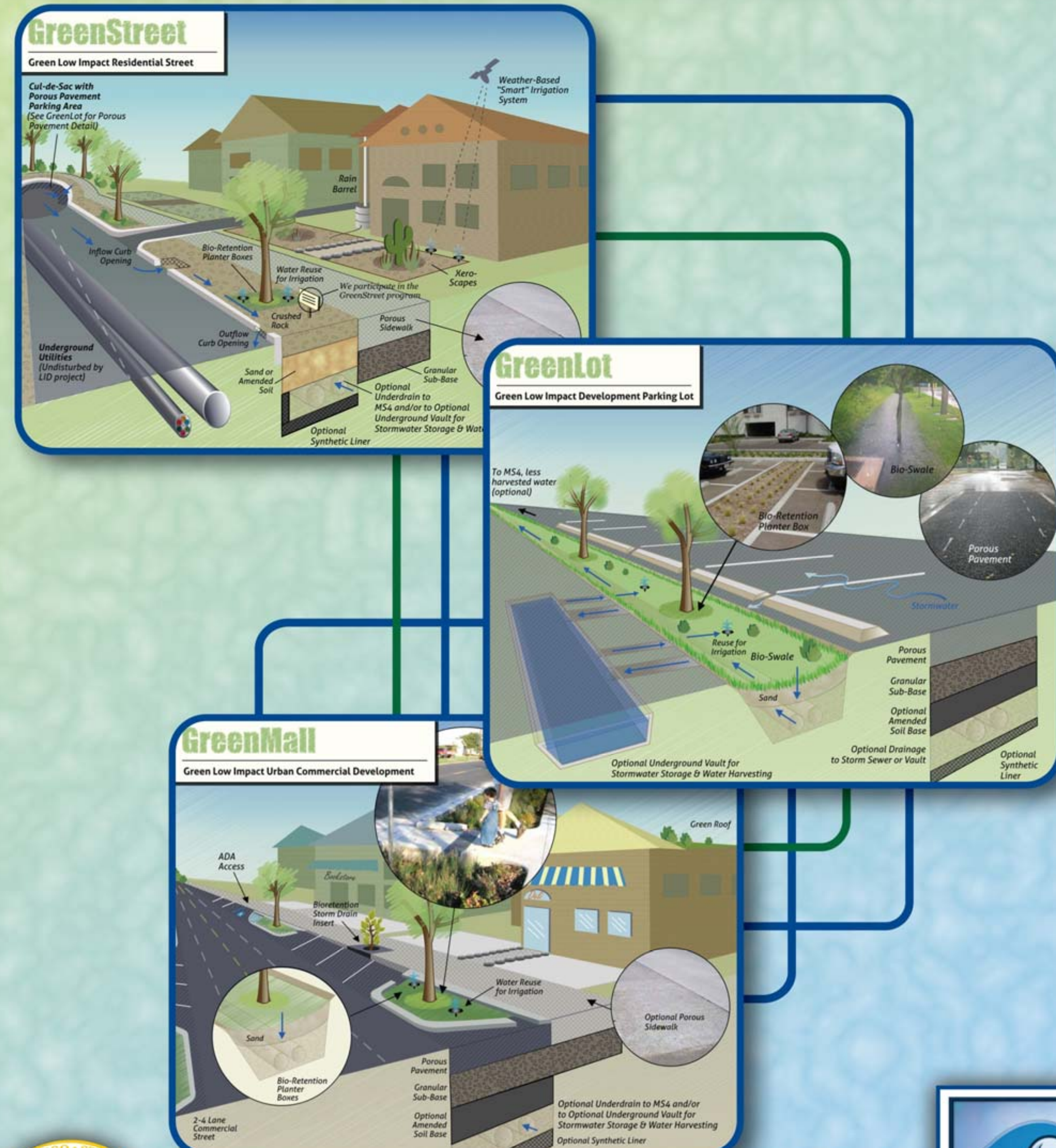
Baseline Effectiveness Assessment Monitoring

43rd Street & Logan Avenue

June 2009



City of San Diego

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Baseline Effectiveness Assessment Monitoring – 43rd Street & Logan Avenue

Final Report

Prepared for:
City of San Diego
Storm Water Department
Storm Water Pollution Prevention Division
9370 Chesapeake Drive, Suite 100, MS 1900
San Diego, CA 92123

Prepared by:

Weston Solutions, Inc.
2433 Impala Drive
Carlsbad, California 92010

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

ASBS	Areas of Special Biological Significance
Basin Plan	Water Quality Control Plan for the San Diego Basin
BMP	best management practice
City	City of San Diego
COC	chain of custody
ECP	Engineering Capital Project
HU	hydrologic unit
LID	Low Impact Development
MPN	most probable number
Permit	San Diego County Municipal Storm Water Permit
Program	Best Management Practice Effectiveness Baseline Monitoring Program
Regional Board	San Diego Regional Water Quality Control Board
Strategic Plan	*Strategic Plan for Watershed Activity Implementation*
TMDL	total maximum daily load
TSS	total suspended solids
WQO	water quality objective

EXECUTIVE SUMMARY

This report presents the baseline water quality conditions associated with one of multiple storm water best management practices (BMP) that the City of San Diego (City) is proposing to implement. The specific site monitored is at the location of the 43rd and Logan Avenue Green Street Project. The baseline monitoring was conducted between December 2008 and March 2009 and represents the pre-project conditions of the site. After the BMPs are implemented, post-construction conditions will be documented and then compared to the data presented in this report to determine the effectiveness of the BMP.

As outlined in the City's *Strategic Plan for Watershed Activity Implementation* (Strategic Plan) (WESTON, 2007), BMPs are planned for implementation in a tiered and phased approach. Activities are grouped into three tiers: Tier I Source Control and Pollution Prevention BMPs, Tier II Structural BMPs, and Tier III Treatment BMPs. Phase I includes the implementation and assessment for effectiveness in reducing pollution as well as cost efficiency for all three tiers of activities, though the focus is on Tier I and Tier II, with demonstration sites planned for the Tier III BMP's where feasible. Findings from Phase I will be used for planning the implementation of the most efficient suite of activities during future phases in order to meet regulatory requirements including the National Pollutant Discharge Elimination System (NPDES) Municipal Storm Water Permit as well as any total maximum daily load (TMDL) requirements and Areas of Special Biological Significance (ASBS) special protections.

Under this monitoring effort, the following Tier II low impact development (LID) retro-fit project site was monitored to document baseline conditions:

- **43rd Street and Logan Avenue** – Green Street LIDs and biofiltration basin in conjunction with a planned street realignment within Chollas Creek Watershed of the San Diego Bay Watershed Management Area (WMA)

The objective of the monitoring effort is to determine the baseline water quality conditions and pollutant loading characteristics of the urban runoff that will be captured by the BMPs and estimate the pollutant load reduction that could be achieved based on the site conditions.

<u>*Results and Key Findings*</u>
This study provides baseline pollutant concentrations, flow volumes, and estimated loads for the proposed Green Street Project. The results of this baseline effectiveness assessment monitoring indicated the following:

- **Metals –**Dissolved copper, total copper, dissolved zinc, and total zinc exceeded criterion maximum concentration (CMC) for both storm events.
- **Pesticides –** The organophosphate pesticide Malathion was detected during both storm events and had a sample concentration of 501.3ng/L during the second storm event. All other tested organophosphate pesticides were below detection during both monitoring events. The synthetic Pyrethroids Bifenthrin was measured in concentrations that exceed the WQO during both storm events.

- **Bacteria –** Fecal coliform concentrations were above the water quality objectives (WQOs) only once during the first storm event and none during the second storm event. Enterococcus concentrations were above the WQOs during both storm events.
- **Load Reduction –** The assessment provides an estimated load reduction for TSS, Total Copper and Total Zinc. These numbers are estimates based on design storm volume and literature reductions values. Actual reductions will be determined during post-construction monitoring.
- **Implementation –** Results from the monitored location confirmed the need for BMP implementation to reduce pollutant loads.
- **Tier I BMPs –** Tier I source control BMPs should be considered in combination with these Tier II BMPs to achieve greater reductions.

Benefits to the City

This BMP Effectiveness Baseline Study provides the following benefits to the City:

- The study in combination with the post-construction monitoring results complies with regulatory requirements laid out under the San Diego Region Municipal Storm Water Permit (Permit) (Final Order R9-2007-0001, 2007).
- The results of the baseline monitoring provided important data for the design of the Green Street project. The results were used to develop the specific filter media in both the curbside filtration units and the biofiltration basin area.
- The results of this study in combination with post-construction monitoring results will help the City to determine the most cost effective approach to meet both the requirements of the NPDES Permit and the applicable TMDLs in each watershed.

1.0 INTRODUCTION

1.1 Regulatory Framework

This section explains the regulatory background to the need for baseline effectiveness assessment.

1.1.1 Municipal Storm Water Permit

The San Diego Region Municipal Storm Water Permit (Permit) (Final Order R9-2007-0001, 2007) requires each Copermittee to implement no less than two Watershed Water Quality Activities and two Watershed Education Activities each year that result in a "significant pollutant load reduction, source abatement, or other quantifiable benefits to discharge or receiving water quality in relation to the watershed's high-priority water quality issues."

1.1.2 San Diego Regional Water Quality Control Board Total Maximum Daily Load Program

This section provides background for the current Total Maximum Daily Load (TMDL) schedules for the target watershed.

Chollas Creek Watershed
The San Diego Regional Water Quality Control Board (Regional Board) adopted an amendment to the Water Quality Control Plan for the San Diego Basin (Basin Plan) on August 14, 2002 (Resolution No. R9-2002-01213) to incorporate a TMDL for Diazinon in the Chollas Creek watershed. This TMDL was developed to address acute and chronic toxicity of aquatic life in the Chollas Creek watershed because of the organophosphate insecticide Diazinon. The TMDL is designed to protect the warm freshwater habitat (WARM) and wildlife habitat (WILD) beneficial uses.

The Regional Board adopted another amendment to the Basin Plan on June 13, 2007, (Resolution No. R9-2007-0043) to incorporate additional TMDLs for dissolved copper, lead, and zinc in the lower 1.2 miles of Chollas Creek. This TMDL addresses impairment to water quality due to metal levels that exceed numeric targets as set forth in the California Toxics Rule (CTR). The State Board Office of Administrative Law (OLA) reviewed and approved the Dissolved Metals TMDL on October 22, 2008. Although the TMDL focused on achieving the stated Waste Load Allocations (WLA) for dissolved copper, lead, and zinc in the receiving waters of the Chollas Creek Watershed, the TMDL Compliance Schedule was extended by 10 years to allow for the implementation of integrated watershed activities. Under this extended timeline, integrated watershed activities address "…bacteria, diazinon, and trash loading which also contribute to water quality problems in the watershed," (Section 8.3, Appendix I, Dissolved Metals TMDL, 2007).

1.2 Strategic Plan for Watershed Activity Implementation Phase I

The City's *Strategic Plan for Watershed Activity Implementation* (Strategic Plan) (WESTON, 2007a) identifies activities to meet the pollutant load reduction requirements within the Permit as well as ones that would meet TMDL requirements. The strategy for the implementation of watershed activities uses an integrated best management practices (BMPs) approach. Source control and pollution prevention Tier I BMPs are the focus of initial Phase I implementation as well as Tier II structural BMPs. These include low impact development (LID) type BMPs that involve the use of porous pavement, bioretention areas, biofiltration areas, bioswales, and planters that infiltrate, filtrate, and/or harvest storm water. These BMPs reduce both the volume and pollutant loading of storm water.

The current Phase I implementation includes the assessment of tiered BMPs to determine pollutant load reduction efficiency. The assessment of BMP effectiveness meets both Permit and the Strategic Plan goals. Furthermore, the results of the Phase I assessments will be used to identify the most cost-effective activities for implementation on a broader scale in subsequent phases throughout City jurisdiction.

BMP effectiveness baseline monitoring effort was initiated to establish baseline water quality and pollutant loading conditions at the proposed BMP locations. The baseline conditions will then be used to compare water quality conditions following the BMP implementation to assess the pollutant reduction effectiveness. Not all BMPs require this baseline monitoring, depending on the type and configuration of the BMP. These baseline monitoring efforts are most applicable to integrated BMPs that cover multiple drainage areas without single influent and effluent points. The baseline water quality and flow monitoring also may be used in the development of performance specification during the planning and design process.

This report focuses on the baseline water quality conditions for the Green Street LID project located at 43rd Street and Logan Avenue in the Chollas Creek Watershed. The monitoring effort was implemented in accordance with the technical memorandum, *BMP Baseline Effectiveness Monitoring, 43rd and Logan Work Plan* (WESTON, 2008). This Green Street project was integrated into a planned transportation project to improve traffic flow and patterns at the intersection of 43rd Street and Logan Avenue as shown on Figure 1. The Storm Water Department worked in collaboration with Engineering and Capital Projects Department (ECP) to integrate additional storm water management and water quality components above the requirements of the Standard Urban Storm Water Mitigation Plan (SUSMP) requirements into this project.

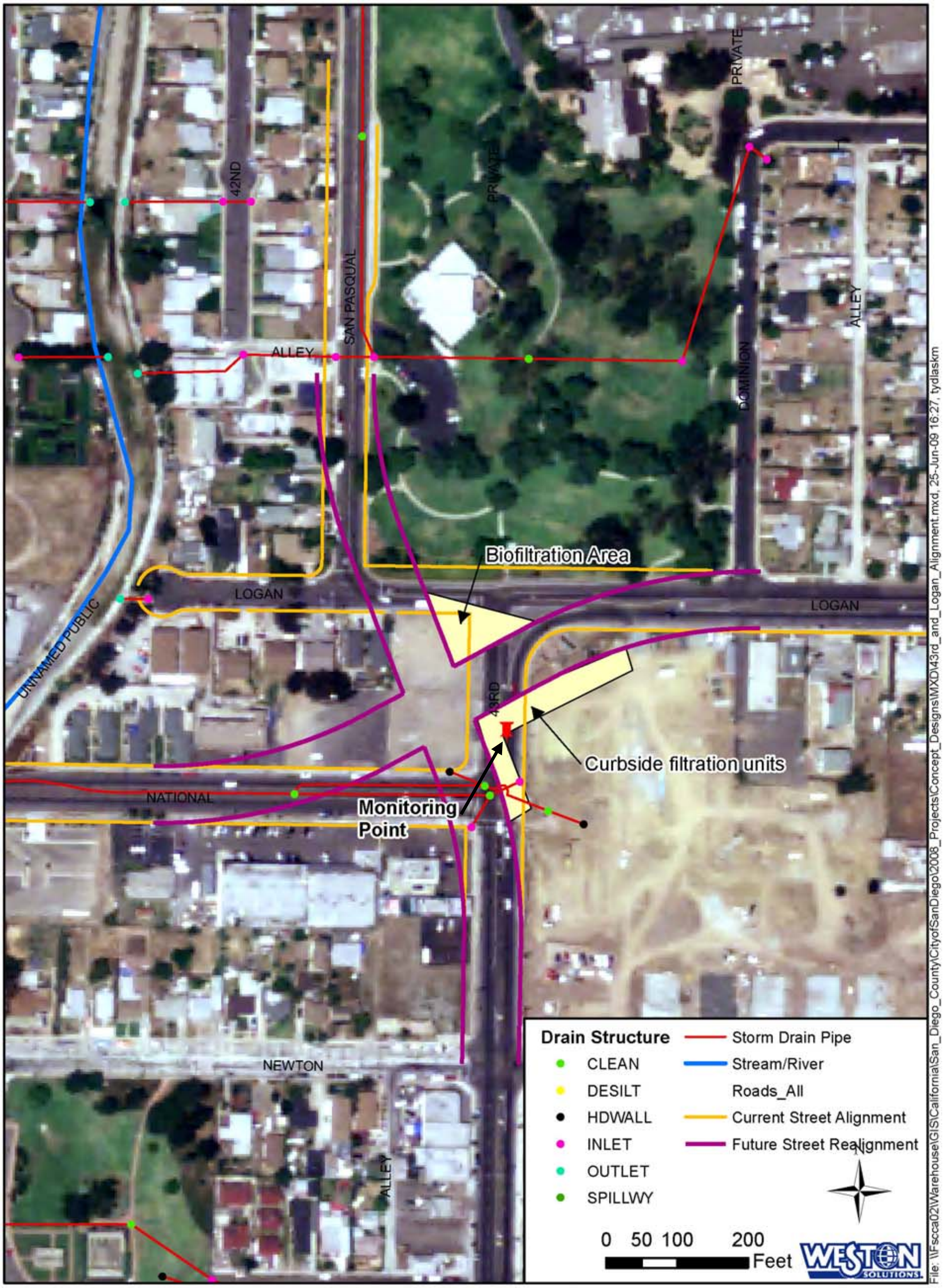


Figure 1. Overview of Proposed Street Realignment and BMPs for the 43rd Street and Logan Avenue Project. Monitoring Point also Shown.

1.3 Project Study Question

The Scope of Work (SOW) for this effort was designed to address the following question:

- **What are the baseline conditions (flow and pollutant concentrations) prior to implementation of the Tier II Green Street BMP proposed for 43rd Street and Logan Avenue in the Chollas Creek Watershed?**

1.4 Background of Study Areas

This section provides a background of the target study areas in terms of watershed size, land use, and relevant watershed activities.

1.4.1 San Diego Bay Watershed Management Area

The San Diego Bay Watershed Management Area (WMA) consists of the following major watersheds:

- Pueblo San Diego Watershed (Hydrologic Unit (HU) 908.00).
- Sweetwater Watershed (HU 909.00).
- Otay Watershed (HU 910.00).

The entire San Diego Bay WMA covers over 888,400 acres, and its major waterbodies include San Diego Bay, Otay River, Sweetwater River, Chollas Creek, and Paradise Creek.

Chollas Creek Watershed
The 43rd Street and Logan Avenue BMPs are located within the Chollas Creek Watershed. The Chollas Creek Watershed is a part of the San Diego Mesa Hydrologic Area (HA), which is a part of the Pueblo San Diego HU. The watershed is approximately 30 square miles and the main stem of the creek is approximately 9 miles long. Figure 2 shows the project in relation to the WMA.

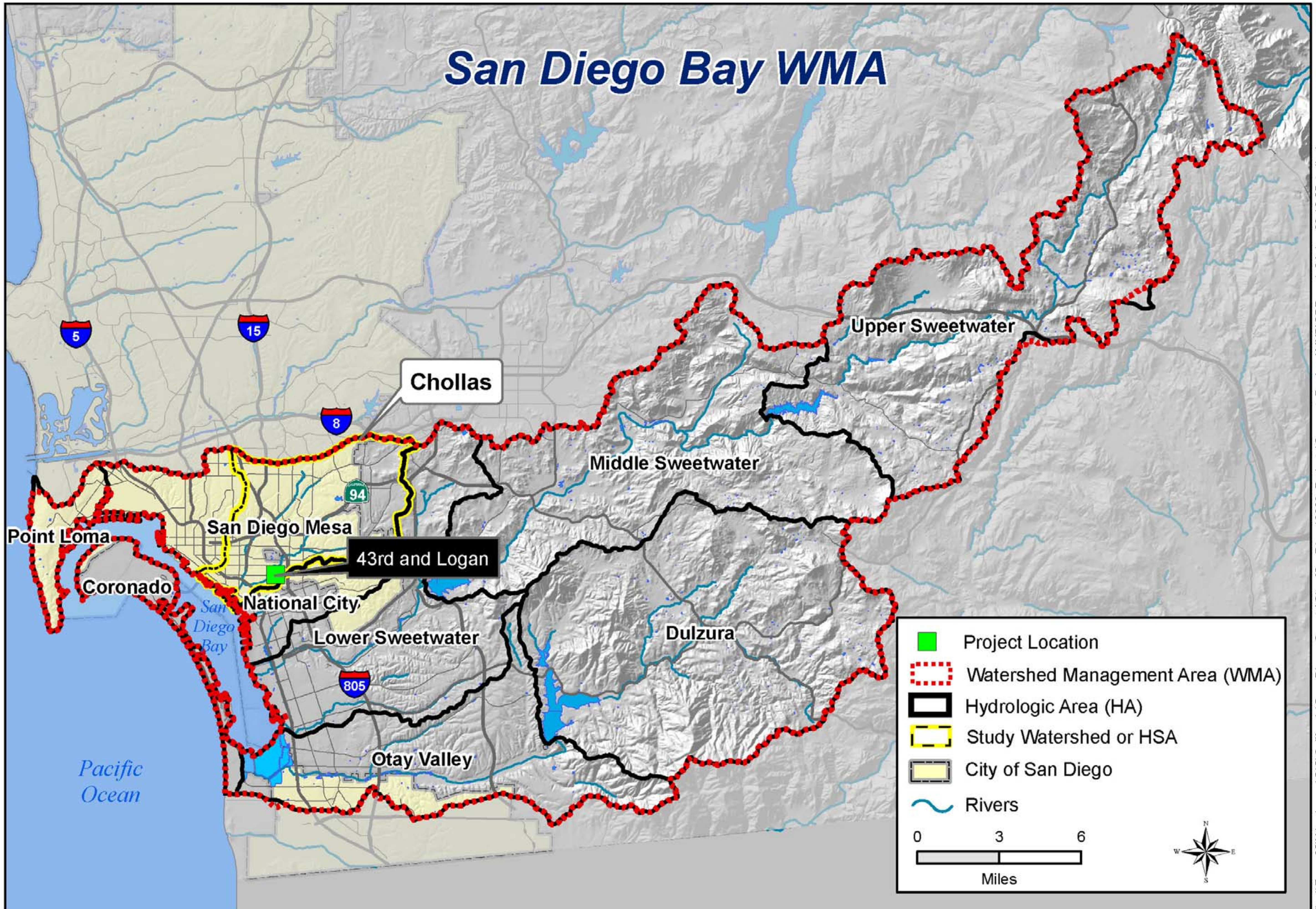


Figure 2. Chollas Creek Watershed

1.5 Targeted Constituents of Concern

The targeted constituents of concern for Chollas Creek Watershed were identified using the San Diego County Municipal Copermittees 2005–2006 Urban Runoff Monitoring Report (2005–2006) priority contaminants of concern and the State Board Section 303(d) listing (State Board, 2006). The potential constituents of concern are provided in Table 1 and are based on those targeted pollutants of concern identified in the Strategic Plan (WESTON, 2007a).

Table 1. Potential Constituents of Concern for the Chollas Creek Watershed

Analyte	Chollas Creek
Total and dissolved metals	●
Organochlorine pesticides	●
Organophosphorus pesticides	●
Synthetic pyrethroid pesticides	●
Nitrate	
Nitrite	
Total phosphorus	
Ammonia	●
Orthophosphate	
Total suspended solids (TSS)	●
Turbidity	●
Total coliforms	●
Fecal coliforms	●
Enterococci	●

1.6 Proposed Best Management Practices

The City's Strategic Plan identifies activities to meet the pollutant load reduction requirements within the permit as well as ones that would meet TMDL requirements. The strategy for the implementation of watershed activities uses an integrated tiered and phased approach. Source control and pollution prevention Tier I BMPs, as well as Tier II activities, are the focus of early implementation, which include runoff reduction, aggressive street sweeping activities, and LID BMPs. BMPs which address current and anticipated TMDL pollutant reduction goals are piloted during Phase I.

The baseline monitoring documents conditions at 43rd Street and Logan Avenue project site prior to the implementation of the BMPs and will be compared with water quality results following installation to assess the pollution reduction efficiency. Design, construction, and operation and maintenance costs will be tracked along with water quality data to assess overall cost efficiency. The City will use these assessment findings to determine the most cost-effective activities to implement in future phases to meet both National Pollutant Discharge Elimination System (NPDES) Storm Water Permit and TMDL requirements within City jurisdiction.

1.6.1 Chollas Creek Watershed – 43rd Street and Logan Avenue

The proposed Tier II BMP includes the installation of Green Street LID components as part of the 43rd Street and Logan Avenue intersection improvement project. The Green Street BMP consists of curbside filtration BMPs along a section of the right-of-way as part of the roadway realignment project that will collect and treat runoff above the SUSMP requirement. Three basins, or areas, were designated for the design of the Green Street sections (CValdo, 2009) (Figure 3). The project also consists of a biofiltration basin area located on an open space parcel that will collect and treat storm water from a portion of the roadway project and surrounding residential drainage area as shown on Figure 4. This lot was also divided into three basins, or sub-drainage areas, to aid in the design process. This BMP will treat storm runoff from the northern half of Logan Avenue from Dominion Street to San Pasqual Street. The design specifications are shown in Table 2.

Table 2. Design Specification Information

Monitoring Location	BMP Description	Drainage Area Monitored (acres)*	Drainage Area Treated by BMP (acres)	Design Storm Performance Specifications (cfs)	Volume of Water to be Treated (cf)**
43rd Street and Logan Avenue	Biofiltration basin area	4.3	Area 1: 0.38 Area 2: 0.24 Area 3: 0.11 Total=0.73	Area 1: 0.07 Area 2: 0.02 Area 3: 0.02 Total=0.11	3,138 754 908 Total=4,800
43rd Street and Logan Avenue	3 Green Street areas	4.3	Area 1: 2.12 Area 2: 0.25 Area 3: 3.39 Total=5.76	Area 1: 0.31 Area 2: 0.05 Area 3: 0.56 Total=0.92	3,788 447 5,481 Total=9,716

cf = cubic feet.
cfs = cubic feet per second.
* 4.3-acre drainage area is the tributary area to the monitoring point located slightly north of existing street catch basin. Based on traffic conditions (intermittent but heavy roadway traffic), poor visibility and inadequate lighting at the catch basin, sampling at the catch basin was not feasible. Based on the similar type of land use (residential) and similar topography, the drainage area monitored is assumed to also represent the portion of the catch basin drainage area (approximately 2.2 acres) located south of the existing catch basin. The proposed project includes realigning roadway and slightly changing the drainage patterns of the existing 6.5-acre drainage area to the catch basin currently located at the site (proposed drainage areas shown in forth column of Table above).

** BMPs are flow based and designed for the 5-year (biofiltration basin area) and 85th percentile (Green Street) SUSMP flow rates of 3.1 in/hr and 0.2 in/hr, respectively. In order to determine design storm pollutant loads, the volume of runoff associated with the design storm event for each BMP was estimated in accordance with the SUSMP manual. These calculations are included in Appendix H.

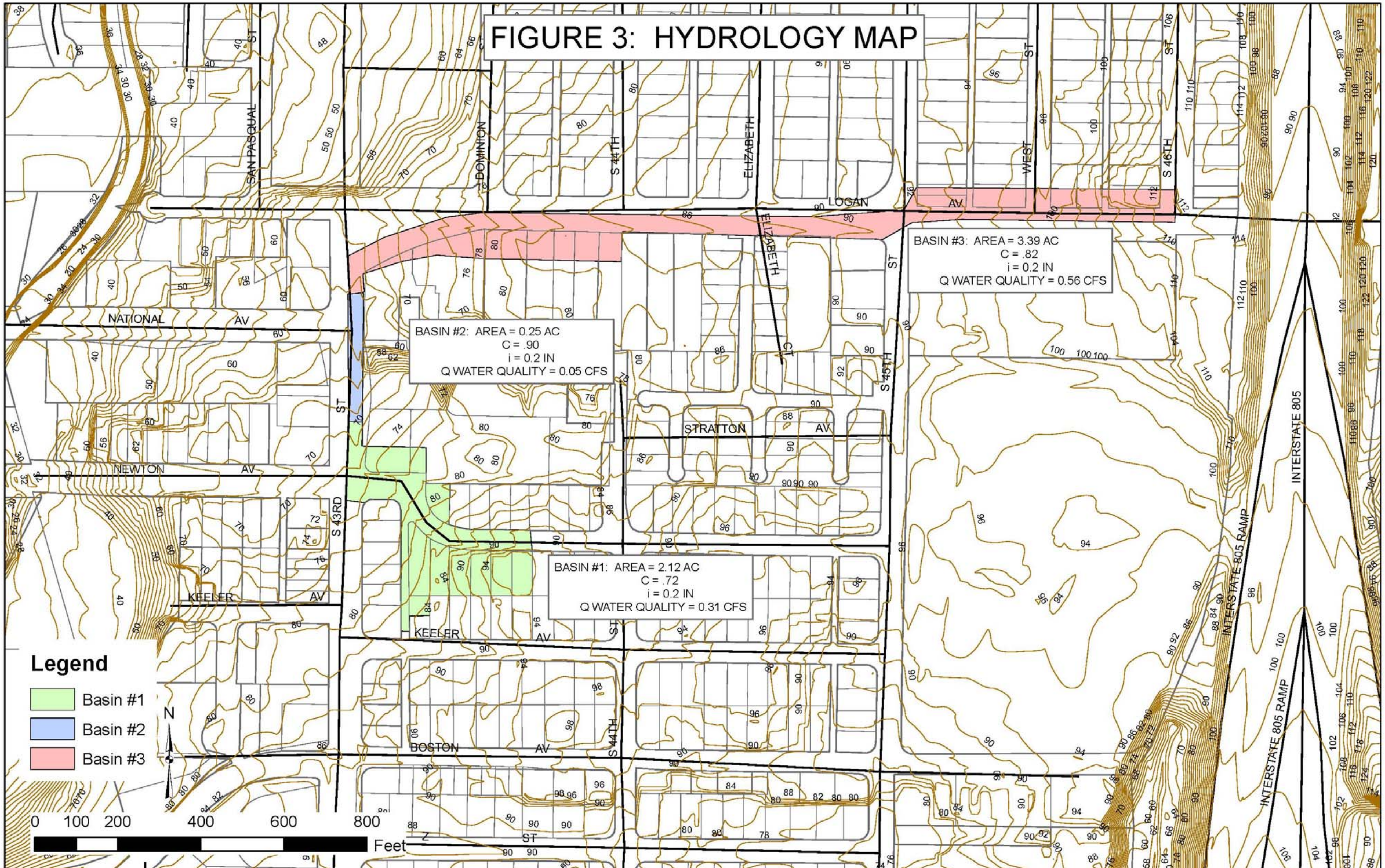


Figure 3. Area Designations for the Three Green Street Areas along 43rd Street and Logan Avenue (Post-construction Condition)

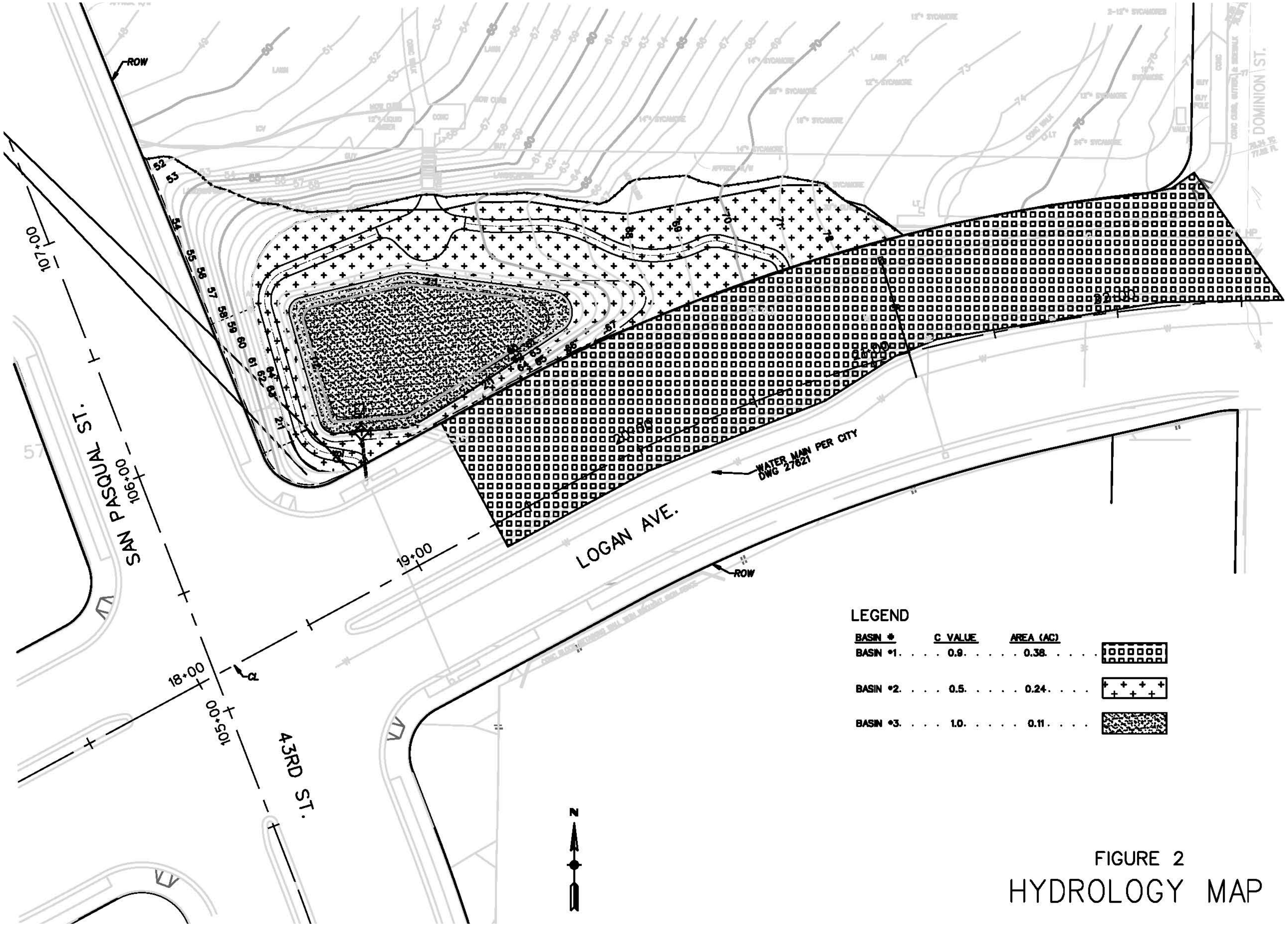


Figure 4. Drainage Areas to the Proposed Biofilter Area along Logan Avenue and San Pasqual Street (Post-construction Condition)

The typical curbside filtration BMP is 40 inches wide with an 18-inch thick filter media. The filter media has a subdrain system that connects to the municipal storm drain system within the adjacent street. The filtration system will run parallel to the curb between the curb and sidewalk and break at driveways, utility boxes, water meter clusters, and other necessary stopping points. Flows in excess of the filtration system capacity will pass across the surface of the filter media and exit the system back to the adjacent street gutter. The filter media will consist of a multi-layer system designed for low maintenance, pollutant removal, and design flows. The filter system includes a three to six inch thick layer of lava rock underlain by a 30 to 36 inch filter media layer of activated zeolite and sand mixture. The filter media layer is separated by the underlying three-quarter inch drainage layer with geotextile fabric. The drainage layer contains a perforated subdrain that transmits filtered storm water into the MS4.

The filtration BMP provides for removal of pollutants, which include total and dissolved metals, bacteria, sediment, oil and grease, pesticides, and trash. The associated treatment flow rate from the 5.76-acre tributary watershed is approximately 0.92 cubic feet per second (cfs). The anticipated required filtration rate is approximately 5.5 inches per hour. Ponding above the filter media occurs within a layer of crushed volcanic rock and is not visible from the surface. The drawdown time within the rock layer at filter unit capacity is less than one hour. Runoff treated within the filtration system will be prevented from moving laterally into the street and sidewalk subgrade by a concrete liner and will be prevented from infiltrating down to subsurface soils by an impermeable synthetic liner. It is anticipated that regular maintenance will be required during the wet season to remove trash from the filtration system inlet opening. The frequency of maintenance will depend upon the amount of rainfall and the amount of litter in the tributary watershed. Observation of the filtration rate and treated runoff pollutant concentrations will dictate the required maintenance frequency of the filter media (CValdo, 2009a).

The triangle lot biofilter basin has a treatment surface area of approximately 0.11 acres, a maximum length of approximately 110 ft, and a maximum width of approximately 65 ft. At treatment capacity, the basin will pond approximately 6 inches of water. The filtration media is approximately 18 inches thick and has a subdrain system that connects to the MS4 within the adjacent street. The basin overflow feature consists of a side-opening catch basin outlet structure set to capture the tributary 100-year peak runoff with a maximum water surface elevation equal to 1 ft below the top of the basin side slopes. It should be noted that the inlet to the biofilter basin does not have the capacity to convey the 100-year peak runoff from the street into the basin, and therefore, the outlet is conservatively oversized. In the event that this outlet structure should clog or fail to function as designed, basin overflow will drain to the adjacent street over the sidewalk. The filter media will consist of granular soils and organic materials. The pollutants to be removed include total and dissolved metals, bacteria, sediment, oil and grease, pesticides, and trash. The associated treatment peak flow rate from the 0.73-acre tributary watershed is approximately 3.1 cfs. The anticipated required filtration rate of the filter media is approximately 1 inch per hour, and the associated drawdown time with the basin at capacity is approximately six hours. Due to the basin proximity to an adjacent slope, the basin will be underlain by an impermeable membrane to prohibit infiltration of filtered runoff into adjacent soils. It is anticipated that regular maintenance will be required during the wet season to remove trash from the basin forebay. The frequency of maintenance will depend upon the amount of rainfall and the amount of litter in the tributary watershed. Regular maintenance will be required of the vegetation within and adjacent to the basin. Observation of the filtration rate and treated runoff pollutant concentrations will dictate the required maintenance frequency of the filter media (CValdo, 2009b).

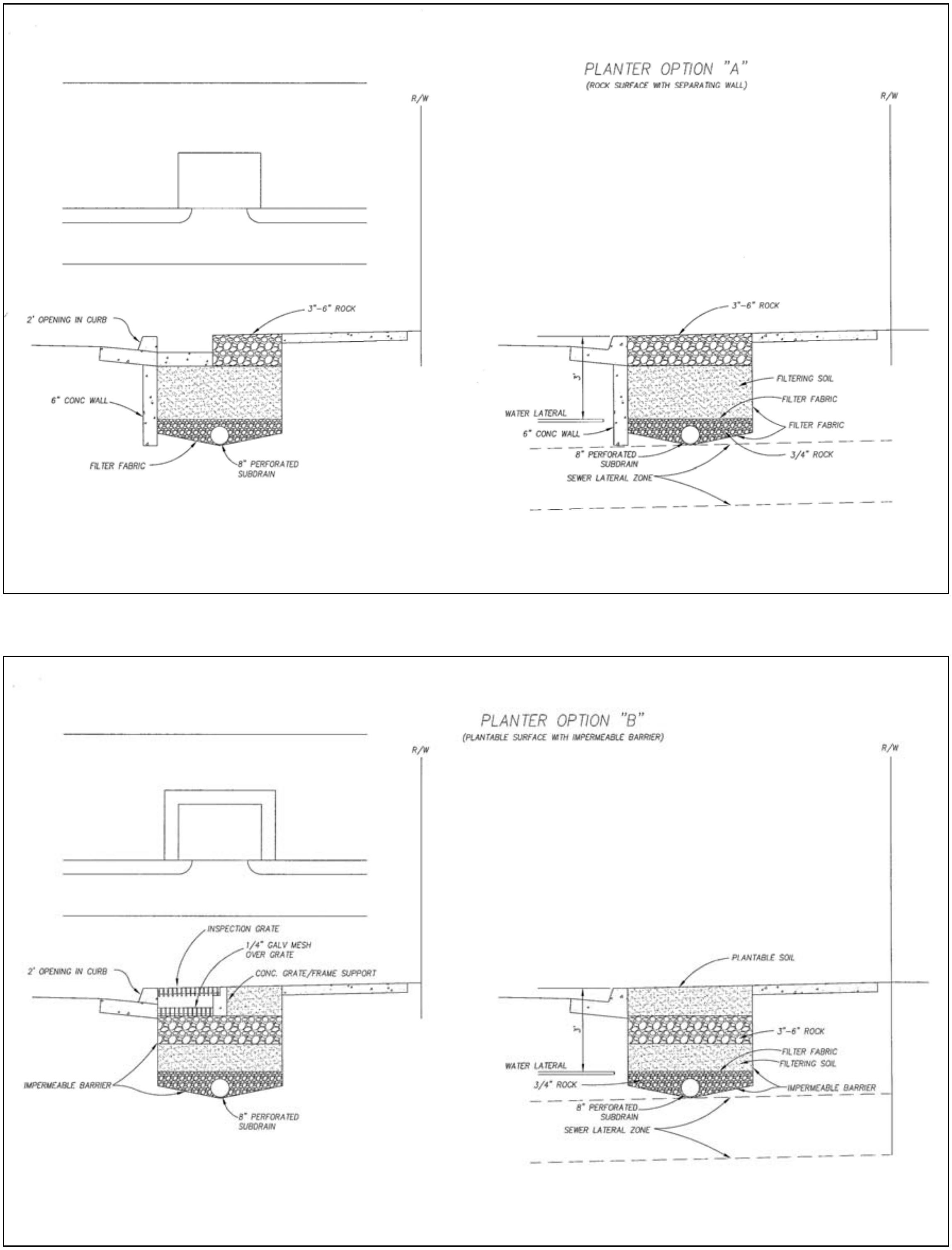
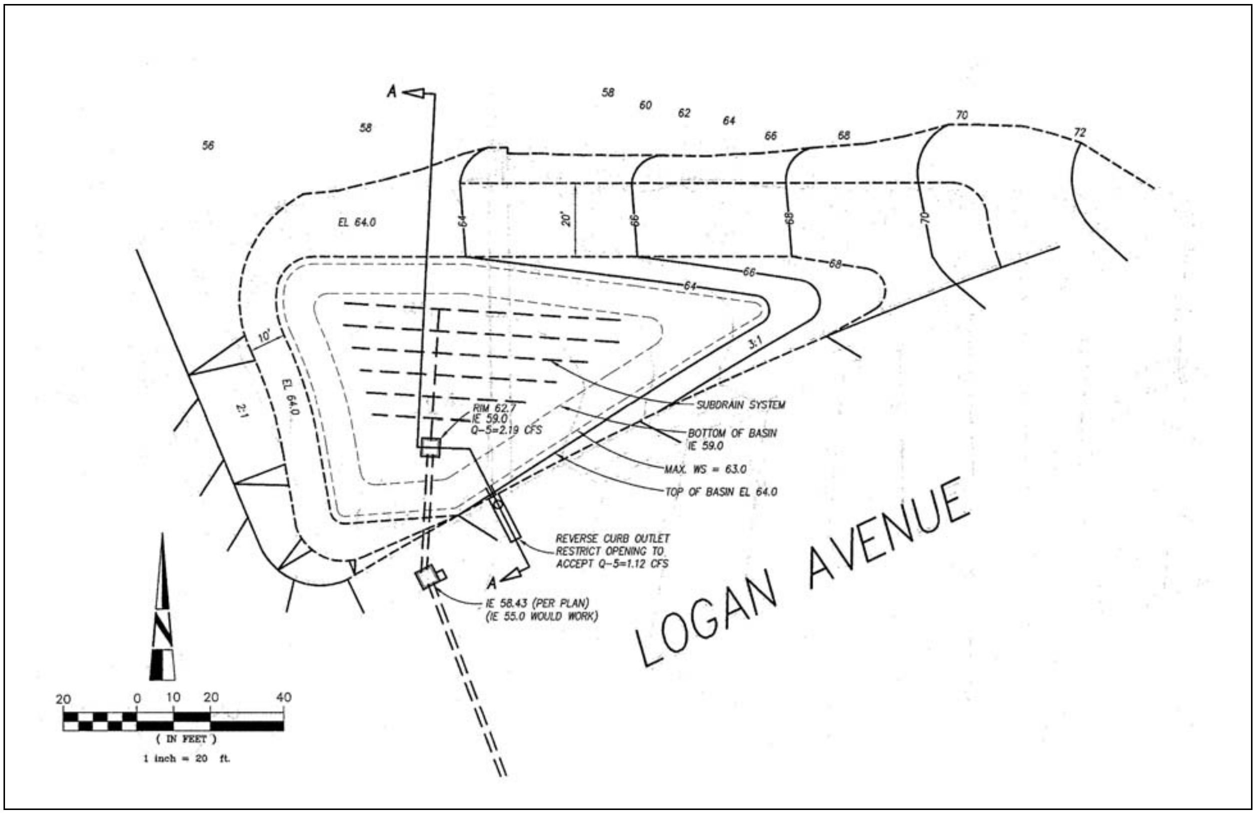


Figure 5. Proposed Curbside Filtration Units along 43rd Street and Logan Avenue



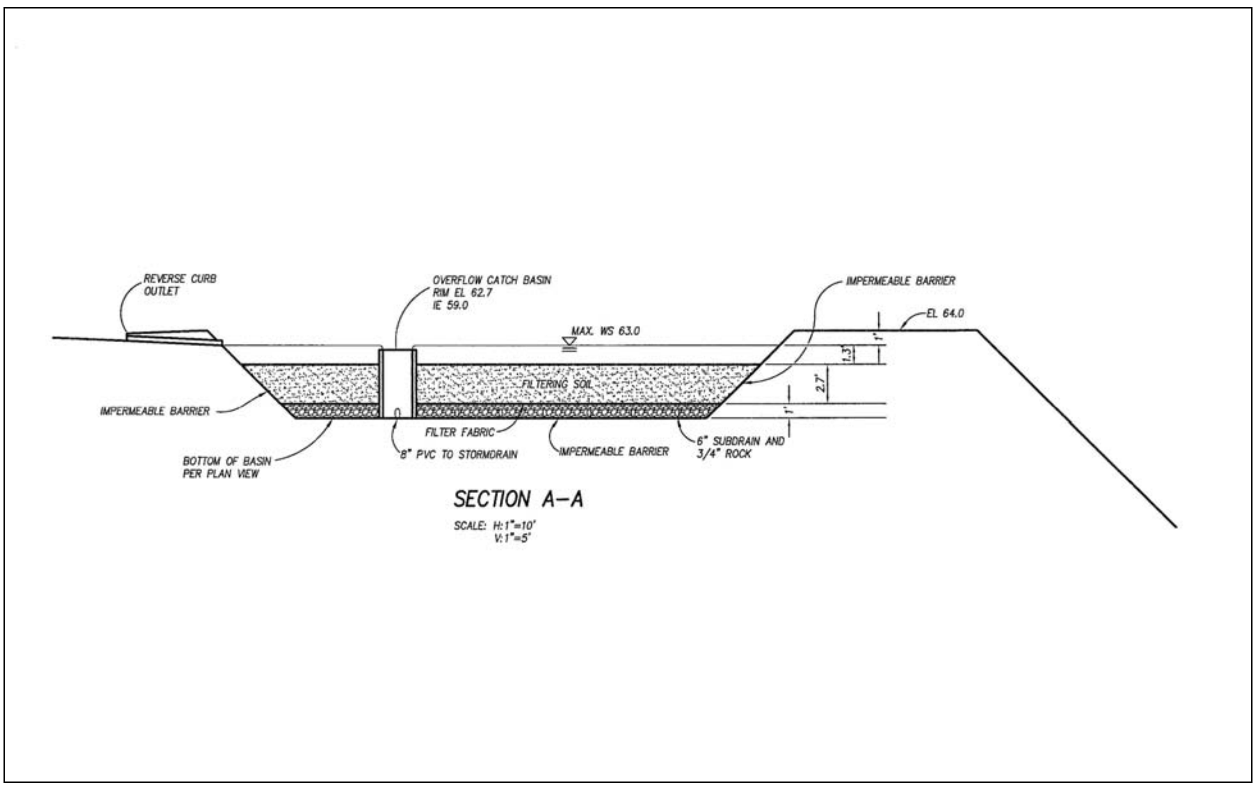


Figure 6. Proposed Biofiltration Basin Area at Logan Avenue and San Pasqual Street

1.7 Monitoring Location

The monitoring site is located approximately 150 ft south of the existing corner of 43rd Street and Logan Avenue. The flow catchment area of the site is predominantly residential since the public park located across the street resides below the grades of 43rd Street. The proposed street realignment project will take place at the intersection of 43rd Street and Logan Avenue, and the Green Street BMPs will be installed on the south and east corners of the intersection. The biofiltration basin area will be located along the northeast corner of the intersection, after the street alignment (Figure 1). For both events, sampling took place at a location slightly north of the existing catch basin that is situated along 43rd Street. This point was chosen in lieu of sampling from the catch basin because of the risk of personnel injury and equipment damage from the combination of several factors, such as intermittent but heavy roadway traffic, poor visibility (from rainfall) and inadequate lighting around the catch basin. Based on the similar type of land use (residential) and similar topography, the drainage area monitored is assumed to also represent the portion of the catch basin drainage area (approximately 2.2 acres) located south of the existing catch basin. Figure 7 and Figure 8 show the monitoring location during dry weather. Table 3 provides the globe positioning system coordinates of the monitoring location.

Table 3. Monitoring Location

Monitoring Location	Watershed	Latitude	Longitude
43rd and Logan	Chollas Creek	32.696834°N	-117.102346°W

Figure 7. 43rd Street and Logan Avenue Realignment,

Figure 8. Bus Stop at 43rd Street and Logan Avenue

2.0 METHODS

This section includes a description of the sampling area as well as an overview of the sampling procedures used during wet weather sampling.

2.1 Site Reconnaissance

WESTON field scientists conducted the early morning reconnaissance of the monitoring location at South 43rd Street and Logan Avenue between 05:00 and 07:00 on November 14, 2008. At the time, the storm drain inlet was dry and there was no moisture or other indication of recent runoff (Figure 9). Neither the curb nor the inlet had staining or calcification to indicate any chronic runoff in this area. There did appear to be a small amount of coarse-grained sediment built up directly in front of the storm drain.

The surrounding neighborhood area was also visited during the site reconnaissance. Potential inputs of runoff included the open space area behind the bus stop that ran into the reverse curb, the street runoff from South 43rd Street to the north, and the street runoff from the south side of Logan Avenue, which extended approximately ten blocks up a slight grade toward Interstate 805. It appeared all potential runoff from the south side of Logan Avenue would run downhill, turn onto South 43rd Street, and empty into the inlet on South 43rd Street. Site topography eliminated the potential for any runoff intrusion from areas south of the monitoring location. Any runoff coming from the south on South 43rd Street drains into a large storm drain inlet at the intersection of South 43rd Street and National Avenue.

To the north of the 43rd Street and Logan Avenue monitoring location, the street curb bent around to the east and turns into Logan Avenue where it proceeded uphill. Only leaf debris and trash were observed up to Elizabeth Street. A small amount of flow was observed from sprinklers at an apartment complex on the southeastern corner of Elizabeth Street and Logan Avenue (Figure 10). The flow traveled approximately 50 ft west on Logan Avenue before becoming ponded and terminating. There was also a wetted area on the southeastern corner of South 45th Street and Logan Avenue that had no observed flow and had a small ponded area. The runoff appeared to be from sprinklers at the apartment complex and also from the nearby Willie Henderson Sports Complex.

Figure 9. Storm Drain Inlet along East Side of 43rd Street, South of Logan Avenue

Figure 10. Sprinkler Runoff at Elizabeth Street and Logan Avenue

2.2 Storm Event Sampling

Storm water sampling was conducted during the 2008–2009 Monitoring Season, defined as October 1, 2008, through April 30, 2009. A storm event was considered acceptable for monitoring if it was forecast to produce 0.15 inch of rain or greater within a 24-hr period, with a minimum of 72 hours between storm events.

Two storm monitoring events were conducted during the 2008–2009 Monitoring Season to assess baseline conditions at the 43rd Street and Logan Avenue location. Table 4 below presents the summary of the monitoring events, including dates, duration, and total rainfall.

Table 4. Wet Weather Monitoring Summary

Event	Date	Duration (hh:mm)	Total Rainfall (inches)
Storm Event 1	December 15, 2008	07:46	1.37
Storm Event 2	February 5 & 6, 2009	07:45	0.30

2.2.1 Sample Collection

During storm monitoring events, a field team was deployed to the sampling location approximately one hour prior to the expected onset of rainfall. A mechanical rain gauge was set up onsite to record site-specific rainfall precipitation during the monitoring period. During the second event, the onsite rain gauge malfunctioned. A working gauge was delivered to the site, and onsite measurements were taken for the later stage of the event. Rain gauge data from Weston's local DPR2 gauge was used to estimate the rainfall for the early stage of the event. At the onset of flow, sampling commenced, and grab samples were collected at the monitoring point.

The objective of the storm monitoring was to capture the rise and fall of the hydrograph from first flush until flow returned to within 10% of base flow (i.e., zero flow) conditions. Variations in rainfall intensity and duration altered the interval of the collected samples. The individual grab samples were combined to produce a time-weighted event mean concentration (EMC) composite sample.

Field samples were collected in appropriate pre-cleaned containers and then were composited at the end of the storm event. The time-weighted composite sample was delivered to the analyzing laboratory in the appropriate sample containers for each of the constituents. CRG Marine Laboratories, Inc. (CRG) of Torrance, California performed the requested analyses on the chemistry samples. The CRG Quality Assurance Project Plan (QAPP) is provided in Appendix A. Indicator bacteria samples were not composited and were sent as individual grab samples to WESTON's Microbiology Laboratory in Carlsbad, California for analysis. Appendix B provides the analyte list for the project, including total and dissolved metals, pyrethroids, organophosphate pesticides, and total suspended solids (TSS).

At each sample collection, the field team completed a field datasheet documenting the time, site conditions, and sample characteristics. Copies of the datasheets are included in Appendix C.

2.2.2 Chain of Custody

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. Chain-of-custody (COC) records, field logbooks, and field tracking forms were the principal documents used to identify samples and to document possession. COC procedures were used for all samples throughout the collection, transport, and analytical process.

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 were kept inside the container containing the samples. Once delivered to the analytical laboratory, the COC form was signed by the person receiving the samples. The condition of the samples were 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.

2.2.3 Flow Measurement

WESTON field staff measured the instantaneous velocity of the storm water flow in the curb gutter using the leaf method protocol as outlined in the United States Department of the Interior Bureau of Reclamation *Water Measurement Manual* (Reclamation, 2001). Since a flowmeter could not be installed at this site, an area velocity calculation was used based on field measurements. This was used to assess street flow for each storm event and to generate the hydrograph for each storm event.

Runoff volume was also estimated for each of the storms. The flow was multiplied by the time interval, and the flow from each interval was summed. This volume is the estimated total volume of water sampled during the course of the storm event.

2.3 Water Quality Analysis

Storm water samples from the 43rd Street and Logan Avenue wet weather monitoring events were sent to CRG for analysis. The storm water samples were analyzed for total and dissolved metals, synthetic pyrethroids, organophosphate pesticides, TSS, and total hardness. A total list of analytes can be found in Appendix B. WESTON's Microbiology Laboratory analyzed the samples for indicator bacteria, specifically total coliform, fecal coliform, and enterococci. The laboratories are certified by the State of California to perform the analyses required. WESTON's field team coordinated the transfer of all analytical samples collected following standard COC practices. Analytical laboratory data reports underwent a thorough quality control (QC) evaluation by the WESTON data management staff prior to incorporation into WESTON's database.

3.0 MONITORING RESULTS SUMMARY

The following section summarizes the results of this baseline assessment. First, a summary of the two monitoring events conducted during this project is presented. Next, the chemistry results are summarized. A table of complete chemistry results is provided in Appendix D. Finally, loading results are summarized and provided in Appendix E.

3.1 Hydrology, Precipitation, and Flow

The weather reports and hydrograph illustrate that the samples taken at 43rd Street and Logan Avenue represented the rise, peak, and fall of the hydrograph of each monitored storm event. Based on best professional judgment, sampling was discontinued before flow returned to base flow (i.e., zero flow) conditions. Rainfall and flows measured by the rain gauge after sampling ended have not been included in the flow and load calculations. A summary of the rain and associated runoff flow data are provided in Table 5. The estimated volume of flow per storm event represents the area monitored, which corresponds to a drainage area of approximately 4.3 acres in size. For more information on the drainage area monitored, see Table 2 and Section 1.7.

Table 5. Cumulative Rainfall and Wet Weather Flow Data for the Monitored Areas

Site	Rain Gauge	1st Storm	2nd Storm
43rd and Logan	On-site	1.37 inches rainfall, 16,500 ft^3 flow/storm	0.42 inch rainfall, 5,500 ft^3 flow/storm

3.1.1 Hydrographs

The first monitoring event at this location was on December 15, 2008. The total storm duration was approximately eight hours. The field team was deployed onsite at 08:00. Samples were collected at hourly intervals, with some exceptions based on rainfall patterns. At each sample collection time, flow was estimated by measuring width, depth, and velocity of the runoff into the storm drain. Figure 11 displays the storm hydrograph, sample collections times, rainfall over the course of the storm, and runoff volume.

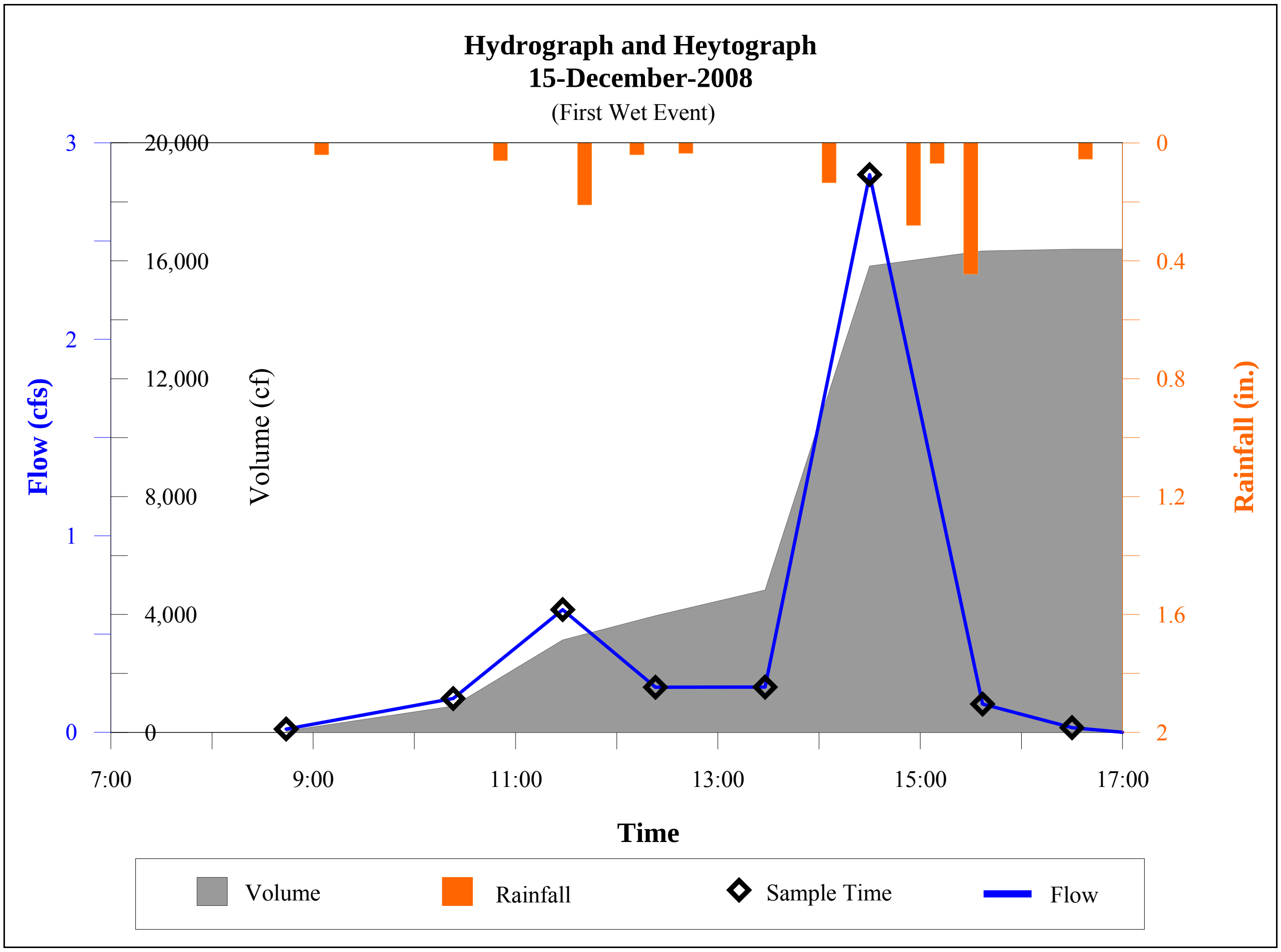


Figure 11. Storm 1 Hydrograph – December 15, 2008

In general, the samples collected were opaque, white, or brown in color, and contained fine particulates and/or sediment. As can be seen in the hydrograph on Figure 11, flow corresponds closely to rainfall amounts, with the highest peak occurring shortly before the greatest rainfall intensity recorded. This is most likely a result of the measuring device not accurately reporting when the peak occurred, which happens if the needle on the device gets stuck, and then become unstuck. This discrepancy does not affect the accuracy of the total rainfall measured. The cumulative volume for this storm event was estimated to be approximately 16,500 cubic feet (cf) from a total of 1.37 inches of rainfall.

The second storm monitoring event at this location was on evening of February 5, 2009 and continued through to the early morning of February 6, 2009. The total storm duration was approximately eight hours. The field team was deployed onsite at 18:00. Samples were collected on hourly intervals, with some exceptions based on rainfall patterns. At each sample collection time, flow was also estimated by measuring width, depth, and velocity of the runoff into the storm drain. Figure 12 displays the storm hydrograph, sample collections times, rainfall over the course of the storm, and runoff volume.

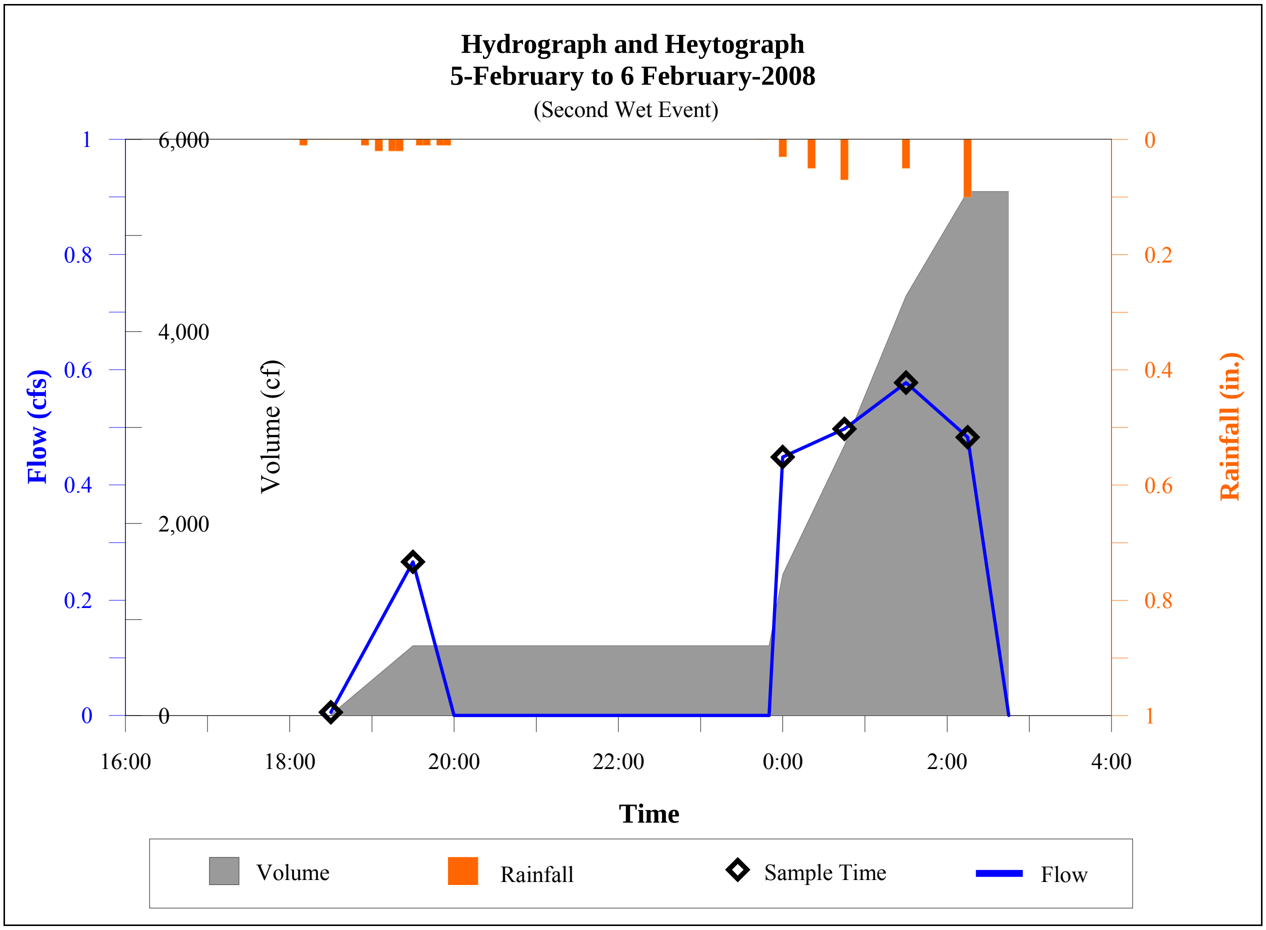


Figure 12. Storm 2 Hydrograph – February 6, 2009

In general, the samples collected were slightly cloudy and brown in color, and foam was observed. This storm had approximately one third of the rainfall of the first event, with a total of 0.42 inch of rainfall. Correspondingly, the maximum flow observed during this storm event and the total volume of runoff estimated were approximately one third of the first storm event. The cumulative volume 5,500 cf was estimated for this storm event.

3.2 Analytical Results

The analytical results for the wet weather events at 43rd Street and Logan Avenue are presented in Table 6.

Table 6. Summary of Analyte Concentrations from 43rd Street and Logan Avenue – Wet Weather

Group	Analyte	Units	Reporting Limit	12/15/2008		02/06/2009		Water Quality Benchmark Source
				Water Quality Benchmarks	Results	Water Quality Benchmarks	Results	
Indicator bacteria	Total coliform	MPN/100 mL	20		61,687		13,822	
	Fecal coliform	MPN/100 mL	10	4,000	1,794	4,000	280	1.Basin Plan REC-1/REC-2
	Enterococci	MPN/100 mL	10		55,566		7,260	
TSS	TSS	mg/L	5	100	52	100	112	2. MSGP 2000, 3. NSQD, Basin Plan
Nutrients	Ammonia-N	mg/L	0.03		0.94			
	Dissolved orthophosphate	mg/L	0.01				0.1376	
	Total phosphorus – low range	mg/L	0.05	2	0.238	2	-	4. MSGP 2000, 19. EPA Nutrient Numeric Endpoint Tool
	Total kjeldahl nitrogen	mg/L	0.5		-		3.1	
Hardness	Total hardness as CaCO3	mg/L	5		13.7		16.6	
CTR metals	Copper (Cu) (dissolved)	µg/L	0.8	2.06	22.9	2.47	31.5	40 CFR 131.38
	Copper (Cu) (total)	µg/L	0.8	2.15	47.9	2.58	42.7	40 CFR 131.38
	Lead (Pb) (dissolved)	µg/L	0.1	7.03	1.75	8.74	1.06	40 CFR 131.38
	Lead (Pb) (total)	µg/L	0.1	6.50	21.89	8.30	20.33	40 CFR 131.38
	Zinc (Zn) (dissolved)	µg/L	0.5	21.75	93.1	25.59	145.9	40 CFR 131.38
	Zinc (Zn) (total)	µg/L	0.5	22.24	163.9	26.16	249.8	40 CFR 131.38
Organophosphorus Pesticides	Malathion	ng/L	6	430 acute/ 100 chronic	<3	430 acute/ 100 chronic	501.3	4. CA Dept. of Fish & Game, 1998, 5. Goldbook
Pyrethroids by NCI	Bifenthrin	ng/L	2	9.3	31.3	9.3	33.9	6. Anderson et al., 2006

Shading denotes exceedance of WQO.
MPN = most probable number.
- Analyte not measured

1. San Diego Regional Water Quality Control Plan for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007)
2. Multisector General Permit for Industrial Activities, Section 2.
3. Research Progress Report, Findings from the National Stormwater Quality Database, January, 2004.
4. Multisector General Permit for Industrial Activities, Section 2
5. U.S. EPA, Quality Criteria for Water, May 1, 1986, EPA 440/5-86-001. (Goldbook)
6. Anderson et al., 2006
7. Wheelock et al. 2004

The following findings were drawn from the chemistry and bacterial analyses performed on samples collected at 43rd Street and Logan Avenue during wet weather monitoring:

- **Metals –** Dissolved copper, total copper, dissolved zinc, and total zinc exceeded the criterion maximum concentration (CMC) for both storm events.
- **Pesticides -** The organophosphate pesticide Malathion was detected during both storm events and was above the water quality benchmark during the second storm event with a sample concentration of 501.3 ng/L. The synthetic pyrethroid Bifenthrin was detected above the benchmark for both storm events. All other tested pesticides were either below the water quality benchmark or below the detection limit.
- **Bacteria –** During the December storm, bacteria concentrations started high, decreased when flow was relatively small and steady, and rose again during the peak flow event (Figure 13). During the February storm bacterial concentrations rose across the peak flow of the storm event (Figure 14).
- **Sediment -** TSS concentrations exceeded the water quality benchmark during the February sampling event.

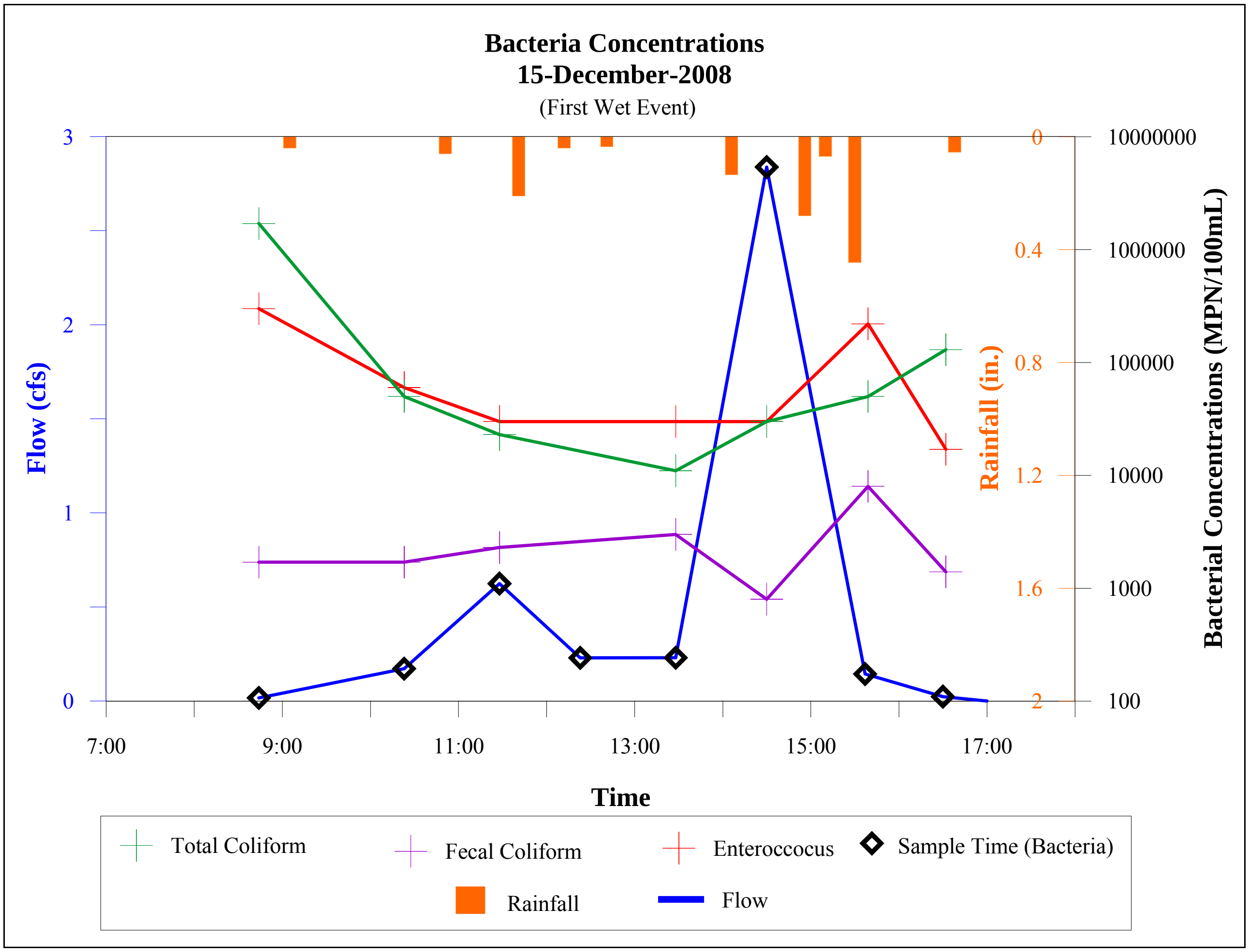


Figure 13. Hydrograph and Sample Concentrations during First Storm Event – December 15, 2008

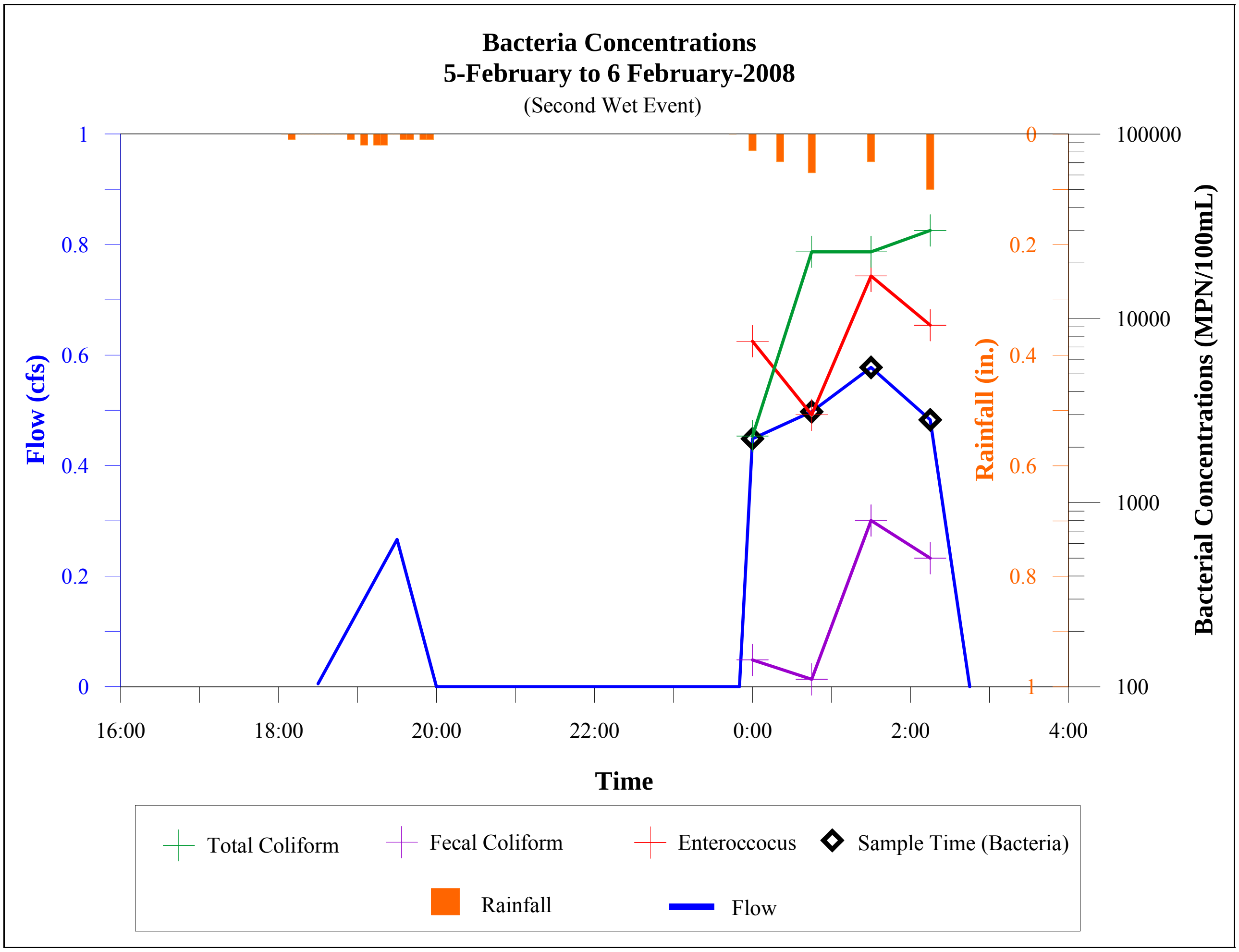


Figure 14. Hydrograph and Sample Concentrations during Second Storm Event – February 5 & February 6, 2009

3.3 Load Calculations

Estimated pollutant loads for the two storms monitored were estimated based on storm flows that were measured using the methods described in Section 2.2.3 and measured analyte concentrations in storm water samples. These load estimates represent the estimated pollutant loads for the size storm monitored. The estimated load reductions presented in Section 4.0 are based on the design storm volumes for the specific BMPs installed.

3.3.1 Pesticides

Based on the total storm volume and the composite concentration for Malathion, the total load for Malathion during the second storm was 132.31 mg. The organophosphate Diazinon was non-detect and, therefore, there was no load during either storm event. The loads for the three synthetic pyrethroids detected during both storms were similar to one another. The other two pyrethroid compounds that were only detected during the first storm event were approximately a factor of ten less than the first 3 synthetic pyrethroid compounds (Table 7).

Table 7. Organophosphate Pesticide and Synthetic Pyrethroids Loads for the First and Second Storm Events

Constituent	First Storm Load (mg)	Second Storm Load (mg)
Diazinon	ND	ND
Malathion	ND	78.07
Bifenthrin	14.60	5.28
Cyfluthrin	16.89	3.58
Cypermethrin	19.41	10.97
Esfenvalerate	1.63	ND
Fenvalerate	2.61	ND

3.3.2 Total and Dissolved Metals

Loads for the various metals varied greatly. The highest loads during both the first and second storm events were from aluminum, iron, and zinc during the first storm. Table 8 presents the estimated loads for the metals that exceeded the WQOs.

Table 8. Metals Loads for the First and Second Storm Events

Constituent	First Storm Load (g)	Second Storm Load (g)
Dissolved copper (Cu)	10.7	4.91
Total copper (Cu)	22.4	6.67
Dissolved lead (Pb)	0.816	0.164
Total lead (Pb)	10.2	3.17
Dissolved zinc (Zn)	43.4	22.8
Total zinc (Zn)	76.5	38.9

3.3.3 Total Suspended Solids

The loads for TSS during the first and second storm events were estimated to be 24.2 kg and 29.6 kg, respectively. TSS exceeded the WQO during the February event.

3.3.4 Bacteria

Bacterial loads from both storms were in the trillions. Bacterial concentrations are measured in most probable number (MPN) per 100 mL (MPN/100 mL). Therefore, when loads are estimated and this concentration is multiplied by the volume of water, the results are expressed in total MPN. In both storm events, the load from total coliform was highest, followed by enterococci, and finally fecal coliform (Table 9).

Table 9. Bacterial Loads for the First and Second Storm Events

Constituent	First Storm Load (MPN)	Second Storm Load (MPN)
Total coliforms	189,000,000,000	29,900,000,000
Fecal coliforms	6,210,000,000	630,000,000
Enterococci	182,000,000,000	15,000,000,000

4.0 ESTIMATED LOAD REDUCTIONS

Using the National Pollutant Removal Performance Database (version 3.0) the anticipated effectiveness of the BMPs were estimated. With this information, it is possible to estimate the anticipated load reductions. Data have been collected and reported for the TSS, Total Copper and Total Zinc pollutants.

The design storm load for 43rd Street and Logan Avenue triangle lot biofiltration basin project is the 5-year storm event (4,800 cf). The 85th percentile event (8,741 cf) is the design storm for the curbside filtration units within the street right-of-ways. The results of this analysis are presented in Table 10 and Table 11.

Table 10. Anticipated Load Reductions at 43rd Street and Logan Avenue Triangle Lot

Analyte	Design Storm Load (kg)	Reduction Percentage*	Anticipated Reduction (kg)	Load after Treatment (kg)
TSS	10.01	86%	8.61	1.40
Total copper	0.0042	37%	0.0016	0.0026
Total zinc	0.1627	87%	0.1415	0.0211

* (Center, 2007)

Table 11. Anticipated Load Reductions at 43rd Street and Logan Avenue

Analyte	Design Storm Load (kg)	Reduction Percentage*	Anticipated Reduction (kg)	Load after Treatment (kg)
TSS	18.24	86%	15.68	2.55
Total copper	0.0077	37%	0.0028	0.0048
Total zinc	0.2962	87%	0.2577	0.0385

* (Center, 2007)

5.0 DISCUSSION

This study provides baseline pollutant concentrations, flow volumes, and analyte loads at the 43rd Street and Logan Avenue monitoring location in preparation of the construction of a Tier II BMP Green Street BMP. The key findings from this study are as follows:

- **Metals –** particularly copper, lead, and zinc, were found to be prevalent and above WQOs during the monitoring period.
- **Bacteria –** Indicator bacteria concentrations were consistently high during both wet weather events.
- **Pesticides –** The organophosphate pesticide Malathion was detected during the second storm event and had a sample concentration of 501.3ng/L. All other tested organophosphate pesticides were below detection during both monitoring events. The synthetic Pyrethroids Bifenthrin was measured in concentrations that exceed the WQO during both storm events.
- **Design Process –** The results of the baseline monitoring provided important data for the design of the Green Street project. The results were used to develop the specific filter media in both the curbside filtration units and the biofiltration basin area.
- **Load Reduction –** The assessment provides an estimated load reduction for TSS, Total Copper and Total Zinc. These numbers are estimates based on the design storm volume and literature reductions values. Actual reductions will be determined during post-construction monitoring.
- **Implementation –** Results from the monitored location confirmed the need for BMP implementation to reduce pollutant loads.
- **Tier I BMPs –** Tier I source control BMPs should be considered in combination with these Tier II BMPs to achieve greater reductions.

6.0 REFERENCES

Anderson, BS, Phillips, BM, Hunt, JW, Richard, N, Connor, V., Tjeerdema, RS. 2006 *Evidence of pesticide impacts in the Santa Maria River watershed (California, USA).* Environ. Toxicol. Chem 25: 1160 – 1170.

CValdo (CValdo Corporation). 2009a. *43rd Street and Logan Avenue Improvements, Water Quality Study*. CValdo Corporation. Prepared for the City of San Diego. January, 2009.

CValdo (CValdo Corporation). 2009b. *Addendum to the 43rd Street and Logan Avenue Improvements, Water Quality Study*. CValdo Corporation. Prepared for the City of San Diego. April, 2009.

Reclamation (United States Department of the Interior). 2001. *Water Measurement Manual.* Bureau of Reclamation. Washington, DC. 2001.

State Board (State Water Resources Control Board). 2006. Accessed at: http://www.swrcb.ca.gov/rwqcb9/water_issues/programs/303d_list/index.shtml

WESTON (Weston Solutions, Inc.) 2007a. *Strategic Plan for Watershed Activity Implementation*. Weston Solutions, Inc. Prepared for the City of San Diego. November 2007.

WESTON (Weston Solutions, Inc.) 2007b. *Tier II and Tier III Storm Water Best Management Practices Conceptual Designs.* Weston Solutions, Inc. Prepared for the City of San Diego. May 2008.

WESTON (Weston Solutions, Inc.) 2008. *BMP Baseline Effectiveness Monitoring, 43rd and Logan Work Plan*. Weston Solutions, Inc. Prepared for the City of San Diego. March 2009.

Center (Center for Watershed Protection), 2007. *National Pollutant Removal Performance Database, Version 3*, September 2007.

Wheelock, C.E., Miller, J.L., Miller, M.J., Gee, S.J., Shan, G., Hammock, B.D. 2004. *Development of toxicity identification evaluation procedures for pyrethroid detection using esterase activity*. Environmental Toxicology and Chemistry, 23:2699–2708. 2009.