum, Copper
Nutrient: Nitrate as N
Organic: Total PAH Compounds
Pesticide: 4,4'-DDD, 4,4'-DDE, Total Chlordane Compounds, Total DDT compounds, Toxaphene

The 2008/09 Annual Monitoring Report (due October 2009) will include results the Stormwater Monitoring Program's additional one wet weather and two dry weather monitoring efforts.

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1. Background

Pursuant to NPDES Permit No. CAS004002[2], 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.

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 2008/09 monitoring season, samples from a November 2008 wet weather event were collected for water chemistry and aquatic toxicity at the agricultural (Wood

[2] This Order expired July 27, 2005. However, in the absence of a State-issued new permit, the Ventura Countywide Stormwater Quality Management Program has continued 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).

Road, A-1) monitoring site. No samples (water chemistry or aquatic toxicity) were collected at the Ortega Street (I-2) and Swan Street (R-1) Land Use sites. In previous years, the Stormwater Monitoring Program 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. At the beginning of the 2007/08 monitoring season, the Stormwater Monitoring Program concluded that it had obtained enough data to amass baseline toxicity information related to land use discharges and had fulfilled its regulatory obligation to collect aquatic toxicity grab samples at these sites.

Receiving Water (Tributaries) Monitoring

Receiving water monitoring is designed to characterize the quality of receiving waters rather than urban discharges to the receiving waters. This type of monitoring evaluates the water quality of smaller water bodies 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 2008/09 monitoring season, the Receiving Water sites La Vista (W-3) and Revolon Slough (W-4) were monitored once in November 2008, 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 enable 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). 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 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. During the 2008/09 monitoring season, water quality samples from three[3] wet weather events were collected for water chemistry at the Mass Emission sites. Also, aquatic toxicity samples were collected at each Mass Emission site during Event 1 (November 2008) and Event 2 (December 2008). As required by the permit, three additional monitoring events (one wet weather and two dry weather) were undertaken later in the current monitoring season and the results will be included in the October 2009 Annual Monitoring Report.

Bioassessment Monitoring

In the past, the Ventura County Stormwater Monitoring Program has also included 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.

[3] Data from Event 4 (wet) and Events 5 and 6 (both dry) will be included in the October 2009 Annual Monitoring Report.

For seven years, starting in 2001, Ventura River watershed bioassessment monitoring was conducted once a year in the fall to compile a baseline data set. This year, however, bioassessment was not conducted. As part of the ongoing NPDES permit negotiations, the Program agreed to participate in the regional monitoring of Southern California's Coastal Watersheds, led by the Southern California Coastal Water Research Project (SCCWRP). This new, area-wide bioassessment monitoring will take place in the spring of each year and will include a greater number of sites in multiple watersheds (Ventura River, Santa Clara River and Calleguas Creek watersheds), as well as a larger number of water quality constituents and other physical measurements of riparian corridor health.

Report Contents

This report discusses wet weather work conducted from October 2008 to early February 2009 and includes precipitation and flow information and associated water quality data from three wet weather events monitored at the Stormwater Monitoring Program's Land Use (Event 1), Receiving Water (Event 1) and Mass Emission (all events) sites. Another wet weather event was conducted in March and dry weather monitoring was conducted in April and June 2009, all at Mass Emission stations. The data from these last three events will be included in the October 2009 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.

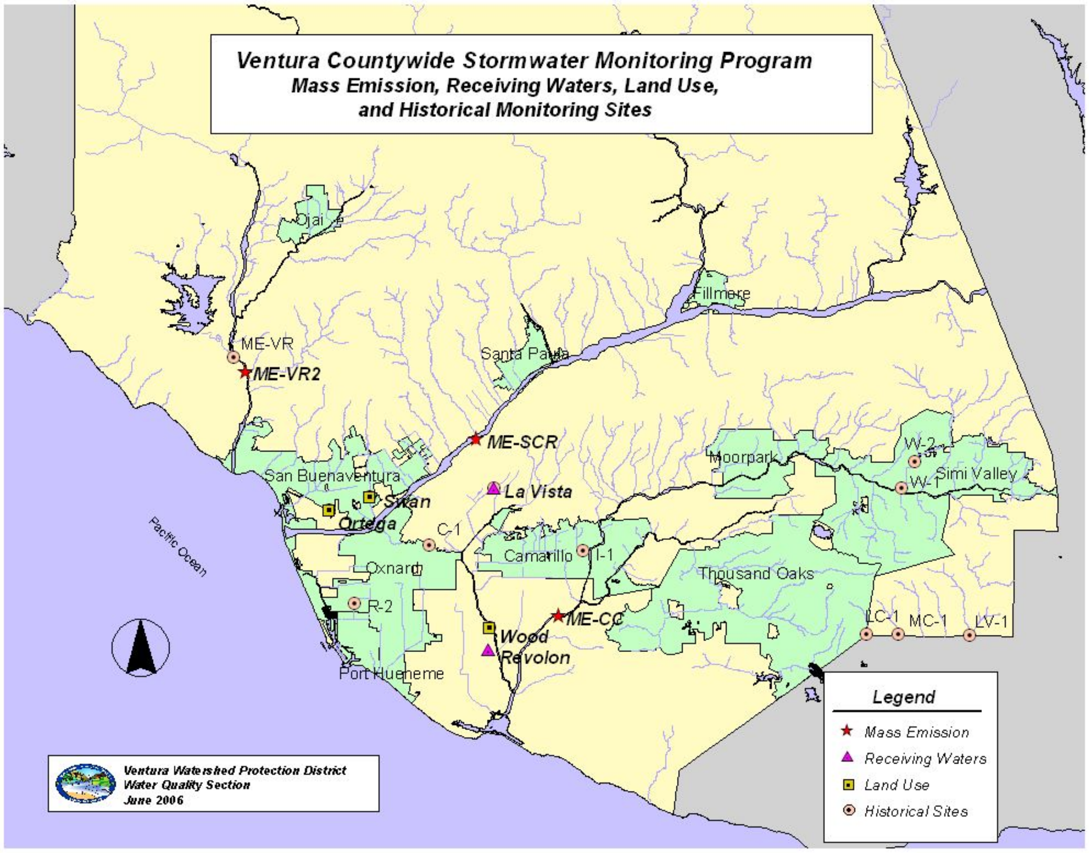

Figure 1: Ventura County Stormwater Monitoring Locations

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

ALERT No.	Standard No.	Gauge	Assoc. Monitoring Site
—	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 2008/09 monitoring season, the only Land Use site that was monitored was the Wood Road (A-1) site during one wet weather event (Event 1 – 11/26/2008). The Ortega Street (I-2) and Swan Street (R-1) sites were not monitored for reasons described in Section 1 of this report. Land Use station characteristics are summarized in Table 2.

Table 2: Land Use Site Characteristics

Station Code	Year Installed	Location	Primary Land Use	Drainage Basin Area (acres)	Rain Gauge Location
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 – 11/26/08) 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

Station Code	Year Installed	Location	Land Uses	Percent Developed	Watershed Area (acres)	Rain Gauge
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, December 2008). The site characteristics are summarized in Table 4. Both the ME-SCR and ME-CC 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

Station Code	Location	Land Uses	Watershed Area (acres)	Rain Gauge
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 3).

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.

The Mass Emission stations are also configured for remote access monitoring using 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 2: Mass Emission Site Photos: ME-CC (Calleguas Creek), ME-SCR (Santa Clara River), and ME-VR2 (Ventura River) during storm flows in December 2008 (Event 2)

Figure 3: ISCO 6712 refrigerated sampler, ISCO 4230 flowmeter, and steel enclosure at Mass Emission site ME-VR2

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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 4 through Figure 9. 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). Thus far, the 2008/09 rain year has produced less than average precipitation totals throughout Ventura County. The rainfall totals from October 2008 to February 2009 ranged from 8.10 inches at the Camarillo-Adohr gauge (Station #194) to 11.76 inches at the Ojai-Stewart gauge (Station #165). Daily precipitation during the 2008/2009 monitoring year and the corresponding monitored storm event dates are shown in Figure 4 through Figure 9. One more wet weather and two dry weather monitoring events conducted during the 2008/09 monitoring season will be discussed in the October 2009 Annual Monitoring Report. The daily precipitation data from October 2008 through February 2009 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.

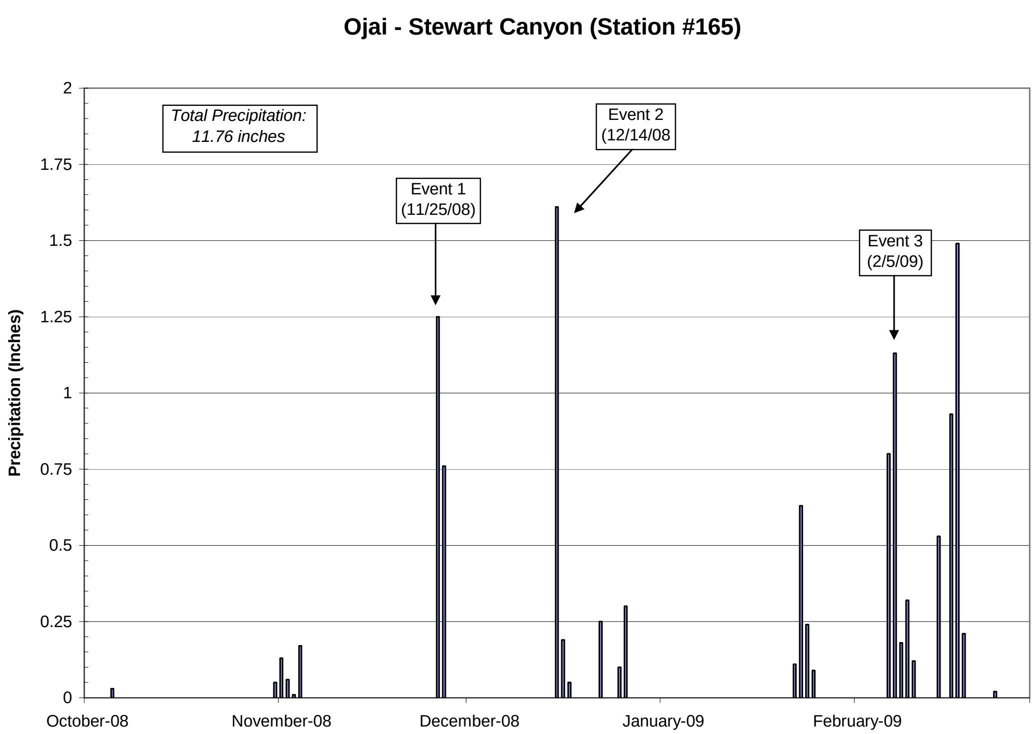

Figure 4: Ojai-Stewart Canyon Rain Gauge (ME-VR2 Monitoring Station)

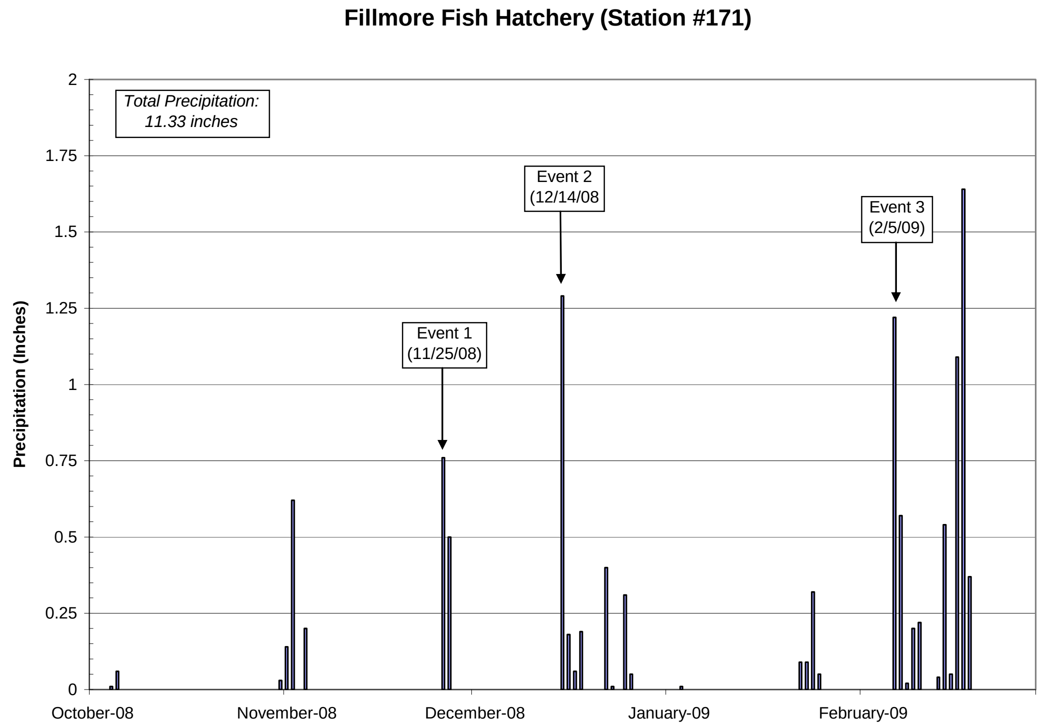

Figure 5: Fillmore Fish Hatchery Rain Gauge (ME-SCR Monitoring Station)

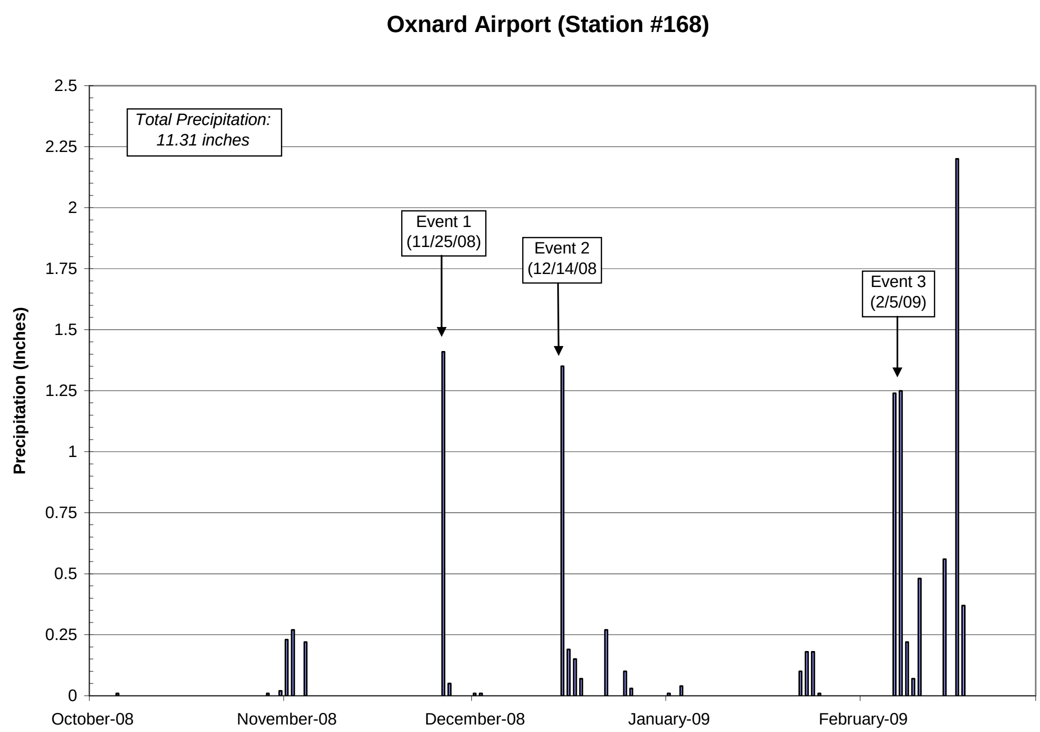

Figure 6: Oxnard Airport Rain Gauge (W-4 and A-1 Monitoring Stations)

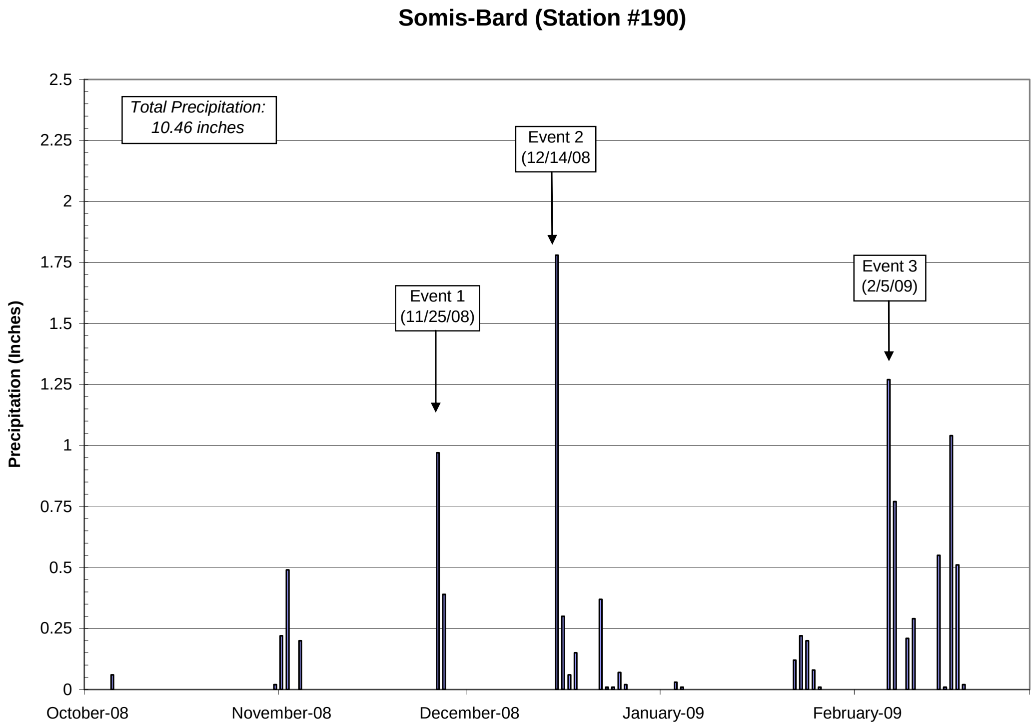

Figure 7: Somis-Bard Rain Gauge (W-3 Monitoring Station)

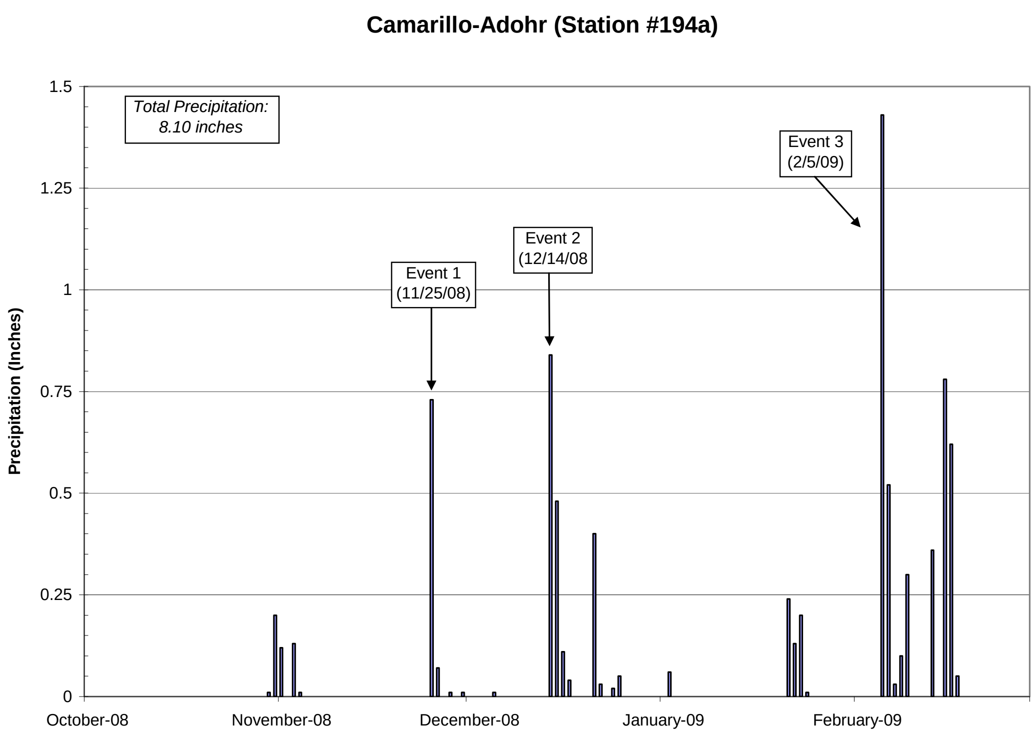

Figure 8: Camarillo-Adohr Rain Gauge (ME-CC Monitoring Station)

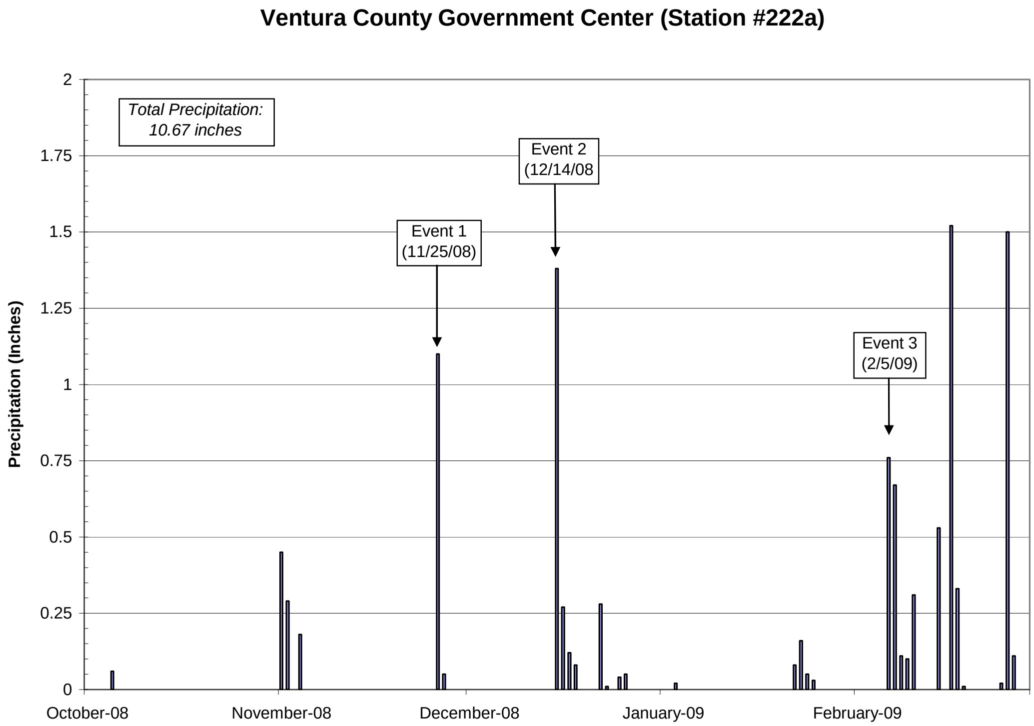

Figure 9: Ventura Co. Govt. Center Rain Gauge (R-1 and I-2 Monitoring Stations)

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 station 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 2008/09 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 over 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 10 and Figure 11). 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 11, 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 10: 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 11–13 show the river diversion gate, infiltration channel, and diversion dam at ME-SCR.

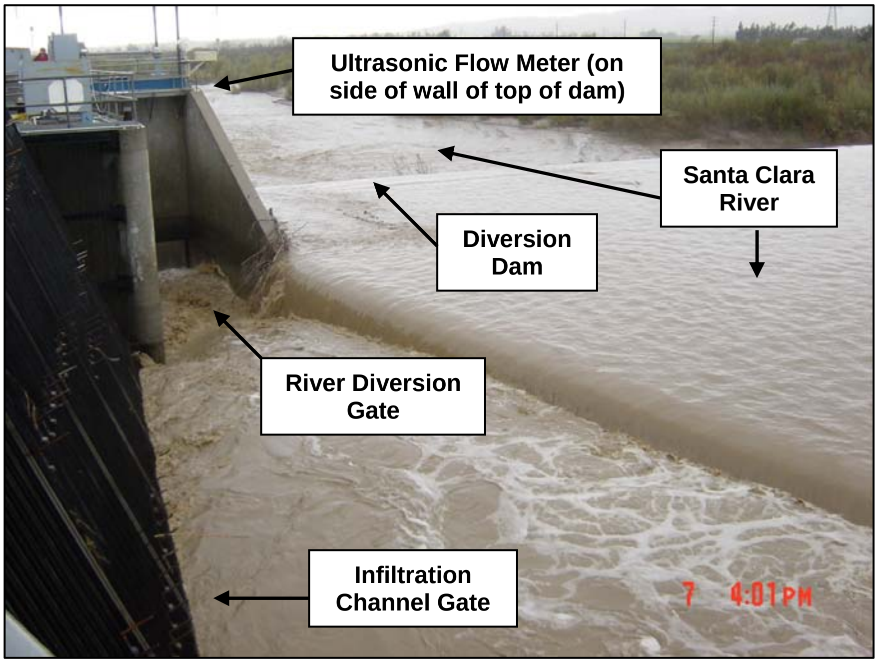

Figure 11: ME-SCR Freeman Diversion Dam (Facing Downstream)

Figure 12: River Diversion Gate (Facing Downstream)

Figure 13: 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 2008/09. 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 portion of the total wet weather flow.

Table 5: Site Flow Data and Event Durations

Site ID	Event No.	Event Date[A]	Average Flow (CFS)	Start Date, Time	End Date, Time	Event Duration
ME-CC	1	11/25/2008	214.09	11/25/2008 18:00	11/26/2008 9:54	15:54
	2	12/14/2008	691.89	12/14/2008 22:00	12/15/2008 14:58	16:58
	3	2/5/2009	702.66	2/5/2009 12:25	2/6/2009 20:48	32:23
ME-VR2	1	11/25/2008	5.83	11/25/2008 18:30	11/26/2008 11:56	17:26
	2	12/14/2008	26.76	12/14/2008 22:01	12/15/2008 15:06	17:05
	3	2/5/2009	14.05	2/5/2009 9:51	2/7/2009 9:47	47:56
ME-SCR[B]	1	11/25/2008	[C]	11/25/2008 18:00	11/26/2008 11:00	17:00
	2	12/14/2008	[C]	12/14/2008 22:01	12/16/2008 8:51	34:50
	3	2/5/2009	[C]	2/5/2009 10:40	2/7/2009 10:10	47:30
A-1	1	11/25/2008	21.83	11/25/2008 18:00	11/26/2008 8:35	14:35
W-3	1	11/25/2008	7.45	11/25/2008 18:00	11/26/2008 7:48	13:48
W-4	1	11/25/2008	[D]	11/25/2008 18:00	11/26/2008 7:48	13:48

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. Events 1, 2 and 3 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. Flow measured at the W-4 site during Event 1 (11/25/08) was considered erroneous due to approximately one foot of sediment that had built up at the stream gauge since its installation. Sediment build-up produced a back water effect that prevented 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 2008/09 monitoring season at the time of this report consisted of the capturing of the first flush storm event in Ventura County on November 25, 2008, followed by the monitoring of two mid-season storms on December 14, 2008 and February 5, 2009. 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 over 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.

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 2008/09 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 2008/09 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 14: Composite Sample Collection 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 2008/09 monitoring season are considered best available estimates of storm EMCs. Table 6 summarizes the samples collected at each of the monitoring locations during the 2008/09 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 2008/09 monitoring season are presented in Appendix D.

Table 6: 2008/09 Monitoring Event Summary

Event Number	Event Date	A-1 Wood Road	W-3 La Vista Avenue	W-4 Revolon Slough	ME-CC Calleguas Creek-CSUCI	ME-SCR Santa Clara River	ME-VR2 Ventura River-OVSDTP
1	11/25/08	CGT	CGT	CGT	CGT	CGT	CGT
2	12/14/08	-	-	-	CGT	CGT	CGT
3	02/05/09	-	-	-	CG	CG	CG

Notes:
"G" indicates that a grab sample was collected
"C" indicates that a composite sample was collected.
"T" indicates that toxicity samples were 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 2008/09 monitoring season are presented in Appendix E.

While defined before the beginning of the wet season, the appurtenant QA/QC sampling schedule is designed to change as conditions warrant. This flexibility was utilized on several occasions during this wet season for several reasons. First, as is often the case, rainfall duration and intensity were difficult to predict, especially in the early part of the season. Second, extremely dry antecedent conditions made forecasting flow conditions at the various monitoring locations complicated. While rainfall-to-runoff tables have been developed for a variety of soil moisture conditions, the ongoing drought has created an environment in which a larger-than-predicted amount of rainfall infiltrates into the ground, thereby reducing modeled flow conditions. Finally, the operation of the diversion canal at ME-SCR by United Water caused the sampler to fail to take a number of aliquots on multiple occasions. Operation of this structure during sampling events will often leave the primary intake line of the sampler out of the water, thereby causing insufficient sample volume as the sampler pulls air instead of river water. While the Program has installed multiple intake lines to deal with this situation, the time at which United Water opens the gates to the diversion structure must be known. Since United Water's operation of this structure depends on turbidity in the river, it is extremely difficult to predict when the primary intake line ceases to become useful and the sampler needs to be switched over to the secondary intake line. In situations where insufficient sample volume was obtained, QA/QC sample analysis was switched from sites with insufficient volume to one with surplus volume.

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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 2008/09 monitoring season:

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

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-821-R-02-012) and *Short-Term Methods for Measuring the Chronic Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms* (EPA-600-R95/136). 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 2008/09 monitoring year.

Table 7: Constituents and Analytical Methods for Water Quality Analyses Conducted by the Stormwater Monitoring Program 2008/09

Classification	***Constituent***	***Fraction***	***Method***	***Analytical Laboratory***
Anion Analyses	Bromide	n/a	EPA 300.0	CRG
	Chloride	n/a	EPA 300.0	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	SM 5210 B	CRG
	Conductivity	n/a	SM 2510	CRG
	Hardness as CaCO3	Total	SM 2340 B	CRG
	pH	n/a	SM 4500 H+	CRG
	Total Dissolved Solids	n/a	SM 2540 C	CRG
	Total Organic Carbon	n/a	SM 5310 B	CRG
	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 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 D	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 1631Em	CRG
	Mercury	Total	EPA 1631Em	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 2008/09

Classification	Constituent	Fraction	Method	Analytical Laboratory
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 351.1	TA
	Total Phosphorus	Dissolved	SM 4500-P E	CRG
	Total Phosphorus	Total	SM 4500-P E	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 2008/09

Classification	*Constituent*	*Fraction*	*Method*	*Analytical Laboratory*
	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
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 003	n/a	EPA 625m	CRG
	PCB 008	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 2008/09

Classification	*Constituent*	*Fraction*	*Method*	*Analytical Laboratory*
PCB Analyses	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 056 + 060	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	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 167	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 174	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 195	n/a	EPA 625m	CRG
	PCB 200	n/a	EPA 625m	CRG

Table 7 (Continued): Constituents and Analytical Methods for Water Quality Analyses Conducted by the Stormwater Monitoring Program 2008/09

Classification	Constituent	Fraction	Method	Analytical Laboratory
PCB Analyses	PCB 201	n/a	EPA 625m	CRG
	PCB 203	n/a	EPA 625m	CRG
	PCB 206	n/a	EPA 625m	CRG
	PCB 209	n/a	EPA 625m	CRG
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
	DCPA (Dacthal)	n/a	EPA 625m	CRG
	Demeton (Total)	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	WL
	Fenchlorophos (Ronnel)	n/a	EPA 625m	CRG
	Fensulfothion	n/a	EPA 625m	CRG

Table 7 (Continued): Constituents and Analytical Methods for Water Quality Analyses Conducted by the Stormwater Monitoring Program 2008/09

Classification	*Constituent*	*Fraction*	*Method*	*Analytical Laboratory*
Pesticide Analyses	Fenthion	n/a	EPA 625m	CRG
	Glyphosate	n/a	EPA 547	WL
	Heptachlor	n/a	EPA 625m	CRG
	Heptachlor epoxide	n/a	EPA 625m	CRG
	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
	Oxychlordane	n/a	EPA 625m	CRG
	Phorate	n/a	EPA 625m	CRG
	Tetrachlorovinphos (Stirofos)	n/a	EPA 625m	CRG
	Tokuthion	n/a	EPA 625m	CRG
	Toxaphene	n/a	EPA 625m	CRG
	trans-Nonachlor	n/a	EPA 625m	CRG
	Trichloronate	n/a	EPA 625m	CRG

Table 8 through Table 12 includes 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 2008/09 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. While field blank samples were collected by the Program during Event 2 (ME-CC) and Event 3 (ME-SCR), most of these samples were mistakenly not analyzed by CRG thus resulting in no field blank results for metals and trace organic compounds as originally scheduled for these two monitoring events.

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 2008/09 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

Event 1			
Monitoring Site	***A-1***	***R-1***	***I-2***
Date	***11/25/2008***	*Not Sampled*	*Not Sampled*
Composite Constituents			
Bromide	✓ (FD, LD, MS/MSD)	—	—
Chloride	✓ (FD, LD, MS/MSD)	—	—
BOD	✓ (FD)	—	—
Hardness as $CaCO_3$	✓ (FD)	—	—
Total Dissolved Solids	✓ (FD)	—	—
Total Organic Carbon	✓ (FD)	—	—
Total Suspended Solids	✓ (FD)	—	—
Turbidity	✓ (FD)	—	—
Metals, Total Recoverable	✓ (FD)	—	—
Metals, Dissolved	✓ (FD)	—	—
Chromium VI	✓ (FD)	—	—
Nitrate as N	✓ (FD)	—	—
Nitrite as N	✓ (FD)	—	—
Orthophosphate as P (Diss)	✓ (FD)	—	—
TKN[2]	✓ (FD)	—	—
Total Phosphorus, Total	✓ (FD)	—	—
Total Phosphorus, Dissolved	✓ (FD)	—	—
Organic – EPA 625m	✓ (FD, LD, MS/MSD)	—	—
PCB – EPA 625m	✓ (FD, LD, MS/MSD)	—	—
Pesticide – EPA 547[4]	✓ (FD)	—	—
Pesticide – EPA 625m	✓ (FD, LD, MS/MSD)	—	—
Pesticide – EPA 8151A[1]	✓ (FD)	—	—
Grab Constituents			
Perchlorate[1]	✓ (FD)	—	—
Bacteriological[3]	✓ (FD)	—	—
pH/Conductivity	✓ (FD)	—	—
Hydrocarbons	✓ (FD)	—	—
Mercury, Total Recoverable	✓ (FD)	—	—
Mercury, Dissolved	✓ (FD)	—	—
Ammonia as N	✓ (FD)	—	—
MTBE – EPA 8260B[1]	✓ (FD, MS/MSD)	—	—
Aquatic Toxicity Bioassay[5]	✓	—	—

Notes

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

"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, 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 TA Laboratories
3. Performed by Ventura County HCA Laboratories
4. Performed Weck Laboratories
5. Performed by Aquatic Bioassay & Consulting Labs, Inc.

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

	Event 1	*Event 1*
Monitoring Site	***W-3***	***W-4***
Date	***11/25/2008***	***11/25/2008***
Composite Constituents		
Bromide	✓	✓
Chloride	✓	✓
BOD	✓	✓[1]
Hardness as $CaCO_3$	✓	✓
Total Dissolved Solids	✓	✓
Total Organic Carbon	✓	✓
Total Suspended Solids	✓	✓
Turbidity	✓	✓
Metals, Total Recoverable	✓	✓
Metals, Dissolved	✓	✓
Chromium VI	✓	✓
Nitrate as N	✓	✓
Nitrite as N	✓	✓
Orthophosphate as P (Diss)	✓	✓
TKN[2]	✓	✓
Total Phosphorus, Total	✓	✓
Total Phosphorus, Dissolved	✓	✓
Organic – EPA 625m	✓	✓
PCB – EPA 625m	✓	✓
Pesticide – EPA 547[4]	✓	✓
Pesticide – EPA 625m	✓	✓
Pesticide – EPA 8151A[1]	✓	✓
Grab Constituents		
Perchlorate[1]	✓	✓
Bacteriological[3]	✓	✓
pH/Conductivity	✓	✓
Hydrocarbons	✓	✓
Mercury, Total Recoverable	✓	✓
Mercury, Dissolved	✓	✓
Ammonia as N	✓	✓
MTBE – EPA 8260B[1]	✓	✓
Aquatic Toxicity Bioassay[5]	✓	✓

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, 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 TA Laboratories
3. Performed by Ventura County HCA Laboratories
4. Performed Weck Laboratories
5. 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 2008/09 monitoring year at the Mass Emission monitoring sites are shown in Table 10 through Table 12.

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

Site ID:	ME-CC Calleguas Creek		
Event Date:	Event 1 11/25/2008	Event 2 12/14/2008	Event 3 02/05/2009
Composite Constituents			
Bromide	✓	✓ (LD, MS/MSD)	✓ (LD, MS/MSD)
Chloride	✓	✓ (LD, MS/MSD)	✓ (LD, MS/MSD)
BOD	✓	✓	✓
Hardness as $CaCO_3$	✓ (LD)	✓ (FB, LD)	✓ (LD)
Total Dissolved Solids	✓ (LD)	✓ (LD)	✓ (LD)
Total Organic Carbon	✓ (LD, MS/MSD)	✓	✓ (LD, MS/MSD)
Total Suspended Solids	✓ (LD)	✓ (LD)	✓ (LD)
Turbidity	✓	✓ (LD)	✓ (LD)
Metals, Total Recoverable	✓ (LD)	✓ (FB, LD)	✓ (LD)
Metals, Dissolved	✓ (LD, MS/MSD)	✓ (LD, MS/MSD)	✓ (LD, MS/MSD)
Chromium VI	✓	✓	✓ (LD, MS/MSD)
Nitrate as N	✓	✓	✓ (LD, MS/MSD)
Nitrite as N	✓	✓	✓ (LD, MS/MSD)
Orthophosphate as P (Diss)	✓	✓	✓ (LD, MS/MSD)
TKN[2]	✓ (LD)	✓ (LD)	✓ (LD)
Total Phosphorus, Total	✓	✓	✓ (LD, MS/MSD)
Total Phosphorus, Dissolved	✓ (LD, MS/MSD)	✓	✓ (LD, MS/MSD)
Organic – EPA 625m	✓	✓ (FB)	✓ (LD, MS/MSD)
PCB – EPA 625m	✓	✓ (FB)	✓ (LD, MS/MSD)
Pesticide – EPA 547[4]	✓	✓	✓ (MS/MSD)
Pesticide – EPA 625	✓	✓ (FB)	✓ (LD, MS/MSD)
Pesticide – EPA 8151A[1]	✓ (MS/MSD)	✓	✓
Grab Constituents			
Perchlorate[1]	✓ (MS/MSD)	✓	✓
Bacteriological[3]	✓	✓ (FB)	✓
pH/Conductivity	✓ (LD)	✓	✓ (LD)
Hydrocarbons	✓ (MS/MSD)	✓	✓ (MS/MSD)
Mercury, Total Recoverable	✓	✓ (FB, LD)	✓ (LD)
Mercury, Dissolved	✓	✓ (FB, LD, MS/MSD)	✓ (LD, MS/MSD)
Ammonia as N	✓ (LD, MS/MSD)	✓ (LD, MS/MSD)	✓ (LD, MS/MSD)
Aquatic Toxicity Bioassay[5]	✓	✓	—

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.

1. Performed by Calscience Environmental Laboratories, Inc.
2. Performed by TA Laboratories
3. Performed by Ventura County HCA Laboratories
4. Performed Weck Laboratories
5. Performed by Aquatic Bioassay & Consulting Labs, Inc.

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

Site ID:	***ME-VR2 Ventura River***		
Event Date:	***Event 1***	***Event 2***	***Event 3***
	11/25/2008	***12/14/2008***	***02/05/2009***
Composite Constituents			
Bromide	✓	✓ (FD)	✓
Chloride	✓	✓ (FD, LD, MS/MSD)	✓
BOD	✓	✓ (FD)	✓
Hardness as $CaCO_3$	✓	✓ (FD)	✓
Total Dissolved Solids	✓	✓ (FD)	✓
Total Organic Carbon	✓	✓ (FD, LD, MS/MSD)	✓
Total Suspended Solids	✓	✓ (FD)	✓
Turbidity	✓	✓ (FD)	✓
Metals, Total Recoverable	✓	✓ (FD)	✓
Metals, Dissolved	✓	✓ (FD)	✓
Chromium VI	✓ (LD, MS/MSD)	✓ (FD, LD, MS/MSD)	✓
Nitrate as N	✓ (LD, MS/MSD)	✓ (FD, LD, MS/MSD)	✓
Nitrite as N	✓ (LD, MS/MSD)	✓ (FD, LD, MS/MSD)	✓
Orthophosphate as P (Diss)	✓ (LD, MS/MSD)	✓ (FD, LD, MS/MSD)	✓
TKN[2]	✓ (MS/MSD)	✓ (FD, MS/MSD)	✓ (MS/MSD)
Total Phosphorus, Total	✓	✓ (FD, LD, MS/MSD)	✓
Total Phosphorus, Dissolved	✓	✓ (FD, LD, MS/MSD)	✓
Organic – EPA 625m	✓	✓ (FD, LD, MS/MSD)	✓
PCB – EPA 625m	✓	✓ (FD, LD, MS/MSD)	✓
Pesticide – EPA 547[4]	✓	✓ (MS/MSD)	✓
Pesticide – EPA 625	✓	✓ (FD, LD, MS/MSD)	✓
Pesticide – EPA 8151A[1]	✓	✓ (FD, MS/MSD)	✓
Grab Constituents			
Perchlorate[1]	✓	✓ (FD, MS/MSD)	✓
Bacteriological[3]	✓	✓ (FD)	✓
pH/Conductivity	✓	✓ (FD, LD)	✓
Hydrocarbons	✓	✓ (FD, MS)	✓ (LD)
Mercury, Total Recoverable	✓ (FB, LD, MS/MSD)	✓ (FD)	✓
Mercury, Dissolved	✓ (FB, LD)	✓ (FD)	✓
Ammonia as N	✓	✓ (FD)	✓
Aquatic Toxicity Bioassay[5]	✓	✓	—

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, 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 TA Laboratories
3. Performed by Ventura County HCA Laboratories
4. Performed Weck Laboratories
5. Performed by Aquatic Bioassay & Consulting Labs, Inc.

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

Site ID:	***ME-SCR Santa Clara River***		
Event Date:	***Event 1***	***Event 2***	***Event 3***
	11/25/2008	***12/14/2008***	***02/05/2009***
Composite Constituents			
Bromide	✓	✓	✓
Chloride	✓	✓	✓
BOD	✓	✓	✓
Hardness as $CaCO_3$	✓	✓	✓ (FB)
Total Dissolved Solids	✓	✓	✓
Total Organic Carbon	✓	✓	✓
Total Suspended Solids	✓	✓	✓
Turbidity	✓ (LD)	✓	✓
Metals, Total Recoverable	✓	✓	✓ (FB)
Metals, Dissolved	✓	✓	✓
Chromium VI	✓	✓	✓
Nitrate as N	✓	✓	✓
Nitrite as N	✓	✓	✓
Orthophosphate as P (Diss)	✓	✓	✓
TKN[2]	✓	✓	✓
Total Phosphorus, Total	✓ (LD, MS/MSD)	✓	✓
Total Phosphorus, Dissolved	✓	✓	✓
Organic – EPA 625m	✓	✓	✓ (FB)
PCB – EPA 625m	✓	✓	✓ (FB)
Pesticide – EPA 547[4]	✓	✓	✓
Pesticide – EPA 625	✓	✓	✓ (FB)
Pesticide – EPA 8151A[1]	✓	✓	✓
Grab Constituents			
Perchlorate[1]	✓	✓	✓
Bacteriological[3]	✓	✓	✓ (FB)
pH/Conductivity	✓	✓	✓
Hydrocarbons	✓	✓	✓
Mercury, Total Recoverable	✓	✓	✓ (FB)
Mercury, Dissolved	✓	✓	✓ (FB)
Ammonia as N	✓	✓	✓
Aquatic Toxicity Bioassay[5]	✓	✓	—

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.

1. Performed by Calscience Environmental Laboratories, Inc.
2. Performed by TA Laboratories
3. Performed by Ventura County HCA Laboratories
4. Performed Weck Laboratories
5. Performed by Aquatic Bioassay & Consulting Labs, Inc.

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 2008/09 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[4] 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 2008/09 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 field-initiated and lab-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. The QA/QC evaluation occurs in two separate steps as the laboratory will review those results that fall outside of its 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 an overall sample integrity evaluation, as well as specific holding time, contamination, accuracy, and precision checks. 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. 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.

Data qualification occurs when the Program assigns a particular *program qualification* to an analytical result as a means to notify downstream data users that the result was produced while one or more DQOs or QA/QC limitations were exceeded. Environmental sample results are qualified in order to provide the user of these data with

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[4] 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.

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" (used to signify 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 2008/09 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 2008/09 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 2008/09 season, and (3) a summary of the 2008/09 QA/QC sample results presented in Table 20 through Table 26 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, 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 supplies new, clean sample bottles and blank water for equipment blanks analyzed for total recoverable metals (EPA 200.8m), total hardness as $CaCO_3$ (SM 2340 B), 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 laboratories 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. In the case of 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 2008/09 monitoring season are described below, along with identified QA/QC issues associated with particular QA/QC sample types.

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. Four analytical laboratories currently employed by the Stormwater Monitoring Program took part in the intercalibration study: CRG Marine Laboratories, Calscience Environmental 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, accuracy, and precision 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 accuracy was judged via the analysis of spiked environmental samples and reference materials, while laboratory precision was based on the reproducibility of replicate sample analyses. 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 late 2009.

Currently the Stormwater Monitoring Program uses established QA/QC limits and information provided by the laboratories to evaluate QA/QC sample results. With regard to the 2008/09 monitoring season, it should be noted that all laboratories analyzing the 15 target analytes considered in the intercalibration study were able to meet or measure below the reporting levels set forth by the 2003 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%.

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

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. The blank water (deionized water) used to evaluate contamination of carboys and tubing can also be analyzed in order to check for contamination of this analytical sample medium. 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. However, pre-season analyses provide useful information regarding possible sources of environmental sample contamination and insight into how contamination issues might be resolved.

Equipment Blank Check – The Stormwater Monitoring Program reviewed the results of its tubing blank analyses performed over two months (09/11/08) prior to monitoring of the first event (11/25/08) of the 2008/09 monitoring season. The results of the pre-season tubing blank showed low-level, detected concentrations of one PAH compound (Naphthalene) and two trace metals (Aluminum and Zinc). The Stormwater Monitoring Program confirmed with CRG Marine Laboratories, Inc., that these detected tubing blank concentrations were accurately reported. Instead of performing a second round of tubing blank analyses on new or re-cleaned tubing, the Stormwater Monitoring Program chose to monitor potential sampling equipment contamination through a review of field blank and method blank results generated during the three wet weather monitoring events. Method blank analyses performed for these three constituents during Events 1 – 3 showed no signs of contamination. However, field blank results from Events 2 and 3 showed significant contamination for these three constituents likely due to either the accidental use of non-blank water when preparing field blank samples or a misidentification of field blank samples prior to analysis. Since method blank analyses performed for Events 1 – 3 revealed no laboratory contamination at CRG Labs, the three pre-season tubing blanks "hits" can be attributed to residue left behind after cleaning. With respect to Aluminum and Zinc, any post-cleaning residual traces of these metals left on sampling equipment are greatly overshadowed by the environmental concentrations of these two metals measured at the Stormwater Monitoring Program's monitoring sites. The Naphthalene concentration measured in the pre-season tubing blank is in line with concentrations measured in the Stormwater Monitoring Program's environmental samples during Events 1 – 3. 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. With respect to the Stormwater Monitoring Program's composite water quality samples, 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 24 of 472 total field duplicates analyzed in 2008/09 fell outside of QA/QC limits, for an overall success rate of 94.9%. Field duplicate results are summarized in Table 13.

Table 13: Field Duplicate Success Rates

Classification	*Total Number*	*Number Outside DQO*	*Success Rate*
Anion	6	0	100%
Bacteriological	8	0	100%
Conventional	16	2	87.5%
Hydrocarbon	4	0	100%
Metal	50	1	98.0%
Nutrient	14	1	92.9%
Organic	133	10	92.5%
PCB	122	0	100%
Pesticide	119	10	91.6%

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. Grab and composite field duplicate samples were collected at A-1 during Event 1 and at ME-VR2 during Event 2 and showed no overlap in the parameters exceeding the DQO for field duplicate samples among the two monitoring sites. 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. All affected environmental data were qualified as “estimated”.

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 and analytical method) 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 (expect Aquatic Bioassay & Consulting Labs and 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. ABC and VCHCA labs do not maintain a QA/QC limit for lab duplicate analyses performed on bacteriological samples. In this instance, the Stormwater Monitoring Program log-transforms bacteriological sample results before calculating RPD values and comparing these to a QA/QC limit of 30%. Only 28 of 665 total lab duplicates analyzed during the current monitoring season fell outside of QA/QC limits, for an overall success rate of 95.8%. Lab duplicate results are summarized in Table 14.

Table 14: Laboratory Duplicate Success Rates

Classification	*Total Number*	*Number Outside DQO*	*Success Rate*
Anion	7	0	100%
Conventional	22	0	100%
Hydrocarbon	1	0	100%
Metal	86	3	96.5%
Nutrient	21	1	95.2%
Organic	198	13	93.4%
PCB	183	0	100%
Pesticide	147	11	92.5%

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 or splitting 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. 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 Receiving Water station water quality results presented in Table 28 and Mass Emission station water quality results presented in Table 35 through Table 37. Figure 15 shows a typical, turbid, wet weather sample collected at Mass Emission site ME-CC during February 2009. All affected environmental data were qualified as “estimated”.

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 sample. 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 stated in the previous section, field blank samples collected during Events 2 and 3 for metals and trace organic compounds mistakenly were not analyzed by CRG. However, field blanks for bacteriological analyses were analyzed for these two events. As shown in Table 15, all field blank samples analyzed for the first three monitoring events of the current season posted 100% success rates.

Figure 15: Wet weather composite sample collected at Mass Emission Station ME-SCR during February 2009 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 µg/L that is associated with an environmental sample with a measured concentration of 8.0 µg/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.

Table 15: Field Blank Success Rates

Event ID	Classification	Method	Total Number	Number Detected	Qualified Environ. Samples	Success Rate
2008/09-1	Metal	EPA 1631E	2	0	0	100%
2008/09-2	Bacteriological	Enterolert	1	0	0	100%
	Bacteriological	MMO-MUG	2	0	0	100%
	Bacteriological	SM 9221E	1	0	0	100%
2008/09-3	Bacteriological	Enterolert	1	0	0	100%
	Bacteriological	MMO-MUG	2	0	0	100%
	Bacteriological	SM 9221E	1	0	0	100%

Due to the 100% success rate of all field blank analyses for Events 1 through 3, no environmental results required qualification as "upper limit" due to field blank contamination.

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 that 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. All method blank samples analyzed for the first three monitoring events of the current season posted 100% success rates. A summary of all method blanks analyzed during the 2008/09 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 is 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.

Due to the 100% success rate of all method blank samples analyzed for Events 1 through 3, no environmental results required qualification 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 spiked analyte 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 16 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.

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 0% (Events 1 and 2, EPA 8151A pesticides) to 100% for most matrix spike recovery analyses performed. A summary of success rates for matrix spike recovery samples analyzed during the 2008/09 monitoring season is presented in Appendix I. With the exception of EPA 8151A pesticide analyses, 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. Pesticide analyses performed via EPA 8151A showed widespread matrix spike recovery problems that Calscience Environmental Laboratories, Inc. attributed to matrix interference However, matrix spike recovery issues, including recoveries below and above acceptance limits, showed a similar pattern across two different matrixes evaluated during Events 1 and 2; no matrix spike analyses were performed for EPA 8151A pesticides for Event 3. When reviewing EPA 8151A matrix spike recoveries from Event 4 (wet weather) and Event 5 (dry weather) that will be addressed in the October 2009 Annual Monitoring Report, similar matrix spike recovery issues were observed leading the Stormwater Monitoring Program to conclude that matrix spike interference is not the only cause of the observed poor recoveries. The Stormwater Monitoring Program has elected to reject matrix spike recovery and matrix spike, RPD analyses for EPA 8151A pesticides for Events 1 and 2. In control laboratory control spike and surrogate method blank analyses support the reporting and use of these data without qualification. The Stormwater Monitoring Program will continue its communication with Calscience in an effort to resolve the matrix spike recovery problem.

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 seven Event 1 and three Event 3 environmental samples being qualified as "high biased" due to matrix interference. Matrix spike recoveries below their lower limits resulted in 26 environmental samples from Event 3 being qualified as "low biased" due to matrix interference. The large number of environmental samples from Mass Emission station ME-CC that were qualified as "low biased" were most certainly the result of matrix interference as noted by both CRG and Calscience laboratories.

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 66.7% (Event 2, EPA 8151A pesticides) 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 2008/09 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 96.5% across Events 1 – 3, whereas the matrix spike RPD success rate for EPA 8151A (chlorinated herbicides) was 83.3% across Events 1 and 2. Historically, EPA 8151A analyses have shown very little susceptibility to matrix interference. However, as noted above, all EPA 8151A matrix spike recoveries for Events 1 and 2 exceeded their DQOs. Apart from EPA 625m and EPA 8151A, 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 16 affected environmental samples being qualified as "estimated".

Table 16: Matrix Spike Qualification Limits

Classification or Constituent	*MS Percent Recovery Limits*		*MS RPD Percent Limit*
	Lower Limit	*Upper Limit*	*Maximum RPD*
Anion	70%	130%	30%
Conventional	50%	150%	30%
Hydrocarbon	70%	130%	30%
Aluminum	22%	182%	30%
Arsenic	74%	151%	30%
Cadmium	74%	131%	30%
Chromium	79%	127%	30%
Chromium VI	70%	130%	30%
Copper	55%	132%	30%
Lead	76%	120%	30%
Mercury	64%	158%	30%
Nickel	77%	108%	30%
Selenium	74%	125%	30%
Silver	73%	127%	30%
Thallium	83%	120%	30%
Zinc	67%	141%	30%
Nutrient (CRG)	70%	130%	30%
TKN (TA)	80%	120%	20%
Organic EPA 625m	variable	variable	30%
Organic EPA 8260B	71%	131%	30%
PCB EPA 625m	variable	variable	30%
EPA 547	68%	134%	20%
Pesticide EPA 625m	variable	variable	30%
Pesticide EPA 8151A	30%	130%	30%

RPD = Relative Percent Difference

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 17 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 17: Surrogate Spike Recovery Limits

Analytical Method	Surrogate Recovery Limits	
	Lower Limit	Upper Limit
EPA 625m*	0%	157%
EPA 8151A	0%	123%
EPA 8260B*	70%	141%

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

Results coming from the analysis of surrogate compounds are not commonly 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 typically 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. However, when other matrix-specific QA/QC sample analyses, such as matrix spike recoveries, are not available for comparison, poor surrogate recoveries can be used to qualify environmental data. For the current monitoring season, surrogate laboratory control spike recoveries, surrogate method blank recoveries, and surrogate equipment blank recoveries for all trace organic analytical methods across all monitoring events posted success rates of 100%. In contrast, surrogate matrix spike recovery success rates ranged from 81.2% (Event 3) to 100% (Events 1 and 2), and surrogate field blank recovery success rates ranged from 75.0% (Events 2 and 3, EPA 625m organic compound surrogates) to 100% (Events 2 and 3, EPA 625m PCB surrogates). Surrogate environmental recovery results posted an overall 88.0% success rate across Events 1 – 3 for all trace organic analytical methods. Surrogate recoveries outside of QA/QC limits were all associated with methods EPA 625m and EPA 8151A, but did not show any discernable pattern with regard to associated monitoring site or event. Surrogate environmental recoveries that exceed DQOs are likely due to matrix interference. A summary of success rates for surrogate environmental recovery analyses performed during the 2008/09 monitoring season is presented in Appendix K.

<u>Laboratory Control Spikes</u>

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 standards. 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 18 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.

Table 18: Laboratory Control Spike Recovery Limits

Classification	*Constituent(s)*	*LCS Recovery Limits*	
		Lower Limit	*Upper Limit*
Anion	Bromide, Chloride	70	130
Anion	Perchlorate	85	115
Conventional	Total Dissolved Solids	70	130
Conventional	Total Organic Carbon	50	150
Hydrocarbon	Oil and Grease, TRPH	70	130
Metal	Chromium VI	70	130
Metal	Mercury	64	158
Nutrient	Ammonia as N, Nitrate as N, Nitrite as N, Orthophosphate as P (Diss), and Total Phosphorus	70	130
Nutrient	TKN	80	120
Organic	EPA 625	variable	variable
Organic	EPA 8260B (MTBE)	82	118
PCB	EPA 625	variable	variable
Pesticide	EPA 547 (Glyphosate)	71	137
Pesticide	EPA 625	variable	variable
Pesticide	EPA 8151A	30	130

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

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 rates of all but two laboratory control spike recovery analyses (including LCS and LCS duplicate recoveries) performed during the 2008/09 monitoring season were 100%. The exceptions were a LCS recovery for 4,4'-DDD (EPA 625m pesticide) evaluated for Event 2 and a LCS recovery for Endrin (EPA 625m pesticide) evaluated for Event 3. The average recovery of the two 4,4'DDD LCS recoveries was within the acceptance range for the analyte and therefore no environmental data required qualification. However, the average recovery of the two Endrin LCS recoveries was below the lower recovery limit for the parameter resulting in the qualification of three environmental samples as "low-biased". A summary of success rates for LCS recovery analyses performed during the 2008/09 monitoring season is presented in Appendix L.

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.

The success rates of all but two LCS RPD values calculated during the 2008/09 monitoring season were 100%. The exceptions were LCS RPD values for 1,2,4-Trichlorobenzne (EPA 625m organic) calculated for Event 1 and Endrin (EPA 625m pesticide) calculated for Event 3. Considering that laboratory duplicate and matrix spike RPD analyses for 1,2,4-Trichlorobenzene and Endrin were observed to be in control for their respective analytical batches, the LCS RPD exceedances were determined to be inconsequential. To this end, no environmental samples were qualified based on this particular QA/QC evaluation. A summary of success rates for LCS RPD values calculated during the 2008/09 monitoring season is presented in Appendix M.

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 elapsed 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 2008/09 monitoring season are presented in Appendix N.

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 19.

Table 19: Program Data Qualification Codes Associated with 2008/09 Program Data

Qualification Code	*Qualification Description*
EST-FD	Result is considered "estimated" due to field duplicate 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-LCSR	Result is considered "low biased" due to a laboratory control spike recovery less than the established lower limit for the analyte. Both laboratory control spike and laboratory control spike duplicate results can fall below the lower limit 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.

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

The codes listed in Table 19 appear in the "Qualifier" data field included in Appendix F that presents all environmental sample results generated by the Stormwater Monitoring Program during the 2008/09 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 2008/09 monitoring season.

In summary, a total of 3307 environmental samples (including 472 field duplicate results) were analyzed during the first three events in the 2008/09 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 76 environmental samples in need of qualification, which translates into the Stormwater Monitoring Program achieving a 97.7% success rate in meeting program data quality objectives. Additionally, 398 QA/QC data records were rejected from the current monitoring season's data set. A total of 380 erroneous field blank results from Events 2 and 3 were rejected due to laboratory mishandling of samples that resulted in the analysis and reporting of Program environmental samples as field blank results. Eighteen rejected records were matrix spike recovery and RPD results (associated with EPA 8151A pesticides) from Events 1 and 2 that showed poor recovery due to a combination of matrix interference and an as-yet-to-be-determined laboratory issue. Overall, the three 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 20 through Table 26 present the success rates observed for each QA/QC evaluation performed by the Stormwater Monitoring Program during the 2008/09 monitoring season on a classification-by-classification basis.

Table 20: QA/QC Success Rates for Anions

QAQC Sample Type	*Total Number*	*Number Successful*	*Success Rate*
Holding Time (HT)*	49	49	100%
Method Blank (MB)	9	9	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)	9	8	88.9%
Matrix Spike Duplicate (MSD)	9	8	88.9%
Matrix Spike, RPD (MSRPD)	9	9	100%
Laboratory Duplicate (LD)	7	7	100%
Field Duplicate (FD)	6	6	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 21: QA/QC Success Rates for Bacteriologicals

QAQC Sample Type	*Total Number*	*Number Successful*	*Success Rate*
Holding Time (HT)*	64	64	100%
Field Blank (FB)	8	8	100%
Field Duplicate (FD)	8	8	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 Conventionals

QAQC Sample Type	Total Number	Number Successful	Success Rate
Holding Time (HT)*	137	137	100%
Method Blank (MB)	17	17	100%
Field Blank (FB)	0	0	---
Laboratory Control Spike (LSC)	6	6	100%
Laboratory Control Spike Duplicate (LCSD)	6	6	100%
Laboratory Control Spike, RPD (LCSRPD)	6	6	100%
Matrix Spike (MS)	3	3	100%
Matrix Spike Duplicate (MSD)	3	3	100%
Matrix Spike, RPD (MSRPD)	3	3	100%
Laboratory Duplicate (LD)	22	22	100%
Field Duplicate (FD)	16	14	87.5%

*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 Hydrocarbons

QAQC Sample Type	Total Number	Number Successful	Success Rate
Holding Time (HT)*	29	29	100%
Method Blank (MB)	6	6	100%
Laboratory Control Spike (LSC)	6	6	100%
Laboratory Control Spike Duplicate (LCSD)	6	6	100%
Laboratory Control Spike, RPD (LCSRPD)	6	6	100%
Laboratory Duplicate (LD)	1	1	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 24: QA/QC Success Rates for Nutrients

QAQC Sample Type	Total Number	Number Successful	Success Rate
Holding Time (HT)*	119	119	100%
Method Blank (MB)	21	21	100%
Laboratory Control Spike (LCS)	24	24	100%
Laboratory Control Spike Duplicate (LCSD)	21	21	100%
Laboratory Control Spike, RPD (LCSRPD)	21	21	100%
Matrix Spike (MS)	21	21	100%
Matrix Spike Duplicate (MSD)	21	21	100%
Matrix Spike, RPD (MS RPD)	21	21	100%
Laboratory Duplicate (LD)	21	20	95.2%
Field Duplicate (FD)	14	13	92.9%

*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 Metals

QAQC Sample Type	*Total Number*	*Number Successful*	*Success Rate*
Holding Time (HT)*	475	475	100%
Method Blank (MB)	86	86	100%
Field Blank (FB)	2	2	100%
Laboratory Control Spike (LCS)	6	6	100%
Laboratory Control Spike Duplicate (LCSD)	6	6	100%
Laboratory Control Spike, RPD (LCSRPD)	6	6	100%
Matrix Spike (MS)	50	50	100%
Matrix Spike Duplicate (MSD)	50	50	100%
Matrix Spike, RPD (MSRPD)	50	50	100%
Laboratory Duplicate (LD)	86	83	96.5%
Field Duplicate (FD)	50	49	98.0%

*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 Trace Organic Compounds

Method	QAQC Sample Type	Total Number	Number Successful	Success Rate
EPA 547	Holding Time (HT)*	13	13	100%
	Method Blank (MB)	3	3	100%
	Laboratory Control Spike (LCS)	3	3	100%
	Matrix Spike (MS)	2	2	100%
	Matrix Spike Duplicate (MSD)	2	1	50%
	Matrix Spike, RPD (MSRPD)	2	2	100%
	Laboratory Duplicate (LD)	0	0	---
	Field Duplicate (FD)	1	1	100%
EPA 625m	Holding Time (HT)*	3518	3518	100%
	Method Blank (MB)	702	702	100%
	Surrogate Method Blank (SMB)	44	44	100%
	Field Blank (FB)	0	0	---
	Surrogate Field Blank (SFB)	22	18	81.8%
	Laboratory Control Spike (LCS)	572	570	99.7%
	Laboratory Control Spike Duplicate (LCSD)	572	572	100%
	Laboratory Control Spike, RPD (LCSRPD)	572	570	99.7%
	Surrogate LCS (SLCS)	44	44	100%
	Surrogate LCS Duplicate (SLCSD)	44	44	100%
	Matrix Spike (MS)	432	357	82.6%
	Matrix Spike Duplicate (MSD)	432	365	84.5%
	Matrix Spike, RPD (MSRPD)	432	417	96.5%
	Surrogate Matrix Spike (SMS)	33	31	93.9%
	Surrogate Matrix Spike Duplicate (SMSD)	33	32	97.0%
	Environmental Sample Surrogates (ESS)	217	191	88.0%
	Laboratory Duplicate (LD)	528	504	95.5%
	Field Duplicate (FD)	352	332	94.3%
EPA 8151A	Holding Time (HT)*	140	140	100%
	Method Blank (MB)	30	30	100%
	Surrogate Method Blank (SMB)	3	3	100%
	Laboratory Control Spike (LCS)	9	9	100%
	Laboratory Control Spike Duplicate (LCSD)	9	9	100%
	Laboratory Control Spike, RPD (LCSRPD)	9	9	100%
	Matrix Spike (MS)	6	6	0%
	Matrix Spike Duplicate (MSD)	6	6	0%
	Matrix Spike, RPD (MSRPD)	6	5	83.3%
	Environmental Sample Surrogates (ESS)	14	4	28.6%
	Laboratory Duplicate (LD)	0	0	---
	Field Duplicate (FD)	20	20	100%

Table 26: (Continued) QA/QC Success Rates for Trace Organic Compounds

Method	*QAQC Sample Type*	*Total Number*	*Number Successful*	*Success Rate*
EPA 8260B	Holding Time (HT)*	4	4	100%
	Method Blank (MB)	1	1	100%
	Laboratory Control Spike (LCS)	1	1	100%
	Laboratory Control Spike Duplicate (LCSD)	1	1	100%
	Laboratory Control Spike, RPD (LCSRPD)	1	1	100%
	Surrogate Method Blank (SMB)	4	4	100%
	Environmental Sample Surrogates (ESS)	16	16	100%
	Laboratory Duplicate (LD)	0	0	---
	Field Duplicate (FD)	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.

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 2008/09 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 six years, VCWPD has invested approximately $200,000 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 2008/09 monitoring year were reported by laboratories in the forms of EDDs and hard copy laboratory reports. 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 *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.

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 and (2) 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 2008/09 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
- Mercury (total recoverable and dissolved)
- Ammonia-Nitrogen
- MTBE (Land Use and Receiving Water Stations)
- Aquatic Toxicity

Receiving Water and Land Use Site Results

Water quality results for the 2008/09 monitoring season from the Land Use and Receiving Water stations are presented in Table 27 through Table 34.

Table 27: Anion, Conventional, Hydrocarbon, and Nutrient Results from Agricultural Land Use Site A-1

Classification	Constituent	Fraction	Units	A-1 Event 2 11/25/08
Anion	Bromide	n/a	mg/L	1.739
Anion	Chloride	n/a	mg/L	128.52
Anion	Perchlorate	n/a	µg/L	< 0.72
Conventional	BOD	n/a	mg/L	4.3
Conventional	Conductivity	n/a	µmhos/cm	4570
Conventional	Hardness as CaCO3	Total	mg/L	854.3
Conventional	pH	n/a	pH Units	7.8
Conventional	Total Dissolved Solids	n/a	mg/L	2086
Conventional	Total Organic Carbon	n/a	mg/L	14.9
Conventional	Total Suspended Solids	n/a	mg/L	331
Conventional	Turbidity	n/a	NTU	290
Hydrocarbon	Oil and Grease	n/a	mg/L	< 1
Hydrocarbon	TRPH	n/a	mg/L	< 1
Nutrient	Ammonia as N	n/a	mg/L	1.94
Nutrient	Nitrate as N	n/a	mg/L	41.07
Nutrient	Nitrite as N	n/a	mg/L	0.22
Nutrient	Orthophosphate as P	n/a	mg/L	0.7864
Nutrient	TKN	n/a	mg/L	0.2
Nutrient	Total Phosphorus	Dissolved	mg/L	0.95
Nutrient	Total Phosphorus	Total	mg/L	2.449

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

Table 28: Anion, Conventional, Hydrocarbon, and Nutrient Results from Receiving Water Sites W-3 and W-4

Classification	Constituent	Fraction	Units	W-3 Event 1 11/25/08	W-4 Event 1 11/25/08
Anion	Bromide	n/a	mg/L	0.223	1.428
Anion	Chloride	n/a	mg/L	18.17	69.03
Anion	Perchlorate	n/a	µg/L	< 0.36	< 0.36
Conventional	BOD	n/a	mg/L	32.1	8.4
Conventional	Conductivity	n/a	µmhos/cm	1056	1527
Conventional	Hardness as CaCO3	Total	mg/L	116.7	479
Conventional	pH	n/a	pH Units	8	7.5
Conventional	Total Dissolved Solids	n/a	mg/L	412	1082
Conventional	Total Organic Carbon	n/a	mg/L	21.2	10.6
Conventional	Total Suspended Solids	n/a	mg/L	2068	283
Conventional	Turbidity	n/a	NTU	1585	336
Hydrocarbon	Oil and Grease	n/a	mg/L	< 1	< 1
Hydrocarbon	TRPH	n/a	mg/L	< 1	< 1
Nutrient	Ammonia as N	n/a	mg/L	0.3	0.2
Nutrient	Nitrate as N	n/a	mg/L	5.05	14.02
Nutrient	Nitrite as N	n/a	mg/L	0.09	0.27
Nutrient	Orthophosphate as P	n/a	mg/L	0.6148	0.1564
Nutrient	TKN	n/a	mg/L	< 0.05	0.12
Nutrient	Total Phosphorus	Dissolved	mg/L	0.762	0.158
Nutrient	Total Phosphorus	Total	mg/L	4.825	1.379

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

Constituent	***Fraction***	***Units***	***A-1***
			Event 2 11/25/08
Aluminum	Dissolved	µg/L	< 5
Arsenic	Dissolved	µg/L	11
Cadmium	Dissolved	µg/L	1.5
Chromium	Dissolved	µg/L	1.6
Copper	Dissolved	µg/L	8.8
Lead	Dissolved	µg/L	DNQ 0.08
Mercury	Dissolved	ng/L	2.2
Nickel	Dissolved	µg/L	15.2
Selenium	Dissolved	µg/L	3.1
Silver	Dissolved	µg/L	< 0.5
Thallium	Dissolved	µg/L	< 0.1
Zinc	Dissolved	µg/L	17.2
Aluminum	Total	µg/L	1095
Arsenic	Total	µg/L	11.6
Cadmium	Total	µg/L	1.8
Chromium	Total	µg/L	4.5
Chromium VI	Total	µg/L	< 5
Copper	Total	µg/L	16.7
Lead	Total	µg/L	2.35
Mercury	Total	ng/L	2.6
Nickel	Total	µg/L	19.6
Selenium	Total	µg/L	2.8
Silver	Total	µg/L	< 0.5
Thallium	Total	µg/L	< 0.1
Zinc	Total	µg/L	40.9

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

Table 30: Metals Results from Receiving Water Sites W-3 and W-4

Constituent	***Fraction***	***Units***	***W-3***	***W-4***
			Event 1 11/25/08	***Event 1 11/25/08***
Aluminum	Dissolved	µg/L	44	< 5
Arsenic	Dissolved	µg/L	2.2	3.3
Cadmium	Dissolved	µg/L	< 0.2	< 0.2
Chromium	Dissolved	µg/L	DNQ 0.3	DNQ 0.1
Copper	Dissolved	µg/L	13.4	0.8
Lead	Dissolved	µg/L	0.16	< 0.05
Mercury	Dissolved	ng/L	1.5	1.1
Nickel	Dissolved	µg/L	4.3	5.3
Selenium	Dissolved	µg/L	2.9	4.4
Silver	Dissolved	µg/L	< 0.5	< 0.5
Thallium	Dissolved	µg/L	< 0.1	< 0.1
Zinc	Dissolved	µg/L	9.9	4.3
Aluminum	Total	µg/L	4233	2034
Arsenic	Total	µg/L	3.7	5.5
Cadmium	Total	µg/L	0.6	0.6
Chromium	Total	µg/L	5.6	4.1
Chromium VI	Total	µg/L	< 5	< 5
Copper	Total	µg/L	65.8	17.8
Lead	Total	µg/L	13.13	7.18
Mercury	Total	ng/L	7	12.6
Nickel	Total	µg/L	17	12.3
Selenium	Total	µg/L	2.3	4
Silver	Total	µg/L	< 0.5	< 0.5
Thallium	Total	µg/L	< 0.1	< 0.1
Zinc	Total	µg/L	93.8	52.7

*See Appendix F for a description of the data qualifier(s) associated with this sample result.
“DNQ” – Constituent detected but not quantified (MDL < result < RL)
“<” – Constituent not detected above specified detection limit.

Table 31: Detected Trace Organic Results from Agricultural Land Use Site A-1

Classification	Method	Constituent	Units	A-1 Event 1 11/25/08
Organic	EPA 625m	1-Methylnaphthalene	µg/L	0.0054
Organic	EPA 625m	2-Chlorophenol	µg/L	< 0.05 *
Organic	EPA 625m	2-Methylnaphthalene	µg/L	0.0099 *
Organic	EPA 625m	4-Chloro-3-methylphenol	µg/L	< 0.1 *
Organic	EPA 625m	4-Nitrophenol	µg/L	< 0.1 *
Organic	EPA 625m	Benzo(b)fluoranthene	µg/L	< 0.001 *
Organic	EPA 625m	Benzo(e)pyrene	µg/L	DNQ 0.0021 *
Organic	EPA 625m	Benzo(g,h,i)perylene	µg/L	DNQ 0.0023 *
Organic	EPA 625m	Bis(2-ethylhexyl)phthalate	µg/L	0.876 *
Organic	EPA 625m	Butyl benzyl phthalate	µg/L	0.133 *
Organic	EPA 625m	Chrysene	µg/L	DNQ 0.0042 *
Organic	EPA 625m	Dibenz(a,h)anthracene	µg/L	< 0.001 *
Organic	EPA 625m	Dibenzothiophene	µg/L	0.0098
Organic	EPA 625m	Diethyl phthalate	µg/L	0.199 *
Organic	EPA 625m	Dimethyl phthalate	µg/L	< 0.05 *
Organic	EPA 625m	Di-n-butylphthalate	µg/L	0.164 *
Organic	EPA 625m	Di-n-octylphthalate	µg/L	< 0.01 *
Organic	EPA 625m	Fluoranthene	µg/L	0.0065 *
Organic	EPA 625m	Naphthalene	µg/L	0.0115 *
Organic	EPA 625m	Pentachlorophenol	µg/L	0.233 *
Organic	EPA 625m	Perylene	µg/L	< 0.001 *
Organic	EPA 625m	Phenanthrene	µg/L	0.0112
Organic	EPA 625m	Phenol	µg/L	0.663 *
Organic	EPA 625m	Pyrene	µg/L	0.0074 *
Pesticide	EPA 625m	2,4'-DDD	µg/L	0.0128 *
Pesticide	EPA 625m	2,4'-DDE	µg/L	DNQ 0.0026 *
Pesticide	EPA 625m	2,4'-DDT	µg/L	0.0188 *
Pesticide	EPA 625m	4,4'-DDD	µg/L	0.0376 *
Pesticide	EPA 625m	4,4'-DDE	µg/L	0.196 *
Pesticide	EPA 625m	4,4'-DDT	µg/L	0.0701 *
Pesticide	EPA 625m	Chlordane-gamma	µg/L	DNQ 0.0013 *
Pesticide	EPA 625m	Chlorpyrifos	µg/L	0.0865 *
Pesticide	EPA 625m	DCPA (Dacthal)	µg/L	0.0548
Pesticide	EPA 625m	Demeton (Total)	µg/L	< 0.001 *
Pesticide	EPA 625m	Disulfoton	µg/L	< 0.001 *
Pesticide	EPA 547	Glyphosate	µg/L	89
Pesticide	EPA 625m	Malathion	µg/L	0.6449 *
Pesticide	EPA 625m	Toxaphene	µg/L	1.1476 *
Pesticide	EPA 625m	trans-Nonachlor	µg/L	< 0.001 *

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

Table 32: Detected Trace Organic Results from Receiving Water Sites W-3 and W-4

Classification	Method	Constituent	Units	W-3 Event 1 11/25/08	W-4 Event 1 11/25/08
Organic	EPA 625m	1-Methylnaphthalene	µg/L	0.007	0.007
Organic	EPA 625m	2-Methylnaphthalene	µg/L	0.013	0.0143
Organic	EPA 625m	Acenaphthene	µg/L	ND	0.0063
Organic	EPA 625m	Biphenyl	µg/L	ND	0.0058
Organic	EPA 625m	Bis(2-ethylhexyl)phthalate	µg/L	1.225	1
Organic	EPA 625m	Butyl benzyl phthalate	µg/L	0.108	0.383
Organic	EPA 625m	Chrysene	µg/L	0.005	0.0051
Organic	EPA 625m	Dibenz(a,h)anthracene	µg/L	ND	0.0057
Organic	EPA 625m	Dibenzothiophene	µg/L	ND	0.0081
Organic	EPA 625m	Diethyl phthalate	µg/L	0.2	0.734
Organic	EPA 625m	Dimethyl phthalate	µg/L	ND	0.091
Organic	EPA 625m	Di-n-butylphthalate	µg/L	0.193	0.177
Organic	EPA 625m	Di-n-octylphthalate	µg/L	ND	0.048
Organic	EPA 625m	Fluoranthene	µg/L	0.0085	0.0093
Organic	EPA 625m	Naphthalene	µg/L	0.013	0.0185
Organic	EPA 625m	Phenanthrene	µg/L	0.0077	0.0098
Organic	EPA 625m	Phenol	µg/L	0.49	1.014
Organic	EPA 625m	Pyrene	µg/L	0.0073	0.0074
Pesticide	EPA 625m	2,4'-DDD	µg/L	ND	0.0164
Pesticide	EPA 625m	2,4'-DDE	µg/L	ND	0.0059
Pesticide	EPA 625m	2,4'-DDT	µg/L	0.0144	ND
Pesticide	EPA 625m	4,4'-DDD	µg/L	0.0369	0.0485
Pesticide	EPA 625m	4,4'-DDE	µg/L	0.276	0.2683
Pesticide	EPA 625m	4,4'-DDT	µg/L	0.1008	0.0198
Pesticide	EPA 625m	Chlordane-alpha	µg/L	ND	0.0061
Pesticide	EPA 625m	Chlordane-gamma	µg/L	ND	0.0065
Pesticide	EPA 625m	Chlorpyrifos	µg/L	4.7321	4.0452
Pesticide	EPA 625m	DCPA (Dacthal)	µg/L	ND	0.0322
Pesticide	EPA 625m	Diazinon	µg/L	ND	0.013
Pesticide	EPA 547	Glyphosate	µg/L	29	ND
Pesticide	EPA 625m	Malathion	µg/L	0.4205	2.3063
Pesticide	EPA 625m	Toxaphene	µg/L	0.4211	0.6403

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

Table 33: Bacteriological Results from Agricultural Land Use Site A-1

Constituent	Units	A-1 Event 1 11/25/08
E. Coli	MPN/100 mL	331
Enterococcus	MPN/100 mL	2,880
Fecal Coliform	MPN/100 mL	310
Total Coliform	MPN/100 mL	1,413,600

Table 34: Bacteriological Results from Receiving Water Sites W-3 and W-4

Constituent	Units	W-3	W-4
		Event 2 12/18/07	Event 1 9/21/07
E. Coli	MPN/100 mL	7,270	6,488
Enterococcus	MPN/100 mL	6,590	3,640
Fecal Coliform	MPN/100 mL	7,000	5,000
Total Coliform	MPN/100 mL	4,352,000	866,400

Mass Emission Site Results

Water quality results for the 2008/09 monitoring season from the Mass Emission stations are presented in Table 35 through Table 46.

Table 35: Anion, Conventional, Hydrocarbon, and Nutrient Results from Mass Emission Site ME-CC

Classification	Constituent	Fraction	Units	Event 1 11/25/08	Event 2 12/14/08	Event 3 2/5/09
Anion	Bromide	n/a	mg/L	0.326	0.191	0.21
Anion	Chloride	n/a	mg/L	98.76	47.83	57.38
Anion	Perchlorate	n/a	µg/L	< 0.36	< 0.36	< 0.36
Conventional	BOD	n/a	mg/L	< 2	10.7	5.2
Conventional	Conductivity	n/a	µmhos/m	812	421	447
Conventional	Hardness as $CaCO_3$	Total	mg/L	184.7	119.4	117.2
Conventional	pH	n/a	pH Units	7.6	7.4	8
Conventional	Total Dissolved Solids	n/a	mg/L	348	364	388
Conventional	Total Organic Carbon	n/a	mg/L	13	20	4.9
Conventional	Total Suspended Solids	n/a	mg/L	924	678	130.5
Conventional	Turbidity	n/a	NTU	510	582	54.6
Hydrocarbon	Oil & Grease	n/a	mg/L	DNQ 2.8	DNQ 2.8	< 1
Hydrocarbon	TRPH	n/a	mg/L	< 1	< 1	< 1
Nutrient	Ammonia as N	n/a	mg/L	0.9	0.48	0.18
Nutrient	Nitrate as N	n/a	mg/L	3.92	2.95	3.14
Nutrient	Nitrite as N	n/a	mg/L	0.08	0.057	0.1
Nutrient	Orthophosphate as P (Diss)	n/a	mg/L	0.3485	0.471	0.524
Nutrient	TKN	n/a	mg/L	0.07	0.12 *	0.38
Nutrient	Total Phosphorus	Diss.	mg/L	1.056	0.617	0.605
Nutrient	Total Phosphorus	Total	mg/L	3.726	1.835	1.056

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

Table 36: Anion, Conventional, Hydrocarbon, and Nutrient Results from Mass Emission Site ME-VR2

Classification	Constituent	Fraction	Units	Event 1 11/25/08	Event 2 12/14/08	Event 3 2/5/09
Anion	Bromide	n/a	mg/L	0.138	0.171	0.164
Anion	Chloride	n/a	mg/L	45.13	56.48	48.17
Anion	Perchlorate	n/a	µg/L	< 0.36	< 0.36	< 0.36
Conventional	BOD	n/a	mg/L	3.5	2.3	< 2
Conventional	Conductivity	n/a	µmhos/m	774	831	810
Conventional	Hardness as $CaCO_3$	Total	mg/L	296.2	292.2	300.8
Conventional	pH	n/a	pH Units	7.5	7.7	8.1
Conventional	Total Dissolved Solids	n/a	mg/L	610	592	642
Conventional	Total Organic Carbon	n/a	mg/L	4.1	4.2	1.7
Conventional	Total Suspended Solids	n/a	mg/L	5.5	15 *	15.5
Conventional	Turbidity	n/a	NTU	6.2	21.1 *	< 1
Hydrocarbon	Oil & Grease	n/a	mg/L	< 1	< 1	< 1
Hydrocarbon	TRPH	n/a	mg/L	< 1	< 1	< 1
Nutrient	Ammonia as N	n/a	mg/L	0.08	DNQ 0.03	0.03
Nutrient	Nitrate as N	n/a	mg/L	0.18	0.848	0.13
Nutrient	Nitrite as N	n/a	mg/L	DNQ 0.03	DNQ 0.046	< 0.01
Nutrient	Orthophosphate as P (Diss)	n/a	mg/L	0.0439	0.066	0.0218
Nutrient	TKN	n/a	mg/L	< 0.05	< 0.05	0.29
Nutrient	Total Phosphorus	Diss.	mg/L	0.06	0.06	DNQ 0.017
Nutrient	Total Phosphorus	Total	mg/L	0.094	0.069 *	DNQ 0.03

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

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

Classification	*Constituent*	*Fraction*	*Units*	*Event 1 11/25/08*	*Event 2 12/14/08*	*Event 3 2/5/09*
Anion	Bromide	n/a	mg/L	0.35	< 0.001	0.18
Anion	Chloride	n/a	mg/L	62.28	47.06	39.18
Anion	Perchlorate	n/a	µg/L	< 0.36	< 0.36	< 0.36
Conventional	BOD	n/a	mg/L	3.9	7.8	3.3
Conventional	Conductivity	n/a	µmhos/m	1558	928	882
Conventional	Hardness as $CaCO_3$	Total	mg/L	370.8	417.8	286.2
Conventional	pH	n/a	pH Units	7.9	7.5	8.1
Conventional	Total Dissolved Solids	n/a	mg/L	756	980	768
Conventional	Total Organic Carbon	n/a	mg/L	6.4	6.9	4.2
Conventional	Total Suspended Solids	n/a	mg/L	756	1362	652
Conventional	Turbidity	n/a	NTU	515	1065	498
Hydrocarbon	Oil & Grease	n/a	mg/L	DNQ 1.3	DNQ 1.2	DNQ 1
Hydrocarbon	TRPH	n/a	mg/L	< 1	< 1	< 1
Nutrient	Ammonia as N	n/a	mg/L	0.4	0.08	0.91
Nutrient	Nitrate as N	n/a	mg/L	2.17	2.894	1.75
Nutrient	Nitrite as N	n/a	mg/L	0.12	0.118	0.11
Nutrient	Orthophosphate as P (Diss)	n/a	mg/L	0.1564	0.174	0.0422
Nutrient	TKN	n/a	mg/L	0.08	0.47	0.43
Nutrient	Total Phosphorus	Diss.	mg/L	0.089	0.207	DNQ 0.042
Nutrient	Total Phosphorus	Total	mg/L	1.353	1.257	1.043

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

Table 38: Metals Results from Mass Emission Site ME-CC

Constituent	Fraction	Units	Event 1 11/25/08	Event 2 12/14/08	Event 3 2/5/09
Aluminum	Dissolved	µg/L	DNQ 8	21	< 5
Arsenic	Dissolved	µg/L	3.8	4.5	2.6
Cadmium	Dissolved	µg/L	< 0.2	< 0.2	< 0.2
Chromium	Dissolved	µg/L	DNQ 0.3	DNQ 0.2	DNQ 0.3
Copper	Dissolved	µg/L	2.4	2.7 *	3.4
Lead	Dissolved	µg/L	DNQ 0.08	< 0.05	< 0.05
Mercury	Dissolved	µg/L	1.8	1.7	1
Nickel	Dissolved	ng/L	4.7	3.2	2.6
Selenium	Dissolved	µg/L	1.5	1.2	1.3
Silver	Dissolved	µg/L	< 0.5	< 0.5	< 0.5
Thallium	Dissolved	µg/L	< 0.1	< 0.1	< 0.1
Zinc	Dissolved	µg/L	13	5	6.2
Aluminum	Total	µg/L	6594	4812	919
Arsenic	Total	µg/L	6.4	5.5	2.8
Cadmium	Total	µg/L	1.5	1.7	0.4
Chromium	Total	µg/L	26.3	11.3	2.6
Chromium VI	Total	µg/L	DNQ 5	< 5	< 5
Copper	Total	µg/L	66.6	38	10.1
Lead	Total	µg/L	18.73	10.88	3.06
Mercury	Total	ng/L	23.1	37.1	24.4
Nickel	Total	µg/L	44.4	28.5	6.6
Selenium	Total	µg/L	1.2	0.9	0.9
Silver	Total	µg/L	< 0.5	< 0.5	< 0.5
Thallium	Total	µg/L	< 0.1	< 0.1	< 0.1
Zinc	Total	µg/L	179	112.9	40.5

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

Table 39: Metals Results from Mass Emission Site ME-VR2

Constituent	Fraction	Units	Event 1 11/25/08	Event 2 12/14/08	Event 3 2/5/09
Aluminum	Dissolved	µg/L	< 5	DNQ 7	< 5
Arsenic	Dissolved	µg/L	1.2	2.2	DNQ 0.4
Cadmium	Dissolved	µg/L	< 0.2	< 0.2	< 0.2
Chromium	Dissolved	µg/L	< 0.1	< 0.1	< 0.1
Copper	Dissolved	µg/L	DNQ 0.5	1.4	0.9
Lead	Dissolved	µg/L	< 0.05	< 0.05	< 0.05
Mercury	Dissolved	µg/L	3.7 *	DNQ 0.8	1.1
Nickel	Dissolved	ng/L	1.5	2	1.1
Selenium	Dissolved	µg/L	1	1.6	1.6
Silver	Dissolved	µg/L	< 0.5	< 0.5	< 0.5
Thallium	Dissolved	µg/L	< 0.1	< 0.1	< 0.1
Zinc	Dissolved	µg/L	2.8	1	0.6
Aluminum	Total	µg/L	75	354	82
Arsenic	Total	µg/L	0.6	2.6	0.6
Cadmium	Total	µg/L	< 0.2	< 0.2	< 0.2
Chromium	Total	µg/L	DNQ 0.2	0.8	DNQ 0.3
Chromium VI	Total	µg/L	< 5	< 5	< 5
Copper	Total	µg/L	1.1	3.7	1.5
Lead	Total	µg/L	0.12	0.55	0.18
Mercury	Total	ng/L	7.8 *	1.3	1.6
Nickel	Total	µg/L	1.9	3.4	1.5
Selenium	Total	µg/L	1	1.6	1.5
Silver	Total	µg/L	< 0.5	< 0.5	< 0.5
Thallium	Total	µg/L	< 0.1	< 0.1	< 0.1
Zinc	Total	µg/L	3.7	11.9 *	2.1

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

Table 40: Metals Results from Mass Emission Site ME-SCR

Constituent	*Fraction*	*Units*	*Event 1 11/25/08*	*Event 2 12/14/08*	*Event 3 2/5/09*
Aluminum	Dissolved	μg/L	< 5	DNQ 7	< 5
Arsenic	Dissolved	μg/L	1.2	3.2	0.7
Cadmium	Dissolved	μg/L	< 0.2	< 0.2	< 0.2
Chromium	Dissolved	μg/L	DNQ 0.1	DNQ 0.1	DNQ 0.1
Copper	Dissolved	μg/L	1.6	1.8	1.1
Lead	Dissolved	μg/L	< 0.05	< 0.05	< 0.05
Mercury	Dissolved	μg/L	DNQ 0.6	1.3	DNQ 0.7
Nickel	Dissolved	ng/L	2	1.4	1.7
Selenium	Dissolved	μg/L	3.6	3.6	3.2
Silver	Dissolved	μg/L	< 0.5	< 0.5	< 0.5
Thallium	Dissolved	μg/L	< 0.1	< 0.1	< 0.1
Zinc	Dissolved	μg/L	4.7	1.2	DNQ 0.4
Aluminum	Total	μg/L	2605	6886	2405
Arsenic	Total	μg/L	2.2	5.4	2.3
Cadmium	Total	μg/L	DNQ 0.3	1	0.6
Chromium	Total	μg/L	4.5	11.1	3.4
Chromium VI	Total	μg/L	DNQ 7	< 5	< 5
Copper	Total	μg/L	10.4	29.7	11.4
Lead	Total	μg/L	3.56	10.64	5.97
Mercury	Total	ng/L	41.8	12.3	160
Nickel	Total	μg/L	10.9	24.7	11.4
Selenium	Total	μg/L	3.1	2.7	2.2
Silver	Total	μg/L	< 0.5	< 0.5	< 0.5
Thallium	Total	μg/L	< 0.1	< 0.1	< 0.1
Zinc	Total	μg/L	29.6	65.2	28

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

Table 41: Detected Trace Organic Results from Mass Emission Site ME-CC

Constituent	Event 1 11/25/08	Event 2 12/14/08	Event 3 2/5/09
EPA 625m Organics ~ µg/L			
2,4-Dinitrophenol	0.62	ND	ND
2-Methyl-4,6-dinitrophenol	0.248	ND	ND
2-Methylnaphthalene	0.0176	0.01	ND
Acenaphthene	0.0083	0.0053	ND
Benzo(a)anthracene	ND	0.0118	ND
Benzo(a)pyrene	0.013	0.0092	ND
Benzo(b)fluoranthene	0.012	0.03	0.0061
Benzo(e)pyrene	0.0181	0.0184	ND
Benzo(g,h,i)perylene	0.03	0.0193	ND
Benzo(k)fluoranthene	ND	0.0096	ND
Bis(2-ethylhexyl)phthalate	4.747	1.153	0.656
Butyl benzyl phthalate	0.493	0.291	0.184
Chrysene	0.0238	0.0302	0.0061
Dibenzothiophene	ND	ND	0.0069
Diethyl phthalate	0.456	2.851	ND
Dimethyl phthalate	ND	0.115	ND
Di-n-butylphthalate	0.181	0.181	ND
Di-n-octylphthalate	0.281	0.128	0.033
Fluoranthene	0.0271	0.0499	0.0231 *
Indeno(1,2,3-cd)pyrene	0.0245	ND	ND
Naphthalene	0.0489	0.0206	DNQ 0.0038 *
N-Nitrosodi-N-propylamine	ND	ND	< 0.05 *
Perylene	0.0068	0.006	ND
Phenanthrene	0.0121	0.0189	ND
Phenol	0.821	ND	ND
Pyrene	0.0268	0.0517	0.0218
EPA 625m PCBs ~ µg/L			
PCB 003	ND	ND	< 0.001 *
PCB 008	ND	ND	< 0.001 *
PCB 018	ND	ND	< 0.001 *
PCB 028	ND	ND	< 0.001 *
PCB 031	ND	ND	< 0.001 *
PCB 033	ND	ND	< 0.001 *
PCB 087	ND	ND	< 0.001 *
PCB 095	ND	ND	< 0.001 *
PCB 141	ND	ND	< 0.001 *
PCB 201	ND	ND	< 0.001 *
PCB 209	ND	ND	< 0.001 *
EPA 547 Pesticide ~ µg/L			
Glyhposate	17	ND	ND
EPA 625m Pesticides ~ µg/L			
2,4'-DDD	0.0108	0.0055	ND
2,4'-DDT	ND	0.0334	ND
4,4'-DDD	0.0312	0.0643	ND
4,4'-DDE	0.2455	0.1906	0.0781 *
4,4'-DDT	0.0212	0.1673	0.0133
BHC-gamma (Lindane)	ND	ND	< 0.001 *
Bolstar	ND	ND	< 0.002 *
Chlordane-alpha	0.0052	0.0075	ND
Chlordane-gamma	ND	0.0062	ND
Chlorpyrifos	2.504	0.5132	0.0402

Table 41 (Continued): Detected Trace Organic Results from Mass Emission Site ME-CC

Constituent	Event 1 11/25/08	Event 2 12/14/08	Event 3 2/5/09
EPA 625m Pesticides ~ μg/L			
DCPA (Dacthal)	0.3408	0.592	1.2982 *
Diazinon	0.0285	0.0538	0.0208 *
Dichlorvos	ND	ND	< 0.003 *
Dimethoate	ND	ND	< 0.003 *
Endrin	ND	ND	< 0.001 *
Ethoprop	ND	ND	< 0.001 *
Fenchlorophos (Ronnel)	ND	ND	< 0.002 *
Malathion	0.3281	0.1133	0.3062
Merphos	ND	ND	< 0.001 *
Methyl parathion	ND	ND	< 0.001 *
Mirex	ND	ND	< 0.001 *
Phorate	ND	ND	< 0.006 *
Tokuthion	ND	ND	< 0.003 *
Toxaphene	0.3376	0.4975	0.132
trans-Nonachlor	ND	0.0067	ND
Trichloronate	ND	ND	< 0.001 *
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.
"DNQ" – Constituent detected but not quantified (MDL < result < RL)
"<" – Constituent not detected above specified detection limit.

Table 42: Detected Trace Organic Results from Mass Emission Site ME-VR2

Constituent	Event 1 11/25/08	Event 2 12/14/08	Event 3 2/5/09
EPA 625m Organics ~ μg/L			
Bis(2-ethylhexyl)phthalate	2.152	0.414 *	ND
Butyl benzyl phthalate	0.235	ND	ND
Diethyl phthalate	0.533	0.314	ND
Di-n-butylphthalate	0.16	ND	ND
Endrin	ND	ND	< 0.001 *
Naphthalene	0.0066	DNQ 0.0047 *	ND
Phenol	0.504	ND	ND
EPA 625m Pesticides ~ μg/L			
Chlorpyrifos	0.022	0.0234	ND
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.
"DNQ" – Constituent detected but not quantified (MDL < result < RL)
"<" – Constituent not detected above specified detection limit.

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

Constituent	*Event 1 11/25/08*	*Event 2 12/14/08*	*Event 3 2/5/09*
EPA 625m Organics ~ µg/L			
1-Methylnaphthalene	0.0163	0.0089	0.0104
1-Methylphenanthrene	0.0056	0.0095	0.0149
2,3,5-Trimethylnaphthalene	ND	ND	0.0064
2,6-Dimethylnaphthalene	0.0099	0.0061	0.0139
2-Methylnaphthalene	0.0215	0.0123	0.0104
Acenaphthene	0.0066	ND	ND
Benzo(a)anthracene	ND	0.0165	ND
Benzo(a)pyrene	ND	0.0095	ND
Benzo(b)fluoranthene	ND	0.0215	ND
Benzo(e)pyrene	ND	0.0118	0.0072
Benzo(g,h,i)perylene	0.0076	0.0061	ND
Biphenyl	0.0053	0.0061	0.0072
Bis(2-ethylhexyl)phthalate	1.154	9.264	5.025
Butyl benzyl phthalate	0.133	0.165	ND
Chrysene	0.0072	0.0328	0.0163
Dibenzothiophene	ND	ND	0.0058
Diethyl phthalate	0.236	0.19	2.045
Di-n-butylphthalate	0.136	0.274	ND
Di-n-octylphthalate	0.052	0.084	ND
Fluoranthene	0.0082	0.03	0.0136
Indeno(1,2,3-cd)pyrene	0.0065	ND	ND
Naphthalene	0.0122	0.014	0.0067
Perylene	0.1137	0.1838	0.1175
Phenanthrene	0.0119	0.0297	0.0191
Phenol	0.537	ND	ND
Pyrene	0.0091	0.0371	0.0216
EPA 625m Pesticides ~ µg/L			
Chlorpyrifos	0.2092	0.0688	ND
DCPA (Dacthal)	ND	0.0121	0.0235
Diazinon	ND	0.014	ND
Endrin	ND	ND	< 0.001 *
Malathion	0.0323	0.0513	ND
Toxaphene	ND	0.16	ND
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.
"DNQ" – Constituent detected but not quantified (MDL < result < RL)
"<" – Constituent not detected above specified detection limit.

Table 44: Bacteriological Results from Mass Emission Site ME-CC

Constituent ~ MPN/100 mL	*Event 1 11/25/08*	*Event 2 12/14/08*	*Event 3 2/5/09*
E. Coli	16,160	12,033	4,106
Enterococcus	20,050	32,400	11,840
Fecal Coliform	16,000	24,000	5,000
Total Coliform	1,732,900	721,500	241,920

Table 45: Bacteriological Results from Mass Emission Site ME-VR2

Constituent ~ MPN/100 mL	*Event 1 11/25/08*	*Event 2 12/14/08*	*Event 3 2/5/09*
E. Coli	11,199	1,198	3,076
Enterococcus	4,780	1,013	6,240
Fecal Coliform	9,000	5,000	5,000
Total Coliform	195,600	34,480	43,520

Table 46: Bacteriological Results from Mass Emission Site ME-SCR

Constituent ~ MPN/100 mL	*Event 1 11/25/08*	*Event 2 12/14/08*	*Event 3 2/5/09*
E. Coli	820	4,884	12,033
Enterococcus	1,184	9,450	11,100
Fecal Coliform	1,600	3,000	9,000
Total Coliform	12,9970	387,300	275,500

Toxicity Results

Samples for both acute and chronic toxicity testing were collected during two wet weather events that occurred on November 26, 2008 (Event 1) and December 15, 2008 (Event 2). 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 47 and Table 48.

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 mortality 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 the 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. When the percent survival in 100% sample falls between 0 and 49, the TUa is calculated by dividing 100 by the LC50. When the percent survival on 100% sample falls between 50 and 100, the analyzing laboratory calculated the TUa using the following equation from the California Ocean Plan[5]:

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

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

[5] California Ocean Plan. State Water Resources Control Board. 2001.

Table 47: Acute Toxicity Results from the Land Use and Receiving Water Stations

Station	Sample Date	Percent Survival in 100% Sample	Acute Ceriodaphnia Survival	
			LC50 % Sample	TUa
A-1 (Wood)	11/25/2008	100	>100.00%	0.00
I-2 (Ortega)	NS	------	------	------
R-1 (Swan)	NS	------	------	------
W-3 (La Vista)	11/25/2008	0	18.06%	5.54
W-4 (Revolon)	11/25/2008	0	3.13%	31.95

NS = Not Sampled

Acute toxicity (as demonstrated by a TUa >1.0) was observed only at Receiving Water sites W-3 (La Vista Avenue) and W-4 (Revolon Slough) for the samples collected during Event #1 (Wet), as shown in Table 47. The permit requires that a TIE Baseline test be initiated for each sample with a TUa >1.0, which was performed for both samples.

The LC50 for W-3 (TIE Baseline) was >72.00% (72% Survival in the 72% sample) and the LC50 for W-4 (TIE Baseline) was >12.40% (95% Survival in the 12.4% sample). No toxicity is indicated by these results. This is indicative of the sample's toxicity dissipating by the time the TIE Baseline testing was initiated. It is noteworthy that common environmental mechanisms may be causing degradation or loss of toxicant(s) over time, including volatilization, photochemical (light) reactions, chemical reactions (oxidation/reduction, hydrolysis, etc.) or biochemical (microbial) transformations. No additional TIE testing was warranted based on the TIE Baseline data.

Chronic Toxicity

Chronic toxicity tests were performed using the Purple Sea Urchin (*Strongylocentrotus purpuratus*) as the test species. Results for chronic toxicity tests are summarized in Table 48.

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 48: Chronic Purple Sea Urchin Fertilization Bioassay

Station	Sample Date	Chronic Sea Urchin Bioassay		
		IC50	NOEC	TUc
ME-CC	11/26/2008	>100.00%	100.00%	1.00
ME-CC	12/15/2008	>100.00%	100.00%	1.00
ME-SCR	11/26/2008	>100.00%	100.00%	1.00
ME-SCR	12/15/2008	>100.00%	100.00%	1.00
ME-VR2	11/26/2008	>100.00%	100.00%	1.00
ME-VR2	12/15/2008	>100.00%	100.00%	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 samples collected during either wet event (Event 1 or Event 2). ABC's toxicity testing reports from the 2008/09 monitoring season are provided in Appendix O.
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 2009 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 2008/09 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 the 2008/09 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 2008/09 at the ME-CC and ME-VR2 stations lasted from just under 17 hours (Event 2 at ME-CC) to just under 2 days (Event 3 at ME-VR2). 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 49 and Table 50.

Example Mass Loading Calculation

A mass loading calculation is shown below for an Event 2 chloride concentration measured at ME-CC (Event Duration = 16 hours 58 minutes = 16.97 hours).

Chloride Concentration
47.83 mg/L (Table 35)

Average Flow Rate for Monitoring Event
691.89 cfs (Table 5)

691.89 cfs x 7.48 gal/cf x 3.785 liters/gal = 19,588.6 liters/sec

Load = Concentration x Volume
19,588.6 liters/sec x 47.83 mg/L = 936,922 mg/sec

936,922 mg/sec x 60 sec/min x 60 min/hr x 16.97 hr/event x 1 kg/10^6 mg = 57,238 kg/event

57,238 kg/event x 2.2 lb/kg = **125,924 lbs/event**

Table 49: ME-CC Estimated Mass Loadings

Classification	Constituent	*Event 1* 11/25/08 *15.90 hours* (lbs/event)	*Event 2* 12/14/08 *16.97 hours* (lbs/event)	*Event 3* 2/5/09 *32.38 hours* (lbs/event)
Anion	Bromide	249	503	1070
Anion	Chloride	75400	126000	293000
Conventional	Total Dissolved Solids	266000	958000	1980000
Conventional	Total Organic Carbon	9920	52700	25000
Conventional	Total Suspended Solids	705000	1790000	666000
Conventional	BOD	ND	28200	26500
Hydrocarbon	Oil and Grease	2140*	7370*	ND
Metal	Aluminum - Total	5030	12700	4690
Metal	Arsenic - Total	4.9	14.5	14.3
Metal	Cadmium - Total	1.1	4.5	2.0
Metal	Chromium - Total	20.1	29.8	13.3
Metal	Chromium VI - Total	3.8*	ND	ND
Metal	Copper - Total	50.8	100	51.5
Metal	Lead - Total	14.3	28.6	15.6
Metal	Mercury - Total	0.02	0.1	0.12
Metal	Nickel - Total	33.9	75.0	33.7
Metal	Selenium - Total	0.92	2.4	4.6
Metal	Zinc - Total	137	297	207
Nutrient	Ammonia as N	687	1260	918
Nutrient	Nitrate as N	2990	7770	16000
Nutrient	Nitrite as N	61.1	150	510
Nutrient	Orthophosphate as P (Diss)	266	1240	2670
Nutrient	TKN	53.4	316	1940
Nutrient	Total Phosphorus - Total	2840	4830	5390
Organic	1-Methylnaphthalene	0.003	0.004	0.01
Organic	1-Methylphenanthrene	ND	0.009	ND
Organic	2,4-Dinitrophenol	0.47	ND	ND
Organic	2,6-Dimethylnaphthalene	0.003	0.01	0.02
Organic	2-Methyl-4,6-dinitrophenol	0.19	ND	ND
Organic	2-Methylnaphthalene	0.01	0.03	0.02
Organic	4-Nitrophenol	0.09	ND	ND
Organic	Acenaphthene	0.006	0.01	0.005
Organic	Anthracene	ND	0.008	ND
Organic	Benzo(a)anthracene	0.004	0.03	0.01
Organic	Benzo(a)pyrene	0.01	0.02	0.01
Organic	Benzo(b)fluoranthene	0.009	0.08	0.03
Organic	Benzo(e)pyrene	0.01	0.05	0.02
Organic	Benzo(g,h,i)perylene	0.02	0.05	0.02
Organic	Benzo(k)fluoranthene	ND	0.03	0.02
Organic	Biphenyl	0.004	0.006	0.01
Organic	Bis(2-ethylhexyl)phthalate	3.6	3.0	3.3
Organic	Butyl benzyl phthalate	0.38	0.77	0.94

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

* - Calculation of mass loading derived from result flagged as DNQ - constituent detected but not quantified (MDL < result < RL)

Table 49 (Continued): ME-CC Estimated Mass Loadings

Classification	Constituent	*Event 1* 11/25/08 *15.90 hours* (lbs/event)	*Event 2* 12/14/08 *16.97 hours* (lbs/event)	*Event 3* 2/5/09 *32.38 hours* (lbs/event)
Organic	Chrysene	0.02	0.08	0.03
Organic	Dibenzothiophene	ND	0.007	0.04
Organic	Diethyl phthalate	0.35	7.5	ND
Organic	Dimethyl phthalate	0.05	0.30	ND
Organic	Di-n-butylphthalate	0.14	0.48	ND
Organic	Di-n-octylphthalate	0.21	0.34	0.17
Organic	Fluoranthene	0.02	0.13	0.12
Organic	Fluorene	ND	0.006	ND
Organic	Indeno(1,2,3-cd)pyrene	0.02	ND	0.03
Organic	Naphthalene	0.04	0.05	0.02*
Organic	Perylene	0.005	0.02	0.009
Organic	Phenanthrene	0.009	0.05	0.02
Organic	Phenol	0.63	ND	ND
Organic	Pyrene	0.02	0.14	0.11
Pesticide	2,4'-DDD	0.008	0.01	ND
Pesticide	2,4'-DDE	ND	0.007	ND
Pesticide	2,4'-DDT	ND	0.09	0.01
Pesticide	4,4'-DDD	0.02	0.17	0.02
Pesticide	4,4'-DDE	0.19	0.50	0.4
Pesticide	4,4'-DDT	0.02	0.44	0.07
Pesticide	Chlordane-alpha	0.004	0.02	ND
Pesticide	Chlordane-gamma	0.001	0.02	ND
Pesticide	Chlorpyrifos	1.9	1.4	0.21
Pesticide	DCPA (Dacthal)	0.26	1.6	6.6
Pesticide	Diazinon	0.02	0.14	0.11
Pesticide	Glyphosate	13.0	ND	ND
Pesticide	Malathion	0.25	0.30	1.6
Pesticide	Toxaphene	0.26	1.3	0.67
Pesticide	trans-Nonachlor	0.001	0.02	0.01

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

* - Calculation of mass loading derived from result flagged as DNQ - constituent detected but not quantified (MDL < result < RL)

Table 50: ME-VR2 Estimated Mass Loadings

Classification	Constituent	*Event 1* 11/25/08 *17.43 hours* (lbs/event)	*Event 2* 12/14/08 *17.08 hours* (lbs/event)	*Event 3* 2/5/09 *47.93 hours* (lbs/event)
Anion	Bromide	3.2	17.5	24.8
Anion	Chloride	1030	5790	7270
Conventional	BOD	79.8	236	ND
Conventional	Total Dissolved Solids	13900	60700	96900
Conventional	Total Organic Carbon	93.5	431	257
Conventional	Total Suspended Solids	125	1540	2340
Metal	Aluminum - Total	1.7	36.3	12.4
Metal	Arsenic - Total	0.01	0.27	0.09
Metal	Chromium - Total	0.005*	0.08	0.05*
Metal	Copper - Total	0.03	0.38	0.23
Metal	Lead - Total	0.003	0.06	0.03
Metal	Mercury - Total	0.18	0.13	0.24
Metal	Nickel - Total	0.04	0.35	0.23
Metal	Selenium - Total	0.02	0.16	0.23
Metal	Zinc - Total	0.08	1.2	0.32
Nutrient	Ammonia as N	1.8	3.1*	4.5
Nutrient	Nitrate as N	4.1	86.9	19.6
Nutrient	Nitrite as N	0.68*	4.7*	ND
Nutrient	Orthophosphate as P (Diss)	1.0	6.8	3.3
Nutrient	TKN	ND	ND	43.8
Nutrient	Total Phosphorus - Total	2.1	7.1	4.5*
Organic	1-Methylnaphthalene	0.0001	0.0002	0.0003
Organic	2,6-Dimethylnaphthalene	0.00005	ND	0.0003
Organic	2-Methylnaphthalene	0.0001	0.0003	0.0004
Organic	Acenaphthene	0.00008	0.0003	ND
Organic	Biphenyl	0.00004	ND	0.0003
Organic	Bis(2-ethylhexyl)phthalate	0.05	0.04	ND
Organic	Butyl benzyl phthalate	0.005	0.003	ND
Organic	Dibenzothiophene	ND	ND	0.0002
Organic	Diethyl phthalate	0.01	0.03	0.02
Organic	Di-n-butylphthalate	0.004	ND	ND
Organic	Fluoranthene	ND	0.0002	0.0005
Organic	Fluorene	ND	0	0.0002
Organic	Naphthalene	0.0002	0.0005*	0.0006
Organic	Phenanthrene	0.00004	0.0002	0.0003
Organic	Phenol	0.01	ND	ND
Organic	Pyrene	0.00005	0.0002	0.0002
Pesticide	Chlorpyrifos	0.0005	0.002	ND

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

* - Calculation of mass loading derived from result flagged as DNQ - constituent detected but not quantified (MDL < result < RL)

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[6] 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 P.

The VCWPD, as Principal 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

[6] California Ocean Plan. State Water Resources Control Board. 2005.

Mass Emission and Receiving Water Analysis

The 2008/09 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.

Table 51 through Table 55 present water quality objective exceedances at Mass Emission and Receiving Water stations based on an analysis of the 2008/09 wet weather stormwater monitoring data.

Table 51: Water Quality Objective Exceedances at Mass Emission Site ME-CC

Classification	Constituent (in μg/L except where noted)	Event 1 11/25/08	Event 2 12/14/08	Event 3 2/5/09	Basin Plan Obj.	Ocean Plan Daily Max	CTR FW Obj.
Bacterio-logical	*E. coli* (MPN/100 mL)	16160	12033	4106	235		
Bacterio-logical	Enterococcus (MPN/100 mL)	20050	32400	11840		104	
Bacterio-logical	Fecal Coliform (MPN/100 mL)	16000	24000	5000	400	400	
Bacterio-logical	Total Coliform (MPN/100 mL)	1732900	721500	241920		10000	
Metal	Aluminum - Total	6594	4812		1000		
Metal	Chromium - Total	26.3	11.3			8	
Metal	Copper - Total	66.6	38			12	
Metal	Lead - Total	18.73	10.88			8	
Metal	Nickel - Total	44.4	28.5			20	
Metal	Zinc - Total	179	112.9			80	
Organic	Bis(2-ethylhexyl)phthalate	4.747			4	3.5	
Organic	PAHs	0.1422	0.1807	0.034		0.0088	
Pesticide	4,4'-DDD	0.0312	0.0643				0.00084^
Pesticide	4,4'-DDE	0.2455	0.1906	0.0781			0.00059^
Pesticide	Chlordane	0.0052	0.0204			0.000023	
Pesticide	DDT	0.3087	0.4611	0.0914		0.00017	
Pesticide	Toxaphene	0.3376	0.4975	0.132		0.00021	

Blank cells denote no exceedance of a water quality objective.
"^" – CTR Human Health objective for consumption of organisms only.

Table 52: Water Quality Objectives Exceedances at Mass Emission Site ME-VR2

Classification	Constituent (in μg/L except where noted)	Event 1 11/25/08	Event 2 12/14/08	Event 3 2/5/09	Basin Plan Obj.	Ocean Plan Daily Max	CTR FW Obj.
Bacterio-logical	*E. coli* (MPN/100 mL)	11199	1198	3076	235		
Bacterio-logical	Enterococcus (MPN/100 mL)	4780	1013	6240		104	
Bacterio-logical	Fecal Coliform (MPN/100 mL)	9000	5000	5000	400	400	
Bacterio-logical	Total Coliform (MPN/100 mL)	195600	34480	43520		10000	

Blank cells denote no exceedance of a water quality objective.
"^" – CTR Human Health objective for consumption of organisms only.

Table 53: Water Quality Objective Exceedances at Mass Emission Site ME-SCR

Classification	Constituent (in μg/L except where noted)	Event 1 11/25/08	Event 2 12/14/08	Event 3 2/5/09	Basin Plan Obj.	Ocean Plan Daily Max	CTR FW Obj.
Bacteriological	*E. coli* (MPN/100 mL)	820	4884	12033	235		
Bacteriological	Enterococcus (MPN/100 mL)	1184	9450	11100		104	
Bacteriological	Fecal Coliform (MPN/100 mL)	1600	3000	9000	400	400	
Bacteriological	Total Coliform (MPN/100 mL)	129970	387300	275500		10000	
Metal	Aluminum - Total	2605	6886	2405	1000		
Metal	Chromium - Total		11.1			8	
Metal	Copper - Total		29.7			12	
Metal	Lead - Total		10.64			8	
Metal	Mercury - Total			0.16			0.051^
Metal	Nickel - Total		24.7			20	
Organic	Bis(2-ethylhexyl)phthalate		9.264	5.025	4	3.5	5.9^
Organic	PAHs	0.0423	0.1532	0.057		0.0088	
Pesticide	Toxaphene		0.16			0.00021	

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 for Receiving Water Site W-3

Classification	Constituent (in μg/L except where noted)	Event 1 11/25/08	Basin Plan Obj.	Ocean Plan Daily Max	CTR FW Obj.
Bacteriological	*E. coli* (MPN/100 mL)	7270	235		
Bacteriological	Enterococcus (MPN/100 mL)	6590		104	
Bacteriological	Fecal Coliform (MPN/100 mL)	7000	400	400	
Bacteriological	Total Coliform (MPN/100 mL)	4352000		10000	
Metal	Aluminum - Total	4233	1000		
Metal	Copper - Total	65.8		12	
Metal	Lead - Total	13.13		8	
Metal	Zinc - Total	93.8		80	
Organic	PAHs	0.02		0.0088	
Pesticide	4,4'-DDD	0.0369			0.00084^
Pesticide	4,4'-DDE	0.276			0.00059^
Pesticide	DDT	0.4281		0.00017	
Pesticide	Toxaphene	0.4211		0.00021	

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-4

Classification	*Constituent (in μg/L except where noted)*	*Event 1 11/25/08*	*Basin Plan Obj.*	*Ocean Plan Daily Max*	*CTR FW Obj.*
Bacteriological	*E. coli* (MPN/100 mL)	6488	235		
Bacteriological	Enterococcus (MPN/100 mL)	3640		104	
Bacteriological	Fecal Coliform (MPN/100 mL)	5000	400	400	
Bacteriological	Total Coliform (MPN/100 mL)	866400		10000	
Conventional	Total Dissolved Solids (mg/L)	1082	500		
Metal	Aluminum - Total	2034	1000		
Metal	Copper - Total	17.8		12	
Nutrient	Nitrate as N (mg/L)	14.02	10		
Organic	PAHs	0.028		0.0088	
Pesticide	4,4'-DDD	0.0485			0.00084^
Pesticide	4,4'-DDE	0.2683			0.00059^
Pesticide	Chlordane	0.0126		0.000023	
Pesticide	DDT	0.3589		0.00017	
Pesticide	Toxaphene	0.6403		0.00021	

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 2008/09 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 56 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 56: Water Quality Objective Exceedances at Agricultural Land Use Site A-1

Classification	*Constituent (in μg/L except where noted)*	*Event 1 11/25/08*	*Basin Plan Obj.*	*Ocean Plan Daily Max*	*CTR FW Obj.*
Bacteriological	*E. coli* (MPN/100 mL)	331	235		
Bacteriological	Enterococcus (MPN/100 mL)	2880		104	
Bacteriological	Fecal Coliform (MPN/100 mL)	500	400	400	
Bacteriological	Total Coliform (MPN/100 mL)	1413600		10000	
Conventional	Total Dissolved Solids (mg/L)	2086	500		
Metal	Aluminum - Total	1095	1000		
Metal	Copper - Total	16.7		12	
Nutrient	Nitrate as N (mg/L)	41.07	10		
Organic	PAHs	0.0186		0.0088	
Pesticide	4,4'-DDD	0.0376			0.00084^
Pesticide	4,4'-DDE	0.196			0.00059^
Pesticide	Chlordane	0.0189		0.000023	
Pesticide	DDT	0.3353		0.00017	
Pesticide	Toxaphene	1.1476		0.00021	0.73^

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 51 through Table 56 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 for all events. Likewise, runoff from the A-1 agricultural Land Use site exceeded bacteriological objectives for these same indicator 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 most 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.

Conventionals

Only Receiving Water site W-4 and the agricultural Land Use site A-1 showed total dissolved solids concentrations above Basin Plan objectives during one or more wet weather events. It is important to note that none of the other sampling stations exceeded these objectives during any wet-weather event. 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 2002/03 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, Receiving Water and Land Use sites, with the exception of Mass Emission site ME-VR2, showed concentrations of total aluminum in excess of Basin Plan water quality objectives during most or all wet weather events. This is the sixth year that aluminum has been monitored by the Stormwater Monitoring Program, and the sixth 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 station ME-CC also recorded concentrations of chromium, copper, lead, nickel and zinc above water quality objectives, while ME-SCR had chromium, copper, lead, mercury, and nickel (all total fractions) levels above these objectives. Last year, Mass Emission site ME-VR2 exceeded water quality objectives for cadmium, chromium, copper, lead, mercury, nickel and zinc (all total fractions), but returned to cleaner water as no metals concentrations above water quality objectives were observed. Both Receiving Water sites exhibited exceedances for copper (total fractions) above water quality standards, in addition to exceedances for total lead and total zinc at La Vista (W-3). Total copper measured at the agricultural Land Use site A-1 exceeded the Ocean Plan Daily Maximum objective.

The Basin Plan total aluminum exceedances notwithstanding, it should be noted that all other metals exceedances observed during 2008/09 wet weather events were for metals concentrations above Ocean Plan objectives, with the exception of one CTR mercury exceedance at ME-SCR. 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

Very few water quality objective exceedances were recorded for nutrients this year. Only the Receiving Water site Wood Road (W-4) and the agricultural Land Use site Wood Road (A-1) registered nitrate levels in excess of the applicable standard. Given that these Basin Plan exceedances appear to be an issue most pertinent to fertilizer use by 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 2008/09 wet weather events were limited to the phthalate compound Bis(2-ethylhexyl)phthalate (Event 1 at ME-CC and Events 2 and 3 at ME-SCR) and various polynuclear aromatic hydrocarbons (PAHs). All monitoring sites recorded concentrations of polynuclear aromatic hydrocarbons (PAHs) above the Ocean Plan's objective for PAH compounds.[7] However, unlike in previous years, no PAH concentrations exceeded CTR Human Health water quality objectives.

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.

PCBs

Last year, for the first time in since the 2000/01 monitoring season, several PCBs were detected in stormwater at concentrations that exceeded applicable standards. This year, however, water quality returned to normal with respect to PCBs as no concentrations exceeded the California Toxics Rule freshwater objectives.

Pesticides

As usual, several pesticide exceedances were observed during 2008/09 wet weather events. Total DDT concentrations exceeded the Ocean Plan's maximum[8] at the Mass Emission monitoring site ME-CC and at all Receiving Water and Land Use sites during all events sampled. Similarly, 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. Also, chlordane-related compounds were detected at the Mass Emission monitoring site ME-CC,the Receiving Water monitoring station W-4, and the agricultural Land Use monitoring site Wood Road (A-1) at levels that exceeded the Ocean Plan's Chlordane objective.[9] Finally, for the first time in the history of this Program, toxaphene (an insecticide) was detected above the Ocean Plan daily maximum at every site except for the Mass Emission monitoring station ME-VR2 during most events.

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

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[7] 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.

[8] 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.

[9] 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 0.000023 μg/L Chlordane objective: alpha-Chlordane, alpha-Chlordene, alpha-Nonachlor, Chlordane, gamma-Chlordane, gamma-Chlordene, gamma-Nonachlor, and Oxychlordane.

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.

Conclusions

This report summarizes the first half of the 2008/09 monitoring season in which the Stormwater Monitoring Program successfully collected and analyzed water quality samples from three 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 97.7% success rate in meeting program data quality objectives. Overall, the three 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.

Data from one wet weather and two dry weather monitoring events remain to be reported for the 2008/09 monitoring season by the Stormwater Monitoring Program. Water quality samples collected from these 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 remaining weather monitoring activities will be presented in the October 2009 Annual Monitoring Report along with the present wet weather monitoring results.