Response to Monitoring in Chollas Creek, Investigation Order No. R9-2004-0277

2006-2007 Water Quality Monitoring Data Summary for Chollas Creek

Final Report

Prepared For:
State Water Resources Control Board

In Coordination With:
Chollas Creek Watershed Municipal Copermittees
City of Lemon Grove
City of La Mesa
City of San Diego
County of San Diego
Port of San Diego

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Prepared By:

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EXECUTIVE SUMMARY

This report summarizes the activities conducted by the Chollas Creek Watershed Municipal Workgroup to comply with Regional Water Quality Control Board Order No. R9-2004-0277 during the 2006-2007 monitoring season. The activities conducted are provided as follows:

- Jurisdictions have exercised their legal authority to regulate pesticide discharges through industrial inspections and dry weather IC/ID investigations.
- Jurisdictions performed education and outreach to area residents.
- Jurisdictions have conducted water quality monitoring during three storm events at Sites SD8(1) and DPR2.

Education and outreach activities included 17 community events, targeted strategic audiences in the Chollas Creek Watershed, and an extensive media (Television and Radio) and print campaign. This included just over 1500 public service announcements promoting the Think Blue Website and the "Ants in your Plants" theme. The Integrated Pest Management (IPM) Pest Tip Cards were the primary outreach materials. Residents were very pleased with the cards and the information they provided. The City of San Diego received numerous requests to provide additional cards to community groups who, in turn, facilitated distribution to residents.

Water quality monitoring study results are presented to comply with RWQCB Order No. R9-2004-0277 requirements. Water quality monitoring was specifically conducted under this program to quantitatively assess potential changes in pesticide use and to quantitatively assess the concentration of metals in Chollas Creek.

Storm water monitoring samples were collected at two mass loading stations in Chollas Creek during three separate storm water events. Site SD8(1) was located in the North Fork of Chollas Creek and site DPR2 was located in the south fork of Chollas Creek. Water quality objective exceedances were noted for total organic carbon (TOC), total suspended solids (TSS), diazinon, malathion, total and dissolved copper, total and dissolved lead, total zinc, and total cadmium. There were no exceedances of the WQO for either dissolved cadmium or dissolved zinc. Synthetic pyrethroids were detected in concentrations above published LC50s for *Hyalella azteca* during all three monitoring events during the 2006-2007 monitoring season.

Acute toxicity to *Ceriodaphnia dubia* survival was not observed at either site SD8(1) or DPR2 during the 2006-2007 monitoring season. Chronic toxicity to *Ceriodaphnia dubia* survival was observed during the first storm event on 10/14/06 at both sites and is likely associated with the combined detections of malathion, diazinon and synthetic pyrethroids during this first event. Toxicity to *Hyalella azteca* was observed during all three events at site SD8(1) and during two events at site DPR2. Toxicity identification evaluations conducted as part of the Regional Monitoring Program indicate the causative agent of toxicity at site SD8(1) is the synthetic pyrethroid class of compounds (Weston, 2007).

Mann-Kendall trend analysis performed on the long term data set at site SD8(1) indicate significant decreasing trends for diazinon and toxicity to *Ceriodaphnia dubia.* However, increasing trends are noted for turbidity, total copper, total zinc and toxicity to *Hyalella azteca*.

It is evident that the concentrations of diazinon have been decreasing with time and that storm water samples are apparently less toxic to *Ceriodaphnia dubia* than in previous years when diazinon was available. However, it is also apparent that detections above the WQO may continue based on the data collected during the 2006-2007 monitoring season. It is expected that the residual supply will eventually be exhausted and detections of diazinon should continue to decrease due to the EPA ban on the manufacture and retail sale of this product. It is evident that synthetic pyrethroids are present in storm water runoff which warrants concern. With this evidence, education and outreach to area residents and businesses should continue in order to reduce the impacts of pesticide use in the Chollas Creek Watershed. With regards to the implementation of the TMDLs for metals for Chollas Creek, it is apparent that toxicity to *Ceriodaphnia dubia* was not observed in the later storms where both dissolved copper and dissolved zinc were frequently measured above the WQO, based on the low hardness concentrations. With regards to these observations, the development of site specific objectives for dissolved metals would be useful.

Special studies were also conducted to answer specific management questions at the jurisdictional level. These additional studies include monitoring at the jurisdictional boundaries of La Mesa and Lemon Grove, an aerial deposition study within Chollas Creek, and storm drain and receiving water monitoring in La Mesa.

1.0 INTRODUCTION

The Chollas Creek Watershed is located within a highly urbanized area of San Diego County having a predominantly residential land use. The Chollas Creek Watershed is a part of the San Diego Mesa Hydrologic Area, which is a part of the Pueblo San Diego Hydrologic Unit. Located south and east of downtown San Diego, the watershed is approximately 30 sq. miles, and the main stem of the creek is approximately 9 mi. long.

Chollas Creek discharges to San Diego Bay and consists of two main tributaries, the North and South fork. The lower approximate 1.0 mi. of the creek is tidally influenced and branches near the upstream extent of the tidal influence. The main stem of Chollas Creek trends north from this point for approximately 1.5 mi. then bends towards the northeast. A few smaller tributaries enter the main stem. The second or southern stem, of Chollas Creek tends generally east-northeasterly, itself branching into two creeks. The creek is a mix of highly developed earthen channels and concrete channels. It tends to be an ephemeral creek, flowing during the wet season, primarily as a conduit for storm water runoff.

The Cities of San Diego, Lemon Grove, and La Mesa, the County of San Diego, and the Port of San Diego are municipal dischargers to the Chollas Creek watershed. The California Department of Transportation and the U.S. Navy also discharge urban runoff to the watershed. Water quality problems in the watershed are primarily related to pesticides, total and dissolved copper, lead, and zinc, fecal bacteria indicators, and water column toxicity to *Hyalella azteca*.

This report provides the activities conducted as part of the annual monitoring and reporting requirements for San Diego Regional Water Quality Control Board (RWQCB) Order No. R9-2004-0277.

Studies conducted in the Chollas Creek Watershed during the 2006-2007 monitoring year include the following:

- Copermittees Legal Authority
- Public Outreach and Education
- Water quality monitoring at Site DPR2 in the south fork of Chollas Creek to satisfy RWQCB Order R9-2004-0277.
- Water quality monitoring at Site SD8(1) in the north fork of Chollas Creek as part of the Regional Monitoring and Reporting Program. This data is also required to be reported under RWQCB Order R9-2004-0277.
- Water quality monitoring at the jurisdictional boundaries of Lemon Grove and La Mesa to understand the jurisdictional contributions of constituents.
- An aerial deposition study to assess the contribution of metals from aerial deposition.
- Water quality monitoring conducted within the City of La Mesa to determine loading characteristics from specific drainage basins.

1.1 Water Quality Background

The Water Quality Control Plan for the San Diego Region (Basin Plan) lists the beneficial uses of Chollas Creek as REC-2 (supports Non-Contact Water Recreation), WARM (supports Warm Freshwater Habitat) and WILD (supports Wildlife Habitat). Chollas Creek has the potential to support the REC-1 beneficial use (Contact Water Recreation). The 2006 Clean Water Act (CWA) Section 303(d) list identifies bacterial indicators, copper, lead and zinc as pollutants within Chollas Creek. Water quality monitoring data indicate that the pesticide diazinon historically exceeded water quality standards in most of the region's watersheds, including Chollas Creek, until recent years. While diazinon was identified as the primary agent associated with pesticide pollution in the San Diego region, diazinon was phased out of manufacturing and is no longer available for retail sale since December 2004. The San Diego Regional Water Quality Control Board (RWQCB) adopted a Total Maximum Daily Load (TMDL) for diazinon in Chollas Creek (Resolution No. R9-2002-0123) in 2002. However, the use of synthetic pyrethroids as a replacement pesticide is evident and has been identified as the current causative agent of toxicity to *H. azteca* in Chollas Creek (Weston, 2007).

Metals have also frequently exceeded the California Toxics Rule (CTR) criteria in Chollas Creek. Both dissolved copper and dissolved zinc have been linked to toxicity of freshwater organisms in Chollas Creek. The San Diego Regional Water Quality Control Board (RWQCB) adopted a Total Maximum Daily Load (TMDL) for dissolved copper, lead, and zinc in Chollas Creek (Resolution No. R9-2007-0043) in 2007. RWQCB Order No. R9-2004-0277 requires monitoring for metals (in addition to diazinon and toxicity) to further assess the condition of metals in Chollas Creek for future use in the development of TMDLs for metals and toxicity in San Diego Bay at the mouth of Chollas Creek. Under RWQCB Order No. R9-2004-0277, annual storm water quality monitoring is required to be performed at the downstream mass loading stations in the north fork [Site SD8(1)] and south fork [Site DPR2] of Chollas Creek.

Monitoring performed under RWQCB Order No. R9-2004-0277 and the San Diego County Municipal Permit indicate that diazinon concentrations have significantly decreased and have been measured above the TMDL waste load allocation only once over the past three monitoring years. Acute and chronic toxicity to *Ceriodaphnia dubia* has also significantly decreased. However, toxicity to *H. azteca* has remained persistent and total and dissolved copper and zinc concentrations are frequently above the water quality objectives based on the California Toxics Rule (CTR). Lead is also listed in the Chollas Creek Metals TMDL and concentrations are measured above the CTR less frequently than copper and zinc. Fecal coliform densities are also frequently above the Basin Plan water quality objective.

1.2 Copermittees Legal Authority

Under California Regional Water Quality Control Board (RWQCB) Order No. R9-2004-0277 (item 2-a), the order requires the reporting of information on how the Copermittees have implemented their legal authority to remedy the condition of pollution. This is accomplished primarily through the current dry weather monitoring program and facility inspections conducted under NPDES Order No. 2001-01. Dry weather monitoring is conducted throughout Chollas

Creek to identify and mitigate illicit discharges and illicit connections. As part of the dry weather monitoring program, diazinon and metals are monitored and any illicit discharge of diazinon or metals would be mitigated through this program by issues of violations and/or citations.

Each of the Chollas Creek Watershed Copermittees has ordinances in place to enforce the illegal and unauthorized discharge of wastes into their storm drain systems. For instance, The City of San Diego Municipal Code includes Storm Water Management and Discharge Control (§43.0301), and Storm Water Runoff and Drainage Regulations (§142.01 and §142.02) both of which protect citizens and water quality by prohibiting pollutants from entering the storm water conveyance system. The Storm Water Program's Code Compliance Section enforces the City's storm water ordinance and implements the administrative civil penalties and citation process.

1.3 Diazinon Toxicity Control Plan

California Regional Water Quality Control Board (RWQCB) Order No. R9-2004-0277 (item 2-c), requires the reporting of information on the implementation and efficacy of a Diazinon Toxicity Control Plan.

Per Investigation Order No. R9-2004-0277, the "pesticide component" of the education program can serve as the Diazinon Toxicity Control Plan required by the TMDL. See Section 1.4.

1.4 Diazinon Public Outreach/Education Program

Under California Regional Water Quality Control Board (RWQCB) Order No. R9-2004-0277 (item 2-c), the order required the reporting of information on the implementation and efficacy of a Diazinon Public Outreach/Education Program.

This Program was a joint effort by the Chollas Creek Watershed Copermittees. It was funded by a State Water Resources Control Board Proposition 13 Grant and uses a network of staff from the County of San Diego, the University of California Cooperative Extension (UCCE), and the City of San Diego to publicize less harmful ways to kill pests. All of the Copermittees were project partners and the Outreach Workgroup serves as the technical advisory committee to the Program's goals and objective. The Copermittees contributed $78,000 of in-kind shared costs to the reproduction of "Healthy Garden, Healthy Home" outreach materials and to the development and air-time for Think Blue IPM Public Service Announcement (PSA). The PSA launched in June 2006 in concert with a watershed-theme PSA in order to leverage air-time costs and to intertwine messages about IPM and water quality.

The City of San Diego participated in twelve workshops and distributed IPM cards (Appendix A) to educate Chollas Creek Watershed residents and other members of the public in San Diego County about using IPM solutions to reduce pesticide levels found in our waterways. IPM uses environmentally sound ways to keep pests under control without harming people, pets, or the environment. These materials were designed to encourage positive behavior changes and attitudes of San Diego residents when dealing with pesticides in their homes and gardens.

The City of La Mesa participated in five outreach/education programs. The City of La Mesa developed and distributed the San Diego Bay Watershed Fact Sheet (Appendix A). This Fact Sheet was designed to encourage residents to practice good housekeeping and storm water pollution prevention measures such as efficient irrigation. IPM cards were also distributed at the three educational events.

Events in which Copermittees have participated are detailed in Table 1-1.

Table 1-1. Community Events (FY 2006-07)

Date	Copermittee	Watershed	Event Type	Event Title	Specific Audience	Estimated Audience #	Site Name/ Location	Materials Distributed
Aug. 12, 2006	City of San Diego	San Diego Bay (All)	Street Fair	Marine Corps Recruit Depot Bayfest	General Public	800	Marine Corps Recruit Depot	IPM Pest Tip Cards, Pest Cards Feedback Forms, Promotional items
Aug. 19, 2006	City of San Diego	San Diego Bay (Chollas Creek)	Street Fair	Encanto Cultural Arts Festival	General Public	~50,000	Imperial Ave, San Diego	IPM Pest Tip Cards, Pest Cards Feedback Forms, Promotional items
Sept. 7, 2006	City of San Diego	San Diego Bay (Chollas Creek)	Street Fair	Filipino Heritage Festival	General Public	~10,000	Paradise Valley Road	IPM Pest Tip Cards, Pest Cards Feedback Forms, Promotional items
Sept. 16, 2006	City of La Mesa	San Diego Bay	Creek Cleanup	California Coastal Cleanup Day	General Public	5	University Channel, La Mesa	San Diego Bay Watershed Fact Sheet
Sept. 30, 2006	City of La Mesa	San Diego Bay	Education for Children	Kids Care Fest La Mesa	General Public	1,200	Briercrest Park, La Mesa	IPM Cards, San Diego Bay Fact Sheet
Oct. 6-8, 2006	City of La Mesa	San Diego Bay	Festival	Ocktoberfest La Mesa	General Public	180,000	La Mesa Blvd	IPM Cards, San Diego Bay Fact Sheet
Oct. 13, 2006	City of La Mesa	San Diego Bay	Outreach-School	Inter-generational Games	La Mesa Middle School and General Public	140	La Mesa Middle School	IPM Cards, San Diego Bay Fact Sheet

Date	Copermittee	Watershed	Event Type	Event Title	Specific Audience	Estimated Audience #	Site Name/ Location	Materials Distributed
31-Mar-07	City of San Diego	San Diego Bay (Chollas Creek)	Street Fair	Cesar Chavez Festival	General Public	~20,000		IPM Pest Tip Cards, Pest Cards Feedback Forms, Promotional items
5-Apr-07	City of San Diego	San Diego Bay (Chollas Creek)	Community Meeting	Normal Heights Planning Committee	Committee Members	20	North Park Library	IPM Pest Tip Cards, Pest Cards Feedback Forms, Promotional items
10-Apr-07	City of San Diego	San Diego Bay (Chollas Creek)	Community Meeting	Mountain View Park Recreation Council	Committee Members	20	Mountain View Recreation Center	IPM Pest Tip Cards, Pest Cards Feedback Forms, Promotional items
17-Apr-07	City of San Diego	San Diego Bay (Chollas Creek)	Community Meeting	Webster Community Council	Committee Members	20	Webster Community Center	IPM Pest Tip Cards, Pest Cards Feedback Forms, Promotional items
25-Apr-07	City of San Diego	San Diego Bay (Chollas Creek)	Community Meeting	Encanto Recreation Council	Committee Members	20	Encanto Recreation Center	IPM Pest Tip Cards, Pest Cards Feedback Forms, Promotional items
28-Apr-07	City of La Mesa	San Diego Bay	Cleanup Event	Creek to Bay Cleanup	General Public	3	University Channel, La Mesa	San Diego Bay Fact Sheet
8-May-07	City of San Diego	San Diego Bay (Chollas Creek)	Community Meeting	Eastern Area Communities Planning Committee	Committee Members	20	2755 55th Street	IPM Pest Tip Cards, Pest Cards Feedback Forms, Promotional items
15-May-07	City of San Diego	San Diego Bay (Chollas Creek)	Community Meeting	Greater North Park Planning Committee	Committee Members	20	2901 North Park Way	IPM Pest Tip Cards, Pest Cards Feedback Forms, Promotional items

Date	Copermittee	Watershed	Event Type	Event Title	Specific Audience	Estimated Audience #	Site Name/ Location	Materials Distributed
12-Jun-07	City of San Diego	San Diego Bay (Chollas Creek)	Community Meeting	Monthly Meeting	Committee Members	20	Oak Park Community Center	IPM Pest Tip Cards, Pest Cards Feedback Forms, Promotional items

1.5 Public Outreach Plan

This report includes a description of outreach and education strategies for the Chollas Creek Watershed component of the program led by the City of San Diego Storm Water Pollution Prevention Program.

1.6 Project Outreach and Education Strategy

Strategic Objectives

Based on the research and general principles of behavioral change through public outreach programs, the outreach and education strategy sought to continue to meet the following objectives:

- Raise awareness among target audiences of the benefits of using IPM practices.
- Provide tools and information that make it easy for target audiences to use IPM.
- Identify third-party spokespeople in the community to help spread information about IPM and reinforce IPM use.

Audiences

Priority audiences for the project's outreach and education strategy included the following members of the Chollas Creek Watershed:

- Residents who use pesticides.
- Community organizations that influence local residents, including ecumenical groups, ethnic organizations and neighborhood groups.
- Property managers.

NOTE: Since partnerships with retail outlets and gardeners are being handled by San Diego County, these audiences are not included in the strategy. However, the broad based regional outreach by the San Diego County and University of California Cooperative Extension should continue to provide valuable messages to San Diego County Residents. Education and outreach materials provided by San Diego County of are included in Appendix A.

Messages

Messages that were stressed in outreach efforts included:

- Chollas Creek is polluted from overuse of pesticides.
- Safe alternatives to pesticides are better for your family and the environment, today and for future generations.
- Using natural methods is easy and inexpensive.

Tools and Tactics

The City of San Diego continued to use the following tools and tactics to achieve the strategic objectives.

Informational Materials

Reproduced educational and informational materials specific to Chollas Creek watershed outreach were used, based upon the University of California Cooperative Extension (UCCE) Statewide IPM model. The Pest Tip Cards were the primary outreach materials. Residents were very pleased with the cards and the information they provided. The City of San Diego received numerous requests to provide additional cards to community groups who, in turn, facilitated distribution to residents.

Media

For the large Hispanic community in the watershed, a special effort was made to get information to Spanish radio and television media, including:

- Español Radio KLNV 106.5 FM
- KLQV 102.9 FM
- XEWT (Hispanic)

Public Service Announcement Development

The City of San Diego placed advertising on local television and radio outlets. The City designed the ad, "Ants in Your Plants" (funded by the San Diego Regional Storm Water Copermittees (Copermittees) and features IPM tips and suggestions the public should implement to control ants.

The “Ants in Your Plants” PSA was placed on the following television and radio stations:

Television

- Cox Media – Cable Stations: HGTV, TNT, Channel 4, Lifetime, USA
- CW - 5
- KFMB
- KNSD
- KUSI
- XEWT (Hispanic)

Radio

- KIFM
- KLNV
- KLQV
- KMYI (Star 94.1)
- KPRI
- KSON
- KYXY

Outdoor Media

The following table (Table 1-2) details the City of San Diego's radio and television Media Buy for Fiscal Year 2007. The highlighted column represents the number of PSAs that aired that related to IPM.

Table 1-2. Think Blue FISCAL YEAR 2007 Media Buy Year End Summary

Station	IPM PSA
Television	
KIFM-Jazz 98.1	207
KLNV	26
KLQV	56
KMYI	27
KPRI 102.1	57
KSON	63
KYXY	42
Radio	
COX NETWORK	800
CW-5	34
KFMB	10
KNSD	29
KUSI TV 9/51	78
XEWT 12 *	72
TOTALS:	**1501**

Think Blue Website

The City of San Diego posted IPM outreach materials developed for the project on the Think Blue Website on an on-going basis throughout the duration of the grant, to provide City of San Diego residents easy access to these materials.

The Think Blue Website featured a link from the home page to the Chollas Creek efforts and IPM information. Web materials included a Fact Sheet that details the overall efforts to reduce pesticides in the Chollas Creek Watershed, a Fact Sheet on How to Hire a Pest Control Service and an electronic version of all of the Tip Cards.

Site visits averaged 11,469 a month with an average of 1,462 also visiting an IPM pest card information page.

1.7 Sampling Locations

The two sampling locations required by Order R9-2004-0277 are depicted in Figure 1-1. Site DPR2 is located in the south fork of Chollas Creek and Site SD8(1) is located in the north fork of Chollas Creek.

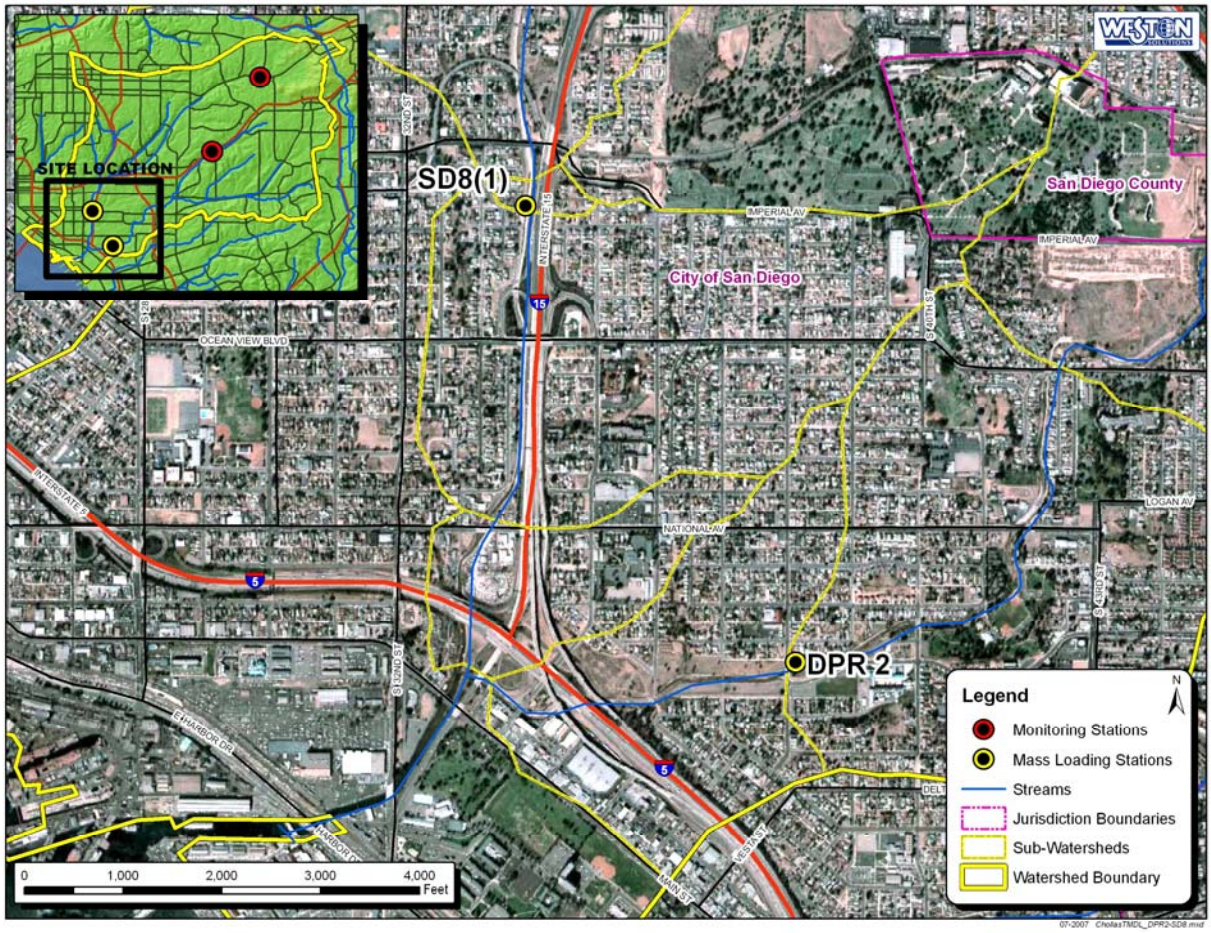


Figure 1-1. DPR2 and SD8(1) Mass Loading Stations (Monitoring Locations)

1.8 Drainage Area and Land Use

The Chollas sub-watershed is divided into two drainage areas. The north fork drains approximately 9,276 acres and the south fork drains approximately 6,997 acres. The drainage areas captured from each station is presented in the Table 1-3. Land use consists of residential (67%), commercial (5%), industrial use (7%), and roadways (4%). The majority of the remaining area is open space (16%) (RWQCB, 2002).

Table 1-3. Estimated Drainage Areas

Watershed	Monitoring Locations	Drainage Areas (acres)
North Fork	SD8(1)	6,198
South Fork	DPR2	5,825

1.9 Rainfall Data

As previously mentioned, Order R9-2004-0277 requires monitoring to be performed at sites SD8(1) and DPR2 for the 1st and 2nd rainfall events of the storm season and the first rainfall after February 1st. Estimation of a representative storm event in the San Diego region was based on the statistical evaluation of the long-term data records from the National Weather Service rain gauge located at Lindbergh Field. Based on the results of this statistical analysis, the "typical" storm event at Lindbergh Field yields 0.19 to 0.57 inches of rain and lasts 6 to 12 hours. Since the depth and duration of a typical storm event varies in different parts of the county where monitoring stations are located, storm events that were preceded by 72 hours of dry weather and were forecast to be greater than 0.10 inches were considered viable events for monitoring.

1.10 Rainfall Data 2006-2007

The total rainfall for the 2006-2007 monitoring year shows that representative storm events that were suitable to monitor occurred in October, January, and February. Figure 1-2 through Figure 1-4 summarize the daily rainfall totals and distributions within San Diego County and specifically for Chollas Creek. The monitored storm event was preceded by at least 72 hours of dry weather. The area received an average rainfall of 5.70 inches for the year. The total annual volumes of water received at the DPR2 and SD8(1) mass loading stations respectively were estimated at 120,525,075 ft^3 and 128,242,818 ft^3. Three storm events were monitored as part of the program on October 14th 2006, December 10th 2006, and February 19th 2007.

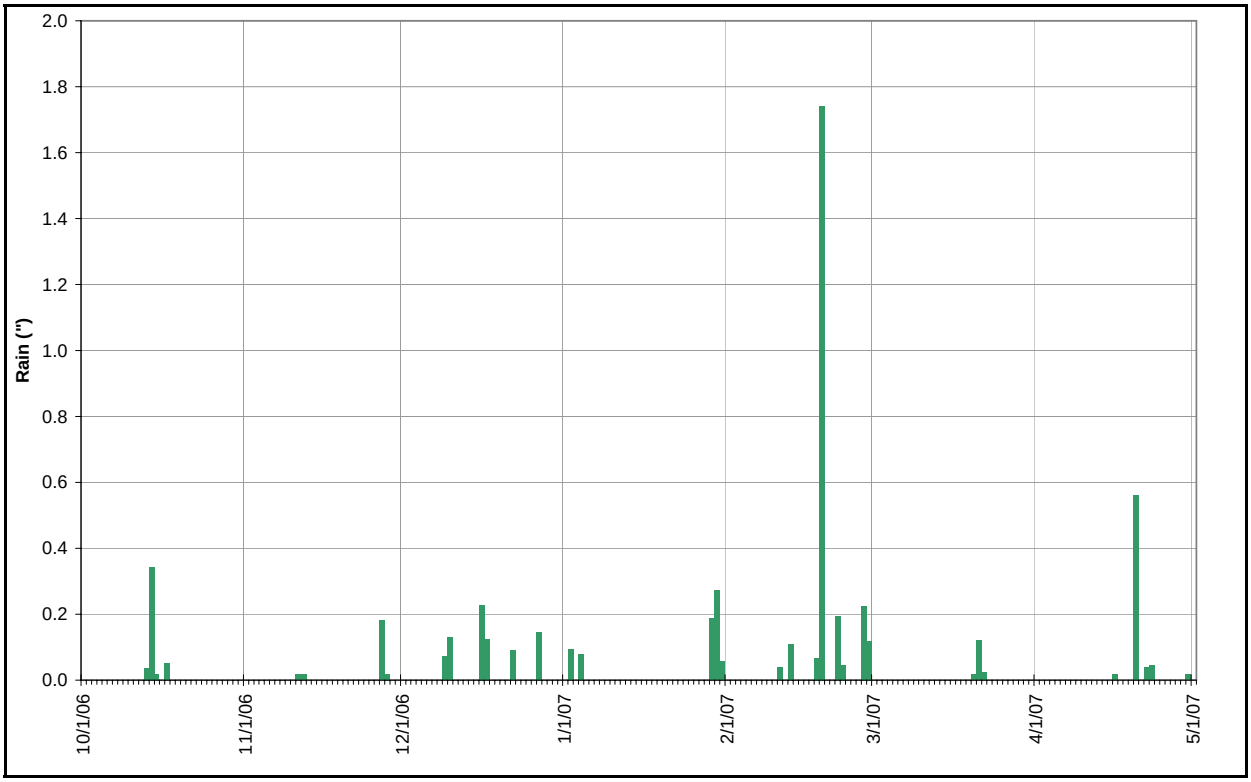


Figure 1-2. 2006-2007 Rainfall Totals (inches) for the Chollas Creek Watershed

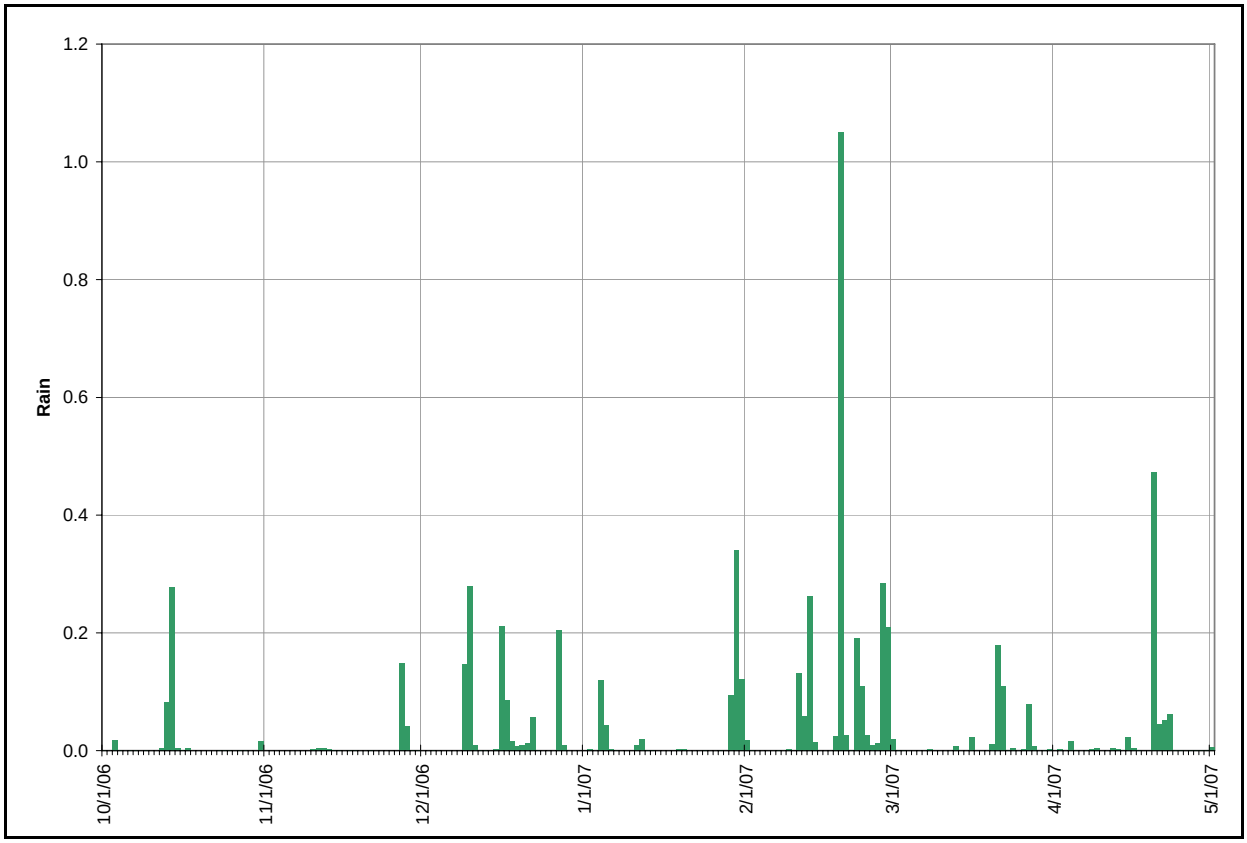


Figure 1-3. 2006-2007 Rainfall Totals (inches) for San Diego County

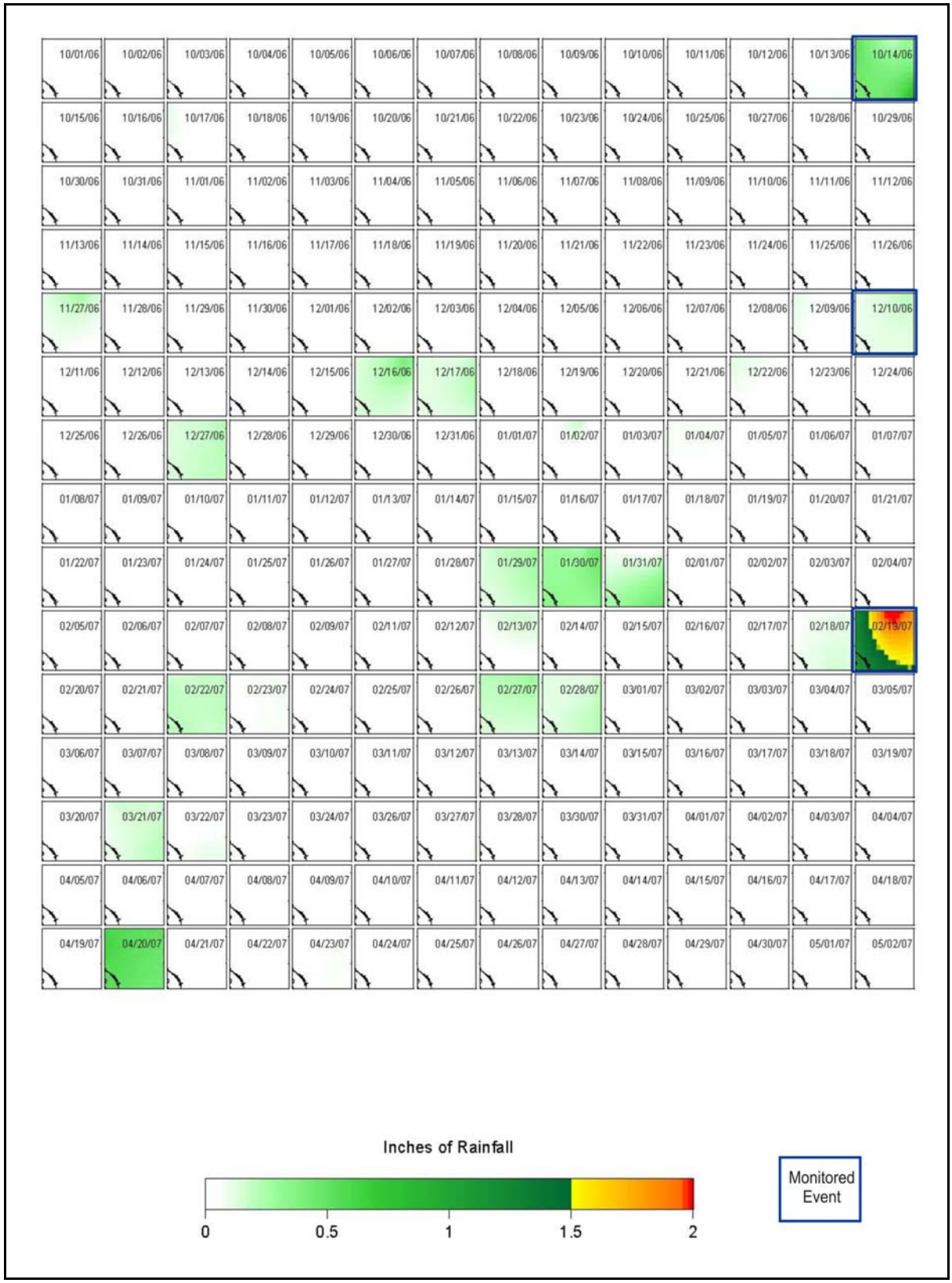


Figure 1-4. Rainfall Events and Distribution for DPR2 and SD8(1) During the 2006-2007 Wet Weather Monitoring Period

2.0 SAMPLING AND ANALYTICAL METHODS

2.1 Sampling Methods

Storm water runoff was collected using flow-weighted composite techniques over the duration of runoff. Sample collection was terminated when the storm flow returned to near 10 % of the base flow condition, upon the end of the precipitation event, and cessation of storm water flow.

2.2 Storm Water Quality Monitoring

Automated flow and sampling equipment were installed at each site to collect flow-weighted composite samples during storm events. American Sigma flow meters with pressure transducers or bubblers were used to measure velocity and stage height. The flow sensors were installed on the channel bottom in the center of the channel.

Using the data collected by the flow meters, sample intervals were set to collect approximately 40-liters of water throughout the storm event. The sample intake point was located adjacent to the flow meter, on the channel bottom in the center of the channel. American Sigma automated samplers were used to collect 1-liter sample grabs at a flow dependent rate. The 1-liter grabs were composited into 20-liter borosilicate glass sample bottles.

The automated sampler collects grab samples via a peristaltic pumping mechanism. Water samples are pumped through a Teflon intake device and Teflon tubing into a 20-liter borosilicate glass sample bottle. Bottles were kept on ice during the storm event. Field crews maintained and replaced the sampling bottles as they filled to capacity. Multiple bottles are composited at Weston's facility and subsampled for delivery to the laboratory for chemistry and bioassay toxicity analyses.

Flow-weighted composite samples were collected and analyzed for the constituents listed in Table 2-1. Bioassay samples were collected for acute and chronic toxicity analyses using the organism *C. dubia* and acute toxicity to *Hyalella azteca*.

Grab samples were collected for those constituents that are not conducive to automated composite sampling. These constituents are pH, temperature, conductivity and fecal indicator bacteria (Table 2-1). Grab samples were collected from the horizontal and vertical center of the channel where possible.

A field data log was completed at each site (Appendix B). The field data log includes empirical observations of the site and water quality characteristics. Observations include parameters such as meteorological conditions at time of sampling; odor, color, and general turbidity of the runoff; and changes in vegetation condition or erosion along the channel's side slope.

Table 2-1. Water Quality Analytical Parameters for the DPR2 and SD8(1) Sites

Analytical Parameter	Analytical Method	Sample Volume	Container Type	Preservation (chemical, temperature, light protected)	Maximum Holding Time: Preparation/ Analysis
pH	N/A	N/A	Analyzed in Field	N/A	N/A
Temperature	N/A	N/A	Analyzed in Field	N/A	N/A
Conductivity	N/A	N/A	Analyzed in Field	N/A	N/A
Total Coliform	SM 9221 B, E	100 ml	Plastic	Store Cool at <4ºC	6 Hours
Fecal Coliform	SM 9221 B, E	100 ml	Plastic	Store Cool at <4ºC	6 Hours
Enterococci	SM 9320	100 ml	Plastic	Store Cool at <4ºC	6 Hours
TSS	SM 2540D	1L	Plastic	Store Cool at <4ºC	7 Days
Total Hardness	SM 2340-B	100 mL	Plastic	HNO_3	6 Months
Nitrate - N	SM 4500-NO_3	100 mL	Plastic or Glass	Store Cool at <4ºC	48 Hours
Nitrite - N	SM 4500-NO_2	100 mL	Plastic or Glass	Store Cool at <4ºC	48 Hours
TKN	EPA 351.3	500 mL	Amber Glass	Acidify to <2 with H_2S0_4	28 Days
Ammonia - N	SM 4500-NH_3	250 mL	Plastic or Glass	Acidify to <2 with H_2S0_4	28 Days
TOC	EPA 415.1	250 mL	Clear Glass	Acidify to <2 with H_2S0_4	28 Days
Organophosphorus Pesticides	EPA 625	2L	Amber Glass	Store Cool at <4ºC	Extraction-7 Days Analysis-40 Days
Synthetic Pyrethroids	EPA 625-NCI	2L	Amber Glass	Store Cool at <4ºC	Extraction-7 Days Analysis-40 Days
Total & Dissolved Cadmium	EPA 200.8	1L	Plastic	Store Cool at <4ºC	6 Months
Total & Dissolved Copper	EPA 200.8	1L	Plastic	Store Cool at <4ºC	6 Months
Total & Dissolved Lead	EPA 200.8	1L	Plastic	Store Cool at <4ºC	6 Months
Total & Dissolved Zinc	EPA 200.8	1L	Plastic	Store Cool at <4ºC	6 Months
Acute Toxicity *C. Dubia* and *H. Azteca*	EPA 821-R-02-012	10L	10L Glass	Store Cool at <6ºC	36 Hours
Chronic Toxicity *C. Dubia*	EPA 821-R-02-013	20L	20L Glass	Store Cool at <6ºC	36 Hours

2.3 QA/QC Procedures

Field measurements for pH, conductivity, and temperature were made using an Oakton CON10 pH/temperature/conductivity meter according to manufacturer's specifications. Calibration of the instruments was conducted prior to each sampling event.

Quality assurance and quality control (QA/QC) for sampling processes included proper collection of the samples in order to minimize the possibility of contamination. All samples were collected in laboratory supplied, laboratory-certified, contaminant free sample bottles while wearing powder free nitrile gloves. All sampling personnel were trained according to the field sampling SOPs. Field staff was made aware of the significance of the project detection limits and the requirement to avoid contamination of samples at all times.

A temperature blank was utilized to ensure sample holding temperatures were maintained from sample collection to delivering to the laboratory.

2.4 Chain-of-Custody Procedures

Chain-of-custody (COC) procedures were used for all samples throughout the collection, transport, and analytical process. Samples were considered to be in custody if they were (1) in the custodian's possession or view, (2) retained in a secured place (under lock) with restricted access, or (3) placed in a container and secured with an official seal such that the sample could not be reached without breaking the seal. The principal documents used to identify samples and to document possession were COC records, field logbooks, and field tracking forms.

The COC procedures were initiated during sample collection. A COC record was provided with each sample or group of samples. Each person who had custody of the samples signed the form and ensured the samples were not left unattended unless properly secured. Documentation of sample handling and custody included the following:

- Sample identifier
- Sample collection date and time
- Any special notations on sample characteristics or analysis
- Initials of the person collecting the sample
- Date the sample was sent to the analytical laboratory
- Shipping company and waybill information.

Completed COC forms were placed in a plastic envelope and kept inside the container with the samples. Once delivered to the analytical laboratory, the COC form was signed by the person receiving the samples. The condition of the samples (i.e., confirming all samples were accounted for and properly labeled, the temperature of the samples, and integrity of the sample jars) was noted and recorded by the receiver. COC records were included in the final reports prepared by the analytical laboratories and are considered an integral part of the report.

3.0 MONITORING RESULTS AND ASSESSMENT

This section presents the water quality monitoring results for sites DPR2 and SD8(1) to satisfy the requirements of RWQCB Order No. R9-2004-0277. The criteria for which results are assessed are also presented.

3.1 Water Quality Criteria

Water chemistry results will be compared to criteria from the following references to determine the magnitude of any impacts from storm water runoff to Chollas Creek:

- Water Quality Control Plan (Basin Plan, RWQCB, 1994) for the San Diego Region
- Title 40 of the Code of Federal Regulations (Part 131; Water Quality Standards) (USEPA, 2000a)
- The National Pollutant Discharge Elimination System (NPDES) Storm Water Multi-Sector General Permit (USEPA, 2000b)
- Water quality criteria for diazinon, chlorpyrifos, and malathion (CDFG, 2000)

Table 3-1 lists the constituents that were monitored during this project and their respective water quality objectives.

Table 3-1. Water Quality Criteria

Constituent	Criteria	Source
Water Samples		
pH	6.5 – 8.5	Basin Plan (RWQCB, 1994)
Conductivity	-	
Temperature	-	
Total Coliform	-	-
Fecal Coliform	4000	Basin Plan (RWQCB, 1994)
Enterococci	-	-
Total Organic Carbon (TOC)	50 mg/L	Multi-Sector General Permit (USEPA, 2000b)
Total Suspended Solids (TSS)	100 mg/L	Multi-Sector General Permit (USEPA, 2000b)
Total and Dissolved Cadmium	(a)	40 CFR 131 (USEPA, 2000a)
Total and Dissolved Copper	(a)	40 CFR 131 (USEPA, 2000a)
Total and Dissolved Lead	(a)	40 CFR 131 (USEPA, 2000a)
Total and Dissolved Zinc	(a)	40 CFR 131 (USEPA, 2000a)
Hardness	-	
Diazinon	72 ng/L/45 ng/L	Resolution No. R9-2002-0123(b)
Chlorpyrifos	20 ng/L	CDFG (2000)
Malathion	430 ng/L	CDFG (2000)
Ammonia (unionized)	0.025 mg/L	Basin Plan (RWQCB, 1994)
Nitrate	10 mg/L	Basin Plan (RWQCB, 1994)
Nitrite	1 mg/L	Basin Plan (RWQCB, 1994)
Total Kjeldahl Nitrogen (TKN)	-	-
Acute Toxicity *Ceriodaphnia dubia*	LC_{50}	-
Acute toxicity *Hyalella azteca*	100 NOEC (%)	-

Constituent	Criteria	Source
Chronic Toxicity *Ceriodaphnia dubia*	100 NOEC (%)	-

(a) Water Quality Objective for total and dissolved metal fractions are based on Total Hardness (as CaCO3) and are calculated as described by Title 40 of the Code of Federal Regulations (Part 131) (USEPA, 2000). Samples are compared to both the acute (CMC) and Chronic (CCC) criteria.

(b) For the Chollas Creek TMDL (Resolution No. R9-2002-0123), the WLA is set at 72 ng/L for acute exposures and 45 ng/L for chronic exposures. The 45 ng/L chronic exposure is applied to samples collected using a flow weighted composite method.

3.2 Sampling Summary

Samples of urban runoff were collected from three storm event during the 2006-2007 wet weather monitoring season (10/14/2006, 12/10/2006 and 02/19/2007). The storm event was considered viable for monitoring if it achieved greater than 0.1 inches of rainfall and was expected to create measurable run-off. Flow-weighted composite samples were collected at the initial flush of runoff and sampling continued throughout the entirety of the storm event. Hydrographs from the monitored storm events for the DPR2 and SD8(1) sites are presented in Figure 3-1 through Figure 3-6.

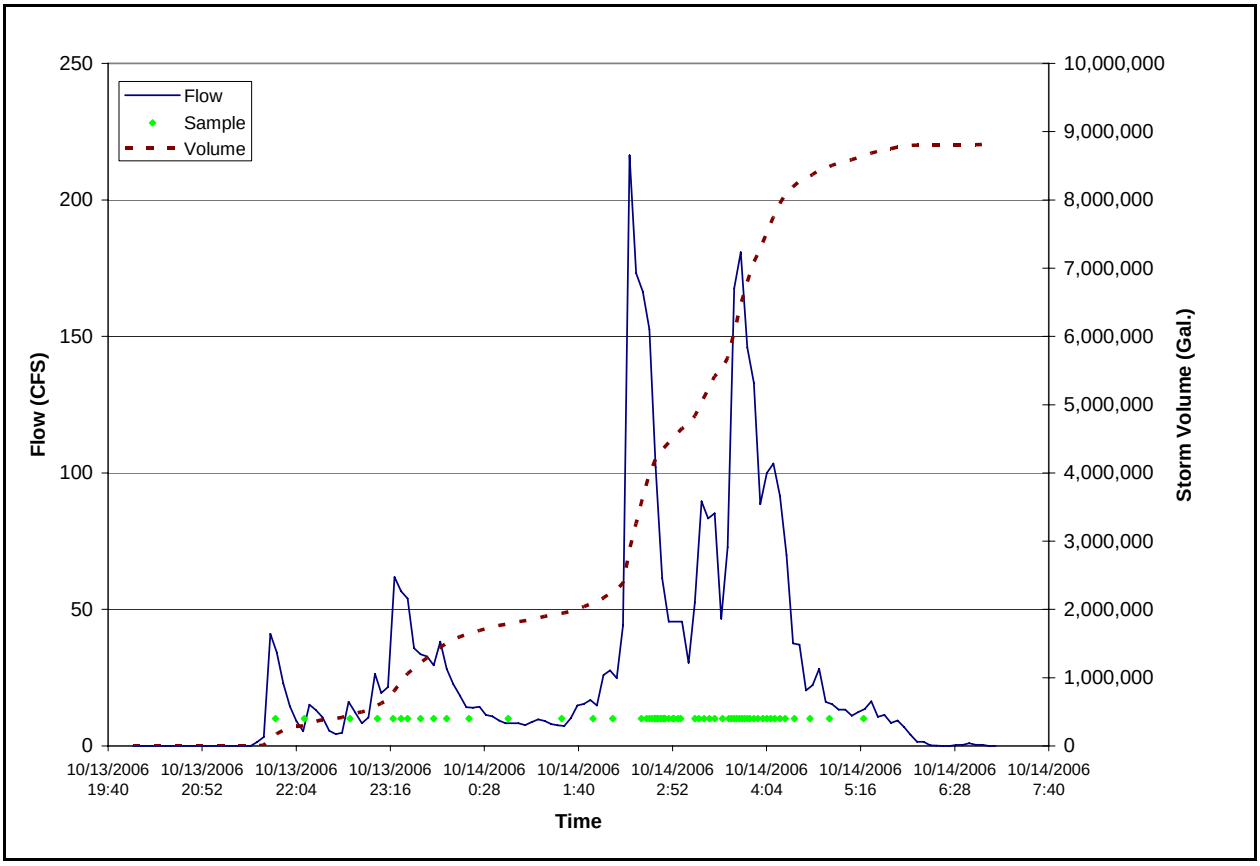


Figure 3-1. Chollas Creek North Fork Downstream Mass Loading Station – SD8(1), October 14, 2006

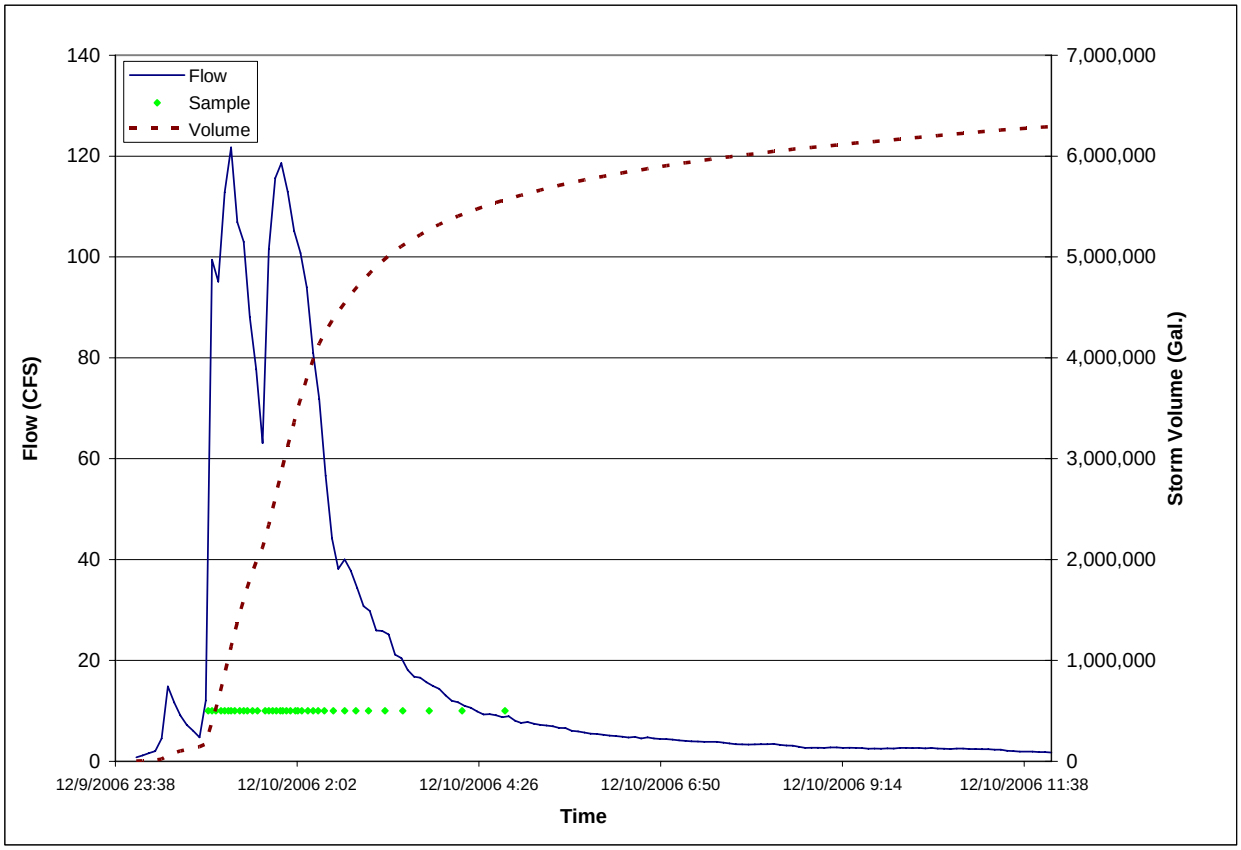


Figure 3-2. Chollas Creek North Fork Downstream Mass Loading Station – SD8(1), December 10, 2006

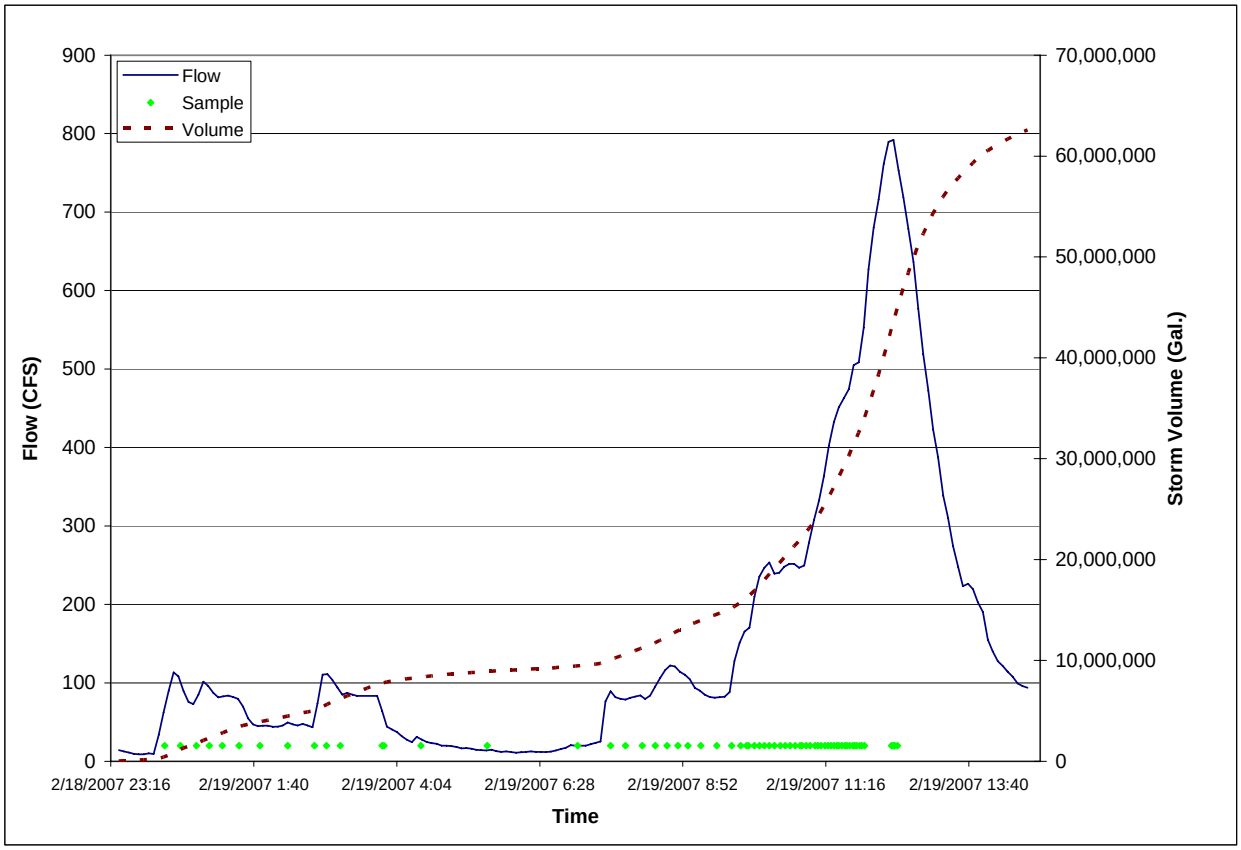


Figure 3-3. Chollas Creek North Fork Downstream Mass Loading Station – SD8(1), February 19, 2007

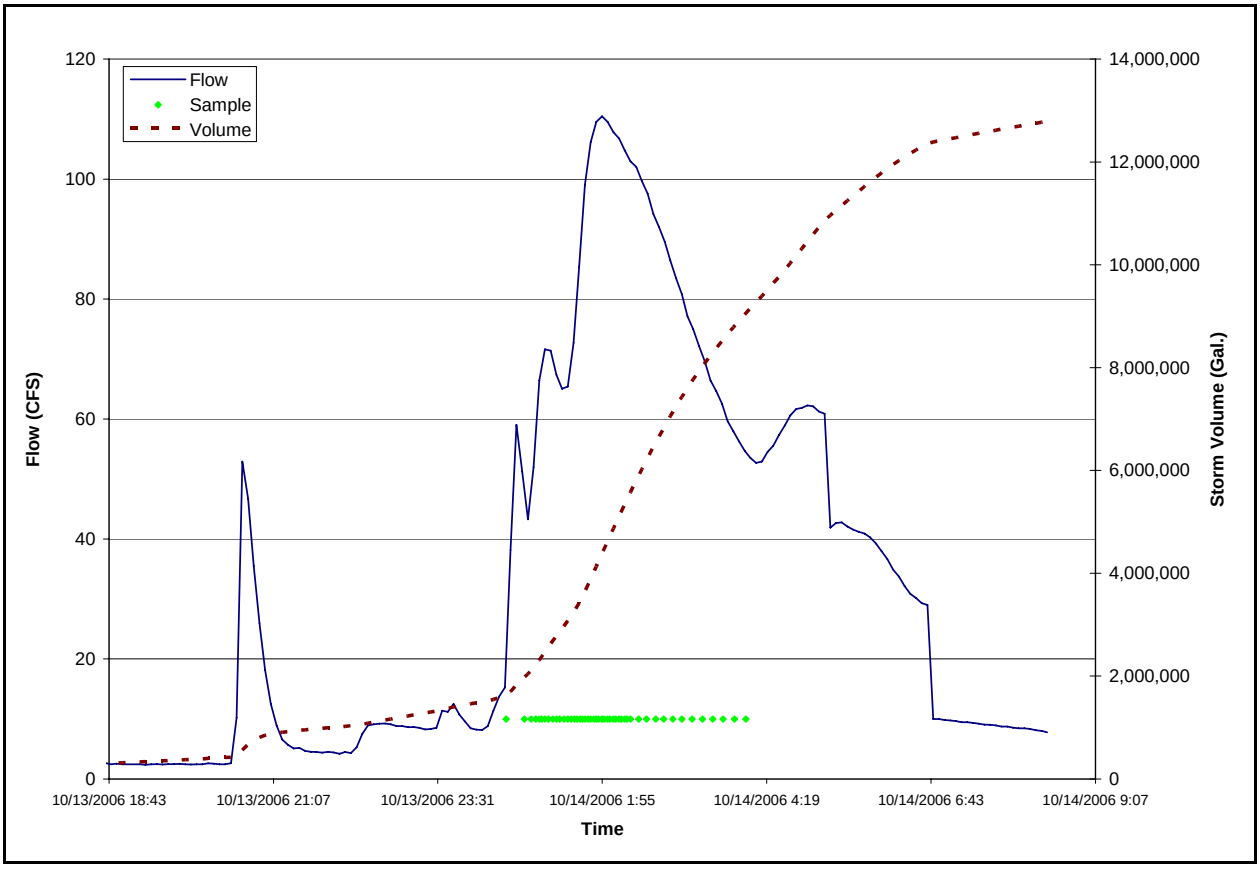


Figure 3-4. Chollas Creek South Fork Downstream – DPR2 Mass Loading Station, October 14, 2006

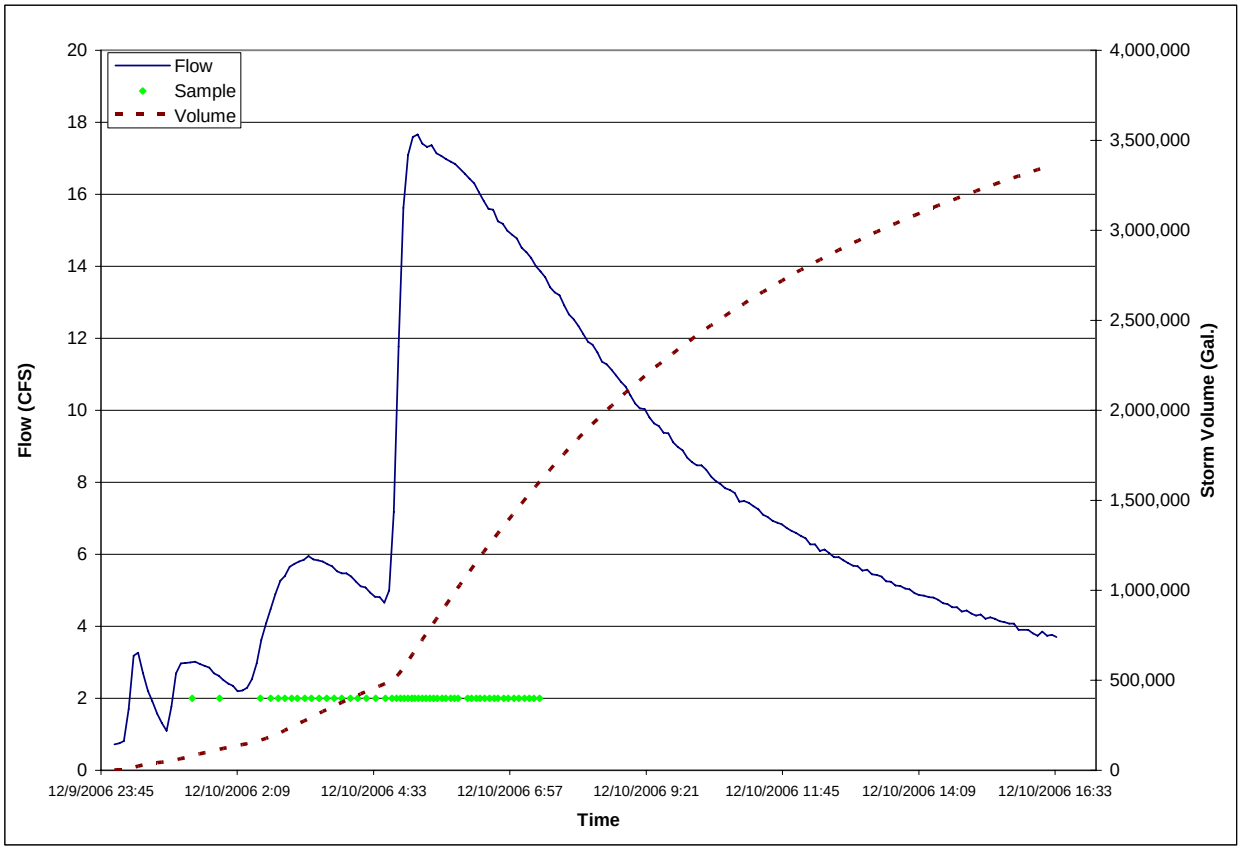


Figure 3-5. Chollas Creek South Fork Downstream – DPR2 Mass Loading Station, December 10, 2006

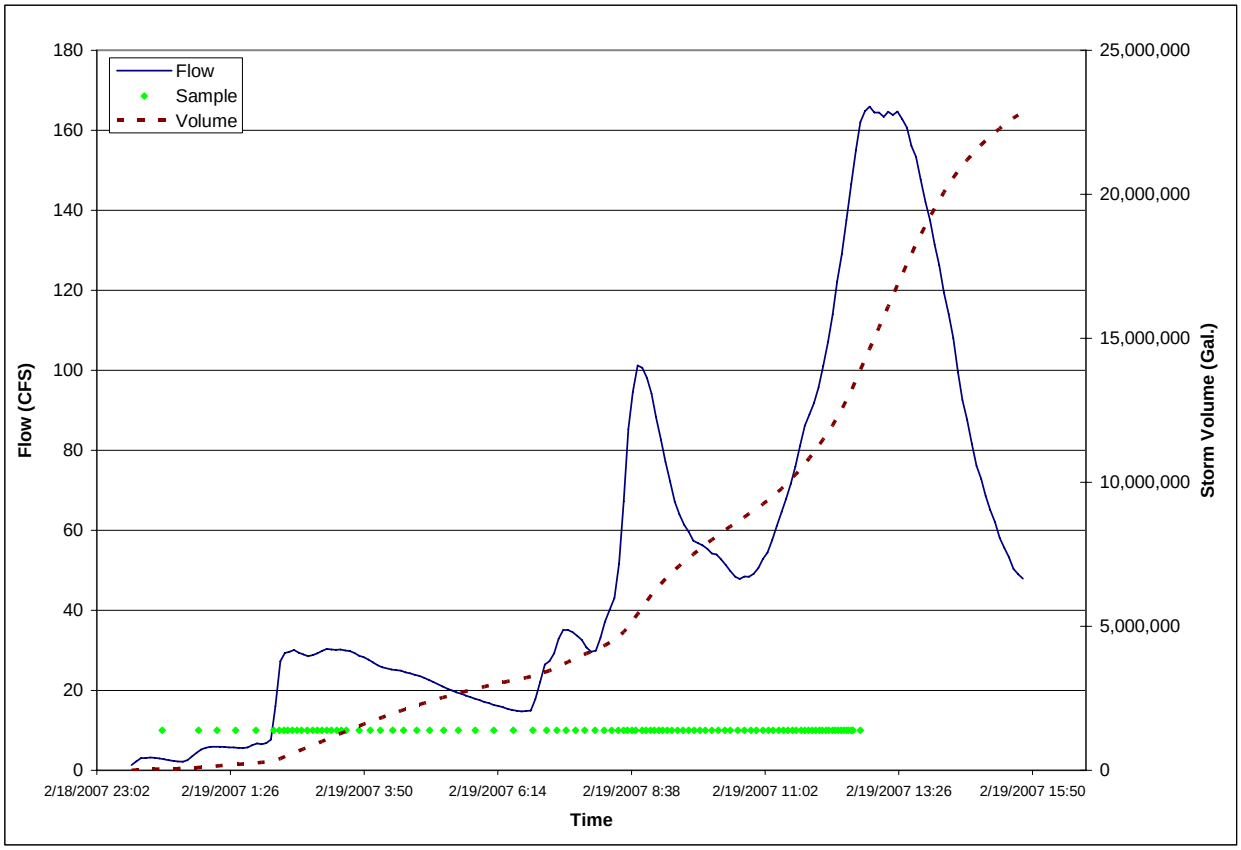


Figure 3-6. Chollas Creek South Fork Downstream – DPR2 Mass Loading Station, February 19, 2007

3.3 Sample Results and Discussion

The bacteria, chemistry, and biological toxicity results for the storm events monitored are presented in Table 3-2 through Table 3-4 respectively. Sample results were compared to the water quality objective benchmark (WQO) in Table 3-1. Values above the WQO are bolded and shaded.

Bacteria

DPR2 Fecal Coliform counts were higher than the Basin Plan's WQO of 4,000 MPN/100 ml for all events sampled. Total Coliform results ranged between 110,000 and 500,000 for the three storm events monitored. Enterococcus results ranged between 50,000 and 230,000 for the same storms. Bacteria results at SD8(1) were above the WQO for two of the three storms monitored. Total coliform and enterococcus results were slightly lower than the south fork site DPR2 but were within the same order of magnitude.

Chemistry

Sample results for general chemistry were above the WQO for total organic carbon (TOC) during the first monitoring event (10/14/2006) at both sites SD8(1) and DPR2. Total suspended solids were above the WQO at both sites during the third monitoring event (2/19/07) which was

also the largest rainfall event of the three storms monitored. All other general chemistry results were below their respective WQO.

Diazinon was above the TMDL waste load allocation (WLA) of 0.45 µg/L during the first storm event (10/14/06) at site SD8(1). This is the first value measured above the TMDL WLA in the past three monitoring years at this site. The TMDL allows for one exceedance every three years. Diazinon was not detected during any other storm event or at site DPR2 during the 2006-2007 monitoring season. Malathion was detected during all storm events at both sites and was above the WQO at site DPR2 and SD8(1) on the first monitoring event (10/14/06). All other organophosphate pesticides analyzed were below their respective detection limits.

Several synthetic pyrethroids were detected during all three storm events at both sites DRP2 and SD8(1). Several values were above the published literature values for LC50s for *Hyalella azteca*. Toxicity identification evaluations performed during the 2005-2006 monitoring period as part of the Regional Monitoring Program identified synthetic pyrethroids as the causative agent of toxicity to *Hyalella azteca* (Weston, 2007). Based on these findings, synthetic pyrethroids and toxicity to *H. azteca* were added as part of the analytical constituent list.

Several metals were detected during the 2006-2007 monitoring period and were similar to historical values detected in the watershed. Total copper and total lead were above the hardness based WQO during all events at both sites SD8(1) and DPR2. Total zinc was above the WQO during two events at site SD8(1) (12/10/06 and 2/19/07 respectively) and one event at site DPR2 (2/19/07). Total cadmium was above the WQO at site SD8(1) during the first two monitoring events. Dissolved copper was above the WQO during all three sample events at site SD8(1) and during one event only at site DPR2. Dissolved lead was above the WQO during the first event at site SD8(1) (10/14/06) and the last event at site DPR2 (2/19/07). Dissolved zinc and dissolved cadmium were below their respective WQO during all monitoring events at both sites.

For ease of comparison to the hardness based water quality objective, the total and dissolved metals results were divided by their respective WQO and are presented in Figure 3-7. This figure presents the magnitude to which the results are above or below the WQO and also shows the mean, upper 25th percentile, and lower 25th percentiles of the historical data (in gray). Chronic WQOs for total and dissolved metals were calculated for each monitoring event at SD8(1) and DPR2, during the current sampling year (2006-2007) and are graphed along with the average WQO ratio. The average WQO ratio for SD8(1) is for the time period of 2001-2007, and for DPR2 2004-2007.

During the current monitoring year, total metals ratios tended to be higher at SD8(1) when compared to DPR2. However, for the third storm of the year (2/19/07) both stations had similar ratios to WQO for total copper, lead, and zinc. Dissolved metals were generally similar to the historical mean WQO ratios for both sites.

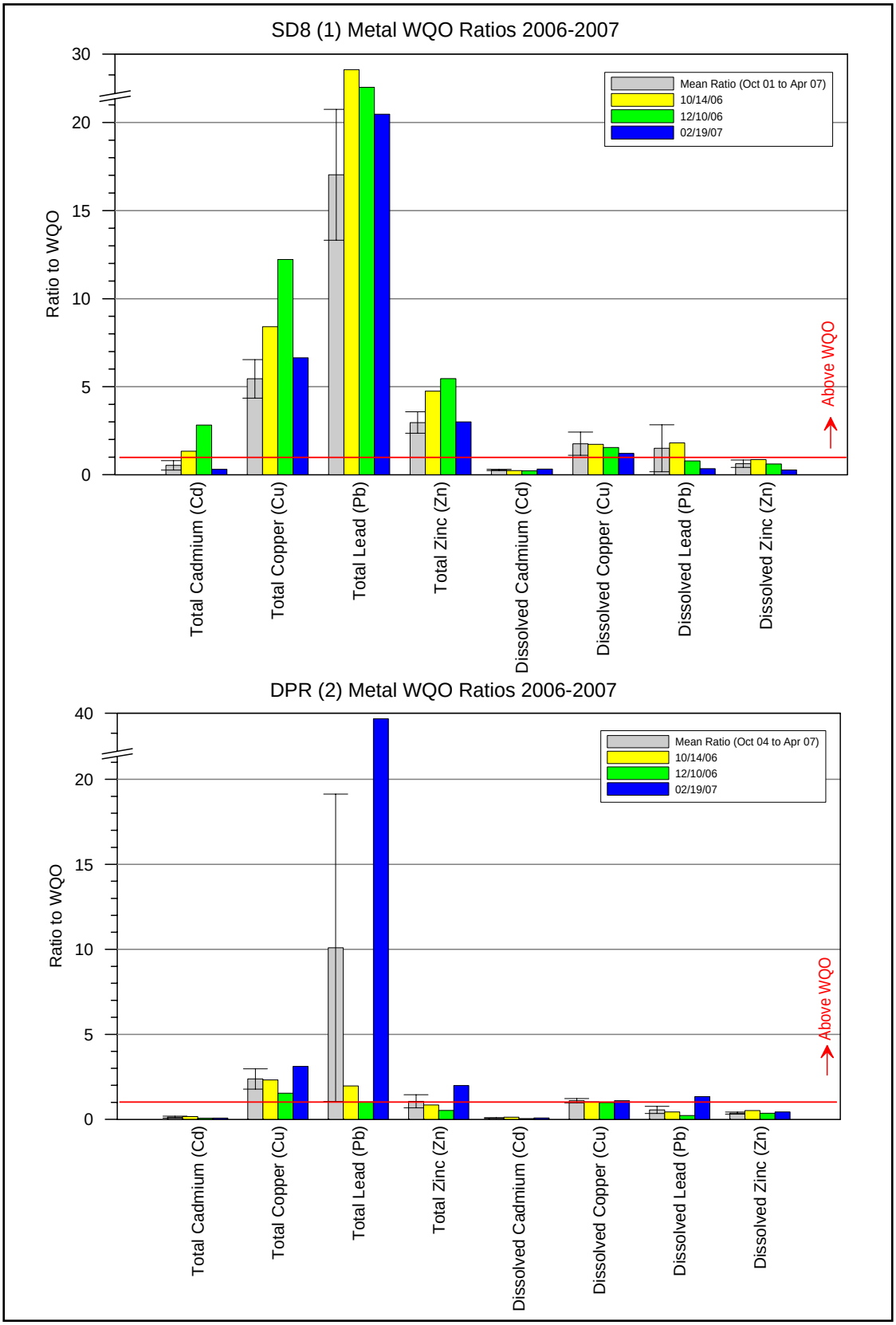


Figure 3-7. Chollas Creek 2006-2007 metals water quality ratios for sites SD8(1) and DPR2.

Toxicity

Toxicity results are presented in Table 3-3 and Table 3-4 for *Ceriodaphnia dubia* and *Hyalella azteca* respectively. RWQCB Order No. R9-2004-0277 requires the Watershed Copermittees to analyze for toxicity to *Ceriodaphnia dubia.* Toxicity to *Hyalella azteca* has been added due to the noted shift in pesticide use from diazinon to synthetic pyrethroids and the resulting toxic effects observed to this organism. Acute toxicity to *Ceriodaphnia dubia* was not observed at either site DPR2 or SD8(1) during the 2006-2007 monitoring season. However, chronic survival toxicity was observed at both sites DPR2 and SD8(1) during the first rainfall event on 10/14/2006 (NOEC=50% for both sites). Reproductive toxicity was observed during the first event only at site DPR2 (NOEC=50%). Diazinon was above the WQO during one storm event at site SD8(1) during the first storm event but below the effects threshold value of 250 ng/L that has been observed to cause acute toxicity to *Ceriodaphnia dubia* (Weston, 2006). Malathion was also above the WQO during the first storm event at both SD8(1) and DPR2. Several synthetic pyrethroids were detected at both location and the possible synergistic effects may play a role in chronic and reproductive toxicity observed to *Ceriodaphnia dubia*.

Toxicity to *Hyalella azteca* was observed at site SD8(1) during all three events monitored. Toxicity to *Hyalella azteca* was observed at site DPR2 was observed during the first rainfall event on 10/14/06 and the third rainfall event monitored on 2/19/07. Toxicity was greatest at site SD8(1) during the first rainfall event and in comparison to results from site DPR2. The higher toxicity to *Hyalella azteca* during the 10/18/06 event at site SD8(1) is likely due to the combination of the pesticides detected (diazinon, malathion, and synthetic pyrethroids) during this event.

Table 3-2. Chemistry Analytical Results for Site DPR2 and Site SD8(1)

Parameters	Fraction	Units	MDL	RL	DPR (2)			SD8 (1)		
					10/14/2006	12/10/2006	2/19/2007	10/14/2006	12/10/2006	2/19/2007
Field Measurement										
pH		pH units	-	-	7.33	7.60	7.84	8.09	8.40	7.80
Conductivity		µS/cm	-	-	693*	579	326	319	239	1890
Temperature		°C	-	-	17.0	12.4	12.8	17.9	14.3	13.7
Bacteria										
Total Coliform	Total	MPN/100ml	20	20	230,000	110,000	500,000	50,000	80,000	110,000
Fecal Coliform	Total	MPN/100ml	20	20	17,000	50,000	22,000	23,000	3,000	8,000
Enterococci	Total	MPN/100ml	20	20	220,000	50,000	230,000	90,000	130,000	50,000
General Chemistry										
TOC	Total	mg/L	2	2	73.0	43.0	16.0	64.0	33.3	11.3
TKN	Total	mg/L	0.5	0.5	7.10	3.10	2.20	4.20	4.50	3.70
Ammonia-N	Total	mg/L	0.01	0.05	0.59	0.42	0.40	1.64	2.12	1.53
Nitrate-N	Total	mg/L	0.02	0.05	1.40	1.39	0.67	2.40	0.27	<0.05
Nitrite-N	Total	mg/L	0.02	0.05	0.06	0.06	0.06	0.10	0.06	0.07
Total Hardness as $CaCO_3$	Total	mg/L	1	5	160	113	44.3	89.0	101	60.0
Total Suspended Solids	Total	mg/L	0.5	0.5	74.0	15.5	106	438	418	239
Oil and Grease		mg/L	1	5	<1	J 2.4	J 2.6	<5	<5	<5
Organophosphorus Pesticides										
Bolstar (Sulprofos)	Total	ng/L	2	4	<2	<2	<2	<2	<2	<2
Chloropyrifos	Total	ng/L	1	2	<1	<1	<1	<1	<1	<1
Demeton	Total	ng/L	1	2	<1	<1	<1	<1	<1	<1
Diazinon	Total	ng/L	2	4	<2	<2	<2	100	<2	<2
Dichlorvos	Total	ng/L	3	6	<3	<3	<3	<3	<3	<3
Dimethoate	Total	ng/L	3	6	<3	<3	<3	<3	<3	<3
Disulfoton	Total	ng/L	1	2	<1	<1	<1	<1	<1	<1
Ethoprop (Ethoprofos)	Total	ng/L	1	2	<1	<1	<1	<1	<1	<1
Fenchlorphos (Ronnel)	Total	ng/L	2	4	<2	<2	<2	<2	<2	<2
Fensulfothion	Total	ng/L	1	2	<1	<1	<1	<1	<1	<1
Fenthion	Total	ng/L	2	4	<2	<2	<2	<2	<2	<2
Malathion	Total	ng/L	3	6	535	92.4	147	949	270	95.0
Merphos	Total	ng/L	1	2	<1	<1	<1	<1	<1	<1
Methyl Parathion	Total	ng/L	1	2	<1	<1	<1	<1	<1	<1
Mevinphos (Phosdrin)	Total	ng/L	8	16	<8	<8	<8	<8	<8	<8
Phorate	Total	ng/L	6	12	<6	<6	<6	<6	<6	<6
Tetrachlorvinphos (Stirofos)	Total	ng/L	2	4	<2	<2	<2	<2	<2	<2
Tokuthion	Total	ng/L	3	6	<3	<3	<3	<3	<3	<3
Trichloronate	Total	ng/L	1	2	<1	<1	<1	<1	<1	<1
Synthetic Pyrethroids										
Allethrin	Total	ng/L	0.5	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bifenthrin	Total	ng/L	0.5	2	11.9	7.20	374	90.0	57.0	398
Cyfluthrin	Total	ng/L	0.5	2	5.48	21.0	87.0	191	354	165
Cypermethrin	Total	ng/L	0.5	2	10.6	31.9	93.5	131	451	116
Danitol	Total	ng/L	0.5	2	<0.5	7.90	<0.5	<0.5	<0.5	<0.5
Deltamethrin	Total	ng/L	0.5	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Parameters	Fraction	Units	MDL	RL	DPR (2)			SD8 (1)		
					10/14/2006	12/10/2006	2/19/2007	10/14/2006	12/10/2006	2/19/2007
Esfenvalerate	Total	ng/L	0.5	2	<0.5	<0.5	6.70	<0.5	<0.5	5.00
Fenvalerate	Total	ng/L	0.5	2	<0.5	<0.5	3.90	<0.5	<0.5	3.00
L-Cyhalothrin	Total	ng/L	0.5	2	<0.5	8.70	42.1	<0.5	<0.5	0.31
Permethrin	Total	ng/L	0.5	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Prallethrin	Total	ng/L	0.5	2	4.10	3.50	<0.5	<0.5	287	10.6
Trace Metals										
Cadmium (Cd)	Dissolved	µg/L	0.20	0.40	0.40	<0.2	<0.2	<1.0	1.00	<1.0
Copper (Cu)	Dissolved	µg/L	0.40	0.80	13.7	9.80	4.90	14.0	14.0	7.00
Lead (Pb)	Dissolved	µg/L	0.10	0.50	1.80	0.65	1.37	4.00	2.00	<1.00
Zinc (Zn)	Dissolved	µg/L	0.10	0.50	92.0	47.0	25.5	92.0	72.0	21.0
Cadmium (Cd)	Total	µg/L	0.20	0.40	0.60	J 0.2	<0.2	3.00	7.00	<1.00
Copper (Cu)	Total	µg/L	0.40	0.80	32.4	15.9	14.5	71.0	115	40.0
Lead (Pb)	Total	µg/L	0.10	0.50	11.4	3.80	42.0	72.0	71.0	34.0
Zinc (Zn)	Total	µg/L	0.10	0.50	152	70.1	120	51.5	659	233
Metals WQO										
Cadmium (Cd)	Dissolved	µg/L	0.20	0.40	3.17	2.45	1.23	2.05	2.25	1.53
Copper (Cu)	Dissolved	µg/L	0.40	0.80	13.80	9.93	4.47	8.11	9.03	5.79
Lead (Pb)	Dissolved	µg/L	0.10	0.50	4.18	2.87	1.03	2.22	2.54	1.44
Zinc (Zn)	Dissolved	µg/L	0.10	0.50	175.93	130.83	59.26	107.03	119.14	76.63
Cadmium (Cd)	Total	µg/L	0.20	0.40	3.56	2.71	1.30	2.25	2.48	1.65
Copper (Cu)	Total	µg/L	0.40	0.80	13.94	10.34	4.65	8.44	9.41	6.03
Lead (Pb)	Total	µg/L	0.10	0.50	5.79	3.71	1.13	2.74	3.22	1.66
Zinc (Zn)	Total	µg/L	0.10	0.50	178.43	132.69	60.11	108.55	120.83	77.72

Bold and shaded values are above the WQO. Values for Bifenthrin and Cypermethrin are bold if above published LC50 values for *Hyalella azteca.*

* The value was incorporated from the composite sample from the bioassay sample results due to a field sampling error.

J = Value is above the laboratory method detection limit and below the reporting limit. The value is considered an estimate.

(a) Water Quality Objective for total and dissolved metal fractions are based on Total Hardness (as CaCO3) and are calculated as described by Title 40 of the Code of Federal Regulations (Part 131) (USEPA 2000). Samples are compared to both the acute (CMC) and Chronic (CCC) criteria.

(b) For the Chollas Creek TMDL (Resolution No. R9-2002-0123), the WLA is set at 72 ng/L for acute exposures and 45 ng/L for chronic exposures. The 45 ng/L chronic exposure is applied to samples collected using a flow weighted composite method.

Table 3-3. Biological Toxicity Results for *Ceriodaphnia dubia*

Test	Reporting Value	Unit	DPR2			SD8(1)		
			10/14/2006	12/10/2006	2/19/2007	10/14/2006	12/10/2006	2/19/2007
96-Hour Acute Toxicity (*C.dubia*)	Mean % Survival for Control	%	100	100	100	100	100	100
96-Hour Acute Toxicity (*C.dubia*)	% Survival in 100% Concentration	%	100	100	100	100	100	100
96-Hour Acute Toxicity (*C.dubia*)	LC_{50}	%	>100	>100	>100	>100	>100	>100
96-Hour Acute Toxicity (*C.dubia*)	LOEC	%	>100	>100	>100	>100	>100	>100
96-Hour Acute Toxicity (*C.dubia*)	TUa		0	0	0	0	0	0
96-Hour Acute Toxicity (*C.dubia*)	LT_{50}	Hours	>96	>96	>96	>96	>96	>96
7-Day Chronic Toxicity (*C.dubia*)	Mean % Survival for Control	%	100	100	100	100	100	100
7-Day Chronic Toxicity (*C.dubia*)	% Survival in 100% Concentration	%	**20**	100	90	**30**	>100	100
7-Day Chronic Toxicity (*C.dubia*)	LC_{50} (survival)	%	**77.11**	>100	>100	**82.03**	>100	>100
7-Day Chronic Toxicity (*C.dubia*)	NOEC (survival)	%	**50**	100	100	**50**	>100	100
7-Day Chronic Toxicity (*C.dubia*)	LOEC (survival)	%	**100**	>100	>100	**100**	>100	>100
7-Day Chronic Toxicity (*C.dubia*)	TUc (survival)		**2**	1	1	**1**	1	1
7-Day Chronic Toxicity (*C.dubia*)	LT_{50}	Hours	**169**	>168	>168	**180**	>168	>168
7-Day Chronic Toxicity (*C.dubia*)	NOEC (reproduction)	%	**50**	100	100	100	100	100
7-Day Chronic Toxicity (*C.dubia*)	LOEC (reproduction)	%	**100**	>100	>100	>100	>100	>100
7-Day Chronic Toxicity (*C.dubia*)	TUc (reproduction)		**2**	1	1	1	1	1

Bold and shaded values are above the WQO

Table 3-4. Biological Toxicity Results for *Hyalella azteca*

Test	Reporting Value	Unit	DPR2			SD8(1)		
			10/14/2006	12/10/2006	2/19/2007	10/14/2006	12/10/2006	2/19/2007
96-Hour Acute Toxicity (*H.azteca*)	Mean % Survival for Control	%	100	100	100	100	87.5	100
96-Hour Acute Toxicity (*H.azteca*)	NOEC	%	**25**	100	**50**	**6.25**	**25**	**25**
96-Hour Acute Toxicity (*H.azteca*)	LC_{50}	%	**70.71**	>100	>100	**28.65**	**56.25**	**54.06**
96-Hour Acute Toxicity (*H.azteca*)	LOEC	%	**50**	>100	100	**12.5**	**50**	**50**
96-Hour Acute Toxicity (*H.azteca*)	TU_a		**1.41**	0.69	0.85	**3.49**	**1.78**	**1.85**

Bold and shaded values are above the WQO

3.3.1 Special Studies

Monitoring results from additional (special) studies conducted by the Chollas Watershed Copermittees, while directly related to the Chollas Creek Watershed, are outside of the current scope of the order requirements and are included as Appendices to this report. The City of San Diego has conducted two special studies as listed below:

- Appendix C (PDF on CD): Chollas Creek Jurisdictional Boundary Water Quality Monitoring Report (Weston Solutions, Inc., 2007).
- Appendix D (PDF on CD): City of San Diego Dry Weather Aerial Deposition Study (Weston Solutions, Inc., 2007)

The City of La Mesa conducted special studies in the north fork of Chollas Creek during dry and wet weather conditions. Monitoring was conducted for diazinon and total metals during the 2006-2007 wet weather monitoring season. Dry weather ambient monitoring was also conducted during the summer of 2007.

Time weighted composite sampling was conducted on 4/20/2007 during the last rainfall event of the season. Results for diazinon were below the detection limit (<0.04 µg/L) at the University Channel Discharge Point. Dissolved lead was below the detection limit (<0.001 mg/L). Dissolved copper (0.011 mg/L), lead (<0.001 mg/L) and zinc (0.054 mg/L) were all below the California Toxics Rule (CTR) hardness based acute and chronic concentration limits per Order 2004-0277 based on the sample hardness of 230 mg CaCO3/L.

During the special dry weather sampling (6/27/07), diazinon (<0.04 µg/L), dissolved lead (<0.001 mg/L) dissolved copper (<0.002 mg/L), and dissolved zinc (<0.01 mg/L) were all below their respective detection limits and metals were below the dissolved CTR acute and chronic limits.

The City of La Mesa is currently drafting a report which will be submitted to the State Water Resources Control Board at a later date.

3.4 Historical Data and Trend Analysis

Historical data have been collected at Site SD8(1) since 1994. Using the long term data set, a non-parametric trend analysis was conducted using the Mann-Kendall trend test to evaluate the presence or absence of significant trends using all available monitoring data. The Mann-Kendall trend analysis was also completed for the three years of data collected at DPR2. This trend test is often employed for analysis of environmental time series data. The test does not assume any single distribution for the data being tested, which is an advantage when analyzing environmental data. The test does not incorporate magnitude, but instead calculates the number of positive and negative differences between samples. The number of positive and negative differences is summed to calculate the S statistic, which is compared to a table value to determine significance.

Sen's estimate of slope is shown on the graphs below to illustrate the median trend of the data per constituent unit per year. This is not a predictive slope, but rather an estimate of the median true slope (change per unit time). This method is not affected by gross outliers or missing data.

Scatterplots with significant trends are shown in Figure 3-7 through Figure 3-10 . Note that because SD8(1) had significant trends, but DPR2 did not, there are no trend plots for DPR2. The results are presented by the constituent groups conventionals, pesticides, metals, and toxicity.

The trend analysis results for conventional constituents show significantly increasing trends for turbidity (S=228). The increasing trend for turbidity has a magnitude of 3.93 NTU/yr.

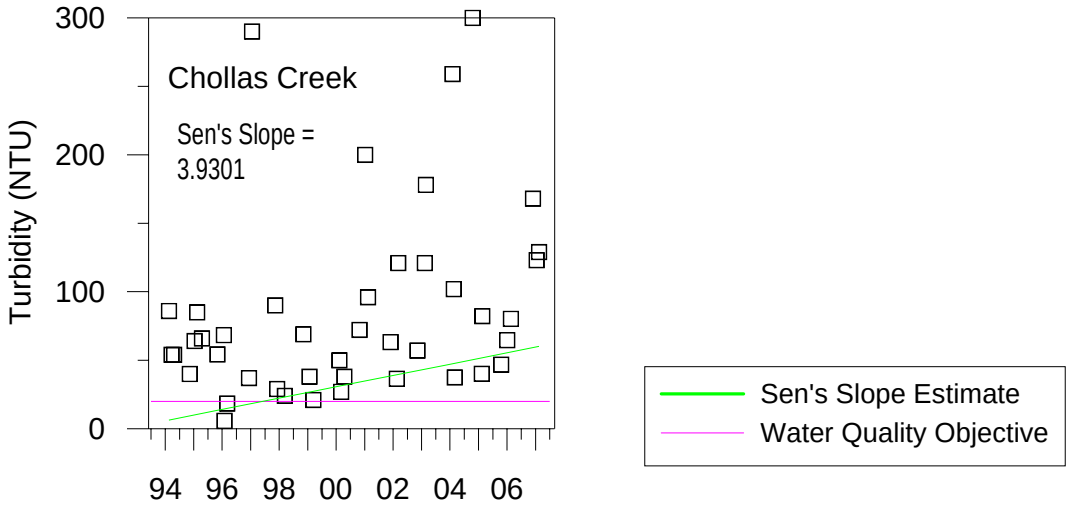


Figure 3-7. Scatterplots of conventional constituents with significant Mann-Kendall Trends and Sen's estimate of slope at the Chollas Creek MLS.

A review of the trend analysis for pesticide constituents indicates a significantly decreasing trend for Diazinon (S=-150) (Figure 3-8) over the monitoring period. However, the Diazinon dataset has greater than 15% non-detect values and so the magnitude of the trend is not reported.

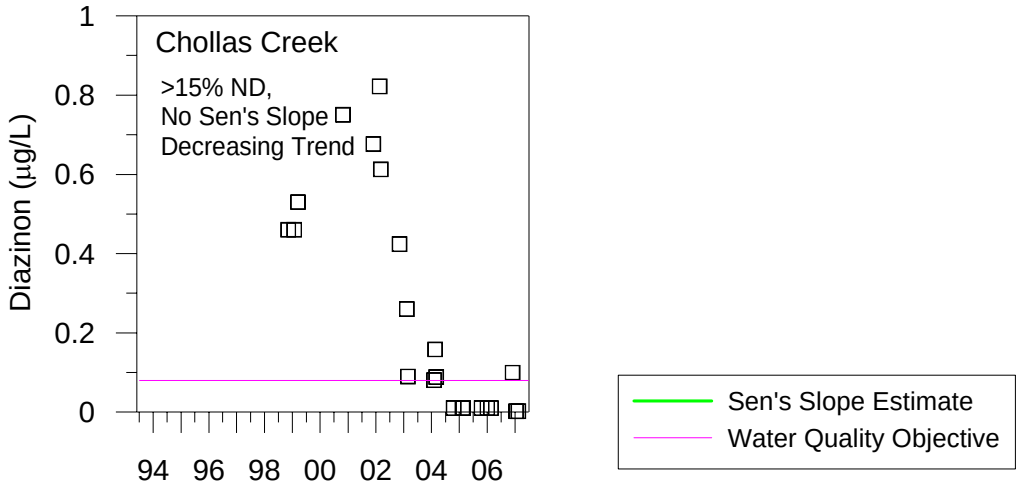


Figure 3-8. Scatterplots of pesticide constituents with significant Mann-Kendall Trends and Sen's estimate of slope at the Chollas Creek MLS.

A review of the trend analysis for metals constituents indicates a significantly increasing trend for total copper and total zinc. The trend for total copper (S=144) has a magnitude of 0.002 mg/L/yr. The trend for total zinc (S=177) has a magnitude of 0.015 mg/L/yr (Figure 3-9).

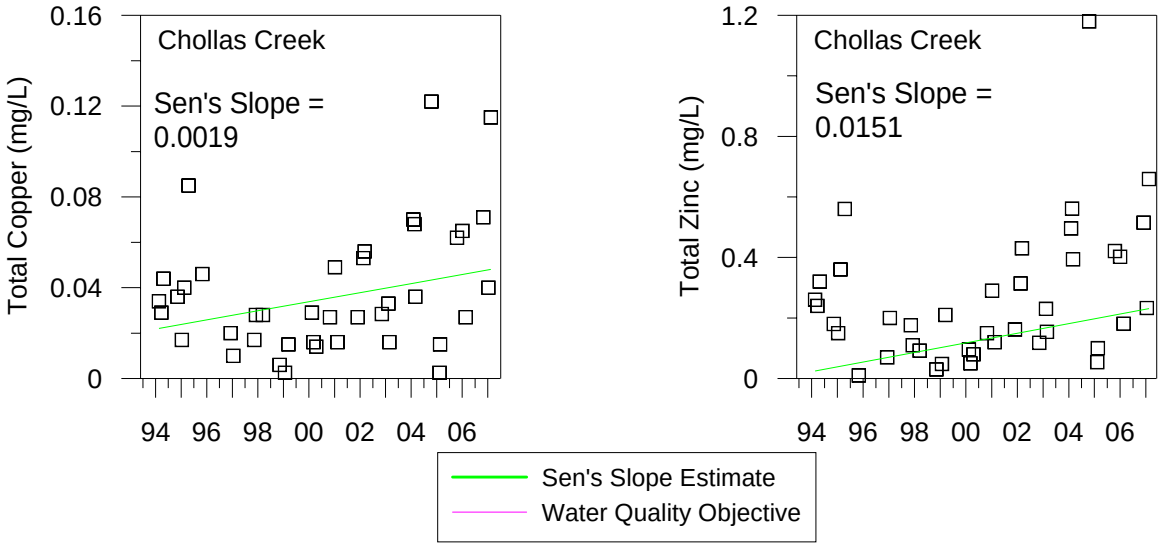


Figure 3-9. Scatterplots of metals constituents with significant Mann-Kendall Trends and Sen's estimate of slope at the Chollas Creek MLS.

A review of the trend analysis for toxicity indicates significantly decreasing trends for the acute *Ceriodaphnia* survival (S=-57), chronic *Ceriodaphnia* survival (-60) and *Ceriodaphnia* reproduction (-55) over the monitoring period. The magnitude of the trends are -2.58 LC50%/yr, -0.377 NOEC%/yr, and -0.033 NOEC%/yr, respectively (Figure 3-10). There is a significantly increasing trend for the acute *Hyalella* survival (S=59) over the monitoring period. The magnitude of the trend is 0.008 NOEC%/yr (Figure 3-10). These trends support the observed shift in pesticide use from diazinon to synthetic pyrethroids.

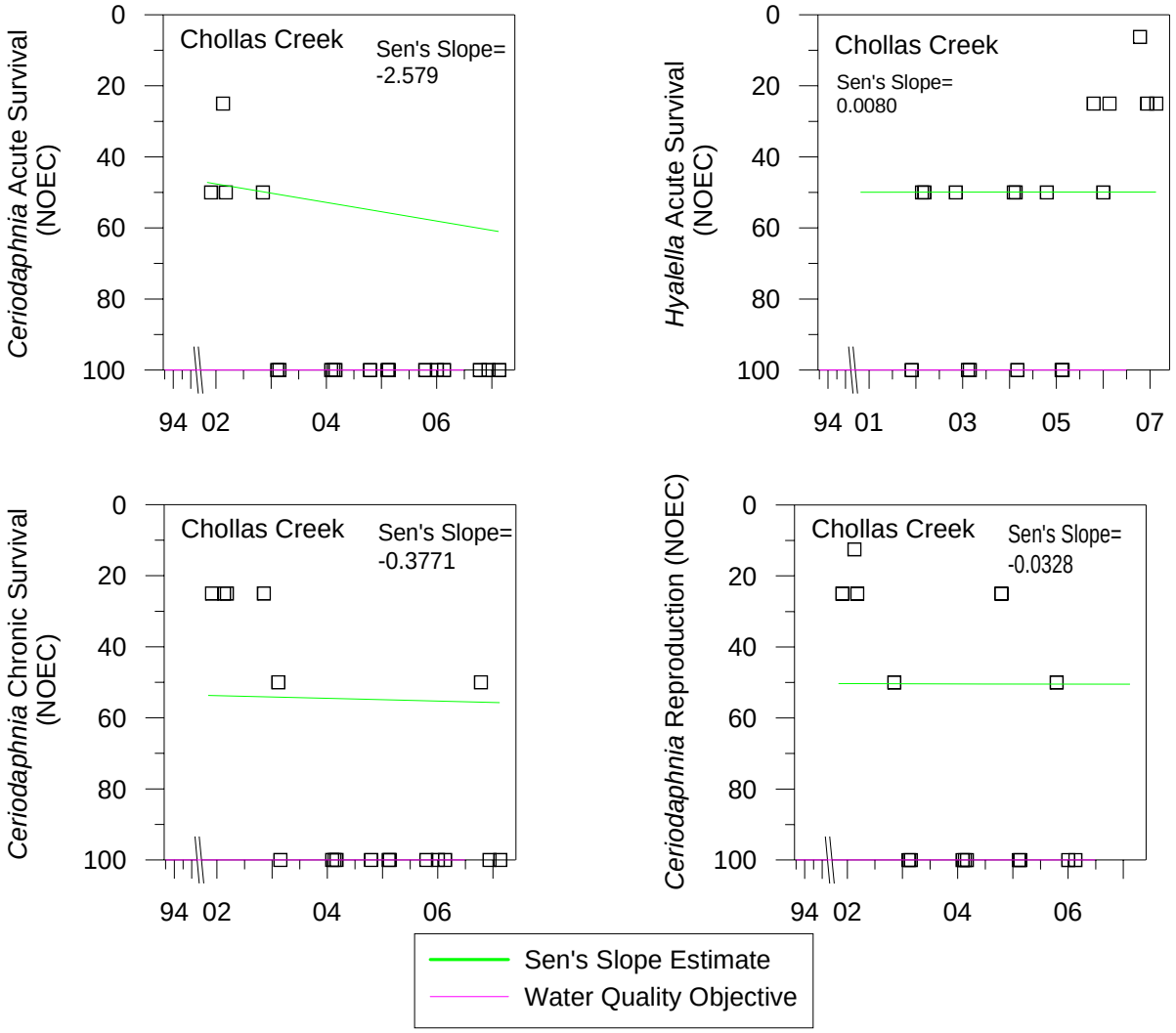
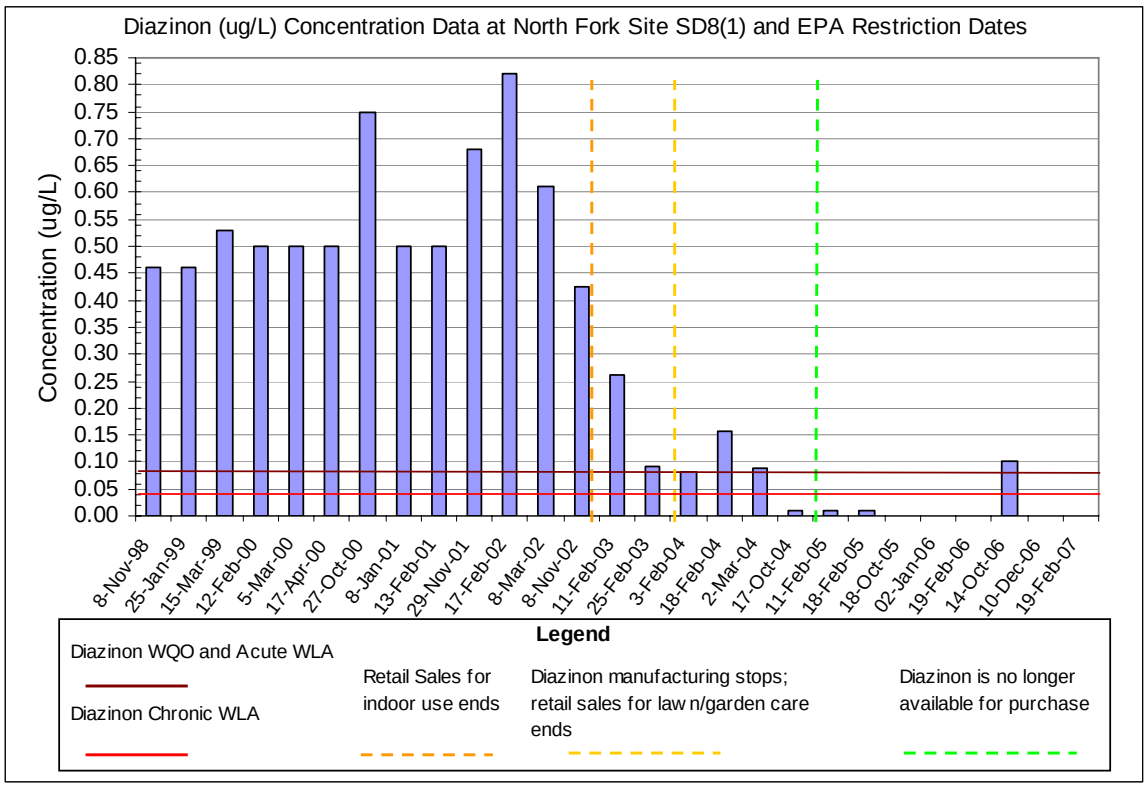


Figure 3-10. Scatterplots of toxicity constituents with significant Mann-Kendall Trends and Sen's estimate of slope at the Chollas Creek

The historical diazinon concentrations observed at sites SD8(1) and DPR2, including the EPA restriction dates, are presented in Figure 3-11. Sampling was conducted at site DPR2 from 2000-2001 as part of a Department of Pesticide Regulation study and in late 2004 as part of the monitoring and reporting requirements of RWQCB Order R9-2004-0277.



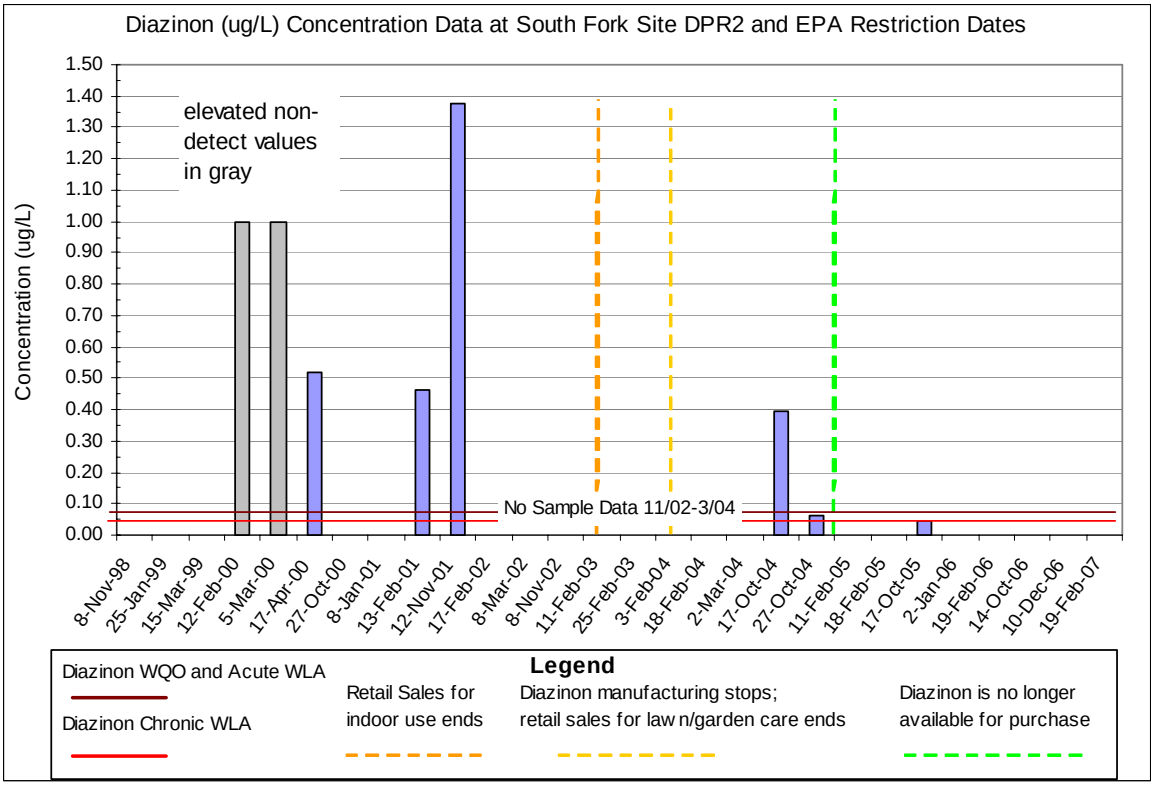


Figure 3-11. Historical Diazinon Concentrations at Sites SD8(1) and DPR2 with Restriction Dates.

The Chollas Creek dissolved metals TMDL sets the numeric targets equal to the California Toxics Rule (CTR) WQO. The CTR is the most current, conservative WQO for dissolved copper, lead, and zinc in fresh water. The CTR WQOs for dissolved and total cadmium, copper, lead, and zinc are comprised of hardness-based equations that can vary depending on sample hardness. The Chollas sub-watershed is unique in that it has significantly lower hardness concentrations and therefore lower WQO, in comparison to other watersheds in San Diego County. The historical mean wet weather hardness concentration at the Chollas Creek MLS is 85 mg $CaCO_3$/L in comparison to other watersheds where the mean wet weather hardness concentrations are approximately 260 mg $CaCO_3$/L. As a result of the low hardness values, it is more likely that slightly elevated wet weather monitoring results for dissolved and total cadmium, copper, lead and zinc will exceed the CTR WQO.

WQOs for total and dissolved metals were calculated for each monitoring event at SD8(1) and DPR2, and the sample result divided by the WQO. The results for the time period of 2001-2007 (at SD8(1)) and 2004-2007 (at DPR2) are presented in Figure 3-12 and Figure 3-13, respectively. The ratios are presented as box-and-whisker plots for each of the eight metal constituents. The purpose of presenting them as such is to illustrate the consistency of some metals (lead and copper, in particular) at levels above the WQO. The pattern between SD8(1) and DPR2 is consistent, with total copper, lead and zinc above the WQO at SD8(1), and total copper and lead above the WQO at DPR2. It is interesting to note that dissolved metals tend to be slightly higher and more variable at SD8(1) when compared to DPR2.

USEPA has provided guidance concerning a procedure that may be used to derive regional aquatic-life criterion such as the CTR into site-specific criterion. The indicator species procedure is based on the assumption that characteristics of ambient water may influence the bioavailability and toxicity of a pollutant. As part of the procedure, acute toxicity in site water and laboratory water is determined in concurrent toxicity tests. The ratio of the ambient to the laboratory water toxicity values, the Water Effects Ratio (WER), would subject the current dissolved metals WQO to a criteria adjustment factor that accounts for the effect of site-specific water characteristics on pollutant bioavailability and toxicity to aquatic life. In Chollas Creek, a WER would likely raise the WQO above the concentrations typically observed for dissolved metals in storm water. This procedure has been used in the Calleguas Creek Watershed which has resulted in WER ranging from 1.51 during dry weather to 3.69 during wet weather conditions (LWA, 2006).

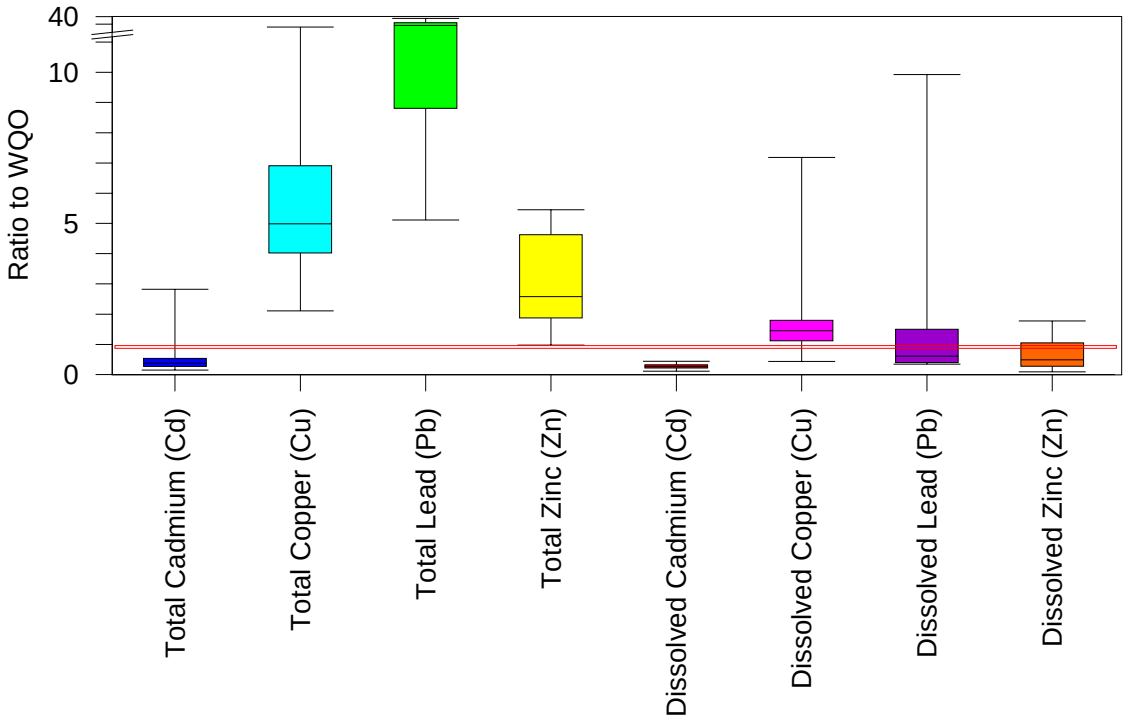


Figure 3-12. Chollas Creek box and whisker plots of metals water quality ratios for site SD8(1).

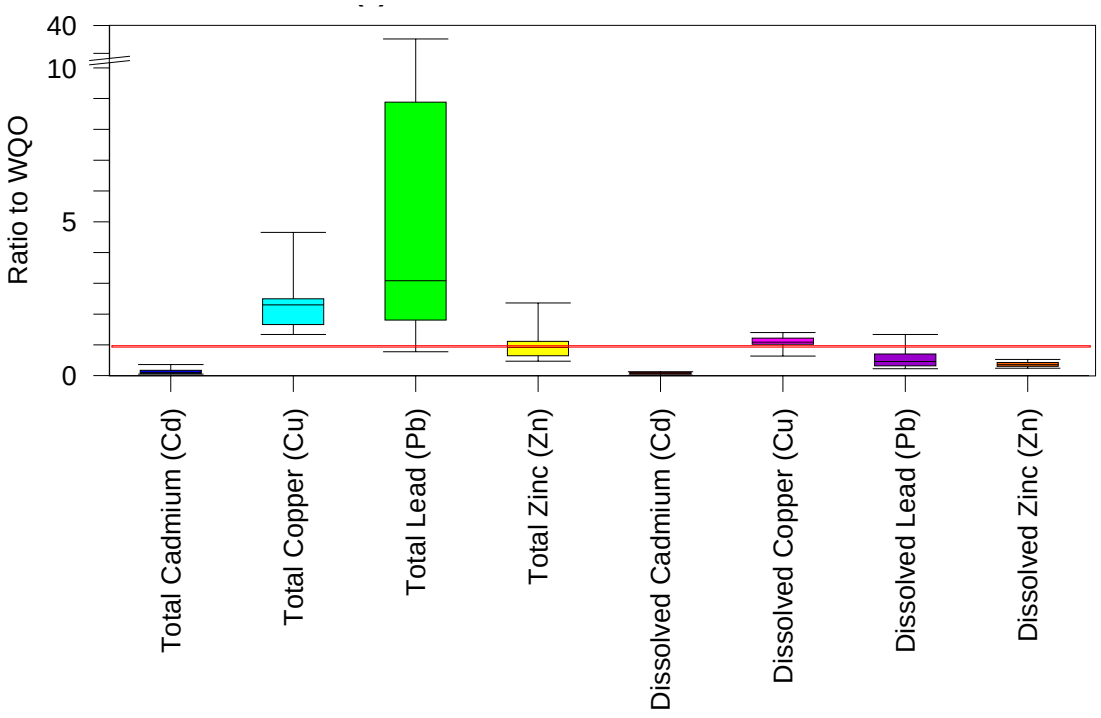


Figure 3-13. Chollas Creek box and whisker plots of metals water quality ratios for site DPR2.

4.0 SUMMARY AND CONCLUSIONS

The Chollas Creek Watershed Municipal Workgroup has complied with RWQCB Order R9-2004-0277 during the 2006-2007 monitoring season by conducting the following activities:

- Jurisdictions have exercised their legal authority to regulate pesticide discharges through industrial inspections and Dry Weather IC/ID investigations,
- performed education and outreach to area residents,
- and have conducted water quality monitoring during three storm events at Sites SD8(1) and DPR2.

Study results are presented to comply with RWQCB Order No. R9-2004-0277 requirements. Water quality monitoring was specifically conducted under this program to quantitatively assess potential changes in pesticide use and to quantitatively assess the concentration of metals in Chollas Creek.

Storm water monitoring samples were collected at two mass loading stations in Chollas Creek during three separate storm water events. Site SD8(1) was located in the North Fork of Chollas Creek and site DPR2. was located in the south fork of Chollas Creek. Water quality objective exceedances were noted for total organic carbon (TOC), total suspended solids (TSS), diazinon, malathion, total and dissolved copper, total and dissolved lead, total zinc, and total cadmium. There were no exceedances of the WQO for either dissolved cadmium or dissolved zinc. Synthetic pyrethroids were detected in concentrations above published LC50s for *Hyalella azteca* during all three monitoring events during the 2006-2007 monitoring season.

Acute toxicity to *Ceriodaphnia dubia* survival was not observed at either site SD8(1) or DPR2 during the 2006-2007 monitoring season. Chronic toxicity to *Ceriodaphnia dubia* survival was observed during the first storm event on 10/14/06 at both sites and is likely associated with the combined detections of malathion, diazinon and synthetic pyrethroids during this first event. Toxicity to *Hyalella azteca* was observed during all three events at Site SD8(1) and during two events at site DPR2. Toxicity identification evaluations conducted as part of the Regional Monitoring Program indicate the causative agent of toxicity at site SD8(1) is the synthetic pyrethroid class of compounds (Weston, 2007).

Mann-Kendall trend analysis performed on the long term data set at site SD8(1) indicate significant decreasing trends for diazinon and toxicity to *Ceriodaphnia dubia.* However, increasing trends are noted for turbidity, total copper, total zinc and *Hyalella azteca*.

It is evident that the concentrations of diazinon have been decreasing with time and that storm water samples are apparently less toxic to *Ceriodaphnia dubia* than in previous years when diazinon was available. However, it also apparent that detections above the WQO may continue based the data collected during the 2006-2007 monitoring season. It is expected that the residual supply will eventually be exhausted and detections of diazinon should continue to decrease with the EPA ban on the manufacture and retail sale of this product. It is evident that synthetic pyrethroids are present in storm water runoff which warrants concern. With this evidence, education and outreach to area residents and businesses should continue in order to reduce the impacts of pesticide use in the Chollas Creek Watershed. With regards to the implementation of

the TMDLs for metals for Chollas Creek, it is apparent that toxicity to *Ceriodaphnia dubia* was not observed in the later storms where both dissolved copper and dissolved zinc were frequently measured above the WQO, based on the low hardness concentrations. With regards to these observations, the development of site specific objectives for dissolved metals would be useful.

Special studies were also conducted to answer specific management questions at the jurisdictional level. These additional studies include the following and are appended to this report:

- Appendix C (PDF on CD): Chollas Creek Jurisdictional Boundary Water Quality Monitoring Report (Weston Solutions, Inc., 2007)
- Appendix D (PDF on CD): City of San Diego Dry Weather Aerial Deposition Study (Weston Solutions, Inc., 2007)

5.0 REFERENCES

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APPENDIX A

Chollas Creek Education and Outreach Materials

APPENDICES B-D are provided on CD

APPENDIX B – Field Data Logs

APPENDIX C – Chollas Creek Jurisdictional Boundary Water Quality Monitoring Report (Weston Solutions, Inc., 2007)

APPENDIX D – City of San Diego Dry Weather Aerial Deposition Study (Weston Solutions, Inc., 2007)