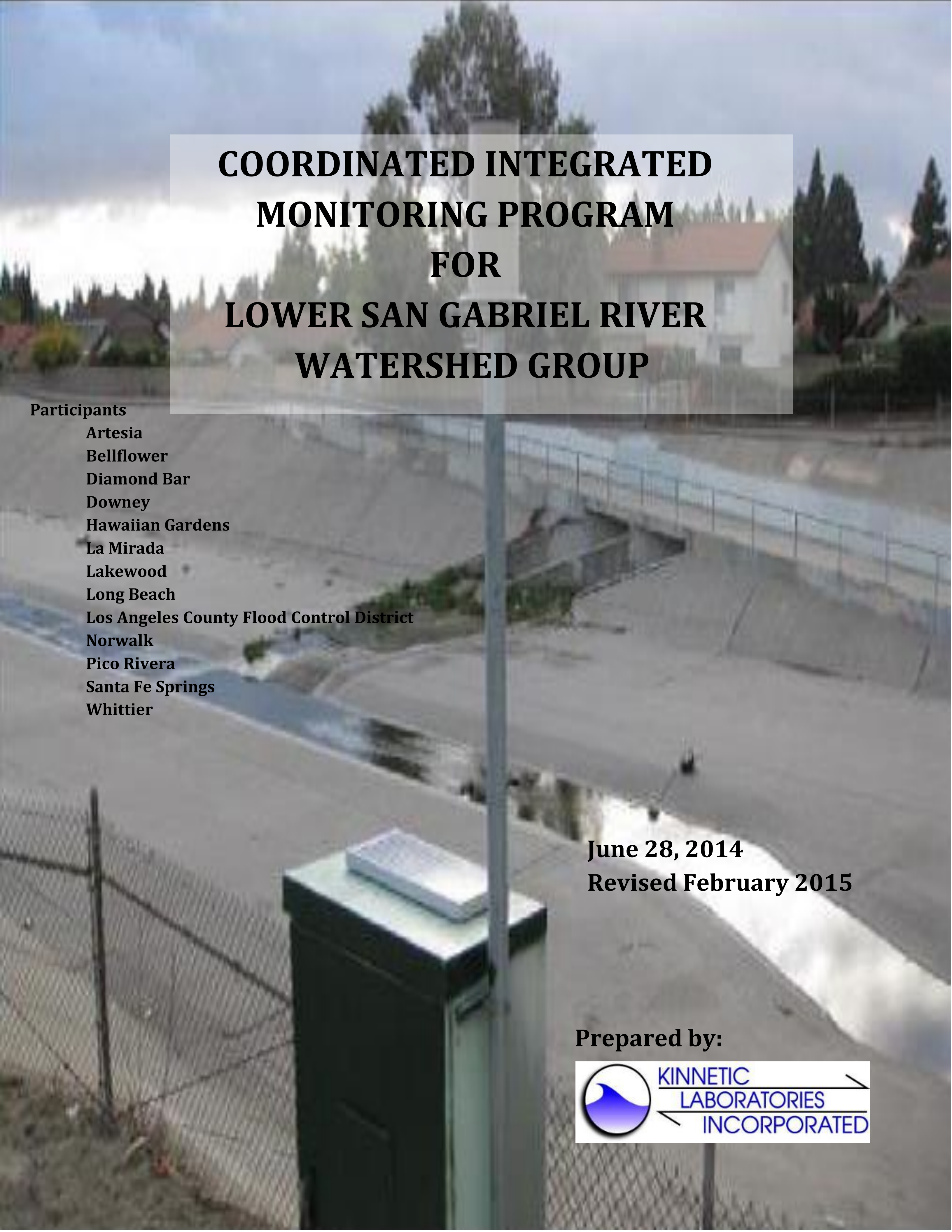

COORDINATED INTEGRATED MONITORING PROGRAM FOR LOWER SAN GABRIEL RIVER WATERSHED GROUP

Participants

- **Artesia**
- **Bellflower**
- **Diamond Bar**
- **Downey**
- **Hawaiian Gardens**
- **La Mirada**
- **Lakewood**
- **Long Beach**
- **Los Angeles County Flood Control District**
- **Norwalk**
- **Pico Rivera**
- **Santa Fe Springs**
- **Whittier**

June 28, 2014
Revised February 2015

Prepared by:

KINNETIC LABORATORIES INCORPORATED

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Coordinated Integrated Monitoring Program
for the
Lower San Gabriel Watershed Group

1. Introduction

The San Gabriel River is one of seven major watersheds partly or completely within Los Angeles County. Most of the river lies in southeastern Los Angeles County, bordering San Bernardino County, but a portion of this watershed originates in northern Orange County. During dry weather conditions, the lower portion of the San Gabriel River is hydrologically separated from the upper San Gabriel River at a location where waters from the upper San Gabriel River and the Rio Hondo Branch of the Los Angeles River pass through a narrow gap in the hills surrounding the San Gabriel Valley. During the rainy season, significant runoff is intercepted from the upper watershed and used to recharge groundwater. Flows measured just above the Whittier Narrows dam must exceed 260 cfs in order for flow to start to pass through into the lower San Gabriel River.

Due to this natural separation, thirteen cities and the Los Angeles County Flood Control District opted to develop a Watershed Monitoring Program (WMP) and Coordinated Integrated Monitoring Program (CIMP) to address the lower portion of the San Gabriel River. The watershed addressed by this group includes Reaches 1 and 2 of the San Gabriel River Watershed and portions of Coyote Creek that originate from jurisdictions within Los Angeles County. In addition, a small portion of Diamond Bar that discharges to Brea Creek and ultimately, San Jose Creek Reach 1 is also addressed by this CIMP (Figure 1-1-1).

The Los Angeles Regional Water Quality Control Board (Regional Board) adopted a National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit No. R4-2012-0175 (Permit) on November 8, 2012 that became effective on December 28, 2012. The purpose of the Permit is to ensure the MS4s in Los Angeles County are not causing or contributing to exceedances of water quality objectives established to protect the beneficial uses in the receiving waters. The Permit includes guidance for development of a Monitoring and Reporting Program (MRP- Attachment E) to demonstrate that water quality within the permitted area is compliant with established receiving water limitations (RWLs).

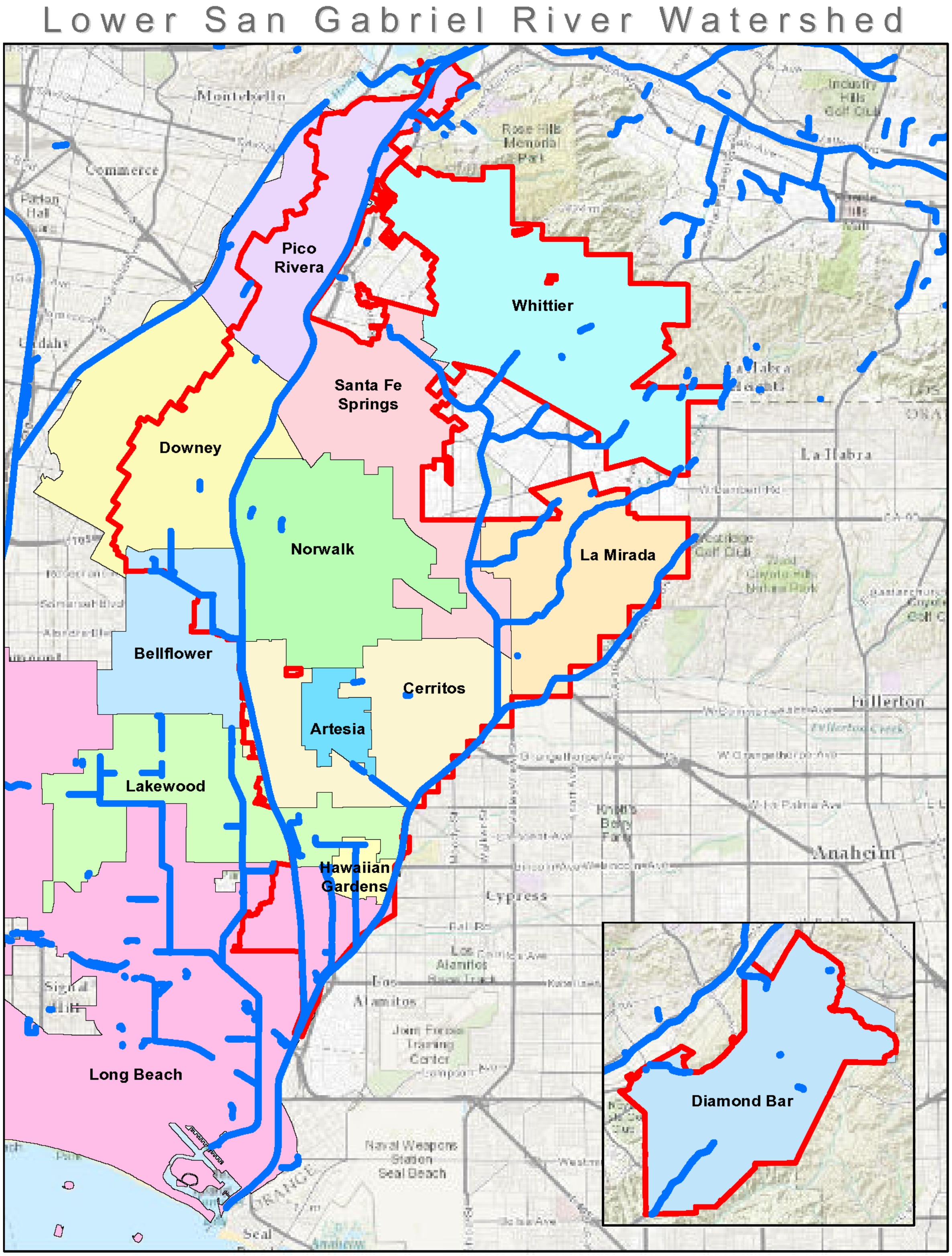

Figure 1-1. Lower San Gabriel River Watershed and Participating Jurisdictions.

The Permit allows development of a Coordinated Integrated Monitoring Program (CIMP) to specify approaches for addressing the objectives of the MRP. The Lower San Gabriel River (LSGR) Watershed Group (WG) chose to develop and implement a CIMP to address the unique conditions of this region. Unlike the upper San Gabriel River Watershed, the LSGR Watershed is largely built out with the exception of portions of the upper North Fork of Coyote Creek (also known as La Canada Verde) that originates in the vicinity of the Whittier Hills. The North Fork of Coyote Creek is a very complex drainage area that includes 11 different water bodies identified by the Regional Board as tributaries in the 2011 Basin Plan Amendments[1].

The LSGR Watershed encompasses approximately 78.5 square miles of Los Angeles County and comprises 11.4% drainage area for the San Gabriel River Watershed. There are 150 stream miles located in the watershed. The LSGR Watershed includes two major branches, Coyote Creek and the lower two reaches of the San Gabriel River. Coyote Creek approximates the jurisdictional boundaries of Orange County and Los Angeles County. Areas north of Coyote Creek are primarily within Los Angeles County while areas to the south of the Creek are largely in Orange County.

Reaches 1 and 2 of the San Gabriel River comprise a narrow drainage area that extends from the Whittier Narrows Dam to San Gabriel River Estuary. The Whittier Narrows is a natural gap formed in the hills along the southern boundary of the San Gabriel Valley. The Whittier Narrows Dam is a flood control and water conservation project managed by the U.S. Army Corps of Engineers. Water that exceeds the infiltration and storage capacity of the facility is released into San Gabriel River Reach 2. This segment of the River has been further modified as a recharge facility (the Montebello Forebay) allowing groundwater recharge. The channel is unlined from the Whittier Narrows Dam to Firestone Boulevard; as such waters entering this area percolate through the unlined channel and typically do not pass through Reach 2 into Reach 1.

Dry weather discharges to San Gabriel River Reach 1 are limited to discharges of tertiary-treated municipal and industrial wastewater from the Los Coyotes Water Reclamation Plant (WRP). The outfall to San Gabriel River Reach 1 is 1,230 feet upstream of the Artesia freeway. During the summer, this water flows into the San Gabriel River Estuary through a low flow channel. The Coyote Creek channel joins the San Gabriel River upstream of the Estuary, but is also contained in a low flow channel until reaching the Estuary.

The CIMP allows the unique characteristics of the LSGR to be addressed while also integrating requirements of the current Los Angeles County MS4 Permit, the City of Long Beach MS4 permit and monitoring required for applicable Total Maximum Daily Loads (TMDLs). This new approach represents an expansion and reorganization of monitoring in order to allow better assessment of the effectiveness of control measures using a watershed-based approach. The program focuses on controlling pollutants that have TMDLs, are 303(d) listed, and have exceeded water quality criteria in the past and may be causing or contributing to exceedances of RWLs.

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[1] LARWQCB 2011. List of Water Bodies added to Tributaries

The CIMP is structured to support the Watershed Management Program's adaptive management process. New information and data resulting from the monitoring program are intended to assist in evaluating the effectiveness of management actions and to regularly re-evaluate the monitoring plan to better identify sources of contaminants. This plan was developed to address five primary objectives listed in Part II.A.1 of the MRP, are as follows:

- Assess the chemical, physical, and biological impacts of discharges from the MS4s on receiving waters.
- Assess compliance with receiving water limitations and water quality-based effluent limitations (WQBELs) established to implement TMDL wet and dry weather load allocations.
- Characterize pollutant loads in MS4 discharges.
- Identify sources of pollutants in MS4 discharges.
- Measure and improve the effectiveness of pollutant controls implemented under the new MS4 permits.

Preparation of a CIMP is intended to allow for development and utilization of alternative approaches as well as providing for coordination of monitoring activities to more cost effectively address the primary objectives listed above. The CIMP proposed for the LSGR Watershed uses an adaptive strategy.

This document provides a brief discussion of the types and locations of monitoring sites, constituents to be monitored at each site, the process of phasing in monitoring sites, and monitoring frequencies. The appendices provide detailed information regarding equipment cleaning and blanking protocol as well as sampling methods and quality control requirements that will be necessary to assure that the monitoring data are valid and suitable for use in making critical decisions regarding program effectiveness and assessment of the effectiveness of control measures.

1.1 Monitoring Objectives

The major elements of the CIMP and primary objectives of each element of the Monitoring Plan include:

- **Receiving Water Monitoring (Wet and Dry Weather)**
    - Are receiving water limitations being met?
    - Are there trends in pollutant concentrations over time or during specified conditions?
    - Are designated beneficial uses fully supported as determined by water chemistry, aquatic toxicity, and bioassessment monitoring?
- **Stormwater Outfall Monitoring**
    - How does the quality of the permittees' discharges compare to Municipal Action Limits?
    - Are the permittees' discharges in compliance with applicable stormwater WQBELs derived from TMDL WLAs?
    - Do the permittees' discharges cause or contribute to an exceedance of the receiving water limitations?

- **Non-Stormwater Outfall Based Monitoring**
    - Are the permittees' discharges in compliance with non-stormwater WQBELs derived from TMDL WLAs.
    - How does the quality of the permittees' discharges compare to Non-Stormwater Action Levels?
    - Do the permittees' discharges cause or contribute to an exceedance of the receiving water limitations?
    - Do the permittees comply with the requirements of the Illicit Connection and Illegal Discharge Program?
- **New Development/Re-development Effectiveness Tracking**
    - Are the conditions established in building permits issued by the Permittees being met?
    - Are stormwater volumes associated with the design storm effectively retained on-site?
- **Regional Studies**
    - How do the permittees plan to participate in efforts to characterize the impact of the MS4 on receiving waters? Include participation in regional studies with the Southern California Stormwater Monitoring Coalition (SMC) and any special studies specified in TMDLs.

2 Water Body-Pollutant Classification

The LSGR Watershed is subject to two TMDLs. The San Gabriel River Metals TMDL was established by USEPA that includes Waste Load Application (WLAs) for MS4 and other dischargers to the San Gabriel River and Coyote Creek. This TMDL includes a dry weather WLA for selenium in San Jose Creek which includes a small portion of the LSGR Watershed. A second TMDL, the Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic TMDL addresses impairments in the sediments, water and biota of the Dominguez Channel, the Ports of Los Angeles and Long Beach and East San Pedro Bay. All jurisdictions subject to the San Gabriel River and Los Angeles River metals TMDLs are required to assess loads of DDTs, PCBs, PAHs and metals associated with sediment discharged from these two watersheds. Although these constituents have not been detected in routine stormwater monitoring, concerns remain that significant loads of toxic chemicals such as DDTs and PCBs may still be transported from urban environments. The stormwater pathway from former manufacturing facilities to the Dominguez Channel and the Harbor waters remains the most probable source of these toxics, but the relative magnitude of contributions from historical use in the urban environment and the importance of these contributions has not been established. Although receiving waters within the LSGR WG are not listed as impaired by these constituents, the LSGR WG is required to assess loads originating from the watershed and implement control measures to address them.

Development of a WMP requires Permittees to develop water quality priorities within each WMA [Section C.5.a (page 58) of the Permit] that will be used to assist in directing implementation of control measures and monitoring to address constituents of concern. These classifications are presented and discussed in Section 2 of the WMP and briefly summarized in this section of the CIMP.

The CIMP was developed to focus on existing water quality conditions. Based on than 10 years of monitoring, data from 2002 to 2012 in Coyote Creek and in upper portions of the San Gabriel River (LACFCD mass emission sites S13 and S14) most of the constituents listed in Table E-2 of the MRP have never been detected and many more have been detected, but have not been found to exceed RWLs. This new program is designed to target constituents that have been identified as constituents of concern in the receiving waters. Available data from historical monitoring were used to classify segments of the LSGR Watershed and establish water body-pollutant combinations into one of the following three categories:

- **Category 1 (Highest Priority):** Water body-pollutant combinations for which water quality-based effluent limitations and/or RWLs are established in Part VI.E and Attachments L through R of the Order.
- **Category 2 (High Priority)**: Pollutants for which data indicate water quality impairment in the receiving water according to the State's Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List (State Listing Policy) and for which MS4 discharges may be causing or contributing to the impairment.
- **Category 3 (Medium Priority)**: Pollutants for which there are insufficient data to indicate water quality impairment in the receiving water according to the State's Listing Policy, but which exceed applicable RWLs contained in the Order and for which MS4 discharges may be causing or contributing to exceedances.

Five water bodies were considered while reviewing data potential impairment of the receiving waters (Table 2-1, Table 2-2). These included the San Gabriel River Reaches 1 and 2 (SG1 and SG2), San Jose Creek Reach 1 (SJC1), Coyote Creek (CC) and the North Fork of Coyote Creek (NFC).

Table 2-1. Summary of Wet Weather Water Body/Pollutant Categories for the Lower San Gabriel River Watershed.

WET WEATHER WATER BODY/POLLUTANT CATEGORIES

CATEGORY	ANALYTE	CLASS	SG1	SG2	SJC1	CC	NFC
1-WET	Copper	Metal				**X**	**X**
	Lead	Metal		**X**	**X**	**X**	**X**
	Zinc	Metal				**X**	**X**
2-WET	Ammonia	Nutrient			**X**	**X**	
	Cyanide	General		**X**		**X**	
	Copper	Metal		**X**	**X**		
	Mercury	Metal					**X**
	Zinc	Metal		**X**	**X**		
	Selenium	Metal					**X**
	PAH	SVOA		**X**	**X**		
	Diazinon	OP Pest				**X**	
	E. coli	Micro	**X**	**X**	**X**	**X**	**X**
	pH	General	**X**		**X**	**X**	
	Toxicity				**X**	**X**	
3-WET	Cyanide	General			**X**		**X**
	Lindane	OC Pest		**X**			
	Selenium	Metal	**X**				
	Dissolved Oxygen	General		**X**	**X**	**X**	
	MBAS	General		**X**		**X**	

SAN GABRIEL/SAN JOSE CR.
SG1= San Gabriel River
SG2= San Gabriel River Reach 2
SJC1= San Jose Creek Reach 1

COYOTE CREEK
NFC= North Fork Coyote Creek
CC= Coyote Creek

Shading differentiates water bodies within the San Gabriel River and Coyote Creek Branches of the watershed.

POLLUTANT CLASSES
Nutrients= nitrogen and phosphorus compounds
OC Pest = organochlorine pesticides
OP Pest = organophosphorus pesticides
Micro = microbiological (fecal indicator bacteria)
SVOA = semivolatile organic compounds (acid, base & neutral

Table 2-2. Summary of Dry Weather Water Body/Pollutant Categories for the Lower San Gabriel River Watershed.

DRY WEATHER WATER BODY/POLLUTANT CATEGORIES

CATEGORY	ANALYTE	CLASS	SG1	SG2	SJC1	CC	NFC
1-DRY	Copper	Metal	X			X	
	Selenium	Metal			X		
2-DRY	Ammonia	Nutrient			X	X	
	Copper	Metal		X	X		
	Lead	Metal				X	
	Mercury	Metal					X
	Nickel	Metal				X	
	Selenium	Metal					X
	Zinc	Metal		X	X	X	
	PAH	SVOC		X	X		
	Diazinon	OP pest				X	
	E. coli	Micro	X	X	X	X	X
	Cyanide	General		X		X	
	Chloride	General			X		
	pH	General	X		X	X	
	TDS	General			X		
	Toxicity				X	X	
3-DRY	Cyanide	General					X
	Copper	Metal					X
	Mercury	Metal					X
	Selenium	Metal	X				
	Zinc	Metal					X
	Chloride	General		X	X	X	
	Sulfate	General		X	X		
	Alpha-endosulfan	OC Pest				X	
	Lindane	OC Pest		X			
	pH	General					X
	Diss. Oxygen	General	X	X	X		
	TDS	General		X			

SAN GABRIEL/SAN JOSE CR.
SG1= San Gabriel River
SG2= San Gabriel River Reach 2
SJC1= San Jose Creek Reach 1

COYOTE CREEK
NFC= North Fork Coyote Creek
CC= Coyote Creek

Shading differentiates water bodies within the San Gabriel River and Coyote Creek Branches of the watershed.

POLLUTANT CLASSES
Nutrients= nitrogen and phosphorus compounds
OC Pest = organochlorine pesticides
OP Pest = organophosphorus pesticides
Micro = microbiological (fecal indicator bacteria)
SVOA = semivolatile organic compounds (acid, base & neutral

3 Monitoring Sites and Approach

The approach presented in this CIMP incorporates all objectives of the MRP and provides a customized approach to address the objectives identified in the MRP for Stormwater Outfall Monitoring based upon the unique characteristics of the Lower San Gabriel River (LSGR) watershed.

During dry weather conditions, the LSGR Watershed is effectively separated from the Upper San Gabriel River Watershed as dry weather flows are typically infiltrated. Dry weather flow in Reach 1 is primarily from two Publicly Owned Treatment Works (POTW), the San Jose and Los Coyotes WRPs.

Unique conditions also exist in Coyote Creek since flows (both dry and wet weather) originate from both Los Angeles County and Orange County. The main branch of Coyote Creek approximates the boundary between Los Angeles County and Orange County thus the source of pollutants measured at the S13 Mass Emission can be difficult to evaluate. With the exception of a County "island" located within this drainage area, the North Fork of Coyote Creek is entirely within the bounds of the LSGR Watershed which provides better opportunities for evaluation of long-term performance and the ability to implement control measures as necessary to meet water quality objectives.

An existing monitoring site in the North Fork of Coyote Creek (NFC1) will be used to monitor trends in trace metals subject to the TMDL and responses to implementation of control measures. This monitoring site was proactively installed in the North Fork of Coyote Creek as part of an early action measure designed to obtain initial data specifically to address the San Gabriel River Metals TMDL.

This CIMP addresses monitoring activities required by the MRP - No. CI-6948 for Order R4-2012-0175, NPDES Permit No. CAS004001 for the LSGR Watershed Group. Development of this CIMP focuses on improving the overall effectiveness of the monitoring program by directing resources to address areas with known problems and increasing the cost effectiveness of the program by coordination of sampling efforts.

Final approval of the CIMP is expected late 2014 or early 2015. Monitoring at the existing S13 Mass Emission Site and North Fork of Coyote Creek will continue.

For planning purposes, the new monitoring described in this CIMP and modifications of existing monitoring are intended to commence on July 1, 2015 or 90 days after the approval of the CIMP, whichever is later. Some elements of the CIMP have already been initiated in order to meet schedules established in the Order. Non-stormwater (NSW) outfall screening efforts are underway in order to identify sites with significant flow that require completions of source identification surveys. A majority of the new monitoring program will start in the summer of 2015 and the following wet weather season, and the entire program will be phased in over a three-year period. The CIMP intends to complete source identification surveys for at least 25% of all major outfalls found to convey significant non-stormwater discharges by December 28, 2015.

The approach presented in this CIMP is designed to address objectives of the MRP by incorporating TMDL monitoring requirements and aligning field efforts to increase cost effectiveness. The following sections provide a broad overview of the monitoring program. A comprehensive list of monitoring sites (Table 3-1) and the locations of these sites within the LSGR Watershed (Figure 3-1) are provided to illustrate the coverage provided for each major element. Later sections will provide detailed monitoring requirements for individual elements of the CIMP.

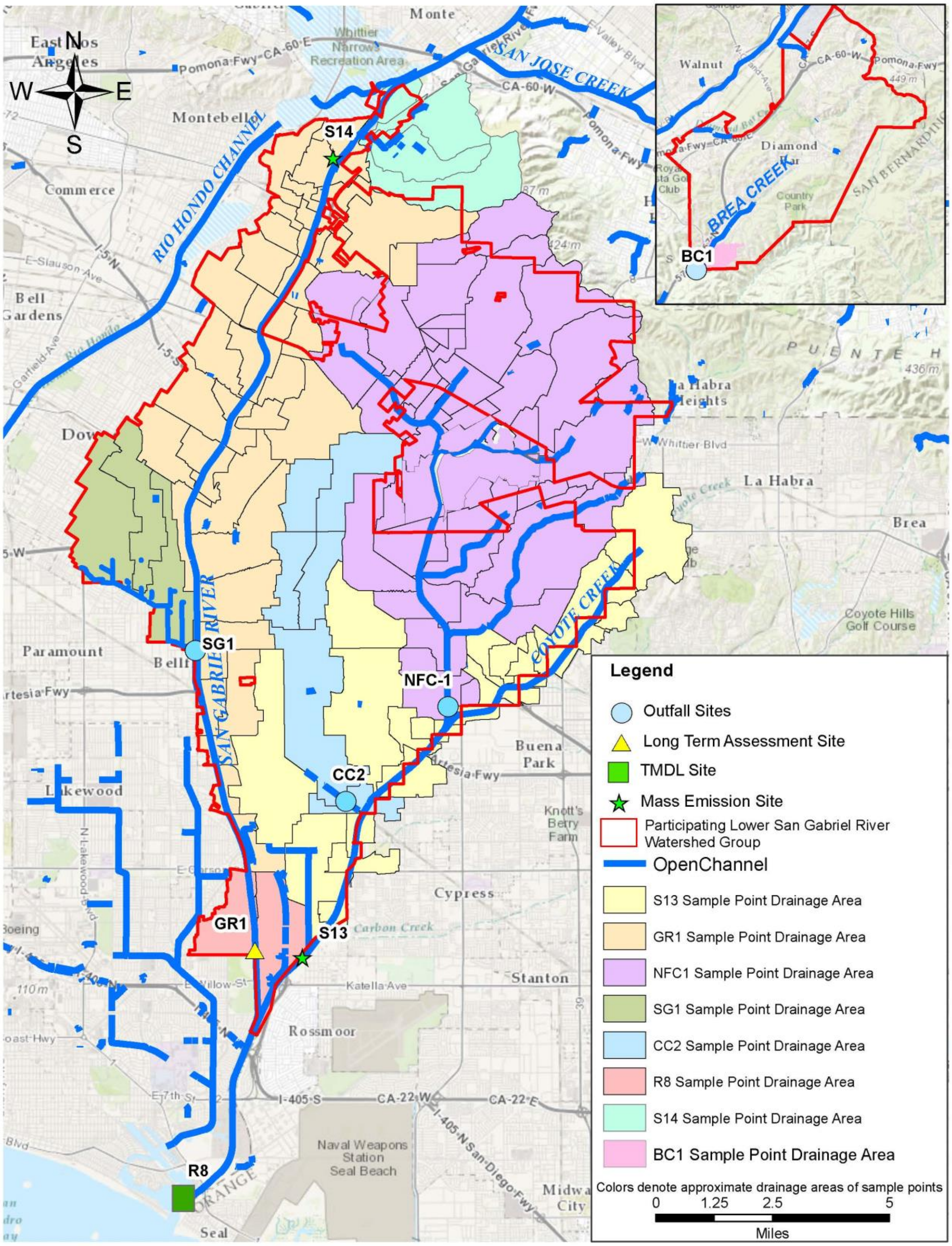

Figure 3-1. **Locations of Monitoring Sites in the Lower San Gabriel Watershed.**

Table 3-1. Monitoring Site Designation and Monitoring Function.

Site Name	Site Description	Datum NAD83 Latitude (N)	Datum NAD83 Longitude (W)	Type of Site: Receiving Water: LTA Mass Emission	LTA	Metals TMDL	Harbor Toxics TMDL	Stormwater Outfall
S13	Coyote Creek at Spring St. (Existing LACFCD Mass Emission)	33.80983	118.07675	X		X	X	
S14[1]	San Gabriel River Reach 3 (Existing LACFCD Mass Emission)	34.01114	118.06758	X		X		
GR1	San Gabriel River above Spring St. (F42B-R)	33.81167	118.09107		X	X	X	
GR2[2]	San Gabriel River @ Firestone	33.92774	118.10881		X	X		
NFC1	N. Fork Coyote Cr.	33.87307	118.03927			X		
CC2	Artesia/Norwalk Drain @ Bloomfield in Cerritos	33.84925	118.06369					X
SG1	Maplewood Channel @ Alondra Blvd.	33.88717	118.10914					X
BC1	Diamond Bar	33.96061	117.85281					X
R8[3]	Mouth of San Gabriel River (Existing LACSD Site)	33.74701	118.11323			X	X	

1. S14 will be monitored by LACFCD and USGR EWMP Group will coordinate with LACFCD for the monitoring Sites in light grey represent potential or alternative sampling locations.
2. **GR2** receives no dry-weather runoff and is an alternative LTA and TMDL site that will be activated if Reach 2 wet weather exceedances are detected at GR1 as discussed in Section 3.1.1 (p. 12).
3. The San Gabriel River Estuary is being separately addressed in the Draft Long Beach IWMP anticipated to be submitted to the Regional Board no later than March 28, 2015. R8 is an existing Sanitation District dry-weather monitoring station and data will be incorporated into this CIMP as part of the overall Toxics monitoring regimen.

3.1 Receiving Water Monitoring

The MRP (Part II.E.1) specifies that receiving water monitoring is to be performed at previously designated mass emission stations, additional receiving water sites as necessary, and TMDL receiving water compliance points, as designated in approved TMDL Monitoring Plans. The objectives of the receiving water monitoring include the following:

- Determine whether the receiving water limitations are being achieved,
- Assess trends in pollutant concentrations over time, or during specified conditions,
- Determine whether the designated beneficial uses are fully supported as determined by water chemistry, as well as aquatic toxicity and bioassessment monitoring.

In order to achieve these requirements, two types of receiving water monitoring sites are included in the CIMP. These include:

- **Long-Term Assessment (LTA) Monitoring Sites-** These sites will serve to provide a long-term measure of compliance with receiving water quality criteria and allow for assessment of trends in pollutant concentrations. The LTA sites receive a significant amount of comingled runoff from essentially the entire San Gabriel River Watershed. The LTA sites will serve as a general indicator of the health of the Lower San Gabriel River. The LTA sites will also serve as TMDL monitoring sites.
- **TMDL Receiving Water (TMDL) Monitoring Sites** – These sites are intended to evaluate compliance or progress towards attainment of allocations for TMDLs and ultimately provide data to evaluate when objectives are met and determine when sufficient data exist to reevaluate the 303(d) listing.

3.1.1 Long-Term Assessment (LTA) Sites

The existing Coyote Creek Mass Emission (ME) monitoring station (S13) will continue to serve as a LTA monitoring station for the LSGR WG. This site is located is located adjacent to an existing gauging station in Coyote Creek (Stream Gauge F354-R) below Spring Street. This site has been monitored by the Los Angeles County Flood Control District (LACFCD) since 1997 and will continue to be monitored by the LACFCD. The LSGR WG will coordinate with LACFCD for any TMDL monitoring that is beyond LACFCD’s existing monitoring program.

Monitoring will also be continued at the San Gabriel River (S14) ME site. This site also has been monitored by the LACFCD since 1997 and will continue to be monitored by the LACFCD. The Upper San Gabriel River Enhanced Watershed Management Program Group (USGR EWMP Group) will coordinate with LACFCD for monitoring at the S14 ME site. Data will be shared to allow evaluation of long-term trends and to evaluate potential additional sampling requirements at sites downstream of S14.

A new LTA monitoring site (GR1) will be established adjacent to the LACFCD gauging station (F42-BR) located at the bottom of Reach 1 in the San Gabriel River. This site was previously used by the Southern California Coastal Water Research Program to collect stormwater runoff samples as part of special studies. This site will utilize automated stormwater sampling as described in Appendix A for all wet weather monitoring. Cleaning protocol and QA/QC measures listed in Appendices B and C will also apply to collection of stormwater runoff samples. Collection of dry weather water quality samples will be based on grab samples with water being collected directly into the laboratory sample containers which will eliminate any potential contamination from the sampling hoses and composite containers. This will also be consistent with sampling methods used for any required monitoring of non-stormwater discharges. This monitoring station will be used to collect both stormwater and dry weather runoff but it is recognized that dry weather flow in San Gabriel River Reach 1 is dominated by discharges from two Wastewater Treatment Plants (WTPs). Urban sources are not expected to be discernable during the dry season (Figure 3-1).

A third LTA monitoring site (GR2) will be considered for potential installation and monitoring starting in the third year of the program. This site is located in the main channel of the San Gabriel River at Firestone Blvd which marks the division between Reach 1 and Reach 2 of the San Gabriel River downstream of the Montebello Forebay groundwater recharge facility. Installation of a monitoring station at this location will be considered if data from the first two years of monitoring at the GR1 LTA site indicates that RWL are exceeded in at least 2/3 of the wet weather surveys. Monitoring data from the S14 ME, located at the upstream extent of San Gabriel River Reach 2, will also be considered to further assess the potential benefits of installing another receiving water quality monitoring station. If after completing an assessment of data from GR1 located downstream of the site and S14 located upstream of the site, it is determined that additional data from GR2 would help to further address the goals of the program, equipment would be installed and monitoring would start the next storm season.

3.1.2 Total Maximum Daily Load (TMDL) Monitoring Sites

The LSGR WG will conduct monitoring necessary to meet objectives of the Los Angeles County NPDES MS4 permit and incorporate monitoring requirements associated with the two TMDLs. Compliance with the Metals TMDL will be evaluated by the three receiving water monitoring sites. These include the existing ME site in Coyote Creek (S13), the new LTA site being installed at GR1 at the base of the San Gabriel River Reach 1, an existing TMDL site installed in North Coyote Creek (NFC1) in 2013. The NFC1 site has been monitored for the past year to provide additional data for trace metal and sediment loads from a segment of the watershed that is fully within the LSGR WG boundaries and includes significant industrial land use.

The Harbor Toxics TMDL requires monitoring of water and sediments at the mouth of the San Gabriel River during both wet and dry weather conditions. Since flow monitoring and collection of composite samples is not feasible at the mouth of the San Gabriel River, monitoring during wet weather conditions will be accomplished by collection of water and suspended sediments from both the main stem of the San Gabriel River and Coyote Creek. Sampling at both these locations allows quantification of loads from the entire watershed as is intended by the TMDL. Water and suspended sediments will be collected at S13 and GR1 to quantify loads of DDTs, PCBs, and PAHs from the watershed. Monitoring at S13 for this TMDL will be coordinated between the LACFCD and LSGR WG, and monitoring at GR1 will be monitored conducted by the LSGR WG. In general, the LSGR WG will coordinate with LACFCD staff for any TMDL monitoring at S13 that is beyond LACFCD's existing monitoring program. Analytical methods and detection limits used by the County's Ag Laboratory for analysis of stormwater and dry weather discharges at the S13 ME site are listed in Appendix E. Detection limits are consistent with the MRLs listed in Table E-2 of the MRP.

Collection of dry weather water and sediment for the Harbor Toxics TMDL will be conducted by Los Angeles County Sanitation District (LACSD) staff. Dry weather water and bed sediment will be collected from their existing site, R8, located where the Marina Bridge crosses at the mouth of the San Gabriel River. Sampling and analytical methods will be consistent with those specified in the Harbor Toxics TMDL. Analytical methods and data quality objectives are listed in Appendix F.

3.2 Stormwater Outfall Monitoring

Three stormwater outfall monitoring sites will be included in the monitoring program. These will include CC2, SG1 and BC1. CC2 collects runoff from the large Artesia-Norwalk Drain and discharges to Coyote Creek. SG1 is located near Maplewood and discharges to Reach 1 of the San Gabriel River. This site was monitored for historically by the LACFCD as part of a special study. The third will be located in Diamond Bar (BC1) in a storm drain that discharges to Brea Creek.

Stormwater outfall sites are intended to ensure representative data by monitoring at least one outfall per major subwatershed (HUC 12) drainage area and assuring that drainage areas for each selected outfall are representative of the land uses within the Permitee's jurisdiction. The drainage areas of the outfall monitoring sites are representative of a wide variety of land uses within the LLSG including residential, commercial and industrial. In addition, the selected outfalls have appropriate configurations to facilitate accurate flow measurements and provide conditions necessary for the safety of monitoring personnel. The land use for sites used as outfall monitoring stations are shown in Table 3-2. The land uses of the four sites shown in Table 3-2 closely matches the land use throughout the LSGR watershed. The overall land use for the LSGR can be seen in Figure 3-2.

There are two major HUC 12 equivalent units in the LSGR, the Coyote Creek – San Gabriel River and Brea Creek - Coyote Creek units. Two stormwater outfall monitoring sites, SG1 and CC2, are located in the Coyote Creek- San Gabriel. The BC1 stormwater outfall monitoring site is located in the Brea Creek- Coyote Creek. The Brea Creek-Coyote Creek HUC 12 equivalent unit has a majority of its area located in Orange County and a lesser area in San Bernardino County. The outfall monitoring site(s) selected only collects drainage from the LSGR areas.

Table 3-2. Land Use for Sites Used as Outfall Monitoring Stations

Outfalls	Land Use %					
	Residential	Commercial	Industrial	Mixed Use	Open Space	Other
NFC1	65.10%	4.28%	14.06%	2.80%	9.55%	3.91%
CC2	65.52%	9.89%	11.44%	1.02%	4.02%	8.10%
SG1	44.13%	16.41%	17.62%	13.53%	1.99%	6.31%
BC1	80.10%	5.13%	0.00%	0.00%	0.00%	14.76%
LSGR Watershed	74.41%	4.82%	7.04%	3.35%	6.11%	4.19%
Average of 4 outfalls	63.71%	8.93%	10.78%	4.34%	3.89%	8.27%

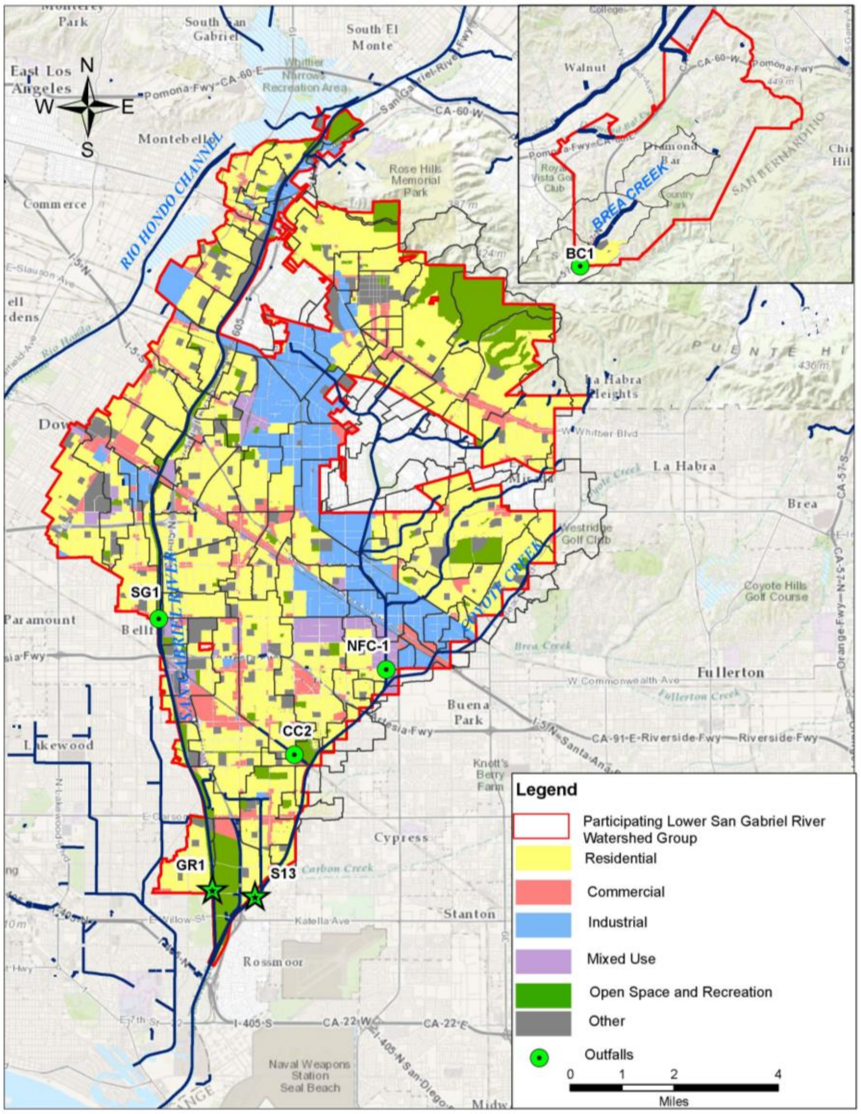

Figure 3-2. Overall Land Use for the Lower San Gabriel River

Recognizing a need for sampling data, the La Mirada Creek HUC 12 equivalent is already being monitored by the early-action monitoring site, NFC1. This site was installed in the North Fork of Coyote Creek in 2013 in anticipation of this CIMP. Upper San Gabriel River Watershed Group is separately proposing an outfall monitoring site at a centrally located site within the NFC subwatershed as shown on Figure 3-3. Outfall parameters will not be added at NFC1 since it is a TMDL site. The LSGR Watershed Group has not independently reviewed the land use of that outfall's drainage area, nonetheless the LSGR Watershed Group will review data from the County's outfall site upstream of NFC1 and add an outfall site during Adaptive Management.

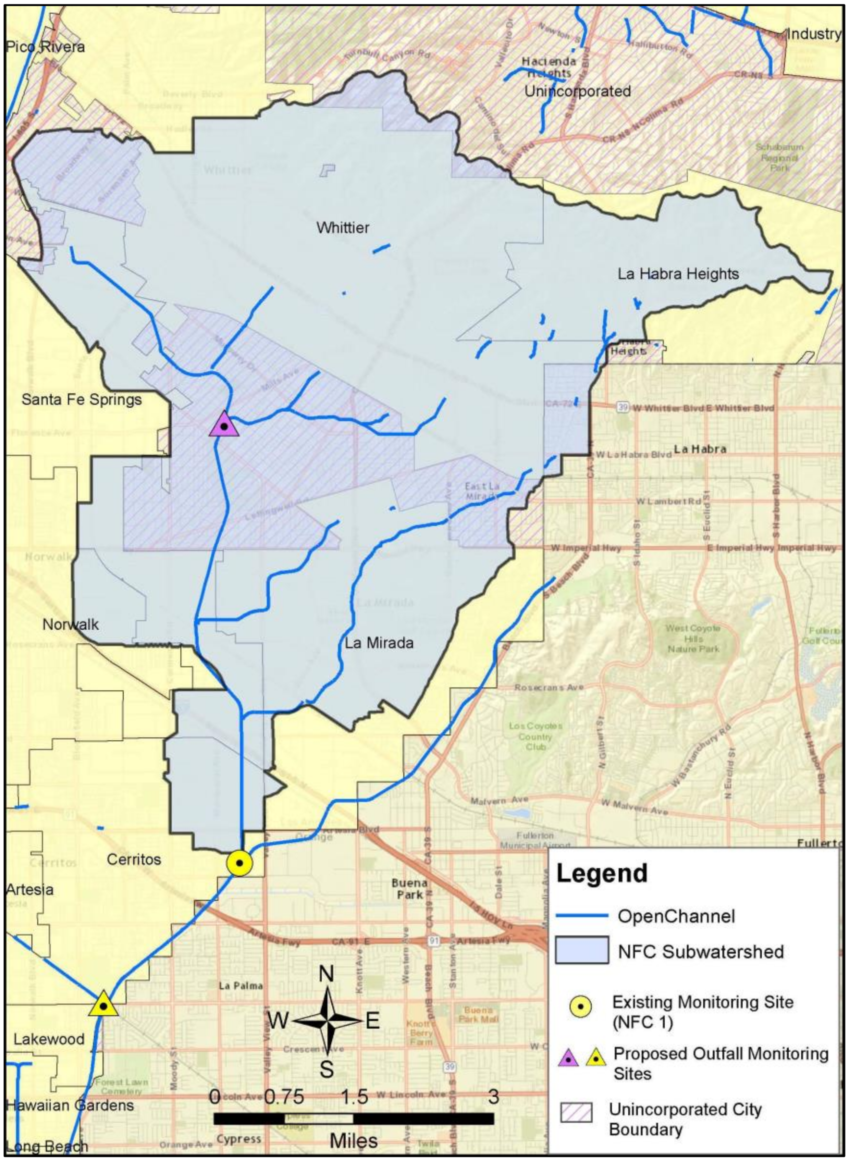

Figure 3-3. **Proposed outfall monitoring site within the NFC subwatershed**

There are two HUC 12 equivalents with significant land area within the LSGR as compared to the other three HUC Units, Upper and Lower San Jose Creek. These only receive runoff from a portion of City of Diamond Bar and a very small area of Whittier primarily consisting of restored native habitat. These areas have similar land use and soil types as the southern portion of Diamond Bar which is located within the Brea –Coyote Creek HUC.

Diamond Bar Creek originates in the city of Diamond Bar, then flows through a heavily industrialized portion of the City of Industry, then again into the City of Diamond Bar before flowing once again into the City of Industry prior to discharging into San Jose Creek. The comingled discharged is not deemed representative of the city of Diamond Bar. The upstream areas of Diamond Bar Creek could be isolated, but are primarily vacant and natural areas and are not representative of land uses (Figures 3-4 and 3-5).

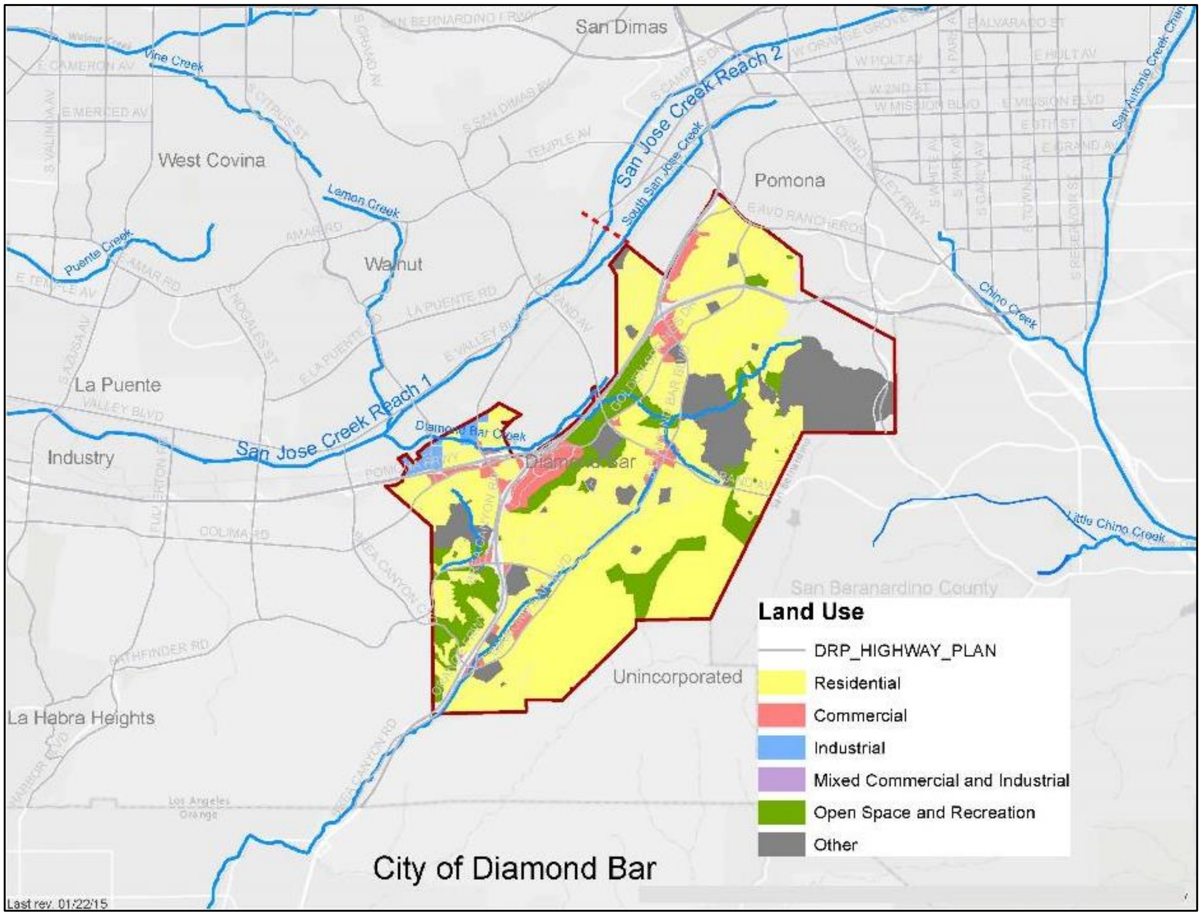

Figure 3-4. **City of Diamond Bar Land Use**

In addition, this portion of San Jose Creek is already well represented by monitoring points as shown in Figure 3-5, which is a compilation based on the Draft CIMPs submitted by multiple watershed groups in areas upstream of the LSGR. The LSGR will commit to reviewing the data reported form these stations and incorporate the findings into the adaptive management process which could include modifications to sampling parameters and locations.

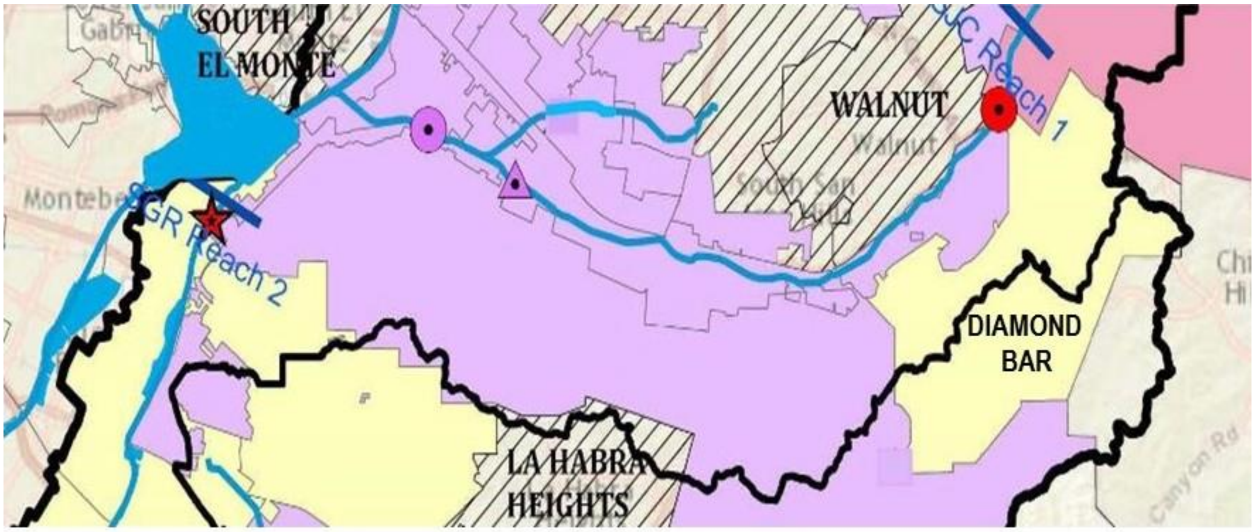

Figure 3-5. **Existing Monitoring Points in San Jose Creek**

Therefore site BC1 was deemed more representative for the land us areas of Diamond Bar. The analysis of the runoff collected at the BC1 site will be reviewed and evaluated as equivalent to the runoff to San Jose Creek Reach 1 being monitored by the USGR WG and the S14 ME site in the San Gabriel River. Selenium and Total Dissolved Solids (TDS), constituents of special concern levels will be reviewed in comparison to runoff from the BC1 site will be re tributaries. Collecting samples from these areas is a low priority.

The proposed monitoring sites in this CIMP are considered to provide representative samples for the entire LSGR Watershed. Outfall monitor is part of an ongoing process which started with the aforementioned already installed early-action site NFC1 and will continue on schedule as described in Table 4-1.

3.3 Non-Stormwater Outfall Monitoring

NSW outfall based monitoring will be conducted for outfalls discharging to receiving waters of the LSGR Watershed. This program is intended to focus on major outfalls defined as those that are greater than 36 inches in diameter and those between 12 and 36 inches that are near areas with industrial land uses. Initially, all pipes greater than 12 inches in diameter will be inventoried. Appendix H provides maps of all outfalls to the LSGR Watershed that are 12-inches or greater in diameter. The database from the first survey will be refined to determine which of the 12-inch to 36-inch pipes are near areas with industrial land uses. Discharge pipes less than 36 inches in diameter and determined not to incorporate runoff from industrial land use areas will be excluded from further surveys. Two additional surveys will be conducted to collect outfall characteristics that may be used to determine outfalls with persistent and significant non-stormwater flows. Once outfalls with significant flows have been identified, the source identification may utilize a combination of field tests and limited laboratory testing to assist in determining whether flows are the result of illicit connections/illicit discharges (IC/IDs), authorized or conditionally exempt non-stormwater flows, natural flows or unknown.

If monitoring of NSW discharges is necessary, samples will be collected twice a year in conjunction with dry weather monitoring at receiving water monitoring sites. In addition, samples would be collected using grab sampling methods consistent with dry weather sampling at the receiving water quality sites.

3.4 New Development/Re-Development Effectiveness Tracking

The MRP requires that Permittees develop a New Development/Re-Development Effectiveness tracking program. Participating agencies have developed mechanisms for tracking information related to new and redevelopment projects that are subject to post-construction best management practice requirements in Part VI.D.7 of the MS4 Permit.

3.5 Regional Studies

The MRP requires participation in regional studies, including participation in the Southern California Monitoring Coalition (SMC) Regional Watershed Monitoring Program (bioassessment) and special studies as specified in approved TMDLs.

The LACFCD currently participates in the SMC Monitoring Program. The LACFCD, on behalf of the LSGR WG, will continue to participate in the Regional Watershed Monitoring Program (Bioassessment Program) being managed by the Southern California Stormwater Monitoring Coalition (SMC). The LACFCD will also continue to coordinate and assist in implementing the bioassessment monitoring requirement of the MS4 permit on behalf of the permittees in Los Angeles County. Initiated in 2008, the SMC's Regional Bioassessment Program is designed to run over a five-year cycle. Monitoring under the first cycle concluded in 2013, with reporting of findings and additional special studies planned to occur in 2014. The SMC Joint Executive Workgroup is currently working on designing the bioassessment monitoring program for the next five-year cycle, which is scheduled to run from 2015 to 2019.

4 Summary of Sampling Frequencies for each CIMP Element

It is proposed that the CIMP will be implemented in a phased process (Table 4-1). Three receiving water stations are proposed for monitoring starting July 1, 2015 or 90 days after the CIMP approval, whichever is later. The existing ME site located at S13 (Coyote Creek) will continue to be operated by the LACFD, and modifications to the existing program will commence on July 1, 2015 or 90 days after the CIMP approval, whichever is later. The LSGR WG will coordinate with LACFCD staff for any TMDL monitoring this that is beyond LACFCD's existing monitoring program. A second receiving water site, GR1, will be installed in the San Gabriel River near Spring Street in 2015-16. The third site, NFC1, was installed in the North Fork of Coyote Creek in 2013 as part of an early action effort to develop contemporary data for this watershed.

Starting July 1, 2015 or 90 days after the CIMP approval, whichever is later, two water quality testing surveys, one wet and one dry, will be conducted at all LTA sites to incorporate the comprehensive list of water quality parameters listed in Table E-2 of the Attachment E of Regional Board Orders No. R4-2012-0175 (NPDES NO. CAS004001) and R-4-2014-0024 (NPDES No. CAS004003) in the first year of monitoring. This full set of analytes will be analyzed in water collected during the first major storm event of the year and during a dry season survey in July when flows are considered to be at historical seasonal lows. The remaining two wet weather events and one dry event will monitor only the prioritized water body-pollutant combinations discussed in Section 1.2 above. If Table E-2 parameters are not detected at the specified Method Detection Limit (MDL) for their respective test method or if the result is below the lowest applicable water quality objective, and is not otherwise identified as a prioritized water body-pollutant combination, the analyte will not be further analyzed. Parameters exceeding the lowest applicable water quality objective will continue to be analyzed beginning year 2 for the remainder of the Order at the receiving water monitoring station where it was detected. The Receiving Water Monitoring Program will also include Aquatic Toxicity Monitoring. Existing data (refer to Aquatic Toxicity section) indicates that bioassay tests using *Ceriodaphnia dubia* are the most appropriate for testing toxicity.

NFC1 was installed in 2013 as part of an early action effort to start collecting data to support the objectives of the San Gabriel River Metals TMDL. This site will continue to be monitored as a TMDL site with four wet weather events and two dry weather monitoring events.

Sampling for the Harbor Toxics TMDL will be initiated during the 2015-16 wet season at both S13 and GR1. Harbor Toxics TMDL dry weather water quality sampling will be conducted by LACSD at R8 and modifications to their existing monitoring program will commence in summer of 2015. Sediment sampling for the Harbor Toxics TMDL will not commence until in the summer of 2016 in order to synchronize with sediment monitoring being conducted by the Harbor Toxics RMP.

The R8 monitoring site proposed for the dry weather monitoring requirement is located at the mouth of the San Gabriel River at the Marina Bridge. This site has been historically monitored by LACSD for water quality, bedded sediment chemistry, benthic community analysis and for sediment toxicity consistent with methods required to assess Part One Sediment Quality Objectives.

Three stormwater outfall monitoring sites will be monitored in the LSGR Watershed. The first two stormwater outfall monitoring sites will be installed and monitored starting in the 2016-17 wet season assuming the CIMP is approved. These will include CC2 (Artesia/Norwalk Drain) and SG1 (Maplewood @ Alondra). CC2 is a large storm drain that discharges to Coyote Creek. SG1 is a site draining to Reach 1 of the San Gabriel River. This site was previously monitored as part of a special study conducted by the Los Angeles County MS4 monitoring program. One additional stormwater outfall monitoring site will be added for the 2017-18 wet season. This stormwater outfall site, BC1, is located in Diamond Bar. The monitoring site will be located at an outfall from a 30" RCP owned by the LACFCD. This site will be sampled either with portable autosampler set to collect time-based samples or by taking manual grab samples.

Table 4-1. Schedule for Implementation of Water Quality Monitoring Activities in the Lower San Gabriel River Watershed.

Task	2014-15	2015-16	2016-17	2017-18
S13 (Coyote Cr. at Spring) Receiving Water/TMDL/ME	Existing Monitoring	X	X	X
GR1 (San Gabriel R. @ Spring) Receiving Water/TMDL/LTA		X	X	X
GR2 (San Gabriel R. @ Firestone) Receiving Water/TMDL				X
NFC1 (N. Fork Coyote Creek) Receiving Water/TMDL	Existing Monitoring	X	X	X
R8 (Mouth of SGR Estuary) Receiving Water/TMDL	Existing Monitoring	X	X	X
Stormwater Outfalls				
CC2 (Artesia/Norwalk)			X	X
SG1 (Maplewood @ Alondra)			X	X
BC1 (Diamond Bar)				X
Non-Stormwater Outfall				
Inventory & Assess[1]	X			
Source ID[2]		X		
Monitoring[3]			X	X

Grey text for tasks and schedules indicate situations that remain uncertain and require further consideration based upon initial monitoring data.

1. Initial Inventory and Screening will be completed in three surveys before the end of 2014. One re-assessment of the Non-Stormwater Outfall Monitoring Program will be conducted prior to December 2017.
2. Investigations designed to track and classify discharges will start during the 2015 dry season. Source tracking and classification work will depend upon the number of sites categorized as having significant flow.
3. Monitoring will be implemented if significant dry weather flows are identified at discharge points that are cannot be identified, are non-essential exempt flows, or identified as illicit flows that are not yet controlled. These sites will be initially monitored twice a year in conjunction with dry weather monitoring of the receiving water site.

5 Chemical/Physical Parameters

This section provides a summary of chemical parameters required to be analyzed at the receiving water monitoring stations a minimum of two dry weather events and four stormwater events each year. The Watershed Group will use wet-weather monitoring results from the first year to consider requesting a reduction in frequency to three wet-weather events in the future. The fourth storm event is only for the purpose of fulfilling the TMDL requirements. Only copper, lead, zinc, total suspended solids (TSS), suspended sediment concentration (SSC), and hardness will be analyzed. The full set of Table E-2 constituents are intended to be analyzed once during the first major storm event of the season at LTA monitoring sites. The full set of Table E-2 constituents will also be analyzed at these sites in July during the critical dry weather period. Nevertheless, dry weather discharges to the San Gabriel River from the MS4 are known to be less than 1-2% of the flow in Reach 1 of San Gabriel River. The San Gabriel River Metals TMDL indicated that median flow measurements at the Los Angeles County Department of Public Works gauging station F42B-R, located just above Spring Street, were 114 cfs. The sum of median flows from the two WRPs totaled 115 cfs, slightly higher than the median flow measured at the downstream gaging station. Contributions of urban flows during dry weather simply are not discernable from discharges from the two WRPs. As a result, it is expected that monitoring of dry weather flows at GR1 will be more reflective of discharges from the WRPs.

Results of initial wet weather and dry weather monitoring of Table E-2 constituents at LTA sites will be used to determine if constituents should be added to the list of constituents monitored at each LTA site in the following year. If these constituents continue to exceed RWLs at an LTA site they will be further considered for inclusion at upstream stormwater outfall sites (Table 5-1). The full set of analytical requirements discussed below is based upon Table E-2 of the Monitoring and Reporting Program and summarized in Table 5-3 through Table 5-9 below.

Analytical requirements for the program are broken out by analytical test requirements since many are associated with an analytical test suite. This is most evident with the semivolatile organic compounds analyzed by EPA Method 625. Although this section identifies recommended methods for each analyte, many of the target constituents can be addressed by alternative methods. Selection of analytical methods is intended to be performance-based to allow laboratories flexibility to utilize methods that meet or exceed MLs listed in the MRP.

The lists of Table E-2 constituents only show Minimum Levels (MLs) required for each analyte under the monitoring program since Method Detection Limits (MDLs) will vary among laboratories. Reporting limits are required to meet the established MLs unless matrix or other interferences are encountered that cannot be eliminated by additional cleanup procedures.

The critical dry weather event is defined as the period when historical in-stream flow records are lowest or during the historically driest month. An analysis of long-term flow records at the F354 gauging station in Coyote Creek (same location as the LACFCD's S13 Mass Emission) found flows to typically reach the most critical condition in July.

Comprehensive monitoring of priority pollutants in the receiving waters at the LTA sites will be conducted during the first year and is intended to assure that all constituents with potential to impact water quality are incorporated into the monitoring program. In addition, any additional constituents found to commonly exceed receiving water limitations at the LTA site will also be incorporated into stormwater outfall monitoring program in order to help identify watershed sources of the pollutants.

Table 5-1. Summary of Wet Weather Water Quality Constituents and Frequency at Mass Emission, LTA and TMDL Monitoring Sites.

CLASS OF MEASUREMENTS	RECEIVING WATERS			
	ME Coyote Creek	LTA San Gabriel River	TMDL	
	S13	GR1	NFC1	GR2[1]
Flow	4	4	4	3
Field Measurements DO, pH, Temp, and Spec. Cond.	4	4	4	3
MRP Table E-2 Constituents[2] (other than those listed below)	1	1	1	1
Aquatic Toxicity[3]	2	2	2	2
Conventionals[4] (Table 5-3) All except total phenols, turbidity, BOD_5, MTBE, and perchlorate, and fluoride.	4	4	4	4
Microbiological Constituents (Table 5-4)				
E. coli	3	3	3	3
Nutrients (Table 5-5)				
Ammonia	3	3	3	3
OC Pesticides and PCBs (Table 5-6)				
Lindane	3	3	3	3
Metals[4] (Table 5-7)				
Copper	4	4	4	4
Lead	4	4	4	4
Mercury	4	4	4	4
Selenium	4	4	4	4
Zinc	4	4	4	4
OP Pesticides (Table 5-8)				
Diazinon	3			
PAHs (Table 5-8)	3			

1. GR2 is a tentative TMDL site located between San Gabriel River Reach 1 and 2. This site will only be considered for monitoring if monitoring at S14 and GR1 provide evidence of increasing concentrations between these two sites.
2. All Table E-2 constituents will be measured during the first major storm event of the season and the critical, low flow dry weather event during July of the first year of the CIMP. Constituents that are detected above the lowest applicable WQOs during the first year of monitoring, will be analyzed for the remainder of the Order at the receiving water monitoring station where it was detected.
3. Aquatic toxicity may be triggered by results at site S13. Aquatic toxicity at NFC1 will only be run if detected at the downstream receiving water station.
4. The fourth storm event is only for the purpose of fulfilling the TMDL requirements. Only metals, TSS, SSC, and hardness will be analyzed.

Table 5-2. Summary of Dry Weather Water Quality Constituents and Frequency at Mass Emission, LTA and TMDL Monitoring Sites.

CLASS OF MEASUREMENTS	RECEIVING WATERS			
	ME Coyote Creek	LTA San Gabriel River	TMDL	
	S13	GR1	NFC1	GR2[1]
Flow	2	2	2	2
Field Measurements DO, pH, Temp, and Spec. Cond.	2	2	2	2
MRP Table E-2 Constituents[2] (other than those listed below)	1	1	1	1
Aquatic Toxicity[3]	1	1		
Conventionals (Table 5-3) All <u>except</u> total phenols, turbidity, BOD_5, MTBE, and perchlorate, and fluoride.	2	2	2	2
Microbiological Constituents (Table 5-4)				
E. coli	2	2	2	2
Nutrients (Table 5-5)				
Ammonia	2	2	2	2
OC Pesticides and PCBs (Table 5-6)				
Alpha-Endosulfan	1			
Lindane				2
Metals (Table 5-7)				
Copper	2	2	2	2
Lead	2		2	
Mercury	2		2	
Selenium	2	2	2	2
Zinc	2		2	2
OP Pesticides (Table 5-8)				
Diazinon	2			
PAHs (Table 5-8)	2			

1. GR2 is a tentative site expected to be dry during the summer. Constituents are listed are based upon S14 which includes input from a very small segment of the LSGR watershed.
2. All Table E-2 constituents will be measured during the first major storm event of the season and the critical, low flow dry weather event during July of the first year of the CIMP. Constituents that are detected above the lowest applicable WQOs during the first year of monitoring, will be analyzed for the remainder of the Order at the receiving water monitoring station where it was detected.
3. Aquatic toxicity may be triggered by results at site S13. Aquatic toxicity at NFC1 will only be run if detected at the downstream receiving water station.

5.1 General and Conventional Pollutants

Six of the conventional pollutants listed in Table 5-3 will continue to be analyzed as part of the base monitoring requirements. These include cyanide, TSS, TDS, Total Hardness, MBAS, and chloride. Specific conductance will be analyzed with along field measurements for dissolved oxygen, pH, and temperature. Additional constituents identified as constituents of concern during the first monitored storm event of the season and/or in association with monitoring conducted during the critical low flow event may also be considered for addition to the analytical suite after the first year. In addition, consideration will be given towards incorporation of other general and conventional constituents in this table that may be useful as indicators of contamination or that help interpret and evaluate sources of contaminants.

Table 5-3. Conventional Constituents, Analytical Methods and Quantitation Limits.

CONSTITUENTS		**Target Reporting Limits**
CONVENTIONAL POLLUTANTS	**METHOD**	**mg/L**
Oil and Grease	EPA1664	5
Total Petroleum Hydrocarbon	EPA 418.1	5
Total Phenols	EPA 420.1	0.1
Cyanide	EPA 335.2,SM 4500-CNE	0.003
Turbidity	EPA 180.1, SM2130B	1
Total Suspended Solids	EPA 160.2, SM2540D	1
Total Dissolved Solids	EPA 160.1, SM2540C	1
Volatile Suspended Solids	EPA 160.4, SM2540E	1
Total Organic Carbon	EPA 415.1 SM 5310B	1
Biochemical Oxygen Demand	EPA 405.1, SM 5210B	3
Chemical Oxygen Demand	EPA 410.1, SM5220D	4
Alkalinity	EPA 310.1, SM2320B	5
Specific Conductance	EPA 120.1, SM2510 B	1
Total Hardness	EPA 130.2, SM2340C	1
MBAS	EPA 425.1, SM5540-C	0.02
Chloride	EPA300.0, SM4110B	2
Fluoride	EPA300.0, SM4110B	0.1
Perchlorate	EPA314.0	4 ug/L
Volatile Organics	**METHOD**	**mg/L**
Methyl tertiary butyl ether (MTBE)	EPA624	1
Field Measurements	**METHOD**	**mg/L**
pH-field instrumentation	EPA 150.1	0 – 14
Temperature-field	In-situ	N/A
Dissolved Oxygen- field [1]	In-situ, SM4500 (OG)	Sensitivity to 5 mg/L

[1] Dissolved Oxygen will only be measured during dry weather surveys.

5.2 Microbiological Constituents

Table E-2 list four microbiological constituents that are used as fecal indicator bacteria (FIB). Since bacteria are not 303(d) listed for the downstream waters of the San Gabriel River Estuary, FIBs used to assess marine waters will not be included in any testing. Only *Escherichia coli* will be monitored at receiving water sites, TMDL sites and stormwater outfall sites.

Table 5-4 provides both upper and lower quantification limits for *E. coli* as well as other FIBs limited to marine waters. Upper quantification limits are provided to assure that measurements result in quantitative values rather than values that are qualified as greater than a fixed value. The intent is to assure that adequate dilutions are used to assure that quantifiable results are obtained.

Table 5-4. Microbiological Constituents, Analytical Methods and Quantitation Limits.

BACTERIA[1]	Method	Lower Limits MPN/100ml	Upper Limits MPN/100ml
Total coliform (marine waters)	SM 9221B	<20	>2,400,000
Fecal coliform (marine waters)	SM 9221B	<20	>2,400,000
Enterococcus (marine waters)	SM 9230C	<20	>2,400,000
E. coli (fresh waters)	SM 9223 COLt	<10	>2,400,000

[1] Microbiological constituents will vary based upon sampling point. Total & fecal coliform and enterococcus will only be measured in marine waters or at locations where either the discharge point or receiving water body will directly impact marine waters. *E. coli* will be analyzed at sites within the freshwater portion of the watershed.

5.3 Nutrients

Nutrients include both nitrogen and phosphorus compounds listed in Table 5-5. Ammonia is the only nutrient that has been 303(d) listed or that has been found to exceed any RWLs in the LSGR region. All nutrients will be analyzed at the three mass emission sites during the first major storm event and the July critical dry weather event. Phosphorus compounds have not been identified as constituents of concern in the watershed and will likely only be analyzed during the first year when sampling includes all Table E-2 constituents.

Table 5-5. Nutrients, Analytical Methods, and Quantitation limits

CONSTITUENT	METHOD	REPORTING LIMIT (mg/L)
Total Kjeldahl Nitrogen (TKN)[1]	EPA 351.1	0.50
Nitrate as Nitrogen (NO3-N)[1,2]	EPA 300.0	0.10
Nitrite as Nitrogen (NO2-N)[1,2]	EPA 300.0	0.05
Total Nitrogen[1]	calculation	NA
Ammonia as Nitrogen (NH3-N)	EPA 350.1	0.10
Total Phosphorus	SM 4500-P E or F	0.1
Dissolved Phosphorus	SM 4500-P E or F	0.1

1. Total Nitrogen is the sum of TKN, nitrate, and nitrite.
2. Nitrate –N and Nitrite-N may be analyzed together using EPA 300

5.4 Organochlorine Pesticides and PCBs

Organochlorine pesticides (OC pesticides) and PCBs have been analyzed in both stormwater and dry weather water samples collected at S13 between 2006 and 2013. Endosulfan I was the only OC pesticide detected. This pesticide was measured at a concentration of 26 ug/L at S13 during a dry weather sampling event. OC pesticides and PCBs are rarely detected in stormwater or dry weather discharges since they are so strongly associated with particulates. Monitoring for PCBs will be reported as the summation of aroclors and a minimum of 50 congeners and will be analyzed using EPA Method 8270, without the use of High Resolution Mass Spectrometry for routine monitoring.

The Harbor Toxics TMDL required testing to be conducted by analyzing these compounds on suspended sediment transported during storm events. A special monitoring program has been proposed to allow better assessment of these compounds while also providing data to support the Harbor Toxics TMDL. Monitoring for these constituents will be conducted at S13 and GR1 to allow quantification of loads from both major branches of the San Gabriel River Watershed.

The Harbor Toxics TMDL requires monitoring of these analytes during two storm events and one dry weather event. Monitoring during the two storm events will use specialized sampling and analytical methods detailed in Section 8.1.2. During dry weather sampling events, suspended sediment concentrations will be too low to allow for direct assessment of chlorinated pesticides and PCBs in the suspended particulate fraction. Monitoring conducted for characterization of dry weather conditions will utilize the same conventional methods (Table 5-6) being used in the receiving waters of the Harbor. Detailed information (reporting limits and data quality objectives) on the dry weather testing program are provided in Appendix E.

Dry weather sampling at the mouth of the San Gabriel River will be conducted by the LACSD, and modification to the existing monitoring program will commence in 2015. Data collected by LACSD will be shared with and analyzed by LSGR WG every other year consistent with the monitoring frequency recommended in the Harbor Toxics TMDL, beginning in 2016 when the Harbor Toxics Regional Monitoring Program is scheduled to conduct the first sediment survey.

Table 5-6. Chlorinated Pesticides and PCB analytical methods, and quantitation limits

CHLORINATED PESTICIDES	METHOD	Reporting Limit ug/*L*
Aldrin	EPA 608	0.005
alpha-BHC	EPA 608	0.01
beta-BHC	EPA 608	0.005
delta-BHC	EPA 608	0.005
gamma-BHC (lindane)	EPA 608	0.02
alpha-chlordane	EPA 608	0.1
gamma-chlordane	EPA 608	0.1
4,4'-DDD	EPA 608	0.05
4,4'-DDE	EPA 608	0.05
4,4'-DDT	EPA 608	0.01
Dieldrin	EPA 608	0.01
alpha-Endosulfan	EPA 608	0.02
beta-Endosulfan	EPA 608	0.01
Endosulfan sulfate	EPA 608	0.05
Endrin	EPA 608	0.01
Endrin aldehyde	EPA 608	0.01
Heptachlor	EPA 608	0.01

Heptachlor Epoxide	EPA 608	0.01
Toxaphene	EPA 608	0.5
POLYCHLORINATED BIPHENYLS		
PCBs[1] (Reported as the summation)	EPA 8270	0.005
Aroclor-1248	EPA 608	0.5
Aroclor-1254	EPA 608	0.5
Aroclor-1260	EPA 608	0.5

[1] Monitoring for PCBs will be reported as the summation of aroclors and a minimum of 50 congeners for routine monitoring. 54 PCB congeners include: 8, 18, 28, 31, 33, 37, 44, 49, 52, 56, 60, 66, 70, 74, 77, 81, 87, 95, 97, 99, 101, 105, 110, 114, 118, 119, 123, 126, 128, 132, 138, 141, 149, 151, 153, 156, 157, 158, 167, 168, 169, 170, 174, 177, 180, 183, 187, 189, 194, 195, 201, 203, 206, and 209. These include all 41 congeners analyzed in the SCCWRP Bight Program and dominant congeners used to identify the aroclors. List of aroclors and congeners were obtained from Table C8 in the State's Surface Water Ambient Monitoring Program's Quality Assurance Program Plan.

5.5 Total and Dissolved Trace Metals

A total of 16 trace metals are listed in Table E-2 of the MRP. Analytical methods and reporting limits for these elements are summarized in Table 5-7. Most metals will be analyzed by EPA Method 200.8 using ICP-MS to provide appropriate detection limits. Hexavalent chromium and mercury both require alternative methods.

Hexavalent chromium has been analyzed at TMDL compliance monitoring sites in both the Los Angeles River (S10) and the San Gabriel River (S14) for the past eight to ten years. Analytical methods and detection limits used for the monitoring have been consistent with those required in Table E-2 of the MRP. Hexavalent chromium will be analyzed with all Table E-2 constituents but this trace metal has never been detected a levels greater than the reporting limit so it will not likely be monitored on a regular basis.

Mercury is not commonly detected at either S13 or S14 but is periodically detected once in Coyote Creek at 0.13 ug/L and four times at the S14 in the San Gabriel River. The highest concentration was 0.43 ug/L at S14 but most concentrations reported in both locations have been near the reporting limit of 0.1 ug/L. Total mercury will be analyzed at both S13 and GR1. Grab samples will be taken for analysis of mercury in order to augment composite samples, which will be analyzed by EPA method 245.1. Grab samples will be analyzed by Method 1631E since this method is less subject to interferences and will be collected at the same time that monitoring crews pull other grab samples required by the monitoring program. Additional QAQC will be employed to support the extremely low detection limits required by the program.

Table 5-7. Metals Analytical Methods, and Quantitation Limits.

METALS (Dissolved & Total)	METHOD	Reporting Limit *ug/L*
Aluminum	EPA200.8	100
Antimony	EPA200.8	0.5
Arsenic	EPA200.8	0.5
Beryllium	EPA200.8	0.5
Cadmium	EPA200.8	0.25
Chromium (total)	EPA200.8	0.5
Chromium (Hexavalent)[1]	EPA218.6	5
Copper	EPA200.8	0.5
Iron	EPA200.8	25
Lead	EPA200.8	0.5
Mercury[1]	EPA245.1	0.2
Mercury (low level)	EPA1631E	0.0005
Nickel	EPA200.8	1
Selenium	EPA200.8	1
Silver	EPA200.8	0.25
Thallium	EPA200.8	0.5
Zinc	EPA200.8	1

1. Only total hexavalent chromium and mercury will be analyzed during the initial wet and dry weather screening of Table E-2 constituents.

5.6 Organophosphate Pesticides and Herbicides

Organophosphate pesticides, triamine pesticides and herbicides list in Table E-2 of the MRP are summarized in Table 5-8. Due to the fact that diazinon and chlorpyrifos are no longer available for residential use, these constituents are now rarely detected. Despite the fact that diazinon has not been detected at either S13 or S14 since 2006, diazinon remains on the 303(d) list and will be included in the list of constituents to be analyzed at the mass emission sites.

Although this analyte remains on the list to be analyzed at the ME station, we will recommend reevaluation after the first two years of monitoring. If concentrations remain below the updated California Department of Fish and Game criteria, we will propose to remove this analyte from the monitoring list for the ME site.

Table 5-8. Organophosphate pesticides and herbicides analytical methods, and quantitation limits

ORGANOPHOSPHATE PESTICIDES	METHOD	Reporting Limit ug/L
Atrazine	EPA507,8141A	1
Chlorpyrifos	EPA8141A	0.05
Cyanazine	EPA8141A	1
Diazinon	EPA8141A	0.01
Malathion	EPA8141A	1
Prometryn	EPA8141A	1
Simazine	EPA8141A	1
HERBICIDES		
Glyphosate	EPA547	5
2,4-D	EPA515.3	0.02
2,4,5-TP-SILVEX	EPA515.3	0.2

5.7 Semivolatile Organic Compounds (Acid, Base/Neutral)

Semivolatile organic compounds from Table E-2 of the MRP are listed in Table 5-9 below. Acids consist mostly of phenolic compounds which are uncommon in stormwater samples. Base/neutrals include polynuclear aromatic hydrocarbons (PAHs) which are the only semivolatile organic compounds considered to be constituents of concern. PAHs are included as part of the Harbor Toxics TMDL and will be analyzed at R8 as part of the Harbor Toxics TMDL monitoring requirements.

PAHs will also be analyzed in association with two storm events at the S13 and GR1 using specialized analytical test procedures to allow for the resolution necessary to quantify total loads of PAHs. The methods are discussed in Section 8.1.2.

Table 5-9. Semivolatile organic compounds analytical methods, and quantitation limits.

SEMIVOLATILE ORGANIC COMPOUNDS	METHOD	Reporting Limit
ACIDS		**ug/L**
2-Chlorophenol	EPA625	2
4-Chloro-3-methylphenol	EPA625	1
2,4-Dichlorophenol	EPA625	1
2,4-Dimethylphenol	EPA625	2
2,4-Dinitrophenol	EPA625	5
2-Nitrophenol	EPA625	10
4-Nitrophenol	EPA625	5
Pentachlorophenol	EPA625	2
Phenol	EPA625	1
2,4,6-Trichlorophenol	EPA625	10
BASE/NEUTRAL		**ug/L**
Acenaphthene	EPA625	1
Acenaphthylene	EPA625	2
Anthracene	EPA625	2
Benzidine	EPA625	5
1,2 Benzanthracene	EPA625	5
Benzo(a)pyrene	EPA625	2
Benzo(g,h,i)perylene	EPA625	5
3,4 Benzofluoranthene	EPA625	10
Benzo(k)fluoranthene	EPA625	2
Bis(2-Chloroethoxy) methane	EPA625	5
Bis(2-Chloroisopropyl) ether	EPA625	2
Bis(2-Chloroethyl) ether	EPA625	1
Bis(2-Ethylhexl) phthalate	EPA625	5
4-Bromophenyl phenyl ether	EPA625	5
Butyl benzyl phthalate	EPA625	10
2-Chloroethyl vinyl ether	EPA625	1
2-Chloronaphthalene	EPA625	10
4-Chlorophenyl phenyl ether	EPA625	5
Chrysene	EPA625	5
Dibenzo(a,h)anthracene	EPA625	0.1
1,3-Dichlorobenzene	EPA625	1
1,4-Dichlorobenzene	EPA625	1
1,2-Dichlorobenzene	EPA625	1
3,3-Dichlorobenzidine	EPA625	5
Diethyl phthalate	EPA625	2
Dimethyl phthalate	EPA625	2
di-n-Butyl phthalate	EPA625	10
2,4-Dinitrotoluene	EPA625	5
2,6-Dinitrotoluene	EPA625	5
4,6 Dinitro-2-methylphenol	EPA625	5
1,2-Diphenylhydrazine	EPA625	1
di-n-Octyl phthalate	EPA625	10
Fluoranthene	EPA625	0.05
Fluorene	EPA625	0.1

SEMIVOLATILE ORGANIC COMPOUNDS	METHOD	Reporting Limit
Hexachlorobenzene	EPA625	1
Hexachlorobutadiene	EPA625	1
Hexachloro-cyclopentadiene	EPA625	5
Hexachloroethane	EPA625	1
Indeno(1,2,3-cd)pyrene	EPA625	0.05
Isophorone	EPA625	1
Naphthalene	EPA625	0.2
Nitrobenzene	EPA625	1
N-Nitroso-dimethyl amine	EPA625	5
N-Nitroso-diphenyl amine	EPA625	1
N-Nitroso-di-n-propyl amine	EPA625	5
Phenanthrene	EPA625	0.05
Pyrene	EPA625	0.05
1,2,4-Trichlorobenzene	EPA625	1

6 Adaptive Management

The CIMP will be reviewed on an annual basis to make any necessary adjustments to the monitoring sites, constituents, frequency of sampling or sampling procedures. The CIMP is intended to require modifications based upon annual monitoring results. Annual changes may include expanded toxicity testing, the addition of constituents monitored at LTA sites, addition of new constituents to stormwater outfall sites, addition or relocation of monitoring sites as well as a range of other program adjustments necessary to improve the ability of the program to monitor water quality improvements and identify major sources of contaminants in needed of targeted control measures.

Water body / pollutant categories and the frequency of exceedance of available RWLs are central to the monitoring approach. Pre-determined triggers will be used to determine if new constituents should be incorporated into the program or if monitoring of a constituent should be discontinued. Monitoring constituents will be adjusted based upon the following guidelines:

- Any constituent exceeding the minimum, appropriate water quality criteria listed in Appendix G during the wet and dry weather screening of E-2 constituents will be added to the monitoring list for the subject receiving water site and season.
- If an E-2 constituent exceeds receiving water criteria in two consecutive surveys, the constituent will be added to the monitoring list at the closest upstream stormwater outfall monitoring site.
- If sampling of an E-2 constituent is added to a stormwater outfall monitoring and the constituent is not detected in excess of the lowest applicable water quality criterion for two consecutive years, monitoring of the constituent at the stormwater outfall site will be discontinued.
- If data indicates that the Water body/ category 2 pollutant meets delisting criteria, it will be proposed to the Regional Water Board to be downgraded and would be subject to Executive Officer approval.

- Pollutants in water body/classification 3 may be removed from the list of monitored constituents at a site if they are not detected at levels that exceed the minimum, appropriate water quality criteria for a period of two consecutive years. The Watershed Group will submit a request to remove the constituent from future sampling to the Regional Water Board and would be subject to Executive Officer approval. This does not include constituents which are basic monitoring requirements.

Monitoring data will be evaluated each year to determine if any modifications are necessary. This will include an assessment of additional monitoring that may be necessary to identify sources of TMDL constituents.

7 Aquatic Toxicity Testing and Toxicity Identification Evaluations

Aquatic toxicity testing supports the identification of best management practices (BMPs) to address sources of toxicity in urban runoff. Monitoring begins in the receiving water and the information gained is used to identify constituents for monitoring at outfalls to support the identification of pollutants that need to be addressed in the WMP. The sub-sections below describe the detailed process for conducting aquatic toxicity monitoring, evaluating results, and the technical and logistical rationale. Control measures and management actions to address confirmed toxicity caused by urban runoff are addressed by the WMP, either via currently identified management actions or those that are identified via adaptive management of the WMP.

7.1 Sensitive Species Selection

The Permit Monitoring and Reporting Program (MRP) (page E-32) states that sensitivity screening to select the most sensitive test species should be conducted unless “a sensitive test species has already been determined, or if there is prior knowledge of potential toxicant(s) and a test species is sensitive to such toxicant(s), then monitoring shall be conducted using only that test species.” Previous relevant studies conducted in the watershed should be considered. Such studies may have been completed via previous MS4 sampling, wastewater NPDES sampling, or special studies conducted within the watershed.

As described in the MRP (page E-31), if samples are collected in receiving waters with salinity less than 1 part per thousand (ppt), or from outfalls discharging to receiving waters with salinity less than 1 ppt, toxicity tests should be conducted on the most sensitive test species in accordance with species and short-term test methods in *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms* (EPA/821/R-02/013, 2002; Table IA, 40 CFR Part 136). Salinities of both dry and wet weather discharges from the Lower San Gabriel River are considered to meet the freshwater criteria. The freshwater test species identified in the MRP are:

- A static renewal toxicity test with the fathead minnow, *Pimephales promelas* (Larval Survival and Growth Test Method 1000.04).
- A static renewal toxicity test with the daphnid, *Ceriodaphnia dubia* (Survival and Reproduction Test Method 1002.05).
- A static non-renewal toxicity test with the green alga, *Selenastrum capricornutum* (also named *Raphidocelis subcapitata*) (Growth Test Method 1003.0).

The three test species were evaluated to determine if either a sensitive test species had already been determined, or if there is prior knowledge of potential toxicant(s) and a test species is sensitive to such toxicant(s). In reviewing the available data in the Los Angeles River, Los Cerritos Channel, and the San Gabriel River watersheds, organophosphate pesticides and/or metals have been identified as problematic and are generally considered the primary aquatic life toxicants of concern found in urban runoff. Pyrethroid pesticides are known to be present in urban runoff and potentially contribute to toxicity in these waters. Tests specific to pyrethroid pesticides are simply less common.

Given the knowledge of the presence of these potential toxicants in the watershed, the sensitivities of each of the three species were considered to evaluate which is the most sensitive to the potential toxicants in the watersheds.

Ceriodaphnia dubia has been reported as a sensitive test species for historical and current use of pesticides and metals, and studies indicate that it is more sensitive to the toxicants of concern than *P. promelas* or *S. capricornutum*. In its aquatic life copper criteria document, the USEPA reports greater sensitivity of *C. dubia* to copper (species mean acute value of 5.93 µg/l) compared to *Pimephales promelas* (species mean acute value of 69.93 µg/l; EPA, 2007). *C. dubia's* relatively higher sensitive to metals is common across multiple metals. Researchers at the University of California, Davis also reviewed available species sensitivity values in developing pesticide criteria for the Central Valley Regional Water Quality Control Board. The UC Davis researchers reported higher sensitivity of *C. dubia* to diazinon and bifenthrin (species mean acute value of 0.34 µg/l and 0.105 µg/l) compared to *P. promelas* (species mean acute value of 7804 µg/l and 0.405 µg/l; Palumbo et al., 2010a, b). Additionally, a study of the City of Stockton urban stormwater runoff found acute and chronic toxicity to *C. dubia*, with no toxicity to *S. capricornutum* or *P. promelas* (Lee and Lee, 2001). The toxicity was attributed to organophosphate pesticides, indicating a higher sensitivity of *C. dubia* compared to *S. capricornutum* or *P. promelas*. *P. promelas* is generally less sensitive to metals and pesticides but has been found to be more sensitive to ammonia than *C. dubia*. However, as ammonia is not typically a constituent of concern for urban runoff and ammonia is not consistently observed above the toxic thresholds in the watershed, *P. promelas* is not considered a particularly sensitive species for evaluating the impacts of urban runoff in receiving waters in the watershed.

Selenastrum capricornutum is a species that is sensitive to herbicides; however, while sometimes present in urban runoff, measured concentrations are typically very low. Herbicides have not been identified as a potential toxicant in the watershed. *S. capricornutum* is also not considered the most sensitive species as it is not sensitive to either pyrethroids or organophosphate pesticides and is not as sensitive to metals as *C. dubia*. The *S. capricornutum* growth test can also be affected by high concentrations of suspended and dissolved solids, color and pH extremes, which can interfere with the determination of sample toxicity. As a result, it is common to manipulate the sample by centrifugation and filtration to remove solids in order to conduct the test. This process may affect the toxicity of the sample. In a study of urban highway stormwater runoff (Kayhanian et. al, 2008), the green alga response to the stormwater samples was more variable than both the *C. dubia* and the *P. promelas* and in some cases the alga growth was considered to be potentially enhanced due to the presence of stimulatory nutrients.

As *C. dubia* is identified as the most sensitive to known potential toxicant(s) typically found in receiving waters and urban runoff in the freshwater potions of the watershed and has demonstrated toxicity in programs within the watershed (CWH and ABC Laboratories, 2013), *C. dubia* is selected as the most sensitive species. The species also has the advantage of being easily maintained in in-house mass cultures. The simplicity of the test, the ease of interpreting results, and the smaller volume necessary to run the test, make the test a valuable screening tool. The ease of sample collection and higher sensitivity will support assessing the presence of ambient receiving water toxicity or long term effects of toxic stormwater over time. As such, toxicity testing will be conducted using *C. dubia*.

An alternative species of water fleas, *Daphnia magna*, may be used if the water being tested has elevated hardness. *C. dubia* test organisms are typically cultured in moderately hard waters (80-100 mg/L CaCO3) and can have increased sensitivity to elevated water hardness greater than 400 mg/L CaCO3), which is beyond their typical habitat range. Because of this, *Daphnia magna* may be substituted in instances where hardness in site waters exceeds 400 mg/L ($CaCO_3$). *Daphnia magna* is more tolerant to high hardness levels and is a suitable substitution for *C. dubia* in these instances (Cowgill and Milazzo, 1990).

7.2 Testing Period

The following describes the testing periods to assess toxicity in samples collected in the LSGR WMP area during dry and wet weather conditions. Short-term chronic tests will be used to assess both survival and reproductive/growth endpoints for *C. dubia* for both wet and dry weather sampling efforts. Although wet weather conditions in the region generally persist for less than the chronic testing periods (7 days), the *C. dubia* chronic test will be used for wet weather toxicity testing in accordance with *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms* (EPA, 2002a). Utilization of standard chronic tests on wet weather samples are not expected to generate results representative of the typical conditions found in the receiving water intended to be simulated by toxicity testing.

7.3 Toxicity Endpoint Assessment and Toxicity Identification Evaluation Triggers

Per the MRP, toxicity test endpoints will be analyzed using the Test of Significant Toxicity (TST) t-test approach specified by the USEPA (USEPA, 2010). The Permit specifies that the chronic in-stream waste concentration (IWC) is set at 100% receiving water for receiving water samples and 100% effluent for outfall samples. Using the TST approach, a t-value is calculated for a test result and compared with a critical t-value from USEPA's TST Implementation Document (USEPA, 2010). Follow-up triggers are generally based on the Permit specified statistical assessment as described below.

For chronic *C. dubia* toxicity testing, if a ≥50% reduction in survival or reproduction is observed between the sample and laboratory control that is statistically significant, a toxicity identification evaluation (TIE) will be performed.

TIE procedures will be initiated as soon as possible after the toxicity trigger threshold is observed to reduce the potential for loss of toxicity due to extended sample storage. If the cause of toxicity is readily apparent or is caused by pathogen related mortality or epibiont interference with the test, the result will be rejected, if necessary, a modified testing procedure will be developed for future testing.

In cases where significant endpoint toxicity effects greater than 50% are observed in the original sample, but the follow-up TIE positive control "signal" is found to not be statistically significant, the cause of toxicity will be considered non-persistent. No immediate follow-up testing is required on the sample. However, future test results will be evaluated to determine if implementation of concurrent TIE treatments are needed to provide an opportunity to identify the cause of toxicity.

7.4 Toxicity Identification Evaluation Approach

The results of toxicity testing will be used to trigger further investigations to determine the cause of observed laboratory toxicity. The primary purpose of conducting TIEs is to support the identification of management actions that will result in the removal of pollutants causing toxicity in receiving waters. Successful TIEs will direct monitoring at outfall sampling sites to inform management actions. As such, the goal of conducting TIEs is to identify pollutant(s) that should be sampled during outfall monitoring so that management actions can be identified to address the pollutant(s).

The TIE approach as described in USEPA's 1991 Methods for Aquatic Toxicity Identification is divided into three phases although some elements of the first two phases are often combined. Each of the three phases is briefly summarized below:

- Phase I utilizes methods to characterize the physical/chemical nature of the constituents which cause toxicity. Such characteristics as solubility, volatility and filterability are determined without specifically identifying the toxicants. Phase I results are intended as a first step in specifically identifying the toxicants but the data generated can also be used to develop treatment methods to remove toxicity without specific identification of the toxicants.
- Phase II utilizes methods to specifically identify toxicants.
- Phase III utilizes methods to confirm the suspected toxicants.

A Phase I TIE will be conducted on samples that exceed a TIE trigger described in Section7.4. Water quality data will be reviewed to future support evaluation of potential toxicants. A range of sample manipulations may be conducted as part of the TIE process. The most common manipulations are described in Table 7-1. Information from previous chemical testing and/or TIE efforts will be used to determine which of these (or other) sample manipulations are most likely to provide useful information for identification of primary toxicants. TIE methods will generally adhere to USEPA procedures documented in conducting TIEs (USEPA, 1991, 1992, 1993a-b).

The LSGR WG will identify the cause(s) of toxicity using a selection of treatments in Table 7-1 and, if possible, using the results of water column chemistry analyses. After any initial assessments of the cause of toxicity, the information may be used during future events to modify the targeted treatments to more closely target the expected toxicant or class of toxicants. Moreover, if the toxicant or toxicant class is not initially identified, toxicity monitoring during subsequent events will confirm if the toxicant is persistent or a short-term episodic occurrence.

Table 7-1. Phase I and II Toxicity Identification Evaluation Sample Manipulations

TIE Sample Manipulation	Expected Response
pH Adjustment (pH 7 and 8.5)	Alters toxicity in pH sensitive compounds (i.e., ammonia and some trace metals)
Filtration or centrifugation*	Removes particulates and associated toxicants
Ethylenediamine-Tetraacetic Acid (EDTA) or Cation Exchange Column*	Chelates trace metals, particularly divalent cationic metals
Sodium thiosulfate (STS) addition	Reduces toxicants attributable to oxidants (i.e., chlorine) and some trace metals
Piperonyl Butoxide (PBO)*	Reduces toxicity from organophosphate pesticides such as diazinon, chlorpyrifos and malathion, and enhances pyrethroid toxicity
Carboxylesterase addition(1)	Hydrolyzes pyrethroids
Temperature adjustments(2)	Pyrethroids become more toxic when test temperatures are decreased
Solid Phase Extraction (SPE) with C18 column*	Removes non-polar organics (including pesticides) and some relatively non-polar metal chelates
Sequential Solvent Extraction of C18 column	Further resolution of SPE-extracted compounds for chemical analyses
No Manipulation*	Baseline test for comparing the relative effectiveness of other manipulations

* Denotes treatments that will be conducted during the initiation of toxicity monitoring, but may be revised as the program is implemented. These treatments were recommended for initial stormwater testing in Appendix E (Toxicity Testing Tool for Storm Water Discharges) of the State Water Resources Control Board's June 2012 Public Review Draft "Policy for Toxicity Assessment and Control".

1 Carboxylesterase addition has been used in recent studies to help identify pyrethroid-associated toxicity (Wheelock et al., 2004; Weston and Amweg, 2007). However, this treatment is experimental in nature and should be used along with other pyrethroid-targeted TIE treatments (e.g., PBO addition).

2 Temperature adjustments are another recent manipulation used to evaluate pyrethroid-associated toxicity. Lower temperatures increase the lethality of pyrethroid pesticides. (Harwood, You and Lydy, 2009)

As the primary goals of conducting TIEs is to identify pollutants for incorporation into outfall monitoring, narrowing the list of toxicants following Phase I TIEs via Phase II/III TIEs is not necessary if the toxicant class determined during the Phase I TIE is sufficient for 1) identifying additional pollutants for outfall monitoring and/or 2) identifying control measures. Thus, if the specific pollutant(s) or classes of pollutants (e.g., metals that are analyzed via EPA Method 200.8) are identified then sufficient information is available to incorporate the additional pollutants into outfall monitoring and to start implementation of control measures to target the additional pollutants.

Phase II TIEs may be utilized to identify specific constituents causing toxicity in a given sample if the results of Phase I TIE testing and a review of available chemistry data fails to provide information necessary to identify constituents that warrant additional monitoring activities or management actions to identify likely sources of the toxicants and lead to elimination of the sources of these contaminants. Phase III TIEs will be conducted following any Phase II TIEs.

For the purposes of determining whether a TIE is inconclusive, TIEs will be considered inconclusive if:

- The toxicity is persistent (i.e., observed in the baseline), and
- The cause of toxicity cannot be attributed to a class of constituents (e.g., insecticides, metals, etc.) that can be targeted for monitoring.

If (1) a combination of causes that act in a synergistic or additive manner are identified; (2) the toxicity can be removed with a treatment or via a combination of the TIE treatments; or (3) the analysis of water quality data collected during the same event identify the pollutant or analytical class of pollutants, the result of a TIE is considered conclusive.

Note that the MRP (page E-33) allows a TIE Prioritization Metric (as described in Appendix E of the Stormwater Monitoring Coalition's Model Monitoring Program) for use in ranking sites for TIEs. However, as the extent to which TIEs will be conducted is unknown, prioritization cannot be conducted at this time. However, prioritization may be utilized in the future based on the results of toxicity monitoring and an approach to prioritization will be developed through the CIMP adaptive management process and will be described in future versions of the CIMP.

7.5 Follow Up on Toxicity Testing Results

Per Parts VIII.B.c.vi and XI.G.1.d of the MRP, if the results of two TIEs on separate receiving samples collected during the same conditions (i.e., wet or dry weather) are inconclusive, a toxicity test conducted during the same conditions (i.e., wet or dry weather), using the same test species, will be conducted at applicable upstream outfalls as soon as feasible (i.e., the next monitoring event that is at least 45 days following the toxicity laboratory's report transmitting the results of an inconclusive TIE). The same TIE evaluation triggers and TIE approach presented in Section 7.3 and 7.4, respectively will be followed based on the results of the outfall sample.

The MRP (page E-33) indicates the following actions should be taken when a toxicant or class of toxicants is identified through a TIE:

1. Group Members shall analyze for the toxicant(s) during the next scheduled sampling event in the discharge from the outfall(s) upstream of the receiving water location.
2. If the toxicant is present in the discharge from the outfall at levels above the applicable receiving water limitation, a toxicity reduction evaluation (TRE) will be performed for that toxicant.

The list of constituents monitored at outfalls identified in the CIMP will be modified based on the results of the TIEs. Similarly, upon completion of a successful dry weather TIE, additional constituents identified in the TIE will be added to monitoring requirements at outfalls with significant non-stormwater flows. Monitoring for those constituents will occur as soon as feasible following the completion of a successful TIE (i.e., the next monitoring event that is at least 45 days following the toxicity laboratory's report transmitting the results of a successful TIE).

The requirements of the TREs will be met as part of the adaptive management process in the WMPs rather than the CIMP. The identification and implementation of control measures to address the causes of toxicity are tied to management of the stormwater program, not the CIMP. It is expected that the requirements of TREs will only be conducted for toxicants that are not already addressed by an existing Permit requirement (i.e., TMDLs) or existing or planned management actions.

The Water Boards' TMDL Roundtable is currently evaluating options to streamline and consistently respond to urban-use pesticide impairment listings throughout the State including a statewide urban-use pesticide TMDL modeled after the San Francisco Bay Area Urban Creeks Pesticides TMDL. In Addition to toxicity testing, statewide efforts will be monitored to study these pesticides being discussed by the California Stormwater Quality Association (CASQA) Pesticides sub-committee and other Regional Water Boards.

7.6 Summary of Aquatic Toxicity Monitoring

The approach to conducting aquatic toxicity monitoring as described in the previous sections is summarized in detail in

Figure 7-1.. The intent of the approach is to identify the cause of toxicity observed in receiving water to the extent possible with the toxicity testing tools available, thereby directing outfall monitoring for the pollutants causing toxicity with the ultimate goal of supporting the development and implementation of management actions. The toxicity approach is subject to modifications based on discussions with the Regional Board.

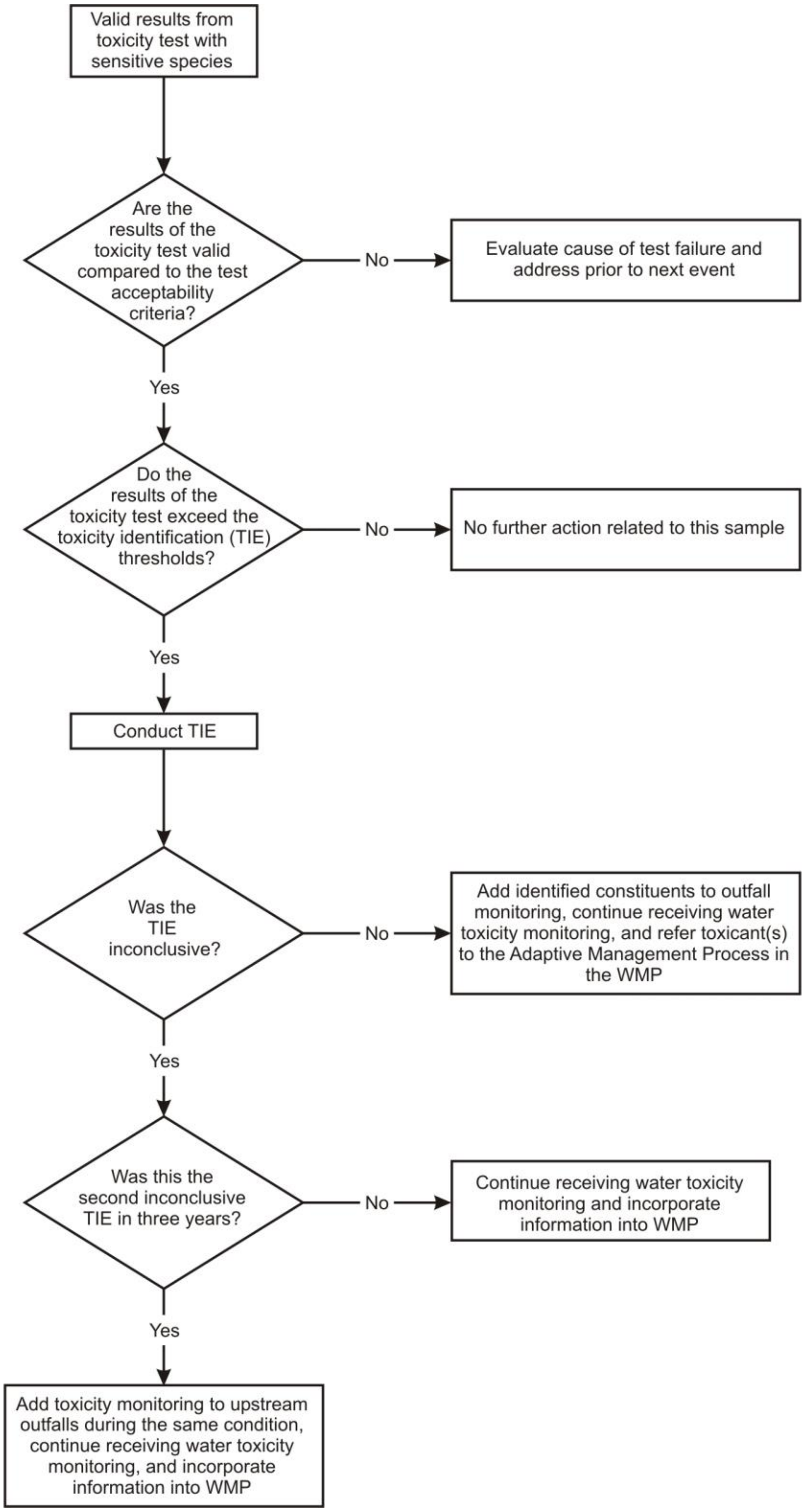

Figure 7-1. Detailed Aquatic Toxicity Assessment Process

8 Receiving Water Monitoring

Two long-term receiving water monitoring sites will be monitoring in the LSGR WG. Receiving water quality monitoring at the Coyote Creek ME site, S13, (Figure 3-1) will continue to be conducted by the LACFCD. The LSGR WG will coordinate with the LACFCD for additional TMDL monitoring to also to be conducted at S13. Additional monitoring will be conducted by the LSGR WG at both the San Gabriel River LTA site, GR1. Flow-weighted composite samples will be collected during each monitoring event and will be analyzed for constituents listed in Table 5-1.

Flow-rated composite samples will be collected and analyzed at each of the receiving water quality monitoring sites three times a year during the wet season and two times a year during dry weather conditions. Dry weather flows at GR1 are heavily dominated by discharges from the two WRPs. Discharges of tertiary treated effluent from the WRPs accounts for more than 98% of the flow measured in Reach 1 of the San Gabriel River during the summer. As part of their NPDES monitoring requirements, LACSD staff collect and monitor water from four sites within Reach 1 to characterize conditions in the watershed. The same sites are monitored.

Screening for Table E-2 constituents listed in the MRP will be conducted during the first significant storm of the year at both sites and during a critically dry weather period at S13. Larger sampling volumes are required to incorporate all analytical tests and associated QA/QC needed for Table E-2 constituents, bioassay tests and to provide sufficient volumes should TIEs be required.

Monitoring at receiving water quality sites will require specific conditions be met in order to be considered a valid stormwater monitoring event.The wet season is defined as ranging from October 1 through April 15. Storm events are further defined in the MRP as:

- Wet Season defined as October 1 through April 15,
- Events preceded by less than 0.1 inches of rainfall within the watershed over a three day period, and
- Rainfall of at least 0.25 inches.

The San Gabriel River Metals TMDL further differentiates dry weather and wet weather flow by the 90th percentile flow condition. Separate flow limits are established for the San Gabriel River and Coyote Creek watersheds.

- San Gabriel River - Maximum flow rates greater than 260 cfs measured at the USGS gauging station 11085000.
- Coyote Creek - Maximum daily flow rates of 156 cfs at the LACFCD flow gauging station F354-R.

Due to the size of the watershed, it is possible that conditions for wet weather flow monitoring could be met in one of the two targeted segments of the LSGR WG but not the other. When possible, monitoring will target events where appropriate sampling conditions are expected to be met in bot segments of the watershed. Professional judgment will be used to determine if conditions are likely to be achieved in both segments.

The MRP defines dry weather (for rivers, streams or creeks) as periods when flow is no more than 20% greater than base flow conditions. In the case of the Estuary, dry weather conditions are further defined by rainfall being less than 0.1 inches of rain on the day of the sampling and having experienced no less than three days of dry weather after a rain event of 0.1 inches or greater within the watershed, as measured from at least 50 percent of Los Angeles County controlled rain gauges within the watershed.

As noted in the previous section, it has been determined that adequate data exist to determine which of the three freshwater species are considered to be most sensitive during both storm events and dry weather periods. Available literature and local data indicate that the most sensitive bioassay test species is *Ceriodaphnia dubia*. The prior section on Aquatic Toxicity Testing and TIEs goes into detail as to species selection and the overall approach recommended for measuring toxicity in the receiving waters and strategies to eliminate any sources of toxicity. During wet weather conditions, bioassay tests will be performed based upon exposure to 100 percent test waters over a 48-hour time period since this time exposure is deemed to be more consistent with the duration of typical storm events. Since exposure times during the dry season are much long, dry weather testing will utilize 7-day chronic toxicity tests that assess both survival and reproductive endpoints for *C. dubia*. Chronic testing will also be conducted on 100 percent undiluted samples.

Table 8-1 provides sample volumes necessary for toxicity tests (both wet and dry weather) as well as minimum volumes necessary to fulfill Phase I TIE testing if necessary. As detailed in the previous section, the sublethal endpoints will be assessed using EPA's TST procedure to determine if there is a statistically significant 50% difference between sample controls and the test waters and ultimately determine if further testing should be is necessary.

Table 8-1. Toxicity Test Volume Requirements for Aquatic Toxicity Testing as part of the Lower San Gabriel River Coordinated Integrated Monitoring Program.

Test Organism	Toxicity Test Type	Test Concentration	Volume Required for Initial Screen (L)	Minimum Volume Required for TIE (L)[1]
Freshwater Tests for Samples with Salinity < 1.0 ppt				
Daphnid Water Flea *(Ceriodaphnia dubia*)	48-Hour Acute Survival 7-day Chronic Survival and Reproduction	100% only	1.5	10
Sample Receipt Water Quality	--	--	1.0	--
Total volume required per event for samples with salinity < 1.0 ppt;			2.5	a

[1] Minimum volumes for TIE are for Phase 1 characterization testing only. The additional volume collected for potential TIE testing can be held in refrigeration (4°C in the dark, no head space) and shipped to the laboratory at a later date if needed.

Note: The NPDES permit targets a 36-hr holding time for initiation of testing but allows a maximum holding time of 72-hr if necessary.

8.1 Receiving Water TMDL Monitoring

The following sections provide a summary of TMDLs applicable to the LSGR, any interim or final Waste Load Allocations applicable to each TMDL, and monitoring requirements required to evaluate compliance with the two TMDLs that impact the LSGR WG. These include the San Gabriel River Metals TMDL and the Harbor Toxics TMDL.

8.1.1 Total Maximum Daily Loads for Metals and Selenium: San Gabriel River and Impaired Tributaries (Metals TMDL). Attachment A to Resolution No. R13-004

The Basin Plan Amendment for the San Gabriel River and Los Cerritos Channel Metals TMDLs established schedules for meeting established water quality goals in these watersheds. In addition, intermediate goals were established to demonstrate progress towards meeting the goals. Overall, monitoring is intended to achieve the following three objectives:

- Determine attainment of numeric targets;
- Determine compliance with the waste load and load allocations;
- Monitor the effect of implementation actions on water quality.

Monitoring was intended to be conducted in both the receiving waters and at outfalls. Use of existing Mass Emission sites was suggested for effective coordination with existing MS4 NPDES monitoring requirements and monitoring of stormwater outfalls was suggested as the most effective way to directly assess attainment of WLAs. NPDES monitoring support of the Los Angeles County MS4 permit and the five WTPs operated by the Los Angeles County Sanitation District (LACSD) have resulted in the majority of receiving water quality data in the San Gabriel River watershed. This monitoring has shown that most water quality exceedances occur during wet weather. Dry weather waste load allocations (WLAs) are limited to copper in Coyote Creek. WLAs were assigned to the San Gabriel River Reach 1 due to the Estuary. San Jose Creek Reach 1 was listed for selenium but that listing is considered to be in error due to an inadequate number of samples. Selenium is has also been identified as originating naturally from old marine sediments.

During wet weather, numeric targets have been established for three metals: lead, copper and zinc. Lead is the only metal with allocations established for both San Gabriel River Reach 2 and Coyote Creek (Table 8-3 and Table 8-4).

Table 8-2. Dry Weather Copper and Selenium Waste Load Allocations for San Jose Creek Reach 1, San Gabriel River Reach 1 and Coyote Creek.

	San Jose Creek Reach 1	San Gabriel River Reach 1	Coyote Creek
Copper	-	18 µg/l	0.941 kg/day
Selenium	5 µg/l	-	-

Table 8-3. Numeric Target (Total Recoverable) and Waste Load Allocations for San Gabriel River.

Condition	Total Lead –Total Allocations		Total Lead –MS4 WLAs[2]	
Wet Weather	166 µg/L*6.8x10^8 liters(1)	106.2 kg/day	0.49*166 µg/L*6.8x10^8 liters(2)	51.8 kg/day

1. The numeric target for total recoverable lead in San Gabriel River Reach 2 is 166 µg/L. TMDL limits are based upon daily storm volume. The total allocation is based upon a flow of 260 cfs (6.8x10^8 liters/day).
2. The MS4 system comprises 49% of the total watershed therefore 49% of the load is allocated to the MS4.

Table 8-4. Numeric Target (Total Recoverable) and Waste Load Allocations for Coyote Creek.

Condition	Total Copper[1]		Total Lead		Total Zinc	
Wet Weather[3]	27 µg/L	9.41 kg/day	106 µg/L	36.9 kg/day	158 µg/L	55.0 kg/day

1 Copper, lead, and zinc numeric targets (µg/L, total) are hardness dependent and were calculated based on a mean Total Hardness of 105 µg/L.

2 For dry weather allocation, EPA used median urban runoff of 19 cfs, as measured at LACDPW Station F354-R.

3 For wet weather, a flow rate of 156 cfs (3.8 x 10^8 liters/day) was applied. For mass-based allocations, the load was determined by the daily storm volume and the percentage of the watershed represented by the MS4 (91.5% of the Coyote Creek watershed).

All receiving water sites, ME, LTA, and TMDL will monitor for the Metals TMDL according to Table 5-1 and Table 5-2. These sites will be used to determine if RWLs are being met.

Additional monitoring has been initiated at NFC1 in Northern Coyote Creek to provide a better measure of sources of metals from the portion of the watershed located within Los Angeles County and the Lower San Gabriel River Watershed.

8.1.2 Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL (Harbor Toxics TMDL) Attachment A to Resolution No. R11-008

Basin Plan Amendment (Resolution No. R11-008) indicates that responsible parties identified in the existing metals TMDLs for San Gabriel River Watershed are responsible for conducting water and sediment monitoring at the mouth of the San Gabriel River Estuary to determine the Rivers' contribution to the impairments in the Greater Harbor waters.

- **Water Column Monitoring**

The Basin Plan Amendment indicates that water samples and total suspended solids samples are to be collected from at least one site during two wet weather events and one dry weather event each year. The first large storm event of the season is to be included as one of the wet weather monitoring events. Water samples and total suspended solid samples are to be analyzed for metals, DDT, PCBs, and PAHs. Sampling is intended to collect sufficient volumes of water to allow for filtration of suspended solids for analysis of the listed pollutants in the bulk sediment. General water chemistry (temperature, dissolved oxygen, pH, and electrical conductivity) and a flow measurement is also be required at each sampling event. General chemistry measurements may be taken in the laboratory immediately following sample collection if auto samplers are used for sample collection or if weather conditions are unsuitable for field measurements.

Quantification of loads from the San Gabriel River Watershed during wet weather requires sampling at two LTA monitoring sites, S13 and GR1 (Table 9-1). Sampling at both sites allows for quantitative assessment of flow, pollutant concentrations, and loads necessary to address the Harbor Toxics objectives. During dry weather, concentrations of these constituents will be measured at the mouth of the Estuary at R8 consistent with the TMDL requirements.

- **Sediment Monitoring**

The Basin Plan Amendment also requires collection of sediment samples from at least one site every two years for analysis of general sediment quality constituents and the full chemical suite as specified in SQO Part 1. Sediment monitoring will be performed at R8 using sampling and analytical methods specified in Appendix F. The sampling schedule will be coordinated with sampling conducted in the Harbor waters by the Harbor Toxics Regional Monitoring Program in order to provide complementary data.

8.1.2.1 Wet Weather Suspended Sediment Sampling Approach

A number of different approaches have been attempted to enable collection of stormwater samples based upon flow-weighted composites and then extract the suspended sediments for analysis. The various approaches have met with varied level of success and typically require extensive labor to extract the sediment for analysis. Regardless of the approach used, none are based upon standard methods.

We are recommending an alternative approach for assessing the loads of toxic contaminants being discharged to the Harbor environment. This approach will utilize High Resolution Mass Spectrometry (HRMS) to analyze for organochlorine pesticides (EPA1699), PCBs (EPA 1668) and PAHs (CARB429m). Test methods for these organic toxic compounds target the required analytes but also enable assessment of each compound included in the Part 1 Sediment Quality Objectives (SQOs). These compounds include chlordane which is 303(d) listed in both the Los Angeles River Estuary sediments and in San Pedro Bay sediments.

During the first three years of Harbor Toxics monitoring, analyses will be conducted on whole water samples. These test methods provide detection limits that are roughly 100 times more sensitive than conventional low resolution tests. In addition, these extremely low detection limits can be achieved with as little as 3-6 liters of stormwater from each monitoring location.

Use of this approach is expected to greatly enhance the ability to consistently obtain appropriate samples for measuring and comparing loads of toxic pollutants associated with each major stormwater discharge. This will assure that all key toxics can be quantified at levels suitable for estimation of mass loads to the Harbor waters. For purposes of load calculations, it would be assumed that 100% of these toxics were associated with suspended solids. Separate analyses of TSS/SSC would be used to normalize the data. After three years (six storm events) the data will be reevaluated to assess whether a modified or alternative approach is required.

Similar approaches have been used by the San Francisco Estuary Institute (SFEI) staff (Gilbreath, Pearce and McKee, 2012) to measure the performance of a rain garden. Autosamplers were used to collect stormwater influent and treated effluent to assess removal efficiency for pesticides, PCBs, mercury, and copper subject to TMDLs. HRMS was used to quantify PCB removal. HRMS methods are also being used in Virginia to assist in identification of sources of PCBs in MS4 and industrial stormwater discharges (Gilinsky, 2009).

8.1.2.2 Sampling and Analytical Procedures-Wet Weather

Stormwater samples for the Harbor Toxics Monitoring Program will be collected using automated stormwater sampling methods and equipment cleaning protocol specified in Appendices A and B. A separate autosampler and intake hose will be installed at each site. Existing flow metering equipment at each site will be used to pace the sampler to obtain a flow-weighted composite sample.

Based on TSS measurements at four mass emission sites in LA County (Table 8-6), use of a TSS concentration of 100 mg/L is expected to provide a conservative basis for estimating reporting limits for OC pesticides, PCBs, and PAHs in suspended sediments based upon 2-liter samples. However, an additional liter of stormwater will be provided for each organic analytical suite for a total of nine liters. An accurate measure of suspended sediments is critical to this sampling approach. TSS will be analyzed; however, SSC will be used as the standard for calculating the concentrations of target constituents in suspended sediments and total contaminant loads associated with those sediments. Each of the measures of suspended solids will require 1-liter samples. Any additional water (up to another six liters) will be provided to the laboratory in 2.5-L amber glass bottles.

This approach requires a maximum of 17 liters of stormwater for analysis of organic constituents and sediment tests required for the Harbor Toxics TMDL. Analyses could be performed on a minimum of eight liters of water but field duplicates would need to be provided from another site. The following configuration of sample containers and sample volumes will provide the laboratory with the maximum degree of flexibility to assure that detection limits are met and suitable water volumes are available to complete analysis of field duplicates for each analytical suite.

- Six 2.5-L amber glass containers (filled to two liters)
- Three 1-L amber glass containers
- Two 1-L HDPE containers for suspended sediment

Since detection limits will depend upon the concentration of suspended sediment in the sample, the laboratory analyzing the suspended sediment concentrations will be asked to provide a rush analysis to provide information that can be used to direct processing of the samples for the organic compounds. Processing of sample waters provided to the laboratory will depend upon the results of the SSC analysis.

- If Suspended Sediment Concentrations (SSC) are less than 150 mg/L, an additional liter of water will be extracted for each subsequent HRMS analysis. If TSS concentrations are between 150 and 200 mg/L, one of the additional liter samples may be used to increase the volume of sample water for just PAHs or the two additional liters may be used as a field duplicate for one of the analyses.

- If SSC concentrations are greater than 200 mg/L, two of the three additional liters may be used as a field duplicate for one analysis. If available, the additional water provided in 2.5 L containers will also be considered for use as field replicates.

- Attainment of PAH target detection limits will be the most impacted by insufficient sediment content in the samples. If the initial SSC sample indicates that sediment content is less than 50 mg/L, additional measures will be taken to improve PAH reporting limits with respect to suspended sediment loads. This would include use of extra sample water to bring up the total sample volume (up to a maximum of 4 liters) or reduction the final extract volume.

- Given adequate sample volumes and normal levels of suspended sediment, a field duplicate will be analyzed for each analysis. Field duplicates for the three HRMS analyses may come from different monitoring sites in the Los Angeles and San Gabriel River watersheds depending on available volumes. Parties conducting the testing at each site will coordinate testing to enhance the opportunity to incorporate at least one field duplicate sample for each test.

Target reporting limits (Table 8-8 and Table 8-9) were established based upon bed sediment reporting limits listed in the *Coordinated Compliance and Reporting Plan for the Greater Los Angeles and Long Beach Harbor Waters* (Anchor QEA, 2013).

Table 8-8 and Table 8-9 provide a summary of the detection limits attainable in water samples using HRMS analytical methods. Estimated detection limits are provided for concentrations of the target constituents in suspended sediments given the assumption that 2-liter sample volumes will be used for each test, suspended sediment content is 100 mg/L and that 100 percent of the target constituents are associated with the suspended sediment. This provides a conservative assumption with respect to evaluating the potential impacts of concentrations of OC pesticides, PCBs, and PAHs in suspended sediment on concentrations in bed sediment. Additionally, Table 8-8 and Table 8-9 present relevant TMDL targets and reporting limits suggested in the SWAMP QAPP (SWRCB, 2008) and the SQO Technical Support Manual (SCCWRP, 2009). The following is a comparison between the estimated detection limits for OC pesticides, PCBs, and PAHs in the suspended sediments. The approach used to assess concentrations of trace metals in suspended sediments is based upon use of the routine monitoring information. Table 8-10 examines the possible limitations of this approach if trace metal concentrations are extremely low, approaching detection limits.

For OC pesticides

- Table 8-8, estimated detection limits in the suspended sediment are comparable or lower than Harbor Toxics TMDL target limits for bed sediments.

For PCBs

- Table 8-8, estimated detection limits in the suspended sediment are below TMDL target limits for bed sediments. Additionally, estimated detection limits in the suspended sediment are at or below target bed sediment reporting limits for the Harbor Toxics sediment monitoring program and below target reporting limits presented in the SWAMP QAPP (SWRCB, 2008) and the SQO Technical Support Manual (SCCWRP, 2009).

- Table 8-8, estimated detection limits in the suspended sediment are below TMDL targets limits for bed sediments. Additionally, estimated detection limits in the suspended sediment are at or below target bed sediment reporting limits for the Harbor Toxics sediment monitoring program and below target reporting limits presented in the SWAMP QAPP (SWRCB, 2008) and the SQO Technical Support Manual (SCCWRP, 2009).

- Most PAH compounds (Table 8-9), are expected to be detectable in the suspended sediment at concentrations similar to target bed sediment reporting limits for the Harbor Toxics monitoring program, target reporting limits presented in the SWAMP QAPP (SWRCB, 2008), and maximum reporting limits cited in the SQO technical Support Manual (SCCWRP, 2009). Only two compounds, naphthalene and phenanthrene, are expected to have detection limits roughly three times the target bed sediment reporting limits for the Harbor Toxics TMDL. Both of these analytes are light weight PAHs that are not considered to be major analytes of concern in stormwater.

- Table 8-10 summarizes the reporting limits applicable to total recoverable metals. Estimated equivalent concentrations in suspended solids are very conservatively estimated based upon 100 percent of the metals being associated with suspended particulates as measured values approach project detection limits. In reality, this is not a likely condition. When concentrations of total recoverable metals approach the very low detection limits used in this program, sediment loads will also be extremely low and the concentrations of metals in the dissolved phase will become a more significant fraction of the total metals concentrations. If concentrations of total cadmium and mercury are extremely low, comparison with TMDL targets in bed sediments could be limited.

Initial monitoring results will be compared against interim sediment Waste Load Allocations (WLAs) established for the respective receiving waters (Table 8-11). For the Los Angeles River, interim WLAs for the Los Angeles River Estuary would apply and for the San Gabriel River watershed, interim allocations for the Nearshore Waters of San Pedro Bay will apply.

8.1.2.3 Water Sampling and Analytical Procedures-Dry Weather

Suspended sediment concentrations during periods of dry weather are extremely low and not suitable for use of methods intended to quantify the concentrations of toxics associated with particulates. Dry weather samples will be collected as grab samples using methods consistent with the procedures specified in the Harbor Toxics Monitoring and Reporting Plan (Anchor, QEA 2013).

Dry weather sampling will be scheduled to be conducted during a time period when flows are historically at the minimum levels.

Water samples will be collected by Los Angeles County Sanitation District (LACSD) personnel and submitted for the following parameters:

- Total Suspended Solids (TSS) and Suspended Sediment Concentrations (SSC)
- Dissolved and total metals
- Organochlorine pesticides (including DDT and its derivatives, chlordane compounds, dieldrin, and toxaphene)
- Polychlorinated biphenyl (PCB) congeners

Analytical methods for each of these constituents will be consistent with methods listed in Section 5 for Table E-2 constituents and methods specified in Appendix F. Appendix F specifies analytical methods and detection limits for analyses of both water and sediment. In addition, data quality objectives are specified for all analytical tests. Analytical methods will also be consistent with methods used in the Harbor waters with the exception of metals which require chelation/extraction methods in saline waters.

In situ measurements will include temperature, dissolved oxygen, pH and salinity. *In situ* measurements will be taken with a calibrated water quality sonde (Hach Quanta or equivalent).

8.1.2.4 Sediment Sampling and Analytical Procedures-Dry Weather

Compliance with the Harbor Toxics TMDL requires collection of sediments from the mouth of the San Gabriel River Estuary every two years for analysis of general sediment quality constituents and the full chemical suite as specified in Sediment Quality Objectives (SQO) Part 1. Sediment will be collected and analyzed for all constituents listed in Table 8-5 in order to calculate the chemical indices necessary for SQO calculations.

Table 8-5. Summary of Chemical Analyses Required for Calculation of Chemical Indices required for Phase I -Sediment Quality Objectives (SQOs).

Chemical Name	Chemical Group	Chemical Name	Chemical Group
Total Organic Carbon	General	Alpha Chlordane	Pesticide
Percent Fines	General	Gamma Chlordane	Pesticide
		Trans Nonachlor	Pesticide
Cadmium	Metal	Dieldrin	Pesticide
Copper	Metal	o,p’-DDE	Pesticide
Lead	Metal	o,p’-DDD	Pesticide
Mercury	Metal	o,p’-DDT	Pesticide
Zinc	Metal	p,p’-DDD	Pesticide
		p,p’-DDE	Pesticide
		p,p’-DDT	Pesticide
Acenaphthene	PAH	2,4'-Dichlorobiphenyl	PCB congener
Anthracene	PAH	2,2',5-Trichlorobiphenyl	PCB congener
Biphenyl	PAH	2,4,4'-Trichlorobiphenyl	PCB congener
Naphthalene	PAH	2,2',3,5'-Tetrachlorobiphenyl	PCB congener
2,6- dimethylnaphthalene			
Fluorene	PAH	2,3',4,4'-Tetrachlorobiphenyl	PCB congener
1-methylnaphthalene	PAH	2,2',4,5,5'-Pentachlorobiphenyl	PCB congener
2-methylnaphthalene	PAH	2,3,3',4,4'-Pentachlorobiphenyl	PCB congener
1-methylphenanthrene	PAH	2,3',4,4',5-Pentachlorobiphenyl	PCB congener
Phenanthrene	PAH	2,2',3,3',4,4'-Hexachlorobiphenyl	PCB congener
Benzo(a)anthracene	PAH	2,2',3,4,4',5'-Hexachlorobiphenyl	PCB congener
Benzo(a)pyrene	PAH	2,2',4,4',5,5'-Hexachlorobiphenyl	PCB congener
Benzo(e)pyrene	PAH	2,2',3,3',4,4',5-Heptachlorobiphenyl	PCB congener
Chrysene	PAH	2,2',3,4,4',5,5'-Heptachlorobiphenyl	PCB congener
Dibenz(a,h)anthracene	PAH	2,2',3,4',5,5',6-Heptachlorobiphenyl	PCB congener
Fluoranthene	PAH	2,2',3,3',4,4',5,6-Octachlorobiphenyl	PCB congener
Perylene	PAH	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	PCB congener
Pyrene	PAH	Decachlorobiphenyl	PCB congener

8.1.2.5 Quality Control Measures

Quality control measures for all HRMS analyses will include field equipment blanks to assess background contamination due to the field equipment and sample handling. One field equipment blank will be analyzed from one set of field equipment prior each monitoring event during the first year. Data will be evaluated at the end of the year to determine if field equipment blanks should be reduced to one per season. For the field blank, two liters of HPLC grade water provided by the laboratory will be pumped through the entire autosampler and intake hose for each analytical test (OC pesticides, PCBs and PAHs). The blank water will be pumped into precleaned sample containers and refrigerated until the stormwater sampling is completed. If the storm does not occur immediately after blanking, the equipment blank will be transmitted under Chain of Custody to the laboratory in order the meet the requirement for extraction of aqueous samples within 7 days of collection. Extracts will be held until stormwater samples are received unless storm does not develop within a period of 30 days after extraction (samples are required to be analyzed within 40 days of extraction). If a successful storm event is monitored immediately after the equipment blank is taken, the equipment blank and stormwater samples will be submitted to the laboratory together. Given adequate sample volumes, field duplicates will also be analyzed to assess variability associated with the sampling and subsampling processes.

Laboratory quality control measures will include analysis of method blanks, initial calibrations, analysis of Ongoing Precision and Recovery (OPR) samples and use of labeled compounds to assess recoveries and matrix interferences. Method blanks will be based upon processing of laboratory water volumes identical to those used for the field samples. Initial calibrations are run periodically but daily calibration checks are conducted to verify stability of the calibration. OPR tests will be conducted with each batch of samples. OPR samples are blanks spiked with labelled isotopes that are used to monitoring continued performance of the test. Labelled isotopes are added to each field sample and analyzed to measure recovery in the sample matrix. Estimated Detection Limits (EDLs) will be calculated for each analyte associated with each field sample. For each analyte 'x', the EDL is calculated by the following formula:

$$EDL_x = \frac{(Na)*(Qis)*(Rah)}{(Ais)*(RRF)*(wv)}$$

Where: Na = Analyte peak to peak noise height.

Qis = Concentration of internal standard.

Rah = Area of Height Ratio

Ais = Area of internal standard

RRF = initial calibration average relative response factor for the congener of interest.

wv = sample weight/volume.

2.5 = Minimum signal to noise ratio.

Quality control measures for water samples taken during dry weather periods will be consistent with all measures applied for sampling suspended sediment, trace metals, organochlorine pesticides and PCBs as part of the Receiving Water Monitoring Program.

8.1.2.6 Summary

In summary, target reporting limits for all but one of the organic compounds of interest are below or comparable to relevant TMDL targets and the overwhelming majority are below bed sediment reporting limits identified in the Harbor Toxics Monitoring Program (Anchor, 2013), the SWAMP QAPP (SWRCB, 2008), the SQO Technical Support Manual (SCCWRP, 2009) and available Effects Range Low (ERL) values used to assess direct effects on Harbor sediments. . In the case of metals, some limitations may exist for two elements, cadmium and mercury, in extreme conditions.

However, neither sediment in both eastern San Pedro Bay nor the Los Angeles River Estuary are cited as being impaired by these two metals.

The sampling approach is based upon collection and analysis of whole water samples to estimate concentrations of target pollutants associated with suspended sediments in flow-rated composite samples of stormwater. Use of this approach is expected to result in very low detection limits that will allow for quantification of total contaminant loads for each constituent of concern. It will also allow for reasonable estimates of the concentrations of target compounds in the suspended sediment and provide for direct comparisons with targets established in the receiving waters for bed sediments. This approach meets the overall objectives of the program while also enhancing the chances of successfully monitoring multiple storm events in the targeted watersheds and providing data necessary to evaluate relative loads from each watershed during multiple storms each year. The proposed methods are also expected to allow incorporation of quality control measures necessary to evaluate potential sources of contamination and evaluate variability associated with both field sampling and analytical processes.

Sampling of dry weather discharges from the Los Angeles River and at the mouth of the Lower San Gabriel River Estuary will be based upon surface grab samples. Samples will be analyzed for suspended sediment, trace metals, organochlorine pesticides and PCBs as part of the Receiving Water Monitoring Program.

Table 8-6. Measurements of Suspended Sediments for Calculation of Harbor Toxics Pollutant Loads.

SAMPLE MEDIUM	CONSTITUENT	METHOD	TARGET REPORTING LIMIT
Water	Total Suspended Solids (TSS)	SM 2540D	1.0 mg/L
	Suspended Sediment Concentration (SSC)	ASTMD 3977, Method B	1.0 mg/L

Table 8-7. Summary of TSS Measurements (mg/L) at Four Mass Emission Monitoring Sites in Los Angeles County.

Site	Site ID	2nd Quartile	Median	3rd Quartile
Los Angeles River - Wardlow	S10	65	143	291
Coyote Creek	S13	33	55	117
Ballona Creek	S01	NA	158	NA
Los Cerritos Channel	LCC1	96	155	260

NA = not available

Table 8-8. Recommended Methods, Estimated Detection Limits, Target Reporting Limits, and Relevant TMDL Targets for Organochlorine Pesticides and Total PCBs

Constituent and Analytical Method	**Water Detection Limit (1)**	**Equivalent Suspended Sediment Detection Limit (2)**	**Harbor Toxics Target Bed Sediment Reporting Limits**	**SWAMP QAPP (2008) Reporting Limit**	**SQO Technical Support Manual (2009) Reporting Limit**	**Harbors Toxics TMDL Sediment Target (Indirect Effects)**	**Harbors Toxics TMDL Sediment Target (Direct Effects)**
	pg/L	**ng/g – dry wt**					
Chlordane Compounds (EPA 1699)							
alpha-Chlordane	40	0.2	2	1	0.5	1.3 (Total Chlordane)	0.5 (Total Chlordane)
gamma-Chlordane	40	0.2	2	1	0.54		
Oxychlordane	40	0.2	1	1	NA		
trans-Nonachlor	40	0.2	2	1	4.6		
cis-Nonachlor	40	0.2	1	2	NA		
Other OC Pesticides (EPA 1699)							
2,4'-DDD	40	0.2	2	2	0.5	1.3 (Total DDT)	1.58 Total DDT)
2,4'-DDE	80	0.4	2	2	0.5		
2,4'-DDT	80	0.4	3	3	0.5		
4,4'-DDD	40	0.2	2	2	0.5		
4,4'-DDE	80	0.4	2	2	0.5		
4,4'-DDT	80	0.4	5	5	0.5		
Total DDT	80	0.4	---	---	0.5		
Total PCBs (EPA 1668)	5-20	0.025-0.1	0.2[3]	0.2	3.0	3.2	22.7

1. Water EDLs based upon 2 liters of water.

2. Suspended Sediment detection limits based upon estimate of 100 mg/L suspended solids.

3. Harbor Toxics high resolution analytical methods include a target of 0.2 ng/g for all congeners except PCB-189 which has a target of 10 ng/g.

Table 8-9. Recommended Methods, Estimated Detection Limits, Target Reporting Limits, and Relevant TMDL Targets for PAHs

Constituent	Water Detection Limit (1)	Equivalent Suspended Sediment Detection Limit (2)	Harbor Toxics Target Bed Sediment Reporting Limits	SWAMP QAPP (2008) Reporting Limit	SQO Technical Support Manual (2009)Reporting Limit	Harbors Toxics TMDL Sediment Target (Direct Effects)
	pg/L	**ng/g – dry wt**				
Low Molecular Weight PAHs						
1-Methylnaphthalene	5	25	20	20	20	
1-Methylphenanthrene	5	25	20	20	20	
2-Methylnaphthalene	5	25	20	20	20	201
2,6-Dimethylnaphthalene	5	25	20	20	20	
Acenaphthene	5	25	20	20	20	
Anthracene	5	25	20	20	20	
Biphenyl	5	25	20	20	20	
Fluorene	5	25	20	20	20	
Phenanthrene	12.5	62.5	20	20	20	240
Naphthalene	12.5	62.5	20	20	20	
				LOW MOLECULAR WT PAHS		**552**
High Molecular Weight PAHs						
Benzo(a)anthracene	5	25	20	20	80	261
Benzo(a)pyrene	5	25	20	20	80	430
Benzo(e)pyrene	5	25	20	20	NA	
Chrysene	5	25	20	20	80	384
Dibenz(a,h)anthracene	5	25	20	20	80	260
Fluoranthene	5	25	20	20	80	
Perylene	5	25	20	20	80	
Pyrene	5	25	20	20	80	665
				HIGH MOLECULAR WT PAHS		**1700**
				TOTAL PAHs		**4700**

1. Water EDLs based upon 2 liter of water and CARB 429m. Detection limits are based upon a final extract of 500 µL. If the SSC is low, either an additional liter of water can be extracted to decrease the detection limit by 1/3 or the final extract volume can be reduced. Depending on sample characteristics, the extract volume can be reduced to as little as 50-100 µL which would drop EDLs by a factor of 0.1 to 0.2 times the listed EDLs.

2. Suspended Sediment detection limits based upon estimate of 100 mg/L suspended solids.

Table 8-10. Recommended Methods, Estimated Detection Limits, Target Reporting Limits, and Relevant TMDL Targets for Metals.

Constituent and Analytical Method	Water Detection Limit (ML)	Equivalent Suspended Sediment Detection Limit (1)	Harbor Toxics Target Bed Sediment Reporting Limits	SWAMP QAPP (2008) Reporting Limit	SQO Technical Support Manual (2009) Reporting Limit	Harbors Toxics TMDL Sediment Target (Direct Effects)
	ug/L	µg/g – dry wt				
Total Metals						
Cadmium	0.25	2.5	0.01	0.01	0.09	1.2
Copper	0.50	5.0	0.01	0.01	52.8	34
Lead	0.50	5.0	0.01	0.01	25.0	46.7
Mercury	0.20	2.0	0.03	0.03	0.09	0.15
Zinc	1	10	0.1	0.1	60	150

1. Suspended Sediment EDLs based upon estimate of 100 mg/L suspended solids.

Table 8-11. Interim Concentration-Based Sediment Waste Load Allocations

Waterbody	Pollutant (µg/g – dry wt)					
	Copper	Lead	Zinc	DDT	PAHs	PCBs
Los Angeles River Estuary	53.0	**46.7**	183.5	0.254	4.36	0.683
San Pedro Bay Near/Off Shore Zones	76.9	66.6	263.1	0.057	**4.022**	0.193

BOLDED values indicate cases where the interim allocations are equal to the final allocations

9 Stormwater Outfall Monitoring

Three outfall monitoring sites (Figure 9-1) have been assessed for potential monitoring. The first two sites, CC2 and SG1, are scheduled for installation and monitoring in year 2 of the monitoring program, 2016-17. Monitoring at the third site, BC1, in Diamond Bar will be sampled starting in year 3 of the program (2017-18). Complete stormwater monitoring stations (Appendix A) will be installed at both CC2 and SG1 to provide for automated collection of flow-weighted composite stormwater samples. These sites will also have rain gauges to augment rainfall information for the LSGR Watershed. Sampling at BC1 will be accomplished either by taking manual grab samples or by use of a portable autosampler configured to collect time-weighted composite samples. This location will be further evaluated during the first year of the program to determine the suitability of this site for the temporary installation of a small security enclosure for monitoring equipment.

These sites were selected to provide good spatial representation of the watershed in terms of HUC12 boundaries, jurisdictional boundaries and land uses within the LSGR WG. An assessment of the factors relative to site selection was addressed in Section 3.2. The schedule for installation and monitoring of each stormwater outfall is summarized in Table 4-1.

Constituents monitored at each stormwater outfall monitoring site are outlined in Table 9-1 and include water body/pollutant priorities under Categories 1, 2 and 3. These include all constituents with established TMDLs, that are 303(d) listed or that have been found to exceed receiving water limitations on at least one occasion. Constituents monitored at each stormwater outfall monitoring site in Coyote Creek will also include any Table E-2 analytes detected at S13. Similarly, Table E-2 constituents exceeding water quality criteria at GR1 will be incorporated into sampling requirements for SG1, the stormwater outfall sites in the San Gabriel River Reach 1. Aquatic Toxicity will be addressed in accordance with the process outlined in Section 7. Any constituents identified detected at levels of concern from Table E-2 will be considered for addition to monitoring requirements for the stormwater outfall sites in the following year after being detected twice during storm events monitored at S13 and GR1. Constituents exceeding RWLs in San Jose Creek Reach 1, which is a TMDL monitoring site that will be monitored by the USGR EWMP Group, will also be incorporated into stormwater outfall monitoring at BC1.

Justification for adding and deleting constituents from the stormwater outfall monitoring program will follow the process established in a Coordinated Monitoring Program (CMP) for a monitoring program in the adjacent Los Angeles River Watershed (Los Angeles River Metals CMP, March 2008). Any Table E-2 constituents incorporated into ongoing monitoring program at the receiving water monitoring site will be added to the upstream stormwater outfall monitoring requirements in the following year after two consecutive exceedances of wet weather receiving water quality limitations. Similarly, it is not intended that constituents continue to be monitored at stormwater outfall sites if they are not detected on a regular basis. Constituents will be removed from the list if they are not detected at levels of concern for two consecutive stormwater monitoring events.

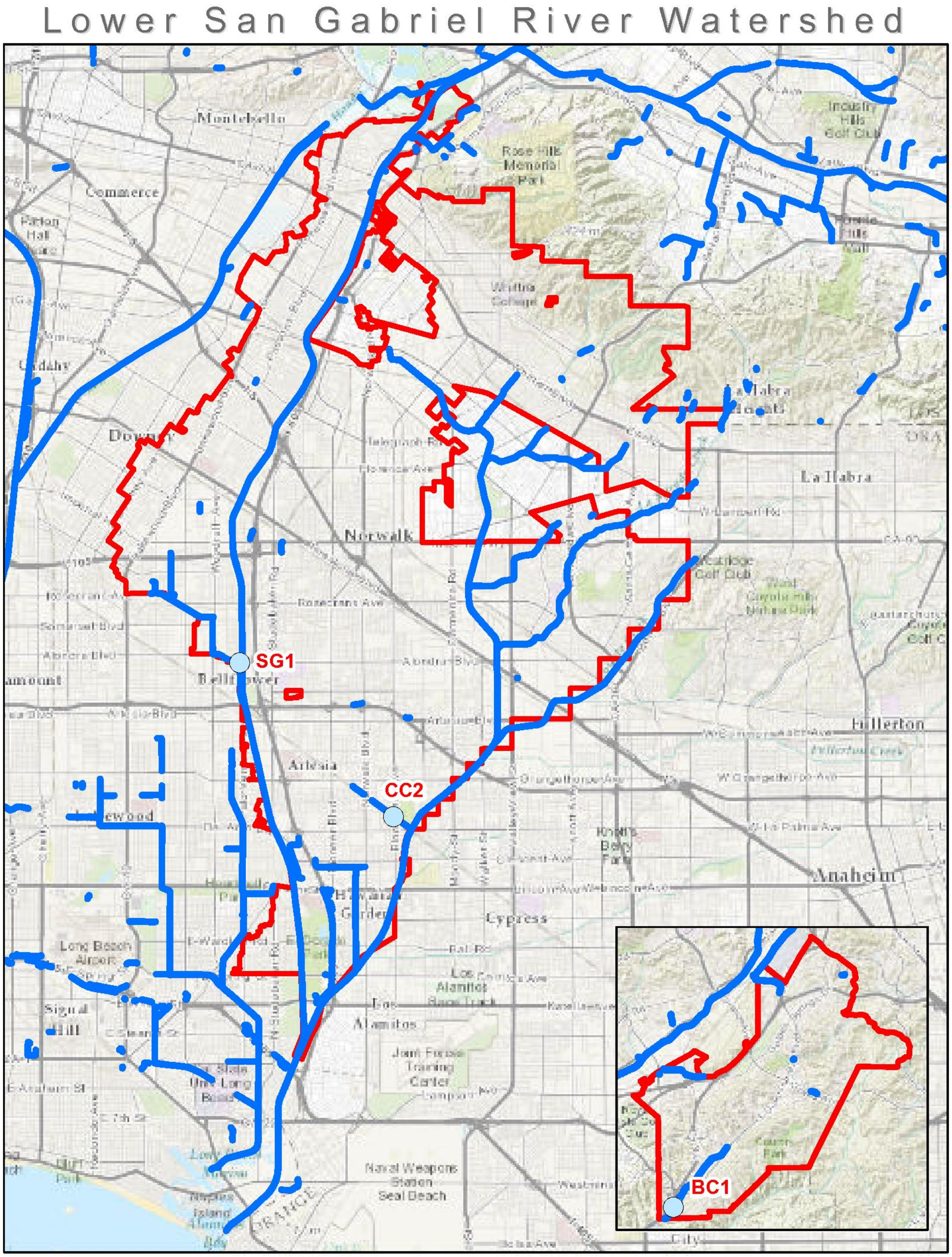

Figure 9-1. Locations of the Three Stormwater Outfall Monitoring Sites in the LSGR WG.

The sampling frequency and mobilization requirements for Stormwater Outfall Monitoring sites will be consistent with monitoring conducted at the S13 (Coyote Creek), GR1 (San Gabriel River Reach 1), and NFC1 (N. Fork Coyote Creek) Receiving Water Monitoring Sites during the wet season. A total of four events will be monitored at each outfall site once they are installed. Monitoring will be concurrent with receiving water monitoring in order to allow for comparison of pollutant loading rates associated with each segment relative to ultimate pollutant loads measured at the ME and LTA sites.

Stormwater monitoring at the stormwater outfall monitoring sites, GR1 (San Gabriel River Reach 1), and NFC1 (N. Fork Coyote Creek) will be conducted by LSGR staff while monitoring at S13 will be coordinated with LACFCD staff.

Monitoring at the outfalls will therefore be restricted to the same wet weather definitions as used for the S13, GR1, and NFC1 stations. These include:

- Wet Season defined as October 1 through April 15.
- Events preceded by less than 0.1 inches of rainfall within the watershed over a three day period.
- Rainfall of at least 0.25 inches.
- San Gabriel River - Maximum flow rates greater than 260 cfs measured at the USGS gauging station 11085000.
- Coyote Creek - Maximum daily flow rates of 156 cfs at the LACFCD flow gauging station F354-R.

Due to the size of the watershed, it is possible that conditions for wet weather flow monitoring could be met in just one of the two targeted segments of the LSGR WG.

Table 9-1. Summary of Water Quality Constituents to be Monitored at Stormwater Outfall Monitoring Sites.

CLASS OF MEASUREMENTS	STORMWATER OUTFALLS (Wet Weather Only)		
	San Gabriel River	**Coyote Creek**	**San Jose Creek**
	SG1	**CC2**	**BC1**
Flow	4	4	4
Field Measurements DO, pH, Temp, and Spec. Cond.	4	4	4
Conventionals[2] (Table 5-3) All <u>except</u> total phenols, turbidity, BOD$_5$, MTBE, and perchlorate, and fluoride.	4	4	4
Microbiological Constituents (Table 5-4)			
E. coli	3	3	3
Nutrients (Table 5-5)			
Ammonia	3	3	3
Metals[2] (Table 5-7)			Note 1
Cadmium			4
Copper	4	4	4
Lead	4	4	4
Total Mercury		4	
Total Selenium	4	4	4
Zinc	4	4	4
OP Pesticides (Table 5-8)			
Diazinon	3	3	3

1. Cadmium, copper and zinc will be monitored at BC1 based upon monitoring required in San Jose Creek Reach 1, which is a TMDL site that will be monitored by the USGR EWMP Group

2. The fourth storm event is only for the purpose of fulfilling the TMDL requirements. Only metals, TSS, SSC, and hardness will be analyzed.

10 Non-Stormwater (NSW) Outfall Monitoring

Ultimately, the NSW program is intended to establish a process for identifying outfalls that serve as potential sources of contaminants. Sites where initial screening indicates the potential for discharges of a magnitude considered to have the potential to cause or contribute to exceedances of receiving water limitations will require further efforts to classify the discharges and determine appropriate actions, if any.

Detailed objectives of the screening and monitoring process (Section IX.A, page E-23 of the MRP) include the following:

1. Develop criteria or other means to ensure that all outfalls with significant non-stormwater discharges are identified and assessed during the term of this Order.
2. For outfalls determined to have significant non-stormwater flow, determine whether flows are the result of illicit connections/illicit discharges (IC/IDs), authorized or conditionally exempt non-stormwater flows, natural flows, or from unknown sources.
3. Refer information related to identified IC/IDs to the IC/ID Elimination Program (Part VI.D.10 of the Order) for appropriate action.
4. Based on existing screening or monitoring data or other institutional knowledge, assess the impact of non-stormwater discharges (other than identified IC/IDs) on the receiving water.
5. Prioritize monitoring of outfalls considering the potential threat to the receiving water and applicable TMDL compliance schedules.
6. Conduct monitoring or other investigations to identify the source of pollutants in non-stormwater discharges.
7. Use results of the screening process to evaluate the conditionally exempt non-stormwater discharges identified in Parts III.A.2 and III.A.3 of the Order and take appropriate actions pursuant to Part III.A.4.d of the Order for those discharges that have been found to be a source of pollutants. Any future reclassification will occur per the conditions in Parts III.A.2 or III.A.6 of the Order.
8. Conduct monitoring or assess existing monitoring data to determine the impact of non-stormwater discharges on the receiving water.
9. Maximize the use of Permittee resources by integrating the screening and monitoring process into existing or planned CIMP efforts.

In cases where flow is determined to be significant, the program will take further action to determine if the flows are illicit, exempt, conditionally exempt essential, conditionally exempt non-essential, or if the source(s) of the discharge cannot be identified (unknown). Illicit discharges require immediate action and, if they cannot be eliminated, monitoring will be implemented until such time that the illicit discharge can be eliminated. Discharges classified as conditionally exempt non-essential or unknown also require ongoing monitoring.

The following sections summarize the elements of the program and processes to ultimately eliminate major sources of non-stormwater discharges.

10.1 Non-Stormwater Outfall Screening and Monitoring Program

The NSW Outfall Screening and Monitoring Program will begin with three screening surveys starting in the summer of 2014 to identify outfalls or other discharges that are considered to be significant and persistent sources of non-stormwater flow to receiving waters.

The initial survey will focus on completing an inventory of all outfalls to receiving waters. Outfalls greater than 12-inches in diameter (or equivalent) will be photographed and documented. The second and third surveys will include outfalls between 12 to 36 inches in diameter (or equivalent) near areas with industrial land uses and outfalls greater than 36 inches in diameter (or equivalent).

Information from all three screening surveys will be consolidated to assist in the identification and ranking of outfalls considered to have significant NSW discharges. Multiple lines of evidence will be considered when assessing the significance of a discharge. The relative magnitude of the discharges, persistence of the flow, visual and physical characteristics recorded at each site, and land uses associated with the drainage will be primary consideration for determination of significant flows.

Upon determination of significant NSW discharges, source identification will be initiated. A combination of field observations, flow measurements and field water quality measurements will be used to classify outfalls into one of the following three categories that will determine further actions (Figure 10-1):

1. **Suspect Discharge** – Outfalls with persistent high flows during at least two out of three visits and with high severity on one or more physical indicators (odors, oil deposits, etc.). Outfalls in this category require prioritization and further investigation.

2. **Potential Discharge** - Flowing or non-flowing outfalls with presence of two or more physical indicators. Outfalls in this category are considered to be low priority but will be continue to be monitored periodically to determine if the sites are subject to less frequent, discharges or determine if actions can be taken to reduce or eliminate the factors that lead to the site being considered a potential source of contaminants.

3**. Unlikely Discharge** - Non-flowing outfalls with no physical indicators of an illicit discharge. Outfalls within this classification would be not be subject to any further screening.

Subsequent source investigations conducted for discharges with significant flow may utilize field water quality instrumentation and/or simple field test kits to assist in further classifying discharges. Collection of water samples for limited laboratory testing may be incorporated into the program as requirements for more complex, accurate and scientifically supportable data become necessary to characterize non-stormwater discharges and provide scientifically supportable data to track the source of these discharges. The Center for Watershed Protection and Pitt (2004) provide an evaluation of twelve analytes for assistance in determining the source of NSW discharges (Table 10-2). Three of the analytes can be measured with *in-situ* instrumentation. Others can be analyzed relatively inexpensively by use of field test kits or can be analyzed in an ELAP-certified laboratory. In addition, three to five of the listed tests are often considered sufficient to screen for illicit discharges. Ammonia, MBAS, fluoride (assuming tap water is fluorinated), and potassium are considered to confidently differentiate between sewage, wash water, tap water and industrial wastes. Incorporation of *in-situ* measurement of temperature, pH, TDS/salinity, turbidity and dissolved oxygen can further assist in characterizing and tracking the source(s) of an NSW discharge.

Table 10-1. Outline of the NSW Outfall Screening and Monitoring Program.

Element	Description	Timing of Completion
1. Outfall Screening	The Permittees will implement a screening process to determine which outfalls exhibit significant NSW discharges and those that do not require further investigation. Data will be recorded on Outfall Reconnaissance Investigation (ORI) forms and in the associated database.	Commence in Summer 2014 and complete by end of 2014
2. Identification of outfalls with significant NSW discharge (Part IX.C of the MRP)	Data from the Outfall Screening process will be used to categorize MS4 outfalls on the basis of discharge flow rates, field water quality and physical observations.	Concurrent with Outfall Screening December 15, 2014 with Annual CIMP Report
3. Inventory of Outfalls with NSW discharge (Part IX.D of the MRP)	Develop an inventory of all major MS4 outfalls, identify outfalls with known NSW discharges and identify outfalls with no flow requiring no further assessment.	Concurrent with Outfall Screening December 15, 2014 with Annual CIMP Report
4. Prioritized source investigation (Part IX.E of the MRP)	Use the data collected during the Outfall Screening process to further prioritize outfalls for source investigations.	Prioritization for Source Investigation will be occur after completion of Outfall Screening
5. Identify sources of significant NSW discharges (Part IX.F of the MRP)	For outfalls exhibiting significant NSW discharges, Permittees will perform source investigations per the established prioritization.	Complete source investigations for 25% of the outfalls with significant NSW discharges by December 28, 2015 and 100% by December 28, 2017.
6. Monitoring NSW discharges exceeding criteria (Part IX.G of the MRP)	Monitor outfalls determined to convey significant NSW discharges comprised of either unknown or conditionally exempt non-essential discharges or illicit discharges that cannot be abated.	Monitoring will commence within 90 days of completing the source investigations or after the Executive Officer approves this CIMP, whichever is later. Commencement of outfall monitoring may be adjusted to allow sampling to be coordinated with dry weather receiving water quality monitoring.

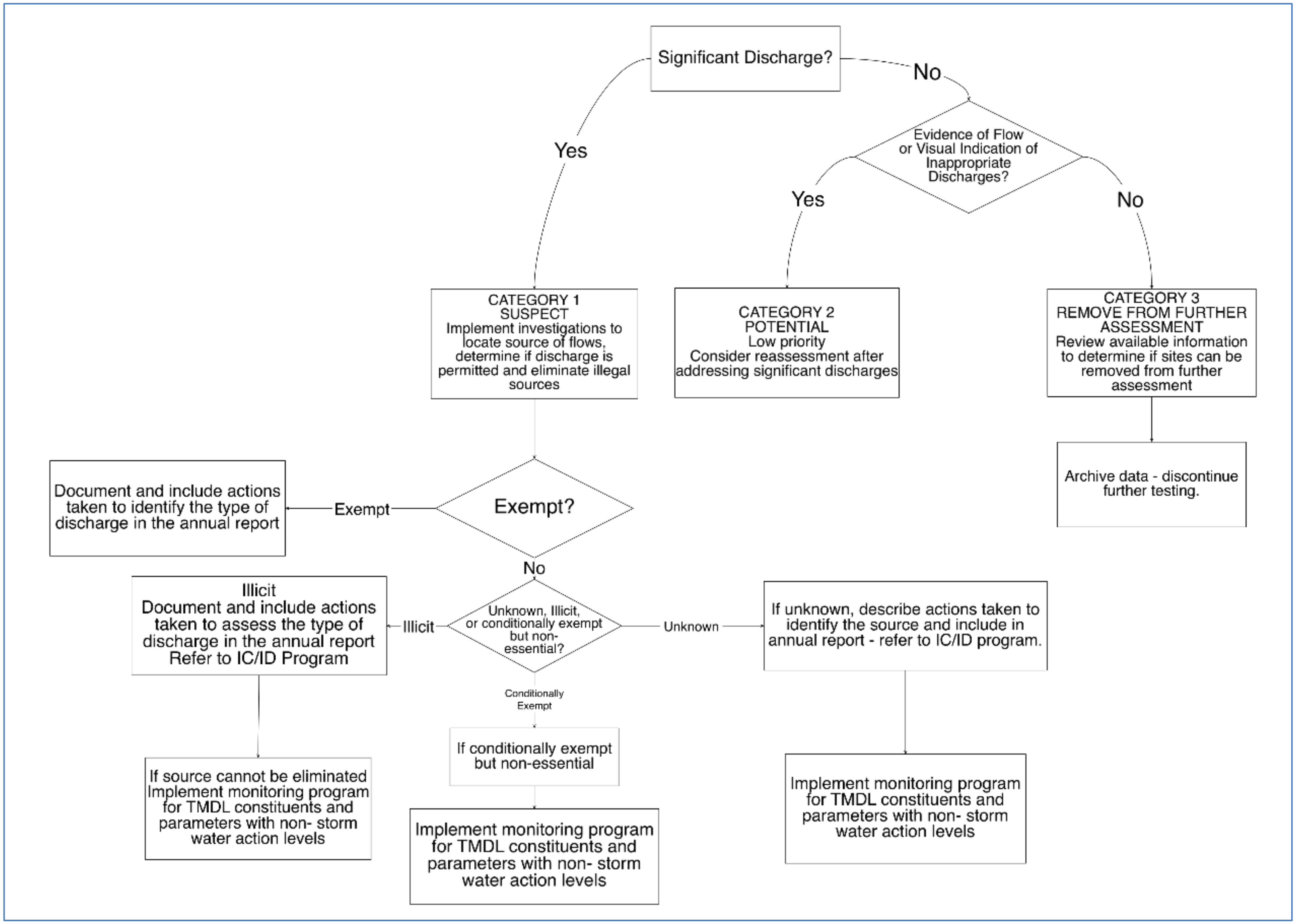

Figure 10-1. Flow Diagram of NSW Outfall Program after Classifying Outfalls during Initial Screening.

Table 10-2. Potential Indicator Parameters for Identification of Sources of NSW Discharges.

Indicator Parameters	
Ammonia	*E. coli*
Boron	Fluoride
Chlorine	Hardness
Color	pH - Field
Conductivity-Field	Potassium
Detergents – Surfactants (MBAS or fluorescence)	Turbidity

Based upon CWP and Pitt 2004. *Illicit Discharge Detection and Elimination A Guidance Manual for Program Development and Technical Assessments*

10.2 Identification of Outfalls with Significant Non-Stormwater Discharges

The screening program is necessary to collect information necessary to identify outfalls with potentially significant NSW discharges. The outfall screening includes collection of information necessary to provide an accurate inventory of the major outfalls, assess flow from each outfall and in the receiving waters, determine the general characteristics of the receiving waters (e.g. is flow present, does the flow from the outfall represent a large proportion of the flow, is it an earthen or lined channel), and record general observations indicative of possible illicit discharges. The initial screening survey(s) will also be used to refine the inventory information required in Section 10.3

The outfall screening process has already been initiated in order to meet the established schedule for completion of 25% of the source identification work. Once the screening process is completed Permittees are required to identify MS4 outfalls with "significant" NSW discharges. The MRP (Section IX.C.1) indicates that significant NSW discharges may be determined based upon one or more of the following characteristics:

a. Discharges from major outfalls subject to dry weather TMDLs.

b. Discharges for which existing monitoring data exceeds Non-Stormwater Action Levels (NALs) identified in Attachment G of the Order.

c. Non-stormwater discharges that have caused or have the potential to cause overtopping of downstream diversions.

d. Discharges exceeding a proposed threshold discharge rate as determined by the Permittee.

The relative magnitude of the discharges, persistence of the flow, visual and physical characteristics recorded at each site, and land uses associated with the drainage will be the primary factors used to determine if flows are significant. Characteristics of the receiving waters (flow, channel characteristics –hard or soft-bottom, etc.) at the discharge location will also be considered when determining the relative significance of NSW discharges. The most important consideration is whether the discharge has the potential to cause or contribute to exceedance of receiving water quality limitations. Factors that provide the best insight with respect to these impacts will receive the greatest weight when establishing the list of "significant" NSW discharges.

10.3 Inventory of MS4 Outfalls with Non-Stormwater Discharges

Part VII.A of the MRP requires that the CIMP plan(s) include a map(s) and/or database of the MS4 that includes the elements listed in Table 10-3. Most required elements are complete and being submitted with this CIMP. Elements requiring further development include the Effective Impervious Area, information on the length of open channels and underground pipes equal to or greater than 18 inches, and the drainage areas associated with each outfall. Subbasins used for the WMMS model are currently associated with each outfall within that subbasin. If an outfall is identified as a significant source of NSW discharges, drainage areas for each targeted outfall will be refined and updated in the database. Additional information such as documenting presence of significant NSW discharges, links to a database documenting water quality measurements at sites with significant NSW discharges will be updated annually and submitted with the CIMP annual report.

Table 10-3. Basic Database and Mapping Information for the Watershed.

Database Element	Status	
	Complete	Schedule
1. Surface water bodies within the Permittee(s) jurisdiction	X	
2. Sub-watershed (HUC 12) boundaries	X	
3. Land use overlay	X	
4. Effective Impervious Area (EIA) overlay (if available)		Will provide if available
5. Jurisdictional boundaries	X	
6. The location and length of all open channel and underground pipes 18 inches in diameter or greater (with the exception of catch basin connector pipes)	X[1]	
7. The location of all dry weather diversions	X	
8. The location of all major MS4 outfalls within the Permittee's jurisdictional boundary. Each major outfall shall be assigned an alphanumeric identifier, which must be noted on the map	X[2]	
9. Notation of outfalls with significant non-stormwater discharges (to be updated annually)	X	ongoing
10. Storm drain outfall catchment areas for each major outfall within the Permittee(s) jurisdiction	X[3]	ongoing
11. Each mapped MS4 outfall shall be linked to a database containing descriptive and monitoring data associated with the outfall. The data shall include:[4]		
a. Ownership		ongoing
b. Coordinates	X	
c. Physical description	X	
d. Photographs of the outfall, where possible to provide baseline information to track operation and maintenance needs over time	X	
e. Determination of whether the outfall conveys significant non-stormwater discharges		ongoing
f. Stormwater and non-stormwater monitoring data		ongoing

1. Locations are identified but the length of all open channel and underground pipes are not fully documented.
2. Attributes in the shapefile contain a Unique ID for all outfalls greater than 12" in diameter.
3. Catchments for each outfall are included as the area of the subbasins associated with each outfall. Several outfalls may drain these subbasins. Data will be developed as needed to resolve the drainage areas specific to each outfall.
4. Efforts are ongoing to define ownership and maintenance responsibility. As data become available, information regarding the conveyance of NSW and associated water quality data will be added to the database. Information will be updated based upon the three screening surveys. Mapping drainage areas and other information from section VII.A of the MRP is ongoing and will be addressed in the 2015-2016 sampling season.

As a component of the inventory and screening process, Permittees are required to document the physical attributes of MS4 outfalls determined to have significant non-stormwater discharges. Table 10-4 summarizes the minimum physical attributes required to be recorded and linked to the outfall database. These data will be maintained using the Outfall Reconnaissance Inventory (ORI) field form and associated database developed by CWP and Pitt (2004). Data entry can be accomplished by completing the ORI form while conducting the screening survey. Current forms are shown in the Appendix D but may be modified as the parameters and database are modified to provide different information more relevant to the NSW program.

Table 10-4. Minimum Physical Attributes Recorded during the Outfall Screening Process.

Database Element
a. Date and time of last visual observation or inspection
b. Outfall alpha-numeric identifier
c. Description of outfall structure including size (e.g., diameter and shape)
d. Description of receiving water at the point of discharge (e.g., natural, soft-bottom with armored sides, trapezoidal, concrete channel)
e. Latitude/longitude coordinates
f. Nearest street address
g. Parking, access, and safety considerations
h. Photographs of outfall condition
i. Photographs of significant non-stormwater discharge (or indicators of discharge) unless safety considerations preclude obtaining photographs
j. Estimation of discharge rate
k. All diversions either upstream or downstream of the outfall
l. Observations regarding discharge characteristics such as turbidity, odor, color, presence of debris, floatables, or characteristics that could aid in pollutant source identification
m. Observations regarding the receiving water such as flow, channel type, hard/soft bottom. (added minimum attribute.

10.4 Prioritized Source Identification

After completion of the initial reconnaissance survey and the two additional screening surveys, sites will be ranked based upon both initial flow observations from the reconnaissance inventory and the classifications assigned during each of the screening surveys. Source investigations will be scheduled to be conducted at sites categorized as Suspected Illicit discharges.

The MRP (IX.E.1) states that prioritization of source investigations should be based upon the following items in order of importance.

a. Outfalls discharging directly to receiving waters with WQBELs or receiving water limitations in the TMDL provisions for which final compliance deadlines have passed.

b. All major outfalls and other outfalls that discharge to a receiving water subject to a TMDL shall be prioritized according to TMDL compliance schedules.

c. Outfalls for which monitoring data exist and indicate recurring exceedances of one or more of the Action Levels identified in Attachment G of this Order.

d. All other major outfalls identified to have significant non-stormwater discharges.

Additional information from the screening process will be used to refine priorities. Sites with evidence of higher, more frequent flow, presence of odors or stains will be assigned higher priorities for source investigations.

10.5 Identify Source(s) of Significant Non-Stormwater Discharges

The screening and source identification component of the program is intended to identify the source or sources of contaminants contributing to an NSW discharge. The prioritized list of major outfalls with significant NSW discharges will be used to direct investigations starting with outfalls deemed to present the greatest risk to the receiving water body.

The Order requires the WMG to develop a source identification schedule based on the prioritized list of outfalls exhibiting significant NSW discharges. Source investigations will be conducted for no less than 25% of the outfalls in the inventory by December 2015 and 100% of the outfalls in the inventory by December 2017.

Part IX.A.2 of the MRP requires Permittees to classify the source investigation results into one of four endpoints: illicit connections/illicit discharges (IC/IDs), authorized or conditionally exempt non-stormwater flows, natural flows, or from unknown sources. If source investigations indicate the source is illicit or unknown, the Permittee will document actions to eliminate the discharge and implement monitoring if the discharge cannot be eliminated.

If the source of a discharge is found to be attributable to natural flows or authorized conditionally exempt NSW discharge, the Permittee must identify the basis for the determination (natural flows) and identify the NPDES permitted discharger. If the source is found to be a conditionally exempt but non-essential discharge, monitoring is required to determine whether the discharge should remain conditionally exempt or be prohibited.

Source investigations will be conducted using a variety of different approaches depending upon the initial screening results, land use within the area drained by the discharge point, and the availability of drainage maps. Any additional water quality sampling may be conducted as necessary.

- Tracking of dry weather flows from the location where they are first observed in an upstream direction along the conveyance system.

- Collection of additional water samples for analysis of NWS indicators for assistance in differentiating major categories of discharges such as tap water, groundwater, wash waters and industrial wastewaters.

- Compiling and reviewing available resources including past monitoring and investigation data, land use/MS4 maps, aerial photography, existing NPDES discharge permits and property ownership information.

If source tracking efforts indicate that the discharge originates from a jurisdiction upstream of the boundaries of the LSGR WG, the appropriate jurisdiction and the Regional Board will be notified in writing of the discharge within 30 days of the determination. All existing information regarding documentation and characterization of the data, contribution determination efforts, and efforts taken to identify its source will be included.

Investigations will be concluded if authorized, natural, or essential conditionally exempt flows are found to be the source of the discharge. If the discharge is determined to be due to non-essential conditionally exempt, illicit, or unknown discharges, further investigations will be considered to assess whether the discharge can be eliminated. Alternatively, if the discharges are either non-essential conditionally exempt or of an unknown source, additional investigations may be conducted to demonstrate that it is not causing or contributing to receiving water impairments.

10.6 Monitor Non-Stormwater Discharges Exceeding Criteria

As required in the MRP (Part II.3.3), outfalls with significant NSW discharges that remain unaddressed after source identification will be monitored. The objectives of the non-stormwater outfall based monitoring program include the following:

a. Determine whether a Permittee's discharge is in compliance with applicable NSW WQBELs derived from TMDL WLAs,

b. Determine whether a Permittee's discharge exceeds NSW action levels, as described in Attachment G of the Order,

c. Determine whether a Permittee's discharge contributes to or causes an exceedance of receiving water limitations

d. Assist a Permittee in identifying illicit discharges as described in Part VI.D.10 of the Order.

After completion of source investigations, outfalls found to convey NSW discharges that could not be abated and were identified as illicit, conditionally exempt but non-essential or unknown will be monitored. Monitoring will be initiated within 90 days of completing the source investigations or as soon as the first scheduled dry weather survey. Conducting NSW monitoring at the same time as receiving water dry weather monitoring will be more cost effective and allow evaluation of whether the NSW discharges are causing or contributing to any observed exceedances of water quality objectives in the receiving water.

Monitoring of NSW discharges is expected to undergo substantial changes from year to year as the result of ongoing actions taken to control or eliminate these discharges. As NSW discharges are addressed, monitoring of the discharges will no longer be required. In addition, if monitoring demonstrates that discharges do not exceed any WQBELs, non-stormwater action levels, or water quality standards for pollutants identified on the 303(d) list after the first year, monitoring of the pollutants meeting all receiving water limitations will be no longer be necessary. Due to potential frequent adjustments in the number and location of outfalls requiring monitoring and pollutants requiring monitoring, the annual CIMP report is expected to communicate adjustments in the number and locations of monitored discharges, pollutants being monitored and justifications for any adjustments.

10.7 Monitoring Parameters and Frequency

The MRP (Section IX.G.1) specifies the minimum parameters for monitoring of NSW discharges. Determination of monitoring parameters at each site requires consideration of a number of factors applicable to each site. Monitoring parameters will include:

- Flow,
- Pollutants assigned a WQBEL or receiving water limitation to implement TMDL Provisions for the respective receiving water, as identified in Attachments L - R of the Order,
- Other pollutants identified on the CWA section 303(d) List for the receiving water or downstream receiving waters,
- Pollutants identified in a TIE conducted in response to observed aquatic toxicity during dry weather at the nearest downstream receiving water monitoring station (S13 or GR1) during the last sample event or, where the TIE conducted on the receiving water sample was inconclusive, aquatic toxicity. If the discharge exhibits aquatic toxicity, then a TIE shall be conducted.
- Other parameters in Table E-2 identified as exceeding the lowest applicable water quality objective at LCC1 (the nearest downstream receiving water station) per Part VI.D.1.d.

The MRP (Part IX.G.2-4) specifies the following monitoring frequency for NSW outfall monitoring:

- For outfalls subject to a dry weather TMDL, the monitoring frequency shall be per the approved TMDL monitoring plan or as otherwise specified in the TMDL or as specified in an approved CIMP.

- For outfalls not subject to dry weather TMDLs, approximately quarterly for first year.

- Monitoring can be eliminated or reduced to twice per year, beginning in the second year of monitoring if pollutant concentrations measured during the first year do not exceed WQBELs, NALs or water quality standards for pollutants identified on the 303(d) List.

While a monitoring frequency of four times per year is specified in the Permit, it is inconsistent with the dry weather receiving water monitoring requirements. The receiving water monitoring requires two dry weather monitoring events per year. Additionally, during the term of the current Permit, outfalls are required to be screened at least once and those with significant NSW discharges will be subject to a source investigation. As a result, the LSGR WG recommends that NSW outfall monitoring events be conducted twice per year. The NSW outfall monitoring events will be coordinated with the dry weather receiving water monitoring events to provide better opportunities to determine if the NSW discharges are causing or contributing to any observed exceedances of water quality objectives in the receiving water.

Any monitoring required will be performed using grab samples (refer to Appendix A for field sampling procedures) rather than automated samplers. Bacteria, which are expected to be the limiting factor at many sites during dry weather, require collection by grab methods and delivery to the laboratory within 6 hours. Based upon the much reduced variability experienced in measurements of dry weather flows associated with ongoing monitoring programs, measured concentrations of other analytes are not expected to vary significantly over a 24-hour period.

11 New Development/Re-Development Effectiveness Tracking

Each permittee will maintain an electronic database to track qualifying new development and redevelopment projects which are subject to the Planning and Land Development Program of the Permit (Section VI.D.7.d.iv). The electronic database contains the information listed in Table 11-1, which includes details about the project and the design of onsite and offsite best management practices (BMPs). Table 11-1 also provides a description of the required information.

Table 11-1. Information Required in the New Development/Redevelopment Tracking Database.

	Required Information	Description
General Site Information	Project Name and Developer Name	Brief name of project and developer information (e.g. name, address, and phone number).
	Project Location and Map	Coordinates and map of the project location. The map should be linked to the GIS storm-drain map required in part VII.A of the Permit.
	Documentation of issuance of requirements to the developer	Date that the project developer was issued the Permit requirements for the project (e.g. conditions of approval).
	Date of Certificate of Occupancy	Date that the Certificate of Occupancy was issued.
On-site BMP Sizing Information	85th percentile storm event (inches per 24 hours)	85th percentile storm depth for the project location calculated using the *Analysis of 85th Percentile 24-hour Rainfall Depths Within the County of Los Angeles.*
	95th percentile storm event (inches per 24 hours)	95th percentile storm depth for the project location calculated using the *Analysis of 85th Percentile 24-hour Rainfall Depths Within the County of Los Angeles*. Only applies if the project drains directly to a natural drainage system[2] and is subject to hydromodification control measures.
	Project design storm (inches per 24 hours)	The design storm for each BMP as calculated using the *Analysis of 85th Percentile 24-hour Rainfall Depths Within the County of Los Angeles*.
	Projects design volume (gallons or MGD)	The design storm volume (design storm multiplied by tributary area and runoff coefficient) for each BMP.
	Percent of design storm volume to be retained on site	The percentage of the design volume which on-site BMPs will retain.
	Other design criteria required to meet hydromodification requirements for projects that directly drain to natural water bodies	Information relevant to determine if the project meets hydromodification requirements as described in the Permit e.g., peak flow and velocity in natural water body, peak flow from project area in mitigated and unmitigated condition, etc.). Only applies if the project drains directly to a natural drainage system.
	One -year, one-hour storm intensity as depicted on the most recently issued isohyetal map published by the Los Angeles County Hydrologist for flow-through BMPs	If flow-through BMPs (e.g., sand filters, media filters) for water quality are used at the project, provide the one-year, one-hour storm intensity at the project site from the most recent isohyetal map issued by LA County.
Off-site BMP Information	Location and maps of off-site mitigation, groundwater replenishment, or retrofit sites	If any off-site mitigation is used, provide locations and maps linked to the GIS storm-drain map required in part VII.A of the Permit.
	Design volume for water quality mitigation treatment BMPs	The calculated design volume, If water quality mitigation is required.
	Percent of design storm volume to be infiltrated at an off-site mitigation or groundwater replenishment project site	The percentage of the design volume which off-site mitigation or groundwater replenishment will retain.
	Percent of design storm volume to be retained or treated with biofiltration at an off-site retrofit project	The percentage of the design volume which off-site biofiltration will retain or treat.

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[2] A natural drainage system is defined as a drainage system that has not been improved (e.g., channelized or armored). The clearing or dredging of a natural drainage system does not cause the system to be classified as an improved drainage system.

12 Reporting

Reporting will normally consist of Annual CIMP Reports and semi-annual data reports. Discharge Assessment Plans will be only submitted if TIEs are found to produce inconsistent results during two consecutive tests. These include the following reports:

Annual CIMP Reports

Annual CIMP monitoring reports are required to be submitted to the Regional Water Board Executive Officer by December 15th of each year in the form of three compact disks (CD) The annual reporting process is intended to meet the following objectives.

Summary information allowing the Regional Board to assess:

a. Each Permittee's participation in one or more Watershed Management Programs.

b. The impact of each Permittee(s) stormwater and non-stormwater discharges on the receiving water.

c. Each Permittee's compliance with receiving water limitations, numeric water quality-based effluent limitations, and non-stormwater action levels.

d. The effectiveness of each Permittee(s) control measures in reducing discharges of pollutants from the MS4 to receiving waters.

e. Whether the quality of MS4 discharges and the health of receiving waters is improving, staying the same, or declining as a result watershed management program efforts, and/or TMDL implementation measures, or other Minimum Control Measures.

f. Whether changes in water quality can be attributed to pollutant controls imposed on new development, re-development, or retrofit projects.

Data Submittals

Analytical data reports are required to be submitted to the Regional Board on a semi-annual basis in accordance with the Southern California Municipal Storm Water Monitoring Coalition's Standardized Data Transfer Formats. These reports are required to be subject to verification and validation prior to submittal. They are to cover monitoring periods of July 1 through December 31 for the mid-year report and January 1- June 30 for the end of year report. These data reports should summarize:

- Exceedances of applicable WQBELs, receiving water limitations, or any available interim action levels or other aquatic toxicity thresholds.
- Basic information regarding sampling dates, locations, or other pertinent documentation.

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APPENDIX A

AUTOMATED STORMWATER MONITORING EQUIPMENT

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1 Automated Stormwater Monitoring Equipment

Monitoring of stormwater runoff at the Mass Emission (ME) sites and Stormwater Outfall Monitoring sites will require use of automated stormwater monitoring equipment. This section addressed equipment and sampling procedures that will be used for sites operated by the LSGR WG. Monitoring conducted at S13 by the Los Angeles County Flood Control District (LACFCD) will utilize similar procedures. Sampling conducted by the LACFCD will use equipment and procedures consistent with those used for monitoring over the past decade.

Sampling at mass emission monitoring sites for collection of stormwater samples will require collection of flow-weighted composite samples. Time-weighted will be considered for sampling at upstream, stormwater outfall monitoring sites. Similar equipment will be necessary regardless of the selected sampling approach. Time-weighted composite samples simply allow for more mobile installations that do not require flow meters, rain gauges, solar panels, or communication equipment. In lieu of communications equipment, such sites require added field personnel to monitor and track performance of the equipment along with added sensors to trigger the equipment to initiate the sampling.

For purposes of this CIMP, it is assumed that all sites requiring collection of flow-weighted composite samples will be established as "permanent" or "long-term" sites with appropriate security to protect the equipment and intake structures from debris coming down the stream or vandalism. As noted, collection of time-weighted samples will be utilize the same types of autosamplers and composite containers but will not include flow meters, rain gauges and telecommunication packages. Monitoring stations designed to take time-weighted composite samples will require sensors to detect initial flows and trigger the sampler. This will allow for use of smaller security enclosures that can temporally be secured at a site or, if necessary, equipment can be deployed in a manhole.

Fixed monitoring sites will utilize automated stormwater sampling stations that incorporate an autosampler (American Sigma or Isco), a datalogger/flow module to monitor flow and pace the autosampler, a rain gauge to monitor and record local rainfall, and telecommunications to allow for remote monitoring and control of each site. Sites without access to AC power will be powered by deep-cycle marine batteries. Sites without direct access to AC power will utilize solar panels to provide the energy needed to maintain the charge on two deep cycle batteries used to power the autosampler, flow meter and datalogger. Providing reliable telecommunications for real-time access to data and to provide command and control functionality has greatly improved efficiency and contributed to improved stormwater data.

Both types of automated stormwater monitoring systems considered for this monitoring program use peristaltic pumping systems. When appropriate measures are taken, it has been demonstrated that these types of systems are capable of collecting blanks that are uncontaminated and high quality, reproducible data using detection limits appropriate to water quality criteria. In order to accomplish this, extreme care must be taken to avoid introduction of contaminants.

Requirements include:

- Assuring that all materials coming into contact with the samples are intrinsically low in trace metals and do not adsorb/absorb metals or other target.
- Materials coming into contact with the sample water are subjected to intensive cleaning using standardized protocol and subjected to systematic blanking to demonstrate and document that blanking standards are met.
- All cleaned sampling equipment and bottles are appropriately tracked so that blanking data can be associated with all component deployed in the field.
- Samples are collected, processed and transported taking care to avoid contamination from field personnel or their gear, and
- Laboratory analysis is conducted in a filtered air environment using ultrapure reagents.

Table 2-1 of the USGS National Field Manual (http://pubs.water.usgs.gov/twri9A/) provides a summary of acceptable materials for use sampling organic and inorganic constituents. The stormwater monitoring stations will primarily utilize 20-L borosilicate glass media bottles for the composite samples, FEP tubing for the sample hose and either 316 SS or Teflon-coated intake strainers. Ten (10) liter borosilicate glass media bottles will be considered for sites where required sample volumes are low and lower sample volumes are acceptable. The peristaltic hose is a silicone-base material that is necessary for operation of the autosamplers. The peristaltic hose can be as source of silica which is not a target compound.

Although the technical limitations of autosamplers are often cited, they still provide the most practical method for collecting representative samples of stormwater runoff for characterization of water quality and have been heavily utilized for this purpose for the past 20 years. The alternative, manual sampling, is generally not practical for collection of flow-weighted composite samples from a large number of sites or for sampling events that occur over an extended period of time. Despite the known drawbacks, autosamplers combined with accurate flow metering remain the most common and appropriate tool for monitoring stormwater runoff.

1.1 Sampler Intake Strainer, Intake Tubing and Flexible Pump Tubing

Intake strainers will be used to prevent small rocks and debris from being drawn into the intake tubing and causing blockages or damage to the pump and peristaltic pump tubing. Strainers will be constructed of a combination of Teflon and 316 stainless or simply stainless steel. The low profile version is typically preferred to provide greater ability to sample shallow flows. Although high grade stainless steel intake strainers are not likely to impact trace metal measurements, it is preferable to use strainers coated with a fluoropolymer coating. If the stainless steel intake is not coated, the strainer will not be subjected to cleaning with acids. Cleaning will be limited to warm tap water, laboratory detergents and MilliQ water rinses.

Tubing comprised of 100% FEP (Fluorinated Ethylene Propylene) will be used for the intake tubing. Several alternative fluoropolymer products are available but 3/8" ID solid FEP tubing has the chemical characteristics suitable for sampling metals and organics at low levels and appropriate physical characteristics. The rigidity of FEP tubing provides resistance to collapse at high head differentials but still is manageable for tight configurations.

The peristaltic hose used in autosamplers is a medical-grade silicon product. The specifications for the peristaltic pump hoses used in these samplers are unique to the samplers. It is very important that hose specified and provided by the manufacturers of the autosamplers be used. Minor differences in the peristaltic hose can cause major deterioration in performance of the samplers. Use of generic peristaltic pump hose from other sources can lead to problems with the ability to calibrate the samplers and maintain intake velocities of greater than 2.5 feet per second with higher lift requirements.

The peristaltic hose is connected to the FEP tubing and fed through the pump head leaving the minimum amount necessary to feed the peristaltic pump hose into the top of the composite bottle. The composite container will always have a lid to prevent dust from settling in the container.

1.2 Composite Containers

The composite containers used for monitoring must be demonstrated to be free of contaminants of interest at the desired levels (USEPA 1996). Containers constructed of fluoropolymers (FEP, PTFE), conventional or linear polyethylene, polycarbonate, polysulfone, polypropylene, or ultrapure quartz are considered optimal for metals but borosilicate glass has been shown to be suitable for both trace metals and organics at limits appropriate to EPA water quality criteria. High capacity borosilicate media bottles (20-liters or ~5-gallons) are preferred for storm monitoring since they can be cleaned and suitably blanked for analysis of both metals and organic compounds. The transparency of the bottles is also a useful feature when subsampling and cleaning the containers for reuse.

Figure 1. Composite Bottle with Label and installed Tubing inside Brute® Container.

These large media bottles are designed for stoppers and thus do not come with lids. Suitable closure mechanisms must be fabricated for use during sampling, transport and storage of clean bottles. The preferred closure mechanism is a Teflon® stopper fitted with a Viton® O-ring (2 3/8" - I.D. x 23/4"- O.D.) that seals the lid against the media bottle. A polypropylene clamp (Figure 2) is used to seal the Teflon® stopper and O-ring to the rim of the composite sample bottle. Two polypropylene bolts with wing-nuts are used to maintain pressure on the seal or to assist in removal of the lid.

Every composite bottle requires one solid lid for use in protecting the bottle during storage and transport. A minimum of one Teflon® stopper should be available for each monitoring site during storm events. Each field sampling crew should have additional stoppers with holes ("sampling stopper") that would be available if a sampling stopper is accidentally contaminated during bottle changes or original installations.

Figure 2. Composite bottle showing bottle bag used for transport and lifting.

The holes in the sampling stoppers should be minimally larger than the external diameter of the peristaltic hose. If a tight fit exists, the pressure created when water is pumped into the bottle will cause the hose to be ejected and the sampling event will to be abandoned.

Transporting composite bottles is best accomplished by use of 10-gallon Brute® containers to both protect them from breakage and simplify handling. They also provide additional capacity for ice while transporting full bottles to the laboratory or subsampling site.

Bottle bags (Figure 2) are also useful in allowing full bottles to be handled easier and reduce the need to contact the bottles near the neck. They are important for both minimizing the need to handle the neck of the bottle and are also an important Health and Safety issue. The empty bottles weigh 15 pounds and they hold another 40 pounds of water when full. These can be very slippery and difficult to handle when removing them from the autosamplers. Bags can be easily fabricated out of square-mesh nylon netting with nylon straps for handles. Use of bottle bags allows two people to lift a full bottle out of the ice in the autosampler and place it in a Brute® container. Whether empty or full, suitable restraints should be provided whenever the 20-L composite bottles and Brute® containers are being transported.

1.3 Flow Monitoring

Retrieval of flow-weighted stormwater samplers requires the ability to accurately measure flow over the full range of conditions that occur at the monitoring site. The ability to accurately measure flow at an outfall site should be carefully considered during the initial site selection process. Hydraulic characteristics necessary to allow for accurate flow measurement include a relatively straight and uniform length of pipe or channel without major confluences or other features that would disrupt establishment of uniform flow conditions. The actual measurement site should be located sufficiently downstream from inflows to the drainage system to achieve well-mixed conditions across the channel. Ideally, the flow sensor and sample collection inlet should be placed a minimum of five pipe diameters upstream and ten pipe diameters downstream of any confluence to minimize turbulence and ensure well-mixed flow. The latest edition of the *Isco Open Channel Flow Measurement Handbook* (Walkowiak 2008) is an invaluable resource to assist in selection of the most appropriate approach for flow measurements and information on the constraints of each method.

The existing mass emission site has an established flow rating curve (Stage-Flow relationships) that only requires measurement of water level to estimate flow. Additional sites requiring flow monitoring are expected to utilize area-velocity sensors that use Doppler-based sensors to measure the velocity of water in the conveyance, a pressure sensor to measure water depth, and information regarding channel dimensions to allow for real-time flow measurements to pace the autosamplers.

1.4 Rainfall Gauges

Electronic tipping bucket rain gauges will be installed at each fixed monitoring location to provide improved assessment of rainfall in the smaller drainages. Use of a localized rain gauge provides better representation of conditions at the site. A variety of quality instruments are available but all require substantial maintenance to ensure maintenance of high data quality.

Tipping bucket rain gauges with standard 8-inch diameter cones will be used at each site. These provide 1 tip per 0.01” of rain and have an accuracy of ± 2% up to 2"/hr. The accuracy of tipping bucket rain gauges can be impacted by very intense rainfall events but errors are more commonly due to poor installation.

Continuous data records will be maintained throughout the wet season with data being output and recorded for each tip of the bucket. The rainfall data is downloaded at the same rate as the flow and stormwater monitoring events.

1.5 Power

Stormwater monitoring equipment can generally be powered by battery or standard 120VAC. If 120VAC power is unavailable, external, sealed deep-cycle marine batteries will be used to power the monitoring site. Even systems with access to 120VAC will be equipped with batteries that can provide backup power in case of power outages during an event. All batteries will be placed in plastic marine battery cases to isolate the terminals and wiring. A second battery will be provided at each site to support the telecommunication packages. Sites relying on battery power will also be equipped with a solar panel to assure that a full charge is available when needed for a storm event.

1.6 Telecommunication for System Command/Control and Data Access

The ability to remotely communicate with the monitoring equipment has been shown to provide efficient and representative sampling of stormwater runoff. Remote communication facilitates preparation of stations for storm events and making last minute adjustments to sampling criteria based upon the most recent forecasts. Communication with the sites also reduces the number of field visits by monitoring personnel. Remote two-way communication with monitoring sites allows the project manager (storm control) to make informed decisions during the storm as to the best allocations of human resources among sampling sites. By remotely monitoring the status of each monitoring site, the manager can more accurately estimate when composite bottles will fill and direct field crews to the site to avoid disruptions in the sampling. Real time access to flow, sampling and rainfall data also provides important information for determining when sampling should be terminated and crews directed to collect and process the samples. Increases in both efficiency and sample quality make two-way communication with monitoring stations a necessity for most monitoring programs.

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APPENDIX B

CLEANING AND BLANKING PROTOCOL

FOR

EQUIPMENT AND SUPPLIES USED IN COLLECTION OF FLOW OR TIME-WEIGHTED COMPOSITES

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CLEANING PROTOCOL FOR:

20-L Borosilicate Glass Composite Bottles (Media Bottles) and Closures

1.0 SCOPE

This Standard Operating Procedure (SOP) describes the procedures for the cleaning of 20-liter composite sample bottles and the related equipment necessary to complete the task. The purpose of these procedures is to ensure that the sample bottles are contaminant-free and to ensure the safety of the personnel performing this procedure.

2.0 APPLICATION

This SOP applies to all laboratory activities that comprise the cleaning of 20-liter composite sample bottles and stoppers.

3.0 HEALTH AND SAFETY CONSIDERATIONS

The cleaning of 20-liter composite-sample bottles and associated equipment involves hazardous materials. Skin contact with all materials and solutions should be minimized by wearing appropriate personal protective equipment (PPE) including: chemical-resistant gloves, laboratory coats, chemical-resistant aprons, and goggles. To ensure that you are aware of the hazards involved, the material safety data sheets (MSDSs) for nitric acid and laboratory detergents should be reviewed before beginning any of these procedures.

Note: Preparations should be made to contain and neutralize any spillage of acid. Be aware of the location of absorbent, neutralizing, and containment materials in the bottle cleaning area.

4.0 DEFINITIONS

4.1 **Composite sample bottle** - 20 liter borosilicate glass bottle that is used with autosamplers to collect a stormwater composite sample.

4.2 **Stopper** - a Teflon® cap used to seal the composite sample bottle (either solid, or drilled with holes for the silicon inlet tubing).

4.3 **O-Ring** - Viton O-ring 23/8"- I.D. x 23/4"- O.D. that is located around the base of stopper.

4.4 **Clamp** - Polypropylene clamp, 2 bolts, and wing nuts specifically designed to fasten the stopper and the O-ring to the rim of the composite sample bottle.

4.5 **De-ionized (DI) water** - commercial de-ionized water (12-13 Megohm/cm)

4.6 **Laboratory Detergent** - 2% solution of Contrad 70® or Micro-90® detergent

5.0 EQUIPMENT

5.1 Instrumentation:

1) Peristaltic pump with a protocol-cleaned sub-sampling hose setup

5.2 Reagents:

1) ACS Reagent Grade nitric acid in a 2 Normal solution (2N HNO_3)

2) Contrad 70® non-phosphate laboratory detergent

3) Contrad 70® anti-foaming agent

4) Micro-90® non-phosphate laboratory detergent

5) Baking soda or equivalent to neutralize acid

6) pH paper

5.3 Apparatus:

1) Bottle Rolling Rack
2) DI Rinse Rack
3) Yellow Neutralization Drip Bucket
4) Neutralization Tank

5.4 Documentation:

The status of each composite sample bottle must be tracked. Bottles should be washed in batches of 10, 20, or 30 and the status of each batch must be made apparent to all personnel by posting a large status label (including the start date) with each batch. This will ensure that all required soak times have been attained and that each bottle was subjected to the proper cleaning procedures. Information on each batch of bottles cleaned (including bottle number, QA batch, date cleaning started, date finished, date blanked, and cleaning technicians) should be entered in the **Bottle Cleaning Log Sheet**.

6.0 CLEANING PROCEDURES

Care must be taken to ensure that no contaminants are introduced at any point during this procedure. If the wash is not performed with this in mind, the possibility for the introduction of contaminants (i.e., from dust, dirty sub-sampling tubing tips, dirty fingers/gloves, automobile emissions, etc.) is increased significantly.

6.1 Teflon® Bottle Stoppers with Holes and Field Extras:

To be performed whenever required for field use.

1) Wash with laboratory detergent using a clean all-plastic brush.

2) Rinse thoroughly (minimum of three times) with tap water.

3) Rinse thoroughly (minimum of three times) with DI water.

4) Wash three times with 2N nitric acid squirt bottle.

5) Rinse thoroughly (minimum of three times) with DI water.

6) Allow to dry in a dust-free environment.

7) Store in two sealed clean Ziploc® bags.

6.2 NPS 20 liter composite sample bottle Cleaning:

6.2.1 Preliminary Bottle Cleaning:

Bottles should undergo a preliminary rinse with tap water as soon as possible after they are available. This includes dumping any remaining stormwater into a sanitary drain and rinsing the bottles and stoppers. This prevents material from adhering to the interior surface of the bottle.

6.2.2 **48 Hour Soak:** Place the bottle to be cleaned into a secondary containment bucket. Prepare a 2% solution of laboratory detergent with tap water directly in the bottle. Note: Since laboratory detergent is a foaming solution, add 3/4 of the tap water first, add the detergent, then add the rest of the water. Should excessive foam be generated, a few drops of Contrad 70® anti-foaming agent may be added. **Make sure that the bottle is filled to the rim and scrub the rim with an all-plastic scrub brush.** Scrub a Teflon® stopper with 2% solution of laboratory detergent and place stopper over the full bottle so overflowing happens. This will allow both the stopper and the bottle to soak for 48 hours. After the 48 hour soak, this solution may be may be retained for reuse (i.e., siphoned into other dirty bottles) or it can be poured off into a sanitary drain.

6.2.3 Teflon® Bottle Stopper and O-ring Cleaning:

This procedure should be performed prior to the bottle washing process so that the stopper can follow the bottle through the acid wash.

1) Rinse thoroughly (minimum of three times) with tap water.

2) Rinse thoroughly (minimum of three times) with DI water.

3) Store temporarily in a similarly cleaned

6.2.4 **Tap Water Rinse:** Tap water rinses detergent better than DI water. Flush upside down bottle with tap water for 20 sec. Rinse each bottle 3 times with tap water being careful not to contaminate the clean surfaces.

6.2.5 **DI Rinse:** Rinse the top and neck of the bottles with DI water using a squirt bottle and then rinse upside down for three minutes on the DI rinse rack for bottles. Make sure to tip bottles from side to side for a more thorough rinsing. Allow 1-2 minutes for the bottles to drain as much as possible. Rinse each stopper with DI water squirt bottle 3 times (being careful not to touch the clean surfaces).

6.2.6 **Acid Wash:** Note that it is important to Wash the bottle with 2N nitric acid according to the following procedure:

1) Place the empty bottle near the 2N nitric acid carboy and peristaltic pump. The location should be able to safely contain a spill if the 20L bottle breaks.
2) Pump acid into the bottle using the peristaltic pump fitted with a protocol-cleaned sub-sampling hose setup
3) Fill the bottle slightly more than half full.
4) Place a protocol-cleaned solid Teflon® stopper (with a properly seated O-ring) (Refer to Section 6.2.3 above) on the bottle and clamp it securely.
5) **Carefully** lift and place the bottle on the roller rack and check for leakage from the stopper. Neutralize any spillage. Often small leaks can be corrected by a slight tightening of the clamp. Roll the bottles for twenty minutes.
6) Pump the acid into another bottle for rolling or back into the 2N nitric acid carboy.

6.2.7 **DI Rinse for Sub-sampling Hose**: After use, the sub-sampling hose setup should be rinsed by pumping 1-2 gallons of DI water through the hoses and into a neutralization tank. Carefully rinse the outside of the hose to remove any acid that may be on the exterior of the hose. pH paper should be used to insure that the fluid in and on the hose is 6.8 or higher. Continue rinsing until your reach neutral pH. Store hose in a clean, large plastic bag between uses. Dispose of rinsate in accordance with all federal, state, and local regulations

6.2.8 **DI Rinse for Bottles**: Allow the bottles to drain into a yellow neutralization bucket for at least 1 minute. Place four bottles at a time on the DI rinse rack and rinse for 5 minutes. Move bottles around to ensure complete and thorough rinsing. Rinse the outside of the bottle with tap water. Allow bottles to drain for 2 minutes.

6.2.9 **DI Rinse for Stoppers**: Rinse caps thoroughly 3 times over neutralization tank. Place on a clean surface where the clean side of the stopper will not be contaminated.

6.3 **Storage:** Clamp a stopper (one that went through the entire cleaning procedure) on the bottle. Properly label the bottle as to the date cleaned and by whom and place on the bottle storage rack or in a secondary containment bucket in a safe area. Also, fill out the **Bottle Cleaning Log Sheet**.

7.0 QUALITY ASSURANCE REQUIREMENTS

7.1 The NPS 20 liter sample bottles must be evaluated ("blanked") for contaminants after they have completed the decontamination procedure. The analytical laboratory performing the evaluation should supply Milli-Q® water that is used as a blanking rinsate, and sample bottles for the appropriate constituents of concern. This evaluation will be accomplished by randomly blanking 10% of the washed bottles, or 1 bottle per batch (whichever is greater) and having the blanking rinsate analyzed by the laboratory for the appropriate constituents.

7.2 If any of the bottles fail the analyses (concentration of any analytes are at or above the limit of detection), all of the bottles from that batch must be decontaminated. Again, 10% of these bottles must be subjected to the blanking process as described-above.

7.3 If results of the evaluation process show that the bottles are not contaminant-free, the cleaning procedure must be re-evaluated. Consult with the Quality Assurance/Quality Control Officer to determine the source of contamination.

CLEANING PROTOCOL FOR:

Miscellaneous Laboratory Equipment used for Cleaning and Blanking

1.0 SCOPE

This Standard Operating Procedure describes the procedures for cleaning the miscellaneous items necessary to complete the tasks of cleaning 20- liter composite sample bottles and hoses. The purpose of these procedures is to ensure that the items are contaminant-free and to ensure the safety of the personnel performing this procedure.

2.0 APPLICATION

This SOP applies to all laboratory activities that comprise the cleaning of ancillary items necessary to complete the tasks of cleaning 20 liter composite sample bottles and NPS hoses.

3.0 HEALTH AND SAFETY CONSIDERATIONS

The cleaning of the following items may involve contact with hazardous materials. Skin contact with all materials and solutions should be minimized by wearing appropriate personal protective equipment (PPE) including: chemically-resistant protective gloves, laboratory coats, chemically-resistant aprons, and goggles. In addition, to ensure that you are aware of the hazards involved and of any new revisions to the procedure, the material safety data sheets (MSDSs) for nitric acid and the laboratory detergent should be reviewed before beginning any of these procedures.

4.0 DEFINITIONS

4.1 Polyethylene Squirt Bottles - ½ and 1 liter squirt bottles for washing and/or rinsing with DI water or nitric acid.

4.2 Polycarbonate and Polyethylene De-ionized Water Jugs - For holding DI water.

4.3 Polyethylene Bucket - For holding tap water, DI water or detergent solutions during hose washing procedures.

4.4 Four-inch Teflon® Connector - For connecting two lengths of silicon peristaltic tubing together.

4.5 Four-inch Silicon Connector - For connecting two lengths of Teflon® hose together.

4.6 Orange Polypropylene Hose Caps - For placing over the ends of clean Teflon® hose to prevent contamination.

4.7 De-ionized (DI) water - Commercial de-ionized water

4.8 Laboratory Detergent - 2% solution of Contrad 70® or Micro-90® detergent.

5.0 EQUIPMENT

5.1 Instrumentation: Not applicable.

5.2 Reagents:

1) ACS Reagent Grade nitric acid as a 2 Normal solution (2N HNO_3)

2) Micro-90® non-phosphate laboratory detergent

3) Contrad 70® non-phosphate laboratory detergent

4) Contrad 70® anti-foaming agent.

5) pH paper or pH meter

6) Baking soda ($NaHCO_3$) or equivalent to neutralize acid

5.3 Apparatus:

1) Clean polyethylene squirt bottles.

2) Clean polyethylene trays or 2000 ml glass beakers.

3) Neutralization Tank

5.4 Documentation:

Label each squirt bottle, DI jug, storage container holding clean items, etc. as to the date each was cleaned and the initials of the cleaning technician.

6.0 CLEANING PROCEDURES

Care must be taken to ensure that no contaminants are introduced at any point during these procedures. If the wash is not performed with this in mind, the possibility for the introduction of contaminants (i.e., from dirty sinks, dirty counter tops, dirty fingers/gloves, dirty hose ends, etc.) is increased significantly.

Rinsing properly is essential to ensure proper cleaning. This is done by squirting the liquid over the item to be cleaned in a top-down fashion, letting the water flow off completely **before** applying the next rinse. Rinse the item in this fashion **a minimum** of three times. **Numerous rinses of relatively small volumes are much better than one or two rinses of higher volume.** Be aware of handling: use clean gloves (it is best if they have gone through the same prior wash as the item to be rinsed) and rinse off the fingers prior to grasping the item to be cleaned. Try to grasp the item in a slightly different place between rinses so ones fingers do not cover a portion of the item throughout the rinses.

6.1 Polyethylene Squirt Bottles:

1) Soak in a 2% solution of laboratory detergent in a protocol-cleaned bucket for 48 hours.

2) Rinse thoroughly (minimum of three times) with tap water.

3) Rinse thoroughly (minimum of three times) with DI water.

4) Wash three times with 2N (10%) nitric acid.

5) Rinse thoroughly (minimum of three times) with DI water. Neutralize and dispose of rinsate in accordance with all federal, state, and local regulations.

6.2 Polycarbonate and Polyethylene DI Water Jugs:

1) Fill to the rim with a 2% solution of laboratory detergent, cap the jug, and let soak for 48 hours. Wash cap with an all-plastic scrub brush after soak.

2) Rinse thoroughly (minimum of three times) with tap water.

3) Rinse thoroughly (minimum of three times) with DI water.

4) Wash three times with 2N (10%) nitric acid.

5) Rinse thoroughly (minimum of three times) with DI water. Neutralize and dispose of rinsate in accordance with all federal, state, and local regulations.

6.3 Polyethylene Bucket:

1) Fill to the rim with a 2% solution of laboratory detergent and let soak for 48 hours.

2) Rinse thoroughly (minimum of three times) with tap water.

3) Rinse thoroughly (minimum of three times) with DI water.

4) Wash three times with 2N (10%) nitric acid squirt bottle.

5) Rinse thoroughly (minimum of three times) with DI water. Neutralize and dispose of rinsate in accordance with all federal, state, and local regulations. **Label as to the date cleaned and initial**.

6.4 Four-inch Teflon® and Silicon Hose Connectors and Orange Polypropylene Hose Caps. The purpose of the four-inch sections of Teflon® and silicon hose is to connect longer lengths of each type of hose together during the hose cleaning procedures. The orange polypropylene hose caps are for the ends of cleaned FEP hoses to prevent contamination prior to use in the field or laboratory.

1) Using a 2% solution of laboratory detergent, soak the four-inch sections of FEP hose, silicon tubing, and orange caps for 48 hours.

2) Rinse thoroughly with tap water (minimum of three rinses).

3) Rinse thoroughly with DI water (minimum of three rinses).

4) Using a squirt bottle filled with 2N (10%) HNO_3, thoroughly rinse the interior and exterior of the connectors and caps thoroughly OR, roll/agitate them in a shallow layer of 2N (10%) HNO_3

in a laboratory detergent cleaned glass beaker or other appropriate, clean container for a more thorough washing.

5) Thoroughly rinse connectors and caps with DI water (minimum of three rinses). Neutralize and dispose of rinsate in accordance with all federal, state, and local regulations. Keep clean connectors and caps in a similarly cleaned (or certified clean) widemouth glass jar or detergent-cleaned resealable bag and **label as clean, date cleaned, and initial**.

NPS 20-Liter Bottle Subsampling Procedure

1.0 Scope

This Standard Operating Procedure (SOP) describes the procedures for the compositing and sub-sampling of non-point source (NPS) 20 liter sample bottles. The purpose of these procedures is to ensure that the sub-samples taken are representative of the entire water sample in the 20-L bottle (or bottles). In order to prevent confusion, it should be noted that in other KLI SOPs relating to 20-L bottles they are referred to as "composite" bottles because they are a composite of many small samples taken over the course of a storm; in this SOP the use of "compositing" generally refers to the calculated combining of more than one of these 20-L "composite" bottles.

2.0 Application

This SOP applies to all laboratory activities that comprise the compositing and sub-sampling of NPS 20 liter sample bottles.

3.0 Health and Safety Considerations

The compositing and sub-sampling of NPS 20 liter sample bottles may involve contact with contaminated water. Skin contact with sampled water should be minimized by wearing appropriate protective gloves, clothing, and safety glasses. Avoid hand-face contact during the compositing and sub-sampling procedures. Wash hands with soap and warm water after work is completed.

4.0 Definitions

4.1 **20 liter sample bottle:** 20 liter borosilicate glass bottle that is used to collect multiple samples over the course of a storm (a composite sample).

4.2 **Large-capacity stirrer**: Electric motorized "plate" that supports a 20 liter bottle and facilitates the mixing of sample water within the bottle by means of spinning a pre-cleaned magnetic stir-bar which is introduced into the bottle.

4.3 **Stir-bar**: Teflon-coated magnetic "bar" approximately 2-3 inches in length which is introduced into a 20 liter bottle and is spun by the stirrer, thereby creating a vortex in the bottle and mixing the sample. Pre-cleaned using cleaning protocols provided in KLI SOP for *Cleaning Procedures for Miscellaneous Items Related to NPS Sampling*.

4.4 **Sub-sampling hose**: Two ~3-foot lengths of Teflon tubing connected by a ~2-foot length of silicon tubing. Pre-cleaned using cleaning protocols provided in SOP for *Teflon Sample Hose and Silicon Peristaltic Tubing Cleaning Procedures*. Used with a peristaltic pump to transfer sample water from the 20-L sample bottle to sample analyte containers.

4.6 **Volume-to-Sample Ratio (VSR):** A number that represents the volume of water that will flow past the flow-meter before a sample is taken (usually in liters but can also be in kilo-cubic feet for river deployments). For example, if the VSR is 1000 it means that every time 1000 liters passes the flow-meter the sampler collects a sample (1000 liters of flow per 1 sample taken). Note: The VSR indicates when a sample should be taken and is NOT an indication of the sample size.

5.0 EQUIPMENT

5.1 Instrumentation: Not applicable

5.2 Reagents: Not applicable.

5.3 Apparatus

1) Large capacity stirrer.

2) Stir bar.

3) Sub-sampling hose.

4) Peristaltic pump.

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APPENDIX C

QUALITY ASSURANCE/QUALITY CONTROL

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1. Quality Assurance/Quality Control

Elements of a Quality Assurance and Quality Control (QA/QC) Plan have been incorporated into the CIMP in order to detail critical activities conducted to assure that both chemical and physical measurements meet the standard of quality needed to evaluate measurements at levels relevant to applicable water quality criteria. With many different monitoring programs being implemented within the region, comparability should remain of the primary goals of the QA/QC monitoring program. The Intergovernmental Task Force on Monitoring Water Quality (ITFM, 1995) defines comparability as the "characteristics that allow information from many sources to be of definable or equivalent quality so that it can be used to address program objectives not necessarily related to those for which the data were collected."

One important aspect of comparability is the use of analytical laboratories that are accredited under a program such as the National Environmental Laboratory Accreditation Program (NELAP), California's Environmental Laboratory Accreditation Program (ELAP) or a well-qualified research laboratory. In addition, the laboratory should be a participant in a laboratory proficiency and intercalibration program. Laboratories have not been selected for this program but participation in the Stormwater Monitoring Coalition's (SMC) intercalibration program will be a primary consideration. Unfortunately, the SMC has not fully completed implementation of a program the full range of analyses included in the MRP Table E-2 list.

Evaluation of data quality will be based upon protocols provided in the *National Functional Guidelines for Inorganic Superfund Data Review (USEPA540-R-10-011)* (USEPA 2010), *National Functional Guidelines for Superfund Organic Methods Data Review (EPA540/R-08-01),* and the *Guidance on the Documentation and Evaluation of Trace Metals Data Collected for Clean Water Act Compliance Monitoring (EPA/821/B/95/002)* (USEPA 1996).

The sections that follow address activities associated with both field sampling and laboratory analyses. Quality assurance activities start with procedures designed to assure that errors introduced in the field sampling and subsampling processes are minimized. Field QA/QC samples are collected and used to evaluate potential contamination and sampling error introduced into a sample prior to its submittal to the analytical laboratory. Laboratory QA/QC activities are used to provide information needed to assess potential laboratory contamination, analytical precision and accuracy, and representativeness.

1.1.1 Sample Handling, Containers and Holding Times.

Table **1** provides a summary of the types of sample volumes, container types, preservation and holding times for each analytical method. Analytical methods requiring the same preservation and container types may be transferred to the laboratory in one container in order to minimize handling prior to transfer to the laboratory.

Table 1. Constituents, Sample Container, Preservation and Holding Times.

Analyte	EPA Method Number	Holding Time	Container Size	Container Type	Preservation	Minimum Level/ Resolution	Units
Conventionals							
pH	150.1	15 minutes		glass or PE	none	+/- 0.1	std. units
Oil and Grease	1664A	28 days	1 L	Glass	HCl	5	mg/L
TPH	418.1	28 days	1 L	Glass	HCl	5	mg/L
Total Phenols	420.1	28 days	500mL-1 L	Glass	H_sSO_4	5	mg/L
Cyanide	SM4500-CN-E	14 days	500 mL	HDPE	NaOH	0.003	mg/L
Turbidity	SM2130B	48 hours	100-250mL	Glass	4-6°C	1	NTU
TSS	160.2	7 days	1 L	HDPE	4-6°C	4	mg/L
SSC[1]	ASTMD3977B	7 days	1 L	HDPE	4-6°C	4	mg/L
TDS	160.1	7 days	1 L	HDPE	4-6°C	1	mg/L
VSS	160.4	7 days	1 L	HDPE	4-6°C	1	mg/L
TOC; DOC	415.1	28 days	250 mL	glass	4°C and HCl or H_2SO_4 to pH<2	1	mg/L
BOD_5	SM5210B	48 hours	600mL-1L	HDPE	4-6°C	3	mg/L
COD	410.1	28 days	20-250 mL	Glass	H_sSO_4	4	mg/L
Alkalinity	SM 2320B	Filter ASAP, 14 days	100-250 mL	HDPE	4-6°C	1	mg/L
Conductivity	SM 2510	28 days	100-250 mL	HDPE	4°C; filter if hold time >24 hours	1	µmho/cm
Hardness	130.2	6 months	100-250 mL	HDPE	and HNO_3 or H_2SO_4 to pH<2	1	mg/L
MBAS	425.1	48 hours	250-500 mL	HDPE	4-6°C	0.02	mg/L
Chloride	300	28 days	250-500 mL	HDPE	4-6°C	2	mg/L
Fluoride	300	28 days	250-500 mL	HDPE	4-6°C	0.1	mg/L
Perchlorate	314.0	28 days	100-250 mL	HDPE	4-6°C	4	µg/L
Volatile Organics							
MTBE	624	14 days	3 40mL VOA	Glass	HCl	1	µg/L

Analyte	EPA Method Number	Holding Time	Container Size	Container Type	Preservation	Minimum Level/ Resolution	Units
Bacteria							
Total Coliform	SM9221B	6 hr-8 hr	100 mL	Sterile HDPE	4-6°C	20-2,400,000	MPN/100mL
Fecal Coliform	SM9221B	6 hr-8 hr	100 mL	Sterile HDPE	4-6°C	20-2,400,000	MPN/100mL
Enterococcus	SM9230B or C	6 hr-8 hr	100 mL	Sterile HDPE	4-6°C	20-2,400,000	MPN/100mL
E. coli	SM 9223 COLt	6 hr-8 hr	100 mL	Sterile HDPE	4-6°C	20-2,400,000	MPN/100mL
Nutrients							
TKN	351.1	28 days	500mL-1L	Amber glass	H_sSO_4	0.5	mg/L
Nitrate-N	300	48 hours	50-125mL	HDPE	4-6°C	0.1	mg/L
Nitrite-N	300	48 hours	50-125mL	HDPE	4-6°C	0.05	mg/L
Total Nitrogen	Calculation					NA	mg/L
Ammonia-N	350.1	28 days	500mL-1L	Amber glass	H_sSO_4	0.1	mg/L
Total Phosphorus	SM4500-P,EorF	28 days	100-250 mL	glass	H_sSO_4	0.1	mg/L
Dissolved Phosphorus	SM4500-P,EorF	28 days	100-250 mL	glass	4-6°C	0.1	mg/L
Organic Compounds (pesticides and herbicides)							
Organochlorine Pesticides & PCBs[1]	608 & 8270	7days:40days	1L	Amber glass	4-6°C	0.005-0.5	µg/L
Organophosphate Pesticides	507	14days	1L	Amber glass	$Na_sS_2O_3$ 4-6°C	0.01-1	µg/L
Glyphosate	547	14days	250mL	Amber glass	$Na_sS_2O_3$ 4-6°C	5	µg/L
Chlorinated Acids	515.3	14days	250mL	Amber glass	$Na_sS_2O_3$ 4-6°C		
2,4-D						0.02	µg/L
2,4,5-TP-Silvex						0.2	µg/L
Semivolatile Organic Compounds	625;8270D	7days;40days	1L	Amber glass	4-6°C	0.05-10	µg/L

1. Monitoring for PCBs will be reported as the summation of aroclors and a minimum of 50 congeners. 54 PCB congeners include: 8, 18, 28, 31, 33, 37, 44, 49, 52, 56, 60, 66, 70, 74, 77, 81, 87, 95, 97, 99, 101, 105, 110, 114, 118, 119, 123, 126, 128, 132, 138, 141, 149, 151, 153, 156, 157, 158, 167, 168, 169, 170, 174, 177, 180, 183, 187, 189, 194, 195, 201, 203, 206, and 209. These include all 41 congeners analyzed in the SCCWRP Bight Program and dominant congeners used to identify the aroclor.

Analyte	EPA Method Number	Holding Time	Container Size	Container Type	Preservation	Minimum Level/ Resolution	Units
Metals (Total and Dissolved)							
Aluminum	200.8	If practical, filter immediately after subsampling. Otherwise filter in laboratory for dissolved fraction and preserve not more than 24 hours after subsampling; 6 months to analysis	250 to500 mL	HDPE	4°C and HNO_3 to pH<2	100	µg/L
Antimony	200.8					0.5	µg/L
Arsenic	200.8					0.5	µg/L
Beryllium	200.8					0.5	µg/L
Cadmium	200.8					0.25	µg/L
Chromium (Total)	200.8					0.5	µg/L
Copper	200.8					0.5	µg/L
Iron	200.8					25	µg/L
Lead	200.8					0.5	µg/L
Nickel	200.8					1	µg/L
Selenium	200.8					1	µg/L
Silver	200.8					0.25	µg/L
Thallium	200.8					0.5	µg/L
Zinc	200.8					1	µg/L
Chromium (Hexavalent)	218.6	Filter as above 24 hours	250 ml	HDPE	4°C	5	µg/L
Mercury	245.1	Filter as above 28 days	250 ml	Glass or Teflon	4°C and HNO_3 to pH<2	0.2	µg/L
Mercury	1631E	Filter as above 28 days	250 ml	Glass or Teflon	4°C and HNO_3 to pH<2	0.0005	µg/L

Abbreviations

TSS=Total Suspended Solids
SSC=Suspended Sediment Concentration
TDS=Total Dissolved Solids
TPH=Total Petroleum Hydrocarbons
VSS=Volatile Suspended Solids
TOC=Total Organic Carbon
BOD_5=Five-day Biochemical Oxygen Demand
COD=Chemical Oxygen Demand
MBAS=Methylene Blue Active Substances
MTBE= Methyl Tertiary Butyl Ether
TKN=Total Kjeldahl Nitrogen
PCBs=Polychlorinated Biphenyls

1.1.2 Precision, Bias, Accuracy, Representativeness, Completeness, and Comparability

The overall quality of analytical measurements is assessed through evaluation of precision, accuracy/bias, representativeness, comparability and completeness. Precision and accuracy/bias are measured quantitatively. Representativeness and comparability are both assessed qualitatively. Completeness is assessed in both quantitative and qualitative terms. The following sections examine how these measures are typically applied.

1.1.2.1 Precision

Precision provides an assessment of mutual agreement between repeated measurements. These measurements apply to field duplicates, laboratory duplicates, matrix spike duplicates, and laboratory control sample duplicates. Monitoring of precision through the process allows for the evaluation of the consistency of field sampling and laboratory analyses.

The Relative Percent Difference (RPD) will be used to evaluate precision based upon duplicate samples. The RPD is calculated for each pair of data is calculated as:

$$RPD=[(x_1-x_2)*100]/[(x_1+x_2)/2]$$

Where:

x_1=concentration or value of sample 1 of the pair

x_2=concentration or value of sample 2 of the pair

In the case of matrix spike/spike duplicate, RPDs are compared with measurement quality objectives (MQOs) established for the program. MQOs will be established to be consistent with the most current SWAMP objectives in the SWAMP Quality Assurance Project Plan (2008) including the most recent updates as well as consultations with the laboratories performing the analyses. In the case of laboratory or field duplicates, values can often be near or below the established reporting limits. The most current SWAMP guidelines rely upon matrix spike/spike duplicate analyses for organic compounds instead of using laboratory duplicates since one or both values are often below detection limits or are near the detection limits. In such cases, RPDs do not provide useful information.

1.1.2.2 Bias

Bias is the systematic inherent in a method or caused by some artifact or idiosyncrasy of the measurement system. Bias may be either positive or negative and can emanate from a number of different points in the process. Although both positive and negative biases may exist concurrently in the same sample, the net bias is all that can be reasonably addressed in this project. Bias is preferably measured through analysis of spiked samples so that matrix effects are incorporated.

1.1.2.3 Accuracy

Accuracy is a measure of the closeness of a measurement or the average of a number of measurements to the true value. Accuracy includes of a combination of random error as measured by precision and systematic error as measured by bias. An assessment of the accuracy of measurements is based on determining the percent difference between measured values and known or "true" values applied to surrogates, Matrix Spikes (MS), Laboratory Control Samples (LCS) and Standard Reference Materials (SRM). Surrogates and matrix spikes evaluate matrix interferences on analytical performance, while laboratory control samples, standard reference materials and blank spikes (BS) evaluate analytical performance in the absence of matrix effects.

Assessment of the accuracy of measurements is based upon determining the difference between measured values and the true value. This is assessed primarily through analysis of spike recoveries or certified value ranges for SRMs. Spike recoveries are calculated as Percent Recovery according to the following formula:

$$\text{Percent Recovery} = [(t-x)/\alpha]*100\%$$

Where:

t=total concentration found in the spiked sample

x=original concentration in sample prior to spiking, and

α=actual spike concentration added to the sample

1.1.2.4 Representativeness, Comparability and Completeness

Representativeness is the degree to which data accurately and precisely represents the natural environment. For stormwater runoff, representativeness is first evaluated based upon the automated flow-composite sample and the associated hydrograph. To be considered as representative, the autosampler must have effectively triggered to capture initial runoff from the pavement and the composite sample should:

- be comprised of a minimum number of aliquots over the course of the storm event,
- effectively represent the period of peak flow,
- contain flow-weighted aliquots from over 80% of the total runoff volume, and
- demonstrate little or no evidence of "stacking".

Stacking occurs when the sampling volume is set too low and commands back up in the memory of an autosampler causing it to continuously cycle until it catches up with the accumulation of total flow measured by the stormwater monitoring station.

Representativeness is also assessed through the process of splitting or subsampling 20 L composite bottles into individual sample containers being sent to the laboratory. The first subsamples removed from the composite bottle should have the same composition as the last. Subsampling should be conducted in accordance with guidance in the subsampling SOP. This SOP is based upon use of large laboratory magnetic stir plate, an autosampler, and precleaned subsampling hoses to minimize variability. Sample splitting can introduce a substantial amount of error especially if significant quantities of coarse sediments (greater than 250 µm) represent as significant fraction of the suspended sediments. Use of a USGS Teflon churns or Decaport cone splitter may also be used but would require development of a separate SOP.

Comparability is the measure of confidence with which one dataset can be compared to another. The use of standardized methods of chemical analysis and field sampling and processing are ways of insuring comparability. Application of consistent sampling and processing procedures is necessary for assuring comparability among data sets. Thorough documentation of these procedures, quality assurance activities and a written assessment of data validation and quality are necessary to provide others with the basic elements to evaluate comparability.

Completeness is a measure of the percentage of the data judged valid after comparison with specific validation criteria. This includes data lost through accidental breakage of sample containers or other activities that result in irreparable loss of samples. Implementation of standardized Chain-of-Custody procedures which track samples as they are transferred between custodians is one method of maintaining a high level of completeness.

A high level of completeness is essential to all phases of this study due to the limited number of samples. Of course, the overall goal is to obtain completeness of 100%, however, a realistic data quality indicator of 95% insures an adequate level of data return.

1.1.3 Laboratory Quality Assurance/Quality Control

The quality of analytical data is dependent on the ways in which samples are collected, handled and analyzed. Data Quality Objectives provide the standards against which the data are compared to determine if they meet the quality necessary to be used to address program objectives. Data will be subjected to a thorough verification and validation process designed to evaluate project data quality and determine whether data require qualification.

The three major categories of QA/QC checks are accuracy, precision, and contamination were discussed in the previous section. As a minimum, the laboratory will incorporate analysis of method blanks, and matrix spike/spike duplicates with each analytical batch. Laboratory duplicates will be analyzed for analytical tests where matrix spike/spike duplicate are not analyzed. Use of Certified Reference Materials (CRM) or Standard Reference Materials (SRM) is also recommended as these allow assessment of long term performance of the analytical methods so that representativeness can be assessed. Laboratories often use an internal CRM that is analyzed with each batch to evaluate any potential long-term shift in performance of the analytical procedures. Recommended minimum quality control samples are provided in **Error! Reference source not found.**.

1.1.4 Field QA/QC

1.1.4.1 Blanks

A thorough system of blanking is an essential element of monitoring. Much of the blanking processes are performed well in advance of the actual monitoring in order to demonstrate that all equipment expected to contact water is free of contaminants at the detection limits established for the program. Equipment components are cleaned in batches. Subsamples from each cleaning batch are rinsed with Type 1 laboratory blank water and submitted to the laboratory for analysis. If hits are encountered in any cleaning batch, the entire batch is put back through the cleaning and blanking process until satisfactory results are obtained. If contaminants are measured in the blanks, it is often prudent to reexamine the cleaning processes and equipment or materials used in the cleaning process. Equipment requiring blanks and the frequency of blanks is summarized below and in Table 2.

Table 2. Summary of Blanking Requirements for Field Equipment.

System Component	Blanking Frequency
Intake Hose	One per batch
Peristaltic Pump Hose	One per batch[1] or 10% for batches greater than 10
Composite Bottles	One per batch or 10% for batches greater than 10
Subsampling Pump Hose	One per batch or 10% for batches greater than 10
Laboratory Sample Containers	2% of the lot[2] or batch, minimum of one
Capsule Filter Blank[3]	One per batch or 10% for batches greater than 10
Churn/Cone Splitter[4]	When field cleaning is performed, process one blank per session

[1] A batch is a group of samples that are cleaned at the same time and in the same manner.

[2] If decontaminated bottles are sent directly from the manufacturer, the batch would be the lot designated by the manufacturer in their testing of the bottles.

[3] If filtration is performed in the laboratory, the capsule filter blanks would be considered part of laboratory QA/QC.

[4] This is applicable to use of a churn or cone splitter to subsample flow-weighted composite samples into individual containers. Splitting may be performed by the sampling team in a protected, clean area or by the laboratory.

1.1.4.2 Field Duplicates

Composite subsampling duplicates associated with flow-weighted composite samples are often referred to as field duplicates but, in fact, they are subsampling replicates. These replicates help assess combined variability associated with subsampling from the composite container and variability associated with the analytical process. They are evaluated against the same criteria as used for laboratory duplicates.

1.1.5 Equipment Cleaning, Blanking and Tracking

Sample collection, handling, and processing materials can contribute and/or sorb trace elements within the time scales typical for collection, processing and analysis of runoff samples. Sampling artifacts are especially important when measured concentrations that are at or near analytical detection limits (Horowitz 1997). Therefore, great care is required to collect and process samples in a manner that will minimize potential contamination and variability in the sampling process (Breault and Granato 2000).

Sampling conducted to measure dissolved metals and other trace contaminants at levels relevant to EPA water quality criteria requires documentation that all sampling equipment is free of contamination and that the processes used to obtain and handle samples do not introduce contamination. This requires documentation that methods used to collect, process and analyze the samples do not introduce contamination. Documentation for the CIMP includes written procedures provided in Appendix B for cleaning all components of the sampling system, blanking processes necessary to verify that system components and sample handling are not introducing contamination, and a system of tracking deployment of protocol-cleaned equipment in the field as described in this section.

All composite containers and equipment used for sample collection in the field and/or sample storage in the laboratory will be decontaminated and cleaned prior to use. These include the FEP tubing, Teflon® lids, strainers and hoses/fittings that are used in the subsampling process (USGS 1993). Personnel assigned to clean and handle the equipment are thoroughly trained and familiar with the cleaning, blanking, and tracking procedures. In addition, all field sampling staff will be trained to be familiar with these processes so that they have a better understanding of the importance of using clean sampling procedures and the effort required to eliminate sources of contamination.

Sample contamination has long been considered one of the most significant problems associated with measurement of dissolved metals and may be accentuated with use of High Resolution Mass Spectroscopy (HRMS) methods for trace levels of organic constituents at levels three orders of magnitude lower than conventional GCMS methods. One of the major elements of QA/QC documentation is establishing that clean sampling procedures are used throughout the process and that all equipment used to collect and process the water samples are free of contamination.

Cleaning protocols are consistent with ASTM (2008) standard D5088 – 02 that covers cleaning of sampling equipment and sample bottles. The generalized cleaning process is based upon a series of washings that typically start with tap water with a phosphate-free detergent, a tap water rinse, soaking in a 10% solution of reagent grade nitric acid, and a final series of rinses with ASTM Type 1 water. Detailed procedures for decontamination of sampling equipment are provided in Appendix A. In addition, Appendix G of the most recent Caltrans Stormwater Monitoring Guidance Manual (Caltrans, 2013) provides alternative cleaning procedure that incorporate use of methylene chloride to remove potential organic contaminants. Experience indicates that this step can be eliminated and still result in blanking data suitable for most target organic contaminants. Addition of this cleaning step or a comparable step to address organic contaminants may be necessary if satisfactory equipment blanks cannot be attained. Significant issues exist with respect to use of methylene chloride. This chemical is highly toxic, must be handled and disposed as a hazardous waste and is difficult to fully remove from the 20-L media bottles used as composite containers.

In order to account for any contamination introduced by sampling containers, blanks must be collected for composite bottles and laboratory bottles used for sample storage for trace contaminants. A sampling container blank is prepared by filling a clean container with blank water and measuring the concentrations of selected constituents (typically metals and other trace contaminants for composite bottles and metals analysis only for metals storage bottles). Blanking of the 20-L composite bottles will be performed by using the minimum amount of blank water necessary for the selected analytical tests. This is typically requires one to two liters. The bottle is capped and then manipulated to assure that all surfaces up to the neck of the bottle are rinsed. The water is then be allowed to sit for a minimum of one hour before decanting the rinse water into sample containers. In order to provide adequate control, media bottles are labelled and tracked. All media bottles cleaned and blanked in one batch are tracked to allow for recall if laboratory analyses reveal any contamination. Further tracking is required in the field to document where bottles from each cleaning batch are used and to assist in tracking of any contamination that might be detected after bottles have been deployed since laboratory turnaround in the middle of the storm season may require use of decontaminated bottles prior to receiving the results of the blank analyses.

Selected constituents for blanking will be dependent upon the list of contaminants with reasonable potential to be present at levels that could impact sample results. Minimum parameters used for blank analyses will include total recoverable trace metals, TDS, TOC and nutrients. Analysis of total metals will allow for detection of any residual metal contamination which will be of concern for all sampling. Nutrients, particularly nitrogen compounds, will assure that residual nitrogen from acid cleaning has been fully removed. TDS and TOC are useful for accessing presence of any residual contaminants. Additional blanking may be added when sampling other constituents with ultra-low analytical methods. These blanks may be submitted "blind" to the laboratory by field personnel or prepared internally by the laboratory.

Certified pre-cleaned QC-grade laboratory containers can be used. These bottles are cleaned using acceptable protocol for the intended analysis and tracked by lots. They come with standard certification forms that document the concentration to which the bottles are considered "contaminant-free" but these concentrations are not typically suitable for program reporting limits required for measurement of dissolved metals. Manufacturers may provide an option of certification to specific limits required by a project but it is preferable to purchase the QC bottles that are tracked by lot and conduct internal blanking studies. Lots not meeting project requirements should be returned to the manufacturer and exchanged for containers from another lot. At least 2% of the bottles in any "lot" or "batch" should be blanked at the program detection limits with a minimum frequency of one bottle per batch. A batch is considered to be a group of samples that are cleaned at the same time and in the same manner; or, if decontaminated bottles are sent directly from the manufacturer, the batch would be the lot designated by the manufacturer in their testing of the bottles. Cleaned bottles are stored in a clean area with lids properly secured.

Subsampling hoses consist of a length of peristaltic hose with short lengths of FEP tubing attached to each end. These are required to be cleaned inside and out since the FEP tubing is immersed in the composite bottle during the subsampling process. Once cleaned, the ends of the subsampling hoses are bagged. All hoses associated with the batch are then stored in large zip-lock containers labeled to identify the cleaning batch. Blanking of subsampling hoses is conducted as part of the composite bottle blanking process. A clean subsampling hose is used to decant blank water from the 20-L composite bottles into clean laboratory containers. Detection of any contaminants in the bottle blanks therefore requires that the subsampling hoses also are subjected another decontamination process. After cleaning, the subsampling hoses should only be handled while wearing clean, powder-free nitrile gloves.

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APPENDIX D

NON-STORMWATER IC/ID AND OUTFALL SCREENING

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Non-Stormwater Outfall Screening 2014
Lower San Gabriel River Watershed

During 2014, an outfall screening program was initiated and completed in accordance with Appendix E Part IX of the MS4 Permit. This screening program is to be concurrent with the development of the CIMP. To accomplish this, four outfall screening events were conducted during this period. This screening program exceeded the Permit specifications (that all storm drains 36 inches in diameter and those 12 inches in diameter draining industrial areas be screened) and instead screened outfalls 12 inches and larger regardless of tributary land uses.

1. April 10 to April 19 2014, the first outfall screening occurred. A total of 541 outfalls were visually inspected, flow/no flow observations record, photographed, latitude and longitude coordinates recorded. Subsequently, the Draft CIMP which was submitted to the Regional Board in June 2014 included additional guidance for screening.
2. October 1 to October 23, 2014, the second screening event took place (513 outfalls were screened, approximately 28 outfalls located in Orange county were removed from list). Observations included more descriptive quantitative flow evaluations and recorded on the newly available Draft CIMP "Outfall Reconnaissance Inventory Field Sheet".
3. October 17 to October 30, 2014 following the same outfall reconnaissance procedures, a total of 519 outfalls were screened.
4. Due to the April 2014, event occurring prior to the screening procedures developed in the Draft CIMP, a fourth event was conducted in October 31 to November 7, 2014 to verify, confirm and/or provide supplemental observations of 517 outfalls.

All data has been recorded on Excel Database. Photos of outfalls were recorded (see below)

The outfall screening is an ongoing process and will continue as part of illicit discharge programs, source control investigations and the adaptive management provisions of the WMP/CIMP.

Lower San Gabriel River Watershed
2014 Non- Stormwater Outfall Screening Summary Report

Eckersall Data April 10-19, 2014	**Dry weather discharge***	**No flow**	**Total Outfalls**
San Garbriel River	42	147	189
Brea Canyon	14	18	32
Coyote Creek	24	156	180
La Mirada	1	56	57
Milan Creek	0	24	24
North Coyote Creek	3	56	59
Total	**84**	**457**	**541**

**cumulative totals for trickle, low, moderate and high flows.*

The outfalls with significant discharges are currenty being determined

JLHA October 1-23,2014	**Dry weather discharge**	**No flow**	**Total Outfalls**
San Garbriel River	49	152	201
Brea Canyon	13	21	34
Coyote Creek	44	89	133
La Mirada	10	49	59
Milan Creek	2	22	24
North Coyote Creek	19	43	62
Total	**137**	**376**	**513**

JLHA October 17-30,2014	**Dry weather discharge**	**No flow**	**Total Outfalls**
San Garbriel River	49	158	207
Brea Canyon	17	17	34
Coyote Creek	37	96	133
La Mirada	12	47	59
Milan Creek	1	23	24
North Coyote Creek	18	44	62
Total	**134**	**385**	**519**

JLHA October 31-November 7,2014	**Dry weather discharge**	**No flow**	**Total Outfalls**
San Garbriel River	36	169	205
Brea Canyon	15	19	34
Coyote Creek	32	99	131
La Mirada	6	54	60
Milan Creek	2	22	24
North Coyote Creek	14	49	63
Total	**105**	**412**	**517**

Operation Procedures	
Illicit Discharge Detection & Elimination: Initial Outfall Screening	
Purpose:	This provides a basic checklist for field crews conducting initial survey of storm drainage system outfalls for use in identification of illicit discharges

Reference: Brown et al., *Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments,* Center for Watershed Protection, Ellicott City, 2004.

Planning Considerations:

- ☐ Employees should have reviewed and understand the information presented in Chapter 11 of the reference manual
- ☐ Inspections are to occur during dry weather (no runoff producing precipitation in last 72 hours)
- ☐ Conduct inspections with at least two staff per crew
- ☐ Conduct inspections during low groundwater (if appropriate).
- ☐ Complete ***Site Info section on Outfall Reconnaissance Inventory Form*** before leaving the office. Additional forms should be available for undocumented outfalls

Field Methods:

- ☐ Ensure outfall is accessible.
- ☐ Inspect outfall only if safe to do so.
- ☐ Characterize the outfall by recording information on the ***LCC Outfall Reconnaissance Inventory Form.***
- ☐ Photograph the outfall with a digital camera (use dry erase board to identify outfall).
- ☐ Enter flow information on form if dry weather flow is present and ***easily*** obtained. If not, provide rough estimate of flow.
- ☐ Document clean, dry outfalls for potential elimination during future screening programs.
- ☐ Water samples will not be collected during the initial survey. In-situ measurements of temperature, conductivity, and pH should be taken if significant flow is present.
- ☐ Do not enter private property without permission.
- ☐ Photograph each site with the site identification written on the dry erase board.

Equipment List:

1. System map
2. Outfall Reconnaissance Inventory Forms
3. City identification or business cards
4. Digital camera (spare batteries)
5. Cell phone
6. GPS unit
7. Clip board and pencils
8. Dry erase board and pens
9. Hand Mirror
10. Flashlight (spare batteries)
11. Disposable gloves
12. Folding wood ruler or comparable
13. Temperature, Conductivity probe
14. pH probe/strips
15. ***Ammonia test strips***
16. ***Ten1-liter (polyethylene) sample bottles***
17. Watch with second hand
18. Calculator
19. Hand sanitizer
20. Safety vests
21. First aid kit
22. ***Cooler***
23. Permanent marker

Bolded, italicized items will only be needed for later surveys. No water quality samples will be taken for laboratory analysis during the first survey.

LOWER SAN GABRIEL R. OUTFALL RECONNAISSANCE INVENTORY/ SAMPLE COLLECTION FIELD SHEET

Section 1: Background Data

Subbasin:		Outfall ID:	
TODAY'S DATE:		**TIME (MILITARY):**	
Investigators:		Form completed by:	
Temperature (°F):	Rainfall (in.): Last 24 hours:	Last 48 hours:	
Latitude:	Longitude:	GPS Unit:	GPS LMK #:
Camera:		Photo #s:	

Land Use in Drainage Area (Check all that apply):

☐ Industrial	☐ Open Space
☐ Ultra-Urban Residential	☐ Institutional
☐ Suburban Residential	Other: ____
☐ Commercial	Known Industries: ______________________________

Notes (e.g.., origin of outfall, if known):

Section 2: Outfall Description

LOCATION	MATERIAL		SHAPE		DIMENSIONS (IN.)	SUBMERGED
☐ **Closed Pipe**	☐ RCP ☐ PVC ☐ Steel ☐ Other: __________	☐ CMP ☐ HDPE	☐ Circular ☐ Elliptical ☐ Box ☐ Other: _____	☐ Single ☐ Double ☐ Triple ☐ Other: _____	Diameter/Dimensions: ______________________	In Water: ☐ No ☐ Partially ☐ Fully With Sediment: ☐ No ☐ Partially ☐ Fully
☐ **Open drainage**	☐ Concrete ☐ Earthen ☐ rip-rap ☐ Other: _____		☐ Trapezoid ☐ Parabolic ☐ Other: _____		Depth: _____ Top Width: _____ Bottom Width: _____	▨
☐ **In-Stream**	**(applicable when collecting samples)**					
Flow Present?	☐ Yes ☐ No *If No, Skip to Section 5*					
Flow Description (If present)	☐ Trickle ☐ Moderate ☐ Substantial					

Section 3: Quantitative Characterization

FIELD DATA FOR FLOWING OUTFALLS

PARAMETER		RESULT	UNIT	EQUIPMENT
☐Flow #1	Volume		Liter	Bottle
	Time to fill		Sec	
☐Flow #2	Flow depth		In	Tape measure
	Flow width	_____' _____"	Ft, In	Tape measure
	Measured length	_____' _____"	Ft, In	Tape measure
	Time of travel		S	Stop watch
Temperature			°F	Meter
pH			pH Units	Meter
Ammonia			mg/L	Test strip

Lower LA River Outfall Reconnaissance Inventory Field Sheet

Section 4: Physical Indicators for Flowing Outfalls Only

Are Any Physical Indicators Present in the flow? ☐ Yes ☐ No *(If No, Skip to Section 5)*

INDICATOR	CHECK if Present	DESCRIPTION	RELATIVE SEVERITY INDEX (1-3)		
Odor	☐	☐ Sewage ☐ Rancid/sour ☐ Petroleum/gas ☐ Sulfide ☐ Other:	☐ 1 – Faint	☐ 2 – Easily detected	☐ 3 – Noticeable from a distance
Color	☐	☐ Clear ☐ Brown ☐ Gray ☐ Yellow ☐ Green ☐ Orange ☐ Red ☐Other:	☐ 1 – Faint colors in sample bottle	☐ 2 – Clearly visible in sample bottle	☐ 3 – Clearly visible in outfall flow
Turbidity	☐	See severity	☐ 1 – Slight cloudiness	☐ 2 – Cloudy	☐ 3 – Opaque
Floatables -Does Not Include Trash!!	☐	☐ Sewage (Toilet Paper, etc.) ☐ Suds ☐ Petroleum (oil sheen) ☐ Other:	☐ 1 – Few/slight; origin not obvious	☐ 2 – Some; indications of origin (e.g., possible suds or oil sheen)	☐ 3 - Some; origin clear (e.g., obvious oil sheen, suds, or floating sanitary materials)

Section 5: Physical Indicators for Both Flowing and Non-Flowing Outfalls

Are physical indicators that are not related to flow present? ☐ Yes ☐ No *(If No, Skip to Section 6)*

INDICATOR	CHECK if Present	DESCRIPTION	COMMENTS
Outfall Damage	☐	☐ Spalling, Cracking or Chipping ☐ Peeling Paint ☐ Corrosion	
Deposits/Stains	☐	☐ Oily ☐ Flow Line ☐ Paint ☐ Other:	
Abnormal Vegetation	☐	☐ Excessive ☐ Inhibited	
Poor pool quality	☐	☐ Odors ☐ Colors ☐ Floatables ☐ Oil Sheen ☐ Suds ☐ Excessive Algae ☐ Other:	
Pipe benthic growth	☐	☐ Brown ☐ Orange ☐ Green ☐ Other:	

Section 6: Overall Outfall Characterization

☐ Unlikely ☐ Potential (presence of two or more indicators) ☐ Suspect (one or more indicators with a severity of 3) ☐ Obvious

Section 7: Data Collection

1. Sample for the lab?	☐ Yes	☐ No			
2. If yes, collected from:	☐ Flow	☐ Pool			
3. Intermittent flow trap set?	☐ Yes	☐ No	If Yes, type:	☐ OBM	☐ Caulk dam

Section 8: Any Non-Illicit Discharge Concerns (e.g., trash or needed infrastructure repairs)?

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APPENDIX E

ANALYTICAL METHODS AND DETECTION LIMITS FOR THE LACFD AG LABORATORY

APPLICABLE TO S13 ME SITE

Table 3. Analytical Methods and Detection Limits of the Los Angeles County Flood Control Departments Ag Lab.

Analytical Method	Analyte	Permit ML	Unit	LACFCD's Ag Lab	
				MRL	MDL
Conventional Pollutants					
EPA 1664A	Oil and Grease	5	mg/L	5	1.44
EPA 420.1	Total Phenols	0.1	mg/L	0.1	0.03
SM 4500-CN- E	Cyanide	0.005	mg/L	0.005	0.005
SM 4500-H+ B	pH	0 - 14	pH	0.1	0.1
SM 2550B	Temperature	N/A	C	0.01	0.01
SM 4500-O G	Dissolved Oxygen	Sensitivity to 5	mg/L	1	1
BACTERIA (single sample limits)					
SM9221B	Total coliform (marine waters)	10,000	MPN/100ml	20	20
SM 9230B	Enterococcus (marine waters)	104	MPN/100ml	20	20
SM 9221E	Fecal coliform (marine & fresh waters)	400	MPN/100ml	20	20
SM 9221E/ Colilert-QT	E. coli (fresh waters)	235	MPN/100ml	1	1
GENERAL					
SM 4500-P E	Dissolved Phosphorus	0.05	mg/L	0.05	0.05
SM 4500-P E	Total Phosphorus	0.05	mg/L	0.05	0.05
SM 2130 B	Turbidity	0.1	NTU	0.1	0.1
SM 2540D	Total Suspended Solids	2	mg/L	2	1
SM 2540E	Volatile Suspended Solids	2	mg/L	1	1
SM 5310B	Total Organic Carbon	1	mg/L	1	0.5
EPA 418.1	Total Petroleum Hydrocarbon	5	mg/L	5	1.5
SM 5210 B	Biochemical Oxygen Demand	2	mg/L	2	1
SM 5220 D	Chemical Oxygen Demand	20-900	mg/L	20	10
SM 4500-NH3 C	Total Ammonia-Nitrogen	0.1	mg/L	0.1	0.1
SM4500-NH3 C	Total Kjeldahl Nitrogen	0.1	mg/L	0.1	0.1
EPA 300.0	Nitrate-N	0.1	mg/L	0.1	0.1
EPA 300.0	Nitrite -N	0.1	mg/L	0.1	0.1
SM 2320B	Alkalinity	2	mg/L	2	2
SM 2510 B	Specific Conductance	1	umho/cm	1	1
SM 2340C	Total Hardness	2	mg/L	2	2
SM 5540C	MBAS	0.5	mg/L	0.5	0.1
EPA 300.0	Chloride	2	mg/L	1	1
EPA 300.0	Fluoride	0.1	mg/L	0.1	0.1
EPA 624	Methyl tertiary butyl ether (MTBE)	1	mg/L	1	0.33
EPA 314.0	Perchlorate	4	μg/L	4	4
METALS (Dissolved & Total)					

Analytical Method	Analyte	Permit ML	Unit	LACFCD's Ag Lab	
				MRL	MDL
EPA 200.8	Aluminum	100	µg/L	100	50
EPA 200.8	Antimony	0.5	µg/L	0.5	0.5
EPA 200.8	Arsenic	1	µg/L	1	0.2
EPA 200.8	Beryllium	0.5	µg/L	0.5	0.1
EPA 200.8	Cadmium	0.25	µg/L	0.25	0.1
EPA 218.6	Chromium (Hexavalent)	5	µg/L	5	0.25
EPA 200.8	Chromium (total)	0.5	µg/L	0.5	0.5
EPA 200.8	Copper	0.5	µg/L	0.5	0.5
EPA 200.8	Iron	100	µg/L	100	50
EPA 200.8	Lead	0.5	µg/L	0.5	0.2
EPA 245.1	Mercury	0.5	µg/L	0.5	0.1
EPA 200.8	Nickel	1	µg/L	1	0.5
EPA 200.8	Selenium	1	µg/L	1	0.5
EPA 200.8	Silver	0.25	µg/L	0.25	0.1
EPA 200.8	Thallium	1	µg/L	1	0.1
EPA 200.8	Zinc	1	µg/L	1	1
	SEMIVOLATILE ORGANIC COMPOUNDS **ACIDS**				
EPA 625	2-Chlorophenol	2	µg/L	2	0.67
EPA 625	4-Chloro-3-methylphenol	1	µg/L	1	1
EPA 625	2,4-Dichlorophenol	1	µg/L	1	1
EPA 625	2,4-Dimethylphenol	2	µg/L	2	0.67
EPA 625	2,4-Dinitrophenol	5	µg/L	5	1
EPA 625	2-Nitrophenol	10	µg/L	10	1
EPA 625	4-Nitrophenol	5	µg/L	5	1
EPA 625	Pentachlorophenol	2	µg/L	2	0.67
EPA 625	Phenol	1	µg/L	1	0.33
EPA 625	2,4,6-Trichlorophenol	10	µg/L	10	3.33
	BASE/NEUTRAL				
EPA 625	Acenaphthene	1	µg/L	1	0.33
EPA 625	Acenaphthylene	2	µg/L	2	0.67
EPA 625 SIM	Acenaphthylene	2	µg/L		
EPA 625	Anthracene	2	µg/L	2	0.67
EPA 625	Benzidine	5	µg/L	5	1.67
EPA 625	1,2 Benzanthracene	5	µg/L	5	1.67
EPA 625	Benzo(a)pyrene	2	µg/L	2	0.67
EPA 625	Benzo(g,h,i)perylene	5	µg/L	5	1.67
EPA 625	3,4 Benzofluoranthene	10	µg/L	10	3.33

Analytical Method	Analyte	Permit ML	Unit	LACFCD's Ag Lab	
				MRL	MDL
EPA 625	Benzo(k)flouranthene	2	µg/L	2	0.67
EPA 625	Bis(2-Chloroethoxy) methane	5	µg/L	5	1.67
EPA 625	Bis(2-Chloroisopropyl) ether	2	µg/L	2	0.67
EPA 625	Bis(2-Chloroethyl) ether	1	µg/L	1	0.33
EPA 625	Bis(2-Ethylhexyl) phthalate	5	µg/L	5	1.67
EPA 625	4-Bromophenyl phenyl ether	5	µg/L	5	1.67
EPA 625	Butyl benzyl phthalate	10	µg/L	10	3.33
EPA624	2-Chloroethyl vinyl ether	1	µg/L	1	0.33
EPA 625	2-Chloronaphthalene	10	µg/L	10	3.33
EPA 625	4-Chlorophenyl phenyl ether	5	µg/L	5	1.67
EPA 625	Chrysene	5	µg/L	5	1.67
EPA 625	Dibenzo(a,h)anthracene	0.1	µg/L	0.1	0.033
EPA 625	1,3-Dichlorobenzene	1	µg/L	1	0.5
EPA 625	1,4-Dichlorobenzene	1	µg/L	1	0.5
EPA 625	1,2-Dichlorobenzene	1	µg/L	1	0.5
EPA 625	3,3-Dichlorobenzidine	5	µg/L	5	1.67
EPA 625	Diethyl phthalate	2	µg/L	2	1
EPA 625	Dimethyl phthalate	2	µg/L	2	1
EPA 625	di-n-Butyl phthalate	10	µg/L	10	3.33
EPA 625	2,4-Dinitrotoluene	5	µg/L	5	1.67
EPA 625	2,6-Dinitrotoluene	5	µg/L	5	1.67
EPA 625	4,6 Dinitro-2-methylphenol	5	µg/L	5	1
EPA 625	1,2-Diphenylhydrazine	1	µg/L	1	0.33
EPA 625	di-n-Octyl phthalate	10	µg/L	10	3.33
EPA 625	Fluoranthene	0.05	µg/L	0.05	0.017
EPA 625	Fluorene	0.1	µg/L	0.1	0.033
EPA 625	Hexachlorobenzene	1	µg/L	1	0.33
EPA 625	Hexachlorobutadiene	1	µg/L	1	0.33
EPA 625	Hexachloro-cyclopentadiene	5	µg/L	5	1.67
EPA 625	Hexachloroethane	1	µg/L	1	0.33
EPA 625	Indeno(1,2,3-cd)pyrene	0.05	µg/L	0.05	0.017
EPA 625	Isophorone	1	µg/L	1	0.33
EPA 625	Naphthalene	0.2	µg/L	0.2	0.067
EPA 625	Nitrobenzene	1	µg/L	1	0.33
EPA 625	N-Nitroso-dimethyl amine	5	µg/L	5	1.67
EPA 625	N-Nitroso-diphenyl amine	1	µg/L	1	0.33
EPA 625	N-Nitroso-di-n-propyl amine	5	µg/L	5	1.67
EPA 625	Phenanthrene	0.05	µg/L	0.05	0.017

Analytical Method	Analyte	Permit ML	Unit	LACFCD's Ag Lab	
				MRL	MDL
EPA 625	Pyrene	0.05	µg/L	0.05	0.017
EPA 625	1,2,4-Trichlorobenzene	1	µg/L	1	0.33
Chlorinated Pesticides					
EPA 608	Aldrin	0.005	µg/L	0.005	0.005
EPA 608	alpha-BHC	0.01	µg/L	0.01	0.01
EPA 608	beta-BHC	0.005	µg/L	0.005	0.005
EPA 608	delta-BHC	0.005	µg/L	0.005	0.005
EPA 608	gamma-BHC (lindane)	0.02	µg/L	0.02	0.02
EPA 608	alpha-chlordane	0.1	µg/L	0.1	0.1
EPA 608	gamma-chlordane	0.1	µg/L	0.1	0.1
EPA 608	4,4'-DDD	0.05	µg/L	0.05	0.05
EPA 608	4,4'-DDE	0.05	µg/L	0.05	0.05
EPA 608	4,4'-DDT	0.01	µg/L	0.01	0.01
EPA 608	Dieldrin	0.01	µg/L	0.01	0.01
EPA 608	alpha-Endosulfan	0.02	µg/L	0.02	0.02
EPA 608	beta-Endosulfan	0.01	µg/L	0.01	0.01
EPA 608	Endosulfan sulfate	0.05	µg/L	0.05	0.05
EPA 608	Endrin	0.01	µg/L	0.01	0.01
EPA 608	Endrin aldehyde	0.01	µg/L	0.01	0.01
EPA 608	Heptachlor	0.01	µg/L	0.01	0.01
EPA 608	Heptachlor Epoxide	0.01	µg/L	0.01	0.01
EPA 608	Toxaphene	0.5	µg/L	0.5	0.5
POLYCHLORINATED BIPHENYLS					
EPA 608	Aroclor-1016	0.5	µg/L	0.5	0.5
EPA 608	Aroclor-1221	0.5	µg/L	0.5	0.5
EPA 608	Aroclor-1232	0.5	µg/L	0.5	0.5
EPA 608	Aroclor-1242	0.5	µg/L	0.5	0.5
EPA 608	Aroclor-1248	0.5	µg/L	0.5	0.5
EPA 608	Aroclor-1254	0.5	µg/L	0.5	0.5
EPA 608	Aroclor-1260	0.5	µg/L	0.5	0.5
ORGANOPHOSPHATE PESTICIDES					
EPA507	Atrazine	2	µg/L	2	0.667
EPA507	Chlorpyrifos	0.05	µg/L	0.05	0.02
EPA507	Cyanazine	2	µg/L	2	0.667
EPA507	Diazinon	0.01	µg/L	0.01	0.003
EPA507	Malathion	1	µg/L	1	0.33
EPA507	Prometryn	2	µg/L	2	0.67
EPA507	Simazine	2	µg/L	2	0.67
HERBICIDES					
EPA 515.3	2,4-D	10	µg/L	0.2	0.02
EPA 547	Glyphosate	5	µg/L	5	5
EPA 515.3	2,4,5-TP-SILVEX	0.5	µg/L	0.2	0.067

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APPENDIX F

SEDIMENT AND WATER QUALITY DATA QUALITY OBJECTIVES FOR THE LOS ANGELES COUNTY SANITATION DISTRICT MONITORING AT R8.

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Table 1. Analytical Methods and Detection Limits Applicable to NPDES Monitoring in Receiving Waters - Los Angeles County Sanitation District.

CMP	COMPOUND	RL	UNITS
METALS AND HARDNESS			
7429-90-5	Aluminum	10	ug/l
7440-36-0	Antimony	0.5	ug/l
7440-38-2	Arsenic	1	ug/l
7440-39-3	Barium	0.5	ug/l
7440-41-7	Beryllium	0.25	ug/l
7440-42-8	Boron	0.02	mg/l
7440-43-9	Cadmium	0.2	ug/l
7440-70-2	Calcium	0.02	mg/l
7440-47-3	Chromium	0.5	ug/l
7440-47-3(3+)	Trivalent Chromium	0.5	ug/l
7440-48-4	Cobalt	0.25	ug/l
7440-50-8	Copper	0.5	ug/l
7439-89-6	Iron	0.02	mg/l
7439-92-1	Lead	0.25	ug/l
7439-95-4	Magnesium	0.02	mg/l
7439-96-5	Manganese	1	ug/l
7439-98-7	Molybdenum	0.25	ug/l
7440-02-0	Nickel	1	ug/l
7440-09-7	Potassium	0.2	mg/l
7782-49-2	Selenium	1	ug/l
7440-21-3	Silicon	0.02	mg/l
7440-22-4	Silver	0.2	ug/l
7440-23-5	Sodium	0.2	mg/l
7440-24-6	Strontium	0.2	ug/l
7440-28-0	Thallium	0.25	ug/l
7440-31-5	Tin	0.5	ug/l
7440-32-6	Titanium	2	ug/l
7440-62-2	Vanadium	1	ug/l
7440-66-6	Zinc	1	ug/l
SiO2	Si as SiO2	0.04	mg/l
CaHARDNESS	Calcium Hardness as CaCO3	0.05	mg/l
MgHARDNESS	Magnesium Hardness as CaCO3	0.08	mg/l
HARDNESS	Total Hardness as CaCO3	0.05	mg/l
PCBS			
12674-11-2	Aroclor 1016	0.1	ug/l
11104-28-2	Aroclor 1221	0.5	ug/l
11141-16-5	Aroclor 1232	0.3	ug/l
53469-21-9	Aroclor 1242	0.1	ug/l
12672-29-6	Aroclor 1248	0.1	ug/l

11097-69-1	Aroclor 1254	0.05	ug/l
11096-82-5	Aroclor 1260	0.1	ug/l
OC PESTICIDES			
309-00-2	Aldrin	0.005	ug/l
319-84-6	alpha-BHC	0.01	ug/l
319-85-7	beta-BHC	0.005	ug/l
5103-73-1	cis-Nonachlor	0.01	ug/l
319-86-8	delta-BHC	0.005	ug/l
60-57-1	Dieldrin	0.01	ug/l
959-98-8	Endosulfan I	0.01	ug/l
33213-65-9	Endosulfan II	0.01	ug/l
1031-07-8	Endosulfan sulfate	0.01	ug/l
72-20-8	Endrin	0.01	ug/l
7421-93-4	Endrin aldehyde	0.01	ug/l
58-89-9	gamma-BHC (Lindane)	0.01	ug/l
5103-71-9	alpha-Chlordane	0.01	ug/l
5103-74-2	gamma-Chlordane	0.01	ug/l
76-44-8	Heptachlor	0.01	ug/l
28044-83-9	Heptachlor epoxide (Isomer A)	0.01	ug/l
1024-57-3	Heptachlor epoxide (Isomer B)	0.01	ug/l
72-43-5	Methoxychlor	0.01	ug/l
2385-85-5	Mirex	0.05	ug/l
53-19-0	o,p'-DDD	0.01	ug/l
3424-82-6	o,p'-DDE	0.01	ug/l
789-02-6	o,p'-DDT	0.01	ug/l
26880-48-8	Oxychlordane	0.01	ug/l
72-54-8	p,p'-DDD	0.01	ug/l
72-55-9	p,p'-DDE	0.01	ug/l
50-29-3	p,p'-DDT	0.01	ug/l
12789-03-6	Technical Chlordane	0.05	ug/l
8001-35-2	Toxaphene	0.5	ug/l
56534-02-2	cis-Chlordene	0.02	ug/l
56641-38-4	trans-Chlordene	0.01	ug/l
39765-80-5	trans-Nonachlor	0.01	ug/l
959-98-8	Endosulfan I	0.01	ug/l
33213-65-9	Endosulfan II	0.01	ug/l
1031-07-8	Endosulfan sulfate	0.01	ug/l
7421-93-4	Endrin aldehyde	0.01	ug/l
PAHS			
83-32-9	Acenaphthene	0.02	ug/l
208-96-8	Acenaphthylene	0.02	ug/l
120-12-7	Anthracene	0.02	ug/l
56-55-3	Benzo(a)anthracene	0.02	ug/l

205-99-2	Benzo(b)fluoranthene	0.02	ug/l
207-08-9	Benzo(k)fluoranthene	0.02	ug/l
50-32-8	Benzo(a)pyrene	0.02	ug/l
191-24-2	Benzo(g,h,i)perylene	0.02	ug/l
218-01-9	Chrysene	0.02	ug/l
53-70-3	Dibenzo(a,h)anthracene	0.02	ug/l
206-44-0	Fluoranthene	0.02	ug/l
86-73-7	Fluorene	0.02	ug/l
193-39-5	Indeno(1,2,3-cd)pyrene	0.02	ug/l
91-20-3	Naphthalene	0.02	ug/l
85-01-8	Phenanthrene	0.02	ug/l
129-00-0	Pyrene	0.02	ug/l

Table 2. Reporting Limits and Data Quality Objectives (DQOs) for Sediment Sampling at R8 for the Harbor Toxics Monitoring Program

Parameter	Fraction	Accuracy		Precision	Completeness	Laboratory	Target Reporting Limits	Units
		Requirements	Recovery					
Grain Size: Estuary Sediment								
Sediment grain size	None	N/A	N/A	Laboratory Duplicate - RPD < 25%	90%	ABC	<2000 - >0.2	µm
Nutrients: Estuary Sediment								
Total Kjeldahl Nitrogen	None	None	N/A	Laboratory Duplicate - RPD < 25%	90%	IIRMES	0.04	mg/Kg dw
Phosphorus as P	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	80 - 120%	Laboratory duplicate, Blind Field duplicate, or MS/MSD 25%. RPD Laboratory duplicate minimum.	90%	IIRMES	0.05	mg/Kg dw
Total Organic Carbon	Total					IIRMES	0.02	% dw
Metals: Estuary Sediment								
Arsenic	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike. Matrix spikes sometimes have poor recovery in sediments, in which case a case a CRM and an LCS may be	75 -125% (70 - 130 % for Hg)	Laboratory Duplicate and Matrix Spike (or CRM) Duplicate - RPD < 25%	90%	IIRMES	0.5	mg/Kg dw
Cadmium	Total					IIRMES	0.4	mg/Kg dw
Chromium	Total					IIRMES	0.5	mg/Kg dw
Copper	Total					IIRMES	0.8	mg/Kg dw
Iron	Total					IIRMES	10	mg/Kg dw
Lead	Total					IIRMES	0.1	mg/Kg dw
Mercury	Total					IIRMES	0.02	mg/Kg dw
Nickel	Total					IIRMES	0.5	mg/Kg dw
Selenium	Total					IIRMES	0.5	mg/Kg dw
Zinc	Total					IIRMES	0.5	mg/Kg dw

Parameter	**Fraction**	**Accuracy**		**Precision**	**Completeness**	**Laboratory**	**Target Reporting Limits**	**Units**
		Requirements	**Recovery**					
		used.						
Organochlorine Pesticides: Estuary Sediment								
Aldrin	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	50 - 150%	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	IIRMES	1	ng/g dw
Chlordane, cis-	Total		50 - 150%			IIRMES	1	ng/g dw
Chlordane, trans-	Total		50 - 150%			IIRMES	1	ng/g dw
DDD(o,p')	Total		50 - 150%			IIRMES	1	ng/g dw
DDD(p,p')	Total		50 - 150%			IIRMES	1	ng/g dw
DDE(o,p')	Total		50 - 150%			IIRMES	1	ng/g dw
DDE(p,p')	Total		50 - 150%			IIRMES	1	ng/g dw
DDT(o,p')	Total		50 - 150%			IIRMES	1	ng/g dw
DDT(p,p')	Total		50 - 150%			IIRMES	1	ng/g dw
Dieldrin	Total		50 - 150%			IIRMES	1	ng/g dw
Endosulfan I	Total		50 - 150%			IIRMES	5	ng/g dw
Endosulfan II	Total		50 - 150%			IIRMES	5	ng/g dw
Endosulfan Sulfate	Total		50 - 150%			IIRMES	5	ng/g dw
Endrin	Total		50 - 150%			IIRMES	5	ng/g dw
Endrin Aldehyde	Total		33 - 138%			IIRMES	5	ng/g dw
Endrin Ketone	Total		50 - 150%			IIRMES	5	ng/g dw
HCH, alpha	Total		50 - 150%			IIRMES	1	ng/g dw
HCH, beta	Total		50 - 150%			IIRMES	1	ng/g dw
HCH, delta	Total		50 - 150%			IIRMES	1	ng/g dw
HCH, gamma	Total		50 - 150%			IIRMES	1	ng/g dw
Heptachlor	Total		50 - 150%			IIRMES	1	ng/g dw
Heptachlor Epoxide	Total		50 - 150%			IIRMES	1	ng/g dw
Methoxychlor	Total		34 - 143%			IIRMES	1	ng/g dw
Mirex	Total		50 - 150%			IIRMES	1	ng/g dw
Nonachlor, cis-	Total		50 - 150%			IIRMES	1	ng/g dw

Parameter	Fraction	Accuracy		Precision	Completeness	Laboratory	Target Reporting Limits	Units
		Requirements	Recovery					
Nonachlor, trans-	Total		50 - 150%			IIRMES	1	ng/g dw
Oxychlordane	Total		50 - 150%			IIRMES	1	ng/g dw
Toxaphene	Total		50 - 150%			IIRMES	1	
PCBs[1]: Estuary Sediment								
PCB 003	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	50 - 150 %	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	IIRMES	0.2	ng/g dw
PCB 008	Total					IIRMES	0.2	ng/g dw
PCB 018	Total					IIRMES	0.2	ng/g dw
PCB 028	Total					IIRMES	0.2	ng/g dw
PCB 031	Total					IIRMES	0.2	ng/g dw
PCB 033	Total					IIRMES	0.2	ng/g dw
PCB 037	Total					IIRMES	0.2	ng/g dw
PCB 044	Total					IIRMES	0.2	ng/g dw
PCB 049	Total					IIRMES	0.2	ng/g dw
PCB 052	Total					IIRMES	0.2	ng/g dw
PCB 056	Total					IIRMES	0.2	ng/g dw
PCB 056/060	Total					IIRMES	0.2	ng/g dw
PCB 060	Total					IIRMES	0.2	ng/g dw
PCB 066	Total					IIRMES	0.2	ng/g dw
PCB 070	Total					IIRMES	0.2	ng/g dw
PCB 074	Total					IIRMES	0.2	ng/g dw
PCB 077	Total					IIRMES	0.2	ng/g dw
PCB 081	Total					IIRMES	0.2	ng/g dw
PCB 087	Total					IIRMES	0.2	ng/g dw
PCB 095	Total					IIRMES	0.2	ng/g dw
PCB 097	Total					IIRMES	0.2	ng/g dw
PCB 099	Total					IIRMES	0.2	ng/g dw
PCB 101	Total					IIRMES	0.2	ng/g dw

1. Monitoring for PCBs will be reported as the summation of aroclors and a minimum of 50 congeners.

Parameter	Fraction	Accuracy		Precision	Completeness	Laboratory	Target Reporting Limits	Units
		Requirements	Recovery					
PCB 105	Total					IIRMES	0.2	ng/g dw
PCB 110	Total					IIRMES	0.2	ng/g dw
PCB 114	Total					IIRMES	0.2	ng/g dw
PCB 118	Total					IIRMES	0.2	ng/g dw
PCB 119	Total					IIRMES	0.2	ng/g dw
PCB 123	Total					IIRMES	0.2	ng/g dw
PCB 126	Total					IIRMES	0.2	ng/g dw
PCB 128	Total					IIRMES	0.2	ng/g dw
PCB 138	Total					IIRMES	0.2	ng/g dw
PCB 141	Total					IIRMES	0.2	ng/g dw
PCB 149	Total					IIRMES	0.2	ng/g dw
PCB 151	Total					IIRMES	0.2	ng/g dw
PCB 153	Total					IIRMES	0.2	ng/g dw
PCB 156	Total					IIRMES	0.2	ng/g dw
PCB 157	Total					IIRMES	0.2	ng/g dw
PCB 158	Total					IIRMES	0.2	ng/g dw
PCB 167	Total					IIRMES	0.2	ng/g dw
PCB 168	Total					IIRMES	0.2	ng/g dw
PCB 168/132	Total					IIRMES	0.2	ng/g dw
PCB 169	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	50 - 150 %	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	IIRMES	0.2	ng/g dw
PCB 170	Total					IIRMES	0.2	ng/g dw
PCB 174	Total					IIRMES	0.2	ng/g dw
PCB 177	Total					IIRMES	0.2	ng/g dw
PCB 180	Total					IIRMES	0.2	ng/g dw
PCB 183	Total					IIRMES	0.2	ng/g dw
PCB 187	Total					IIRMES	0.2	ng/g dw
PCB 189	Total					IIRMES	0.2	ng/g dw

Parameter	Fraction	Accuracy		Precision	Completeness	Laboratory	Target Reporting Limits	Units
		Requirements	Recovery					
PCB 194	Total					IIRMES	0.2	ng/g dw
PCB 195	Total					IIRMES	0.2	ng/g dw
PCB 209	Total					IIRMES	0.2	ng/g dw
PAHs: Estuary Sediment		Reference Material (CRM, SRM or LCS) and Matrix Spike		Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%			
Acenaphthene	Total		50 - 150%			IIRMES	5	ng/g dw
Acenaphthylene	Total		50 - 150%			IIRMES	5	ng/g dw
Anthracene	Total		50 - 150%			IIRMES	5	ng/g dw
Benz(a)anthracene	Total		50 - 150%			IIRMES	5	ng/g dw
Benzo(a)pyrene	Total		50 - 150%			IIRMES	5	ng/g dw
Benzo(b)fluoranthene	Total		50 - 150%			IIRMES	5	ng/g dw
Benzo(e)pyrene	Total		50 - 150%			IIRMES	5	ng/g dw
Benzo(g,h,i)perylene	Total		50 - 150%			IIRMES	5	ng/g dw
Benzo(k)fluoranthene	Total		50 - 150%			IIRMES	5	ng/g dw
Biphenyl	Total		50 - 150%			IIRMES	5	ng/g dw
Chrysene	Total		50 - 150%			IIRMES	5	ng/g dw
Dibenz(a,h)anthracene	Total		50 - 150%			IIRMES	5	ng/g dw
Dibenzothiophene	Total		50 - 150%			IIRMES	5	ng/g dw
Dimethylnaphthalene, 2,6-	Total		50 - 150%			IIRMES	5	ng/g dw
Fluoranthene	Total		50 - 150%			IIRMES	5	ng/g dw
Fluorene	Total		50 - 150%			IIRMES	5	ng/g dw
Indeno(1,2,3-c,d)pyrene	Total		50 - 150%			IIRMES	5	ng/g dw
Methylnaphthalene, 1-	Total		50 - 150%			IIRMES	5	ng/g dw
Methylnaphthalene, 2-	Total		50 - 150%			IIRMES	5	ng/g dw
Methylphenanthrene, 1-	Total		50 - 150%			IIRMES	5	ng/g dw
Naphthalene	Total		41 - 109%			IIRMES	5	ng/g dw
Perylene	Total		50 - 150%			IIRMES	5	ng/g dw
Phenanthrene	Total		50 - 150%			IIRMES	5	ng/g dw

Parameter	Fraction	Accuracy		Precision	Completeness	Laboratory	Target Reporting Limits	Units
		Requirements	Recovery					
Pyrene	Total		50 - 150%			IIRMES	5	ng/g dw
Trimethylnaphthalene, 2,3,5-	Total		50 - 150%			IIRMES	5	ng/g dw
Toxicity: Estuary Sediment								
Eohaustorius sp.	N/A	Meets EPA control response standards; DMR intralab results w/in criteria	N/A	Ref Tox ± 2 SD of preceding 20 tests	90%	ABC	N/A	Survival (%)
Mytilus Sediment Water Interface	N/A					ABC		Mortality/ Normality (%)
Invertebrate Identifications: Estuary Sediment								
Sampling	N/A	≤10 seconds of nominal Lat/Long (300 m radius)	N/A	N/A	90%	ABC	1.0 seconds Lat/Long	N/A
Sorting	N/A	A minimum of 10% of all material will be resorted. Sorting accuracy within 5% (equivalent to 95% removal efficiency).	95 % Sorting Efficiency	N/A	90%	ABC	N/A	N/A

Table 3. Data Quality Objectives for Water Quality Monitoring during Dry Weather at R8

	Accuracy			
Parameter	**Requirements**	**Recovery**	**Precision**	**Completeness**
Temperature-field pH-field instrumentation Dissolved Oxygen- field				90%
CONVENTIONALS Oil and Grease Total Petroleum Hydrocarbon Total Phenols Cyanide Turbidity Total Suspended Solids Total Dissolved Solids Volatile Suspended Solids Total Organic Carbon Biochemical Oxygen Demand Chemical Oxygen Demand Alkalinity Specific Conductance Total Hardness MBAS Chloride Fluoride Perchlorate	Field Duplicate Laboratory Duplicate Matrix Spike/Spike Dup	80 - 120%	Field Duplicate - RPD < 25% Laboratory Dup. - RPD < 25%	90%
VOLATILE Methyl tertiary butyl ether (MTBE)				
BACTERIA Total coliform (marine waters) Fecal coliform (marine waters) Enterococcus (marine waters) E. coli (fresh waters)	None	N/A	Laboratory Duplicate - RPD < 25%	90%
NUTRIENTS Total Kjeldahl Nitrogen (TKN) Nitrate as Nitrogen (NO3-N) Nitrite as Nitrogen (NO2-N) Total Nitrogen Ammonia as Nitrogen (NH3-N) Total Phosphorus Dissolved Phosphorus	Reference Material (CRM, SRM or LCS) and Matrix Spike	80 - 120%	Laboratory duplicate, Blind Field duplicate, or MS/MSD 25%. RPD Laboratory duplicate minimum.	90%

APPENDIX G

MINIMUM CRITERIA FOR EVALUATION OF WATER QUALITY CONSTITUENTS IN TABLE E-2 OF THE MRP

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SUMMARY OF MINIMUM APPLICABLE WATER QUALITY CRITERIA FOR THE SAN GABRIEL RIVER WATERSHED

Constituent	Minimum Level		Water Quality Objective/Criterion			Notes	
	Value	Units	Source	Value	Units		
Oil and Grease	5	mg/L	Basin Plan	Waters shall not contain oils, greases, waxes or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect beneficial uses.	N/A		
Total Phenols	100	µg/L	None	None	N/A		
Cyanide (Total)	5	µg/L	CTR Freshwater (1 hr avg.)	22	µg/L		
			CTR Freshwater (4 day avg.)	5.2			
pH	0 - 14	N/A	MS4 MAL[1]	7.7	N/A		
			Basin Plan	The pH of inland surface waters shall not be depressed below 6. 5 or raised above 8. 5 as a result of waste discharges. Ambient pH levels shall not be changed more than 0. 5 units from natural conditions as a result of waste discharge.			
				The pH of bays or estuaries shall not be depressed below 6. 5 or raised above 8. 5 as a result of waste discharges. Ambient pH levels shall not be changed more than 0. 2 units from natural conditions as a result of waste discharge.			
Temperature	None	°F	Basin Plan	The natural receiving water temperature of all regional waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration in temperature does not adversely affect beneficial uses. Alterations that are allowed must meet the requirements below.	°F		
				For waters designated WARM, water temperature shall not be altered by more than 5 °F above the natural temperature. At no time shall these WARM designated waters be raised above 80 °F as a result of waste discharges.			
				For waters designated COLD, water temperature shall not be altered by more than 5 °F above the natural temperature.			

Constituent	Minimum Level		Water Quality Objective/Criterion			Notes	
	Value	Units	Source	Value	Units		
Dissolved Oxygen	Sensitivity to 5 mg/L	mg/L	Basin Plan	At a minimum (see specifics below), the mean annual dissolved oxygen concentration of all waters shall be greater than 7 mg/L, and no single determination shall be less than 5.0 mg/L, except when natural conditions cause lesser concentrations. The dissolved oxygen content of all surface waters designated as WARM shall not be depressed below 5 mg/L as a result of waste discharges. The dissolved oxygen content of all surface waters designated as COLD shall not be depressed below 6 mg/L as a result of waste discharges. The dissolved oxygen content of all surface waters designated as both COLD and SPWN shall not be depressed below 7 mg/L as a result of waste discharges.	mg/L		
Fecal coliform (fresh waters)	20	MPN/100 ml	Basin Plan (REC-1, log mean, >= 4 samples for any 30-day period)	200	MPN/100 ml	Daily Maximum	
			Basin Plan (REC-1, <10% samples during any 30-day period)	400			
E. coli (fresh waters)	1	MPN/100 ml	None	None	N/A		
Dissolved Phosphorus	0.05	mg/L	Basin Plan	Waters shall not contain biostimulatory substances in concentrations that promote aquatic growth to the extent that such growth causes nuisance or adversely affects beneficial uses.	mg/L		
Total Phosphorus	0.05	mg/L	MS4 MAL	0.8	mg/L		
Turbidity	0.1	NTU	Basin Plan	Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in natural turbidity attributable to controllable water quality factors shall not exceed the following limits: (1) Where natural turbidity is between 0 and 50 NTU, increases shall not exceed 20%; (2) Where natural turbidity is greater than 50 NTU, increases shall not exceed 10%; (3) Allowable zones of dilution within which higher concentrations may be tolerated may be defined for each discharge in specific Waste Discharge Requirements.	NTU		

	Minimum Level		Water Quality Objective/Criterion			Notes	
Constituent	Value	Units	Source	Value	Units		
Total Suspended Solids (TSS)	2	mg/L	Basin Plan	Waters shall not contain suspended or settleable material in concentrations that cause nuisance or adversely affect beneficial uses.			
			MS4 MAL	264.1	mg/L		
Suspended Sediment Concentration (SSC)	0.5	mg/L	Basin Plan	Waters shall not contain suspended or settleable material in concentrations that cause nuisance or adversely affect beneficial uses.	mg/L		
Total Dissolved Solids (TDS)	2	mg/L	USEPA Secondary MCL	500	mg/L		
			CA Dept. Public Health Recommended Upper Level	1,000			
			CA Dept. Public Health Recommended Short-term Level	1,500			
Volatile Suspended Solids (VSS)	2	mg/L	Basin Plan	Waters shall not contain suspended or settleable material in concentrations that cause nuisance or adversely affect beneficial uses.	mg/L		
Total Organic Carbon (TOC)	1	mg/L	None	None	N/A		
Total Petroleum Hydrocarbons (extractable fraction, i.e., diesel and motor oil range hydrocarbons)	5	mg/L	None	None	none		
Biochemical Oxygen Demand	2	mg/L	Basin Plan	Waters shall be free of substances that result in increases in the BOD which adversely affect beneficial uses.			
Chemical Oxygen Demand	20-900	mg/L	MAL	247.5	mg/L		
Total Ammonia-Nitrogen (NH_3-N)	0.1	mg/L	Basin Plan	Varies based on pH and temperature for Cold waters and Warm Waters (Table 3-1 to 3-4 of Basin Plan)			
Total Kjeldahl Nitrogen (TKN)	0.1	mg/L	MS4 MAL	4.59	mg/L		
Nitrate+Nitrite (NO_2+NO_3 as N)	0.1	mg/L	MS4 MAL	1.85			
			Basin Plan	10 as NO3-N + NO2-N			

Constituent	Minimum Level		Water Quality Objective/Criterion			Notes	
	Value	Units	Source	Value	Units		
Alkalinity	2	mg/L	USEPA National Recommended Water Quality Criteria (Freshwater)	20,000	ug/L		
Specific Conductance	1	umho/cm	CA Dept. Public Health Secondary MCL	900	µmhos/cm		
Total Hardness (as CaCO3)	2	mg/L	None	None	N/A		
Methylene Blue Active Substances (MBAS)	500	µg/L	CA Dept. Public Health Secondary MCL	500	µg/L		
			Basin Plan Federal MCL	500			
Chloride	2	mg/L	Basin Plan	150	mg/L		
Fluoride	100	µg/L	CA Dept. Public Health MCL (drinking water)	2,000	µg/L		
Methyl tertiary butyl ether (MTBE)	1000	µg/L	USEPA National Recommended Water Quality Criteria 4-day average (freshwater)	51,000	µg/L		
			USEPA National Recommended Water Quality Criteria 1-hour average (freshwater)	151,000	µg/L		
Perchlorate	4	µg/L	CA Dept. Public Health MCL (drinking water)	6	µg/L		
Aluminum	100	µg/L	USEPA National Recommended Water Quality Criteria 4-day average (freshwater)	87	µg/L	-	
			USEPA National Recommended Water Quality Criteria 1-hour average (freshwater)	750		-	
Antimony	0.5	ug/L	USEPA National Recommended Water Quality Criteria Freshwater (acute)	9000	µg/L		
			USEPA National Recommended Water Quality Criteria Freshwater (chronic)	1600			

	Minimum Level		Water Quality Objective/Criterion			Notes	
Constituent	Value	Units	Source	Value	Units		
Arsenic	1	µg/L	CTR Freshwater (1 hr avg.) dissolved	340	µg/L		
			CTR Freshwater (4 day avg.) dissolved	150	µg/L		
Beryllium	0.5	µg/L	USEPA National Recommended Water Quality Criteria Freshwater (acute)	130	µg/L		
			USEPA National Recommended Water Quality Criteria Freshwater (chronic)	5.3			
Cadmium	0.25	µg/L	MS4 MAL	2.52	µg/L		
			CTR Freshwater (1 hr avg.) dissolved	1.6	µg/L		
			CTR Freshwater (4-day avg.) dissolved	1.1			
Chromium	0.5	µg/L	MS4 MAL	20.2	µg/L		
			National Toxics Rule Freshwater (4-day avg.) dissolved	84			
			National Toxics Rule Freshwater (1-hour avg.) dissolved	260			
Chromium (Hexavalent)	5	µg/L	CTR Freshwater (1 hr avg.) dissolved	16	ug/L		
			CTR Freshwater (4 day avg.) dissolved	11			

	Minimum Level		Water Quality Objective/Criterion			Notes
Constituent	Value	Units	Source	Value	Units	
Copper	0.5	µg/L	CTR Freshwater (1 hr avg.) dissolved	5.7	ug/L	
			CTR Freshwater (4 day avg.) dissolved	4.1		
			San Gabriel River Metals TMDL	Dry Weather: Coyote Creek 0.941	kg/day	Calculated based upon the median flow at LACDPW Station F354-R of 19 cfs multiplied by the numeric target of 20 µg/L, minus direct air deposition of 0.002 kg/d.
				Dry Weather: San Gabriel River Estuary 3.7	ug/L	
				Dry Weather: San Gabriel River Reach 1 18		
				Wet Weather: Coyote Creek 24.71		Multiply WLA by daily storm volume (L)
Iron	100	µg/L	USEPA National Recommended Water Quality Criteria 4-day average (freshwater)	1,000	ug/L	
Lead	0.5	ug/L	CTR Freshwater (1 hr avg.) dissolved	24	ug/L	
			CTR Freshwater (4 day avg.) dissolved	0.92		
			San Gabriel River Metals TMDL	Wet Weather: Coyote Creek 96.99	ug/L	Multiply WLA by daily storm volume (L)
				Wet Weather: San Gabriel River Reach 2 81.34		
				Wet Weather: San Jose Creek Reach 1 81.34		

Constituent	Minimum Level		Water Quality Objective/Criterion			Notes	
	Value	Units	Source	Value	Units		
Nickel	1	µg/L	MS4 MAL	27.43	µg/L		
			CTR Freshwater (1 hr avg.) dissolved	220			
			CTR Freshwater (4 day avg.) dissolved	24			
Selenium	1	µg/L	CTR Freshwater (1 hr avg.) dissolved	20	ug/L		
			CTR Freshwater (4 day avg.) dissolved	5			
			San Gabriel River Metals TMDL	San Jose Creek Reach 1 0.228	kg/day		
Silver	0.25	µg/L	CTR Freshwater (1 hr avg.)	0.71	ug/L		
Thallium	1	µg/L	USEPA National Recommended Water Quality Criteria chronic (freshwater)	40	ug/L		
			USEPA National Recommended Water Quality Criteria acute (freshwater)	1400			
Zinc	1	µg/L	CTR Freshwater (1 hr avg.) dissolved	54	ug/L		
			CTR Freshwater (4 day avg.) dissolved	54			
			San Gabriel River Metals TMDL	Wet Weather: Coyote Creek 144.57	ug/L	Multiply WLA by daily storm volume (L)	
				Dry Weather: San Jose Creek Reach 1 5			
Mercury	0.5	µg/L	CTR Human Health Protection (30-d avg; fish consumption only)	0.051	µg/L		
2-Chloroethylvinyl ether[4]	1	µg/L	None	None	µg/L		
2-Chlorophenol	2	µg/L	CTR Human Health Protection (Sources of Drinking water)	120	µg/L		
4-Chloro-3-methylphenol	1	µg/L	USEPA National Recommended Water Quality Criteria (Taste & Odor)	3,000	µg/L		
2,4-Dichlorophenol	1	µg/L	CTR Human Health Protection (Sources of Drinking water)	93	µg/L		

Constituent	Minimum Level		Water Quality Objective/Criterion			Notes	
	Value	Units	Source	Value	Units		
2,4-Dimethylphenol	2	µg/L	CTR Human Health Protection (Sources of Drinking water)	540	µg/L		
2,4-Dinitrophenol	5	µg/L	CTR Human Health Protection (Sources of Drinking water)	70	µg/L		
2-Nitrophenol	10	µg/L	None	None	N/A		
4-Nitrophenol	5	µg/L	None	None	N/A		
Pentachlorophenol	2	µg/L	CTR Fresh Water (4 day avg.) at pH 6.5	4	ug/L		
			CTR Freshwater (1 hr avg.) at pH 6.5	5.3			
Phenol	1	µg/L	CTR Human Health Protection (Sources of Drinking water)	21,000	µg/L		
2,4,6-Trichlorophenol	10	µg/L	CTR Human Health Protection (Sources of Drinking water)	2.1	µg/L		
Acenaphthene	1	µg/L	USEPA National Recommended Water Quality Criteria acute (freshwater)	170	µg/L		
			USEPA National Recommended Water Quality Criteria toxicity to algae	520			
Acenaphthylene	2	µg/L	None	None	N/A		
Anthracene	2	µg/L	CTR Human Health Protection (other waters)	110,000	µg/L		
Benzidine	5	µg/L	CTR Human Health Protection (Sources of Drinking water)	0.00012	µg/L		
1,2 Benzanthracene	5	µg/L	CTR Human Health Protection (other waters)	0.049	µg/L		
Benzo(a)pyrene	2	µg/L	CTR Human Health Protection (other waters)	0.049	µg/L		
Benzo(g,h,i)perylene	5	µg/L	None	None	N/A		
3,4 Benzoflouranthene	10	µg/L	CTR Human Health Protection (other waters)	0.049	µg/L		
Benzo(k)flouranthene	2	µg/L	CTR Human Health Protection (other waters)	0.049	µg/L		
Bis(2-Chloroethoxy) methane	5	µg/L	None	None	N/A		
Bis(2-Chloroisopropyl) ether	2	µg/L	None	None	N/A		

Constituent	Minimum Level		Water Quality Objective/Criterion			Notes	
	Value	Units	Source	Value	Units		
Bis(2-Chloroethyl) ether	1	µg/L	None	None	N/A		
Bis(2-Ethylhexl) phthalate	5	µg/L	National Toxics Rule (other waters)	5.9	N/A		
4-Bromophenyl phenyl ether	5	µg/L	None	None	N/A		
Butyl benzyl phthalate	10	µg/L	None	None	N/A		
2-Chloronaphthalene	10	µg/L	None	None	N/A		
4-Chlorophenyl phenyl ether	5	µg/L	None	None	N/A		
Chrysene	5	µg/L	CTR Human Health Protection (other waters)	0.049	µg/L		
Dibenzo(a,h)anthracene	0.1	µg/L	CTR Human Health Protection (other waters)	0.049	µg/L		
1,3-Dichlorobenzene	1	µg/L	USEPA National Recommended Water Quality Criteria acute (freshwater)	1,120	µg/L		
			USEPA National Recommended Water Quality Criteria chronic (freshwater)	763			
1,4-Dichlorobenzene	1	µg/L	USEPA National Recommended Water Quality Criteria acute (freshwater)	1,120	µg/L		
			USEPA National Recommended Water Quality Criteria chronic (freshwater)	763			
1,2-Dichlorobenzene	1	µg/L	USEPA National Recommended Water Quality Criteria acute (freshwater)	1,120	µg/L		
			USEPA National Recommended Water Quality Criteria chronic (freshwater)	763			
3,3-Dichlorobenzidine	5	µg/L	None	None	N/A		
Diethyl phthalate	2	µg/L	None	None	N/A		
Dimethyl phthalate	2	µg/L	None	None	N/A		
Di-n-Butyl phthalate	10	µg/L	None	None	N/A		

	Minimum Level		Water Quality Objective/Criterion			Notes	
Constituent	Value	Units	Source	Value	Units		
2,4-Dinitrotoluene	5	µg/L	None	None	N/A		
2,6-Dinitrotoluene	5	µg/L	USEPA Toxicity LOEL	330 (acute)	µg/L		
				230 (chronic)			
4,6 Dinitro-2-methylphenol	5	µg/L	None	None	N/A		
1,2-Diphenylhydrazine	1	µg/L	None	None	N/A		
Di-n-Octyl phthalate	10	µg/L	USEPA Toxicity LOEL	940 acute	µg/L		
				3 chronic			
Fluoranthene	0.05	µg/L	USEPA National Recommended Water Quality Criteria acute (freshwater)	398	ug/L		
Fluorene	0.1	µg/L	CTR Human Health Protection (other waters)	14,000	ug/L		
Hexachlorobenzene	1	µg/L	None	None	N/A		
Hexachlorobutadiene	1	µg/L	None	None	N/A		
Hexachloro-cyclopentadiene	5	µg/L	None	None	N/A		
Hexachloroethane	1	µg/L	None	None	N/A		
Indeno(1,2,3-cd)pyrene	0.05	µg/L	CTR Human Health Protection (other waters)	0.049	µg/L		
Isophorone	1	µg/L	None	None	N/A		
Naphthalene	0.2	µg/L	USEPA National Recommended Water Quality Criteria chronic (freshwater)	620	ug/L		
			USEPA National Recommended Water Quality Criteria acute (freshwater)	2,300			
Nitrobenzene	1	µg/L	None	None	N/A		
N-Nitroso-dimethyl amine	5	µg/L	USEPA National Recommended Water Quality Criteria acute (freshwater)	585	ug/L		
N-Nitroso-diphenyl amine	1	µg/L	None	None	N/A		
N-Nitroso-di-n-propyl amine	5	µg/L	None	None	N/A		

Constituent	Minimum Level		Water Quality Objective/Criterion			Notes	
	Value	Units	Source	Value	Units		
Phenanthrene	0.05	µg/L	None	None	N/A		
Pyrene	0.05	µg/L	CTR Human Health Protection (other waters)	11,000	ug/L		
1,2,4-Trichlorobenzene	1	µg/L	USEPA National Recommended Water Quality Criteria acute (freshwater)	250	ug/L		
			USEPA National Recommended Water Quality Criteria chronic (freshwater)	50			
Aldrin	0.005	µg/L	CTR freshwater instantaneous max.	3	ug/L		
alpha-BHC	0.01	µg/L	CTR Human Health Protection (other waters)	0.013	ug/L		
beta-BHC	0.005	µg/L	CTR Human Health Protection (other waters)	0.046	ug/L		
delta-BHC	0.005	µg/L	None	None	N/A		
gamma-BHC (lindane)	0.02	µg/L	CTR Freshwater (1 hr avg.)	0.95	ug/L		
alpha-chlordane[1]	0.1	µg/L	None	None	N/A		
gamma-chlordane[1]	0.1	µg/L	None	None	N/A		
4,4'-DDD	0.00004	µg/L	USEPA National Recommended Water Quality Criteria acute (freshwater)	0.06	ug/L		
4,4'-DDE	0.00008	ug/L	USEPA National Recommended Water Quality Criteria acute (freshwater)	105	ug/L		
4,4'-DDT	0.00008	µg/L	CTR Freshwater (4-day avg.)	0.001	ug/L		
			CTR freshwater instantaneous max.	1.1			
Dieldrin	0.01	µg/L	CTR Freshwater (1 hr avg.)	0.24	ug/L		
			CTR Freshwater (4-day avg.)	0.056			
alpha-Endosulfan	0.02	µg/L	CTR Freshwater (1 hr avg.)	0.22	ug/L		
			CTR Freshwater (4-day avg.)	0.056			
beta-Endosulfan	0.01	µg/L	CTR Freshwater (1 hr avg.)	0.22	ug/L		
			CTR Freshwater (4-day avg.)	0.056			

	Minimum Level		Water Quality Objective/Criterion			Notes	
Constituent	Value	Units	Source	Value	Units		
Endosulfan sulfate	0.05	µg/L	USEPA 24 hr avg	0.056	µg/L		
Endrin	0.01	µg/L	CTR Freshwater (1 hr avg.)	0.086	µg/L		
			CTR Freshwater (4-day avg.)	0.036			
Endrin aldehyde	0.01	µg/L	None	None	N/A		
Heptachlor	0.01	µg/L	National Toxics Rule Freshwater (4-day avg.)	0.0038	ug/L		
			CTR freshwater instantaneous max.	0.52			
Heptachlor epoxide	0.01	µg/L	National Toxics Rule Freshwater (4-day avg.)	0.0038	ug/L		
			CTR freshwater instantaneous max.	0.52			
Toxaphene	0.5	µg/L	CTR Freshwater (1 hr avg.)	0.73	ug/L		
			CTR Freshwater (4-day avg.)	0.0002			
Total PCBs (sum of 166 congeners)	range for all congeners: 0.000005-0.000020	µg/L	National Toxics Rule Freshwater (4-day avg.)	0.014	ug/L		
	Total PCBs: 0.00002		California Primary MCL	0.5			
Atrazine	2	µg/L	USEPA National Recommended Water Quality Criteria Freshwater (1-hour avg)	1,500	ug/L		
Chlorpyrifos	0.05	µg/L	California Dept. of Fish and Game Freshwater (1-hour avg)	0.02	ug/L		
			California Dept. of Fish and Game Freshwater (4-day avg)	0.014			
Cyanazine	2	µg/L	None	None	N/A		
Diazinon	0.01	µg/L	California Dept. of Fish and Game Freshwater (4-day avg)	0.05	µg/L		
			California Dept. of Fish and Game Freshwater (1-hour avg)	**0.08**			
Malathion	1	µg/L	USEPA National Recommended Water Quality Criteria for Freshwater Aquatic Life (max instant.)	0.1	µg/L		

	Minimum Level		Water Quality Objective/Criterion			Notes	
Constituent	Value	Units	Source	Value	Units		
Prometryn	2	µg/L	None	None	N/A		
Simazine	2	µg/L	USEPA National Recommended Water Quality Criteria for Freshwater Aquatic Life (max instant.)	10	µg/L		
2,4-D	10	µg/L	USEPA National Recommended Water Quality Criteria (water+fish consumption)	100	ug/L		
Glyphosate	5	µg/L	None	None	N/A		
2,4,5-TP-SILVEX	0.5	µg/L	USEPA National Recommended Water Quality Criteria (water+fish consumption)	10	ug/L		

[1] MAL = Municipal Action Level as defined by Los Angeles County Permit Order No. R4-2012-0175 Attachment G.

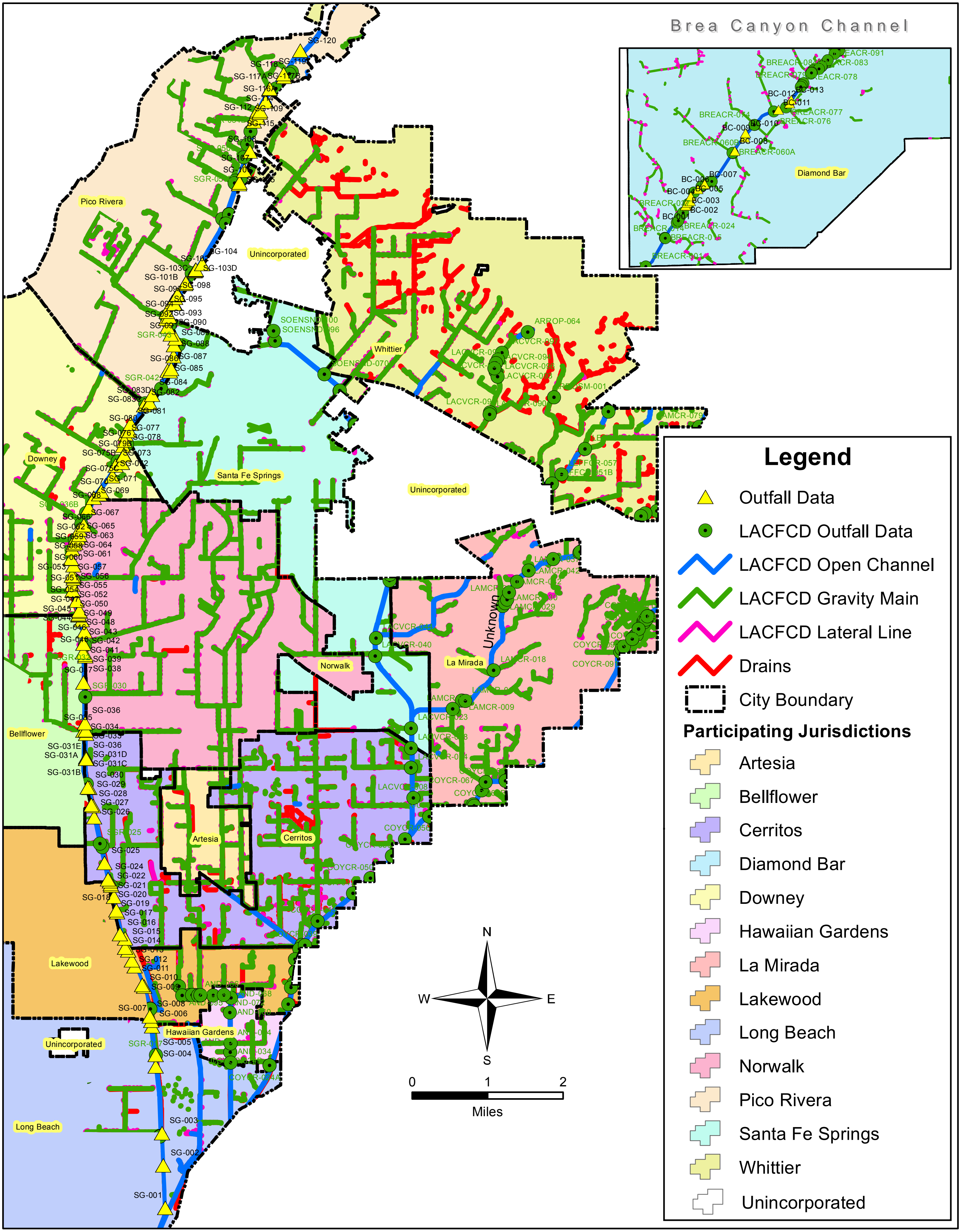
APPENDIX H

Outfall Identification

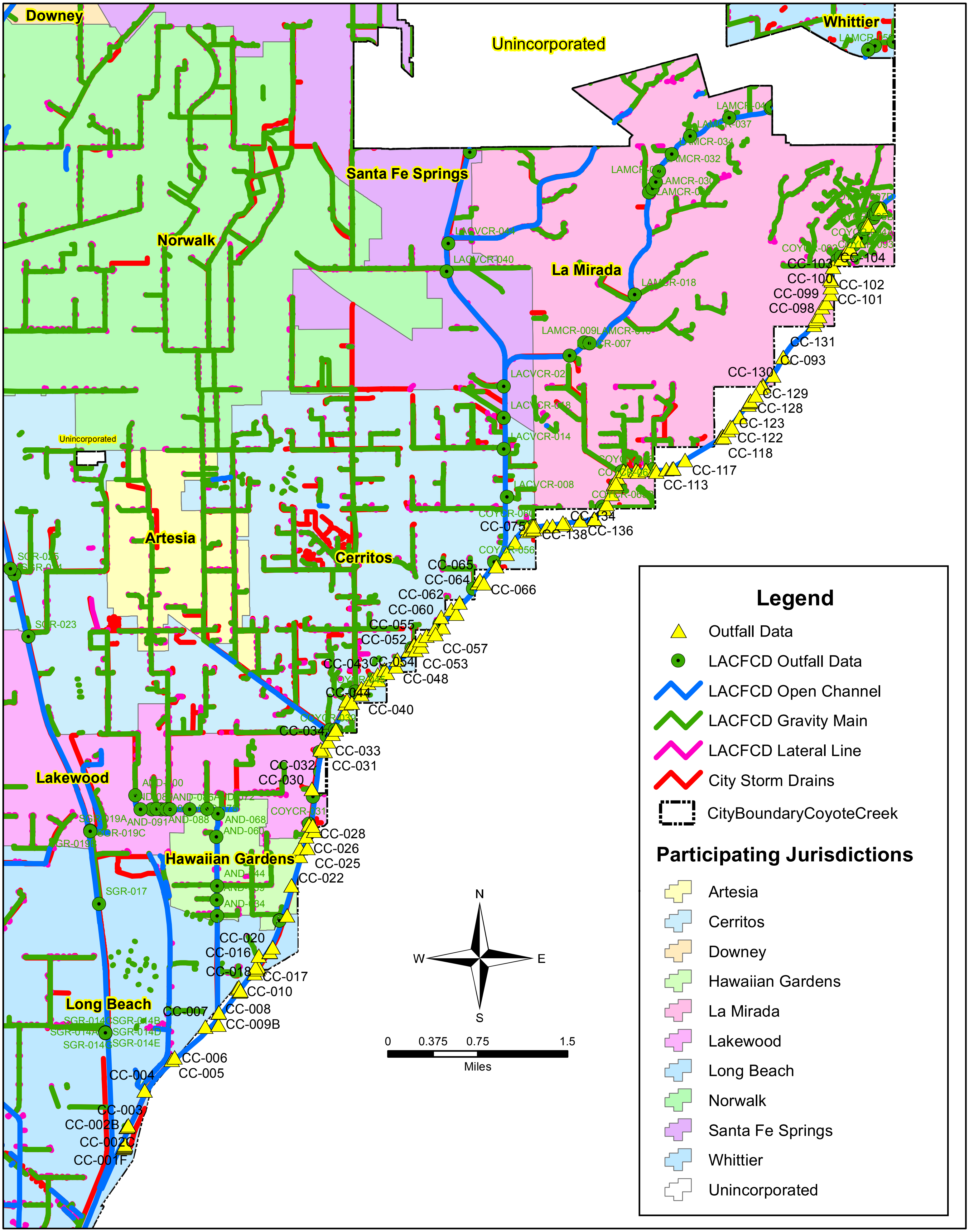
Per Section VII, Attachment E

Outfalls 12 inches and greater were surveyed. Maps showing the location of these outfalls are contained in this Appendix. Photographs collected during the survey and a database with outfall attributes is available upon request

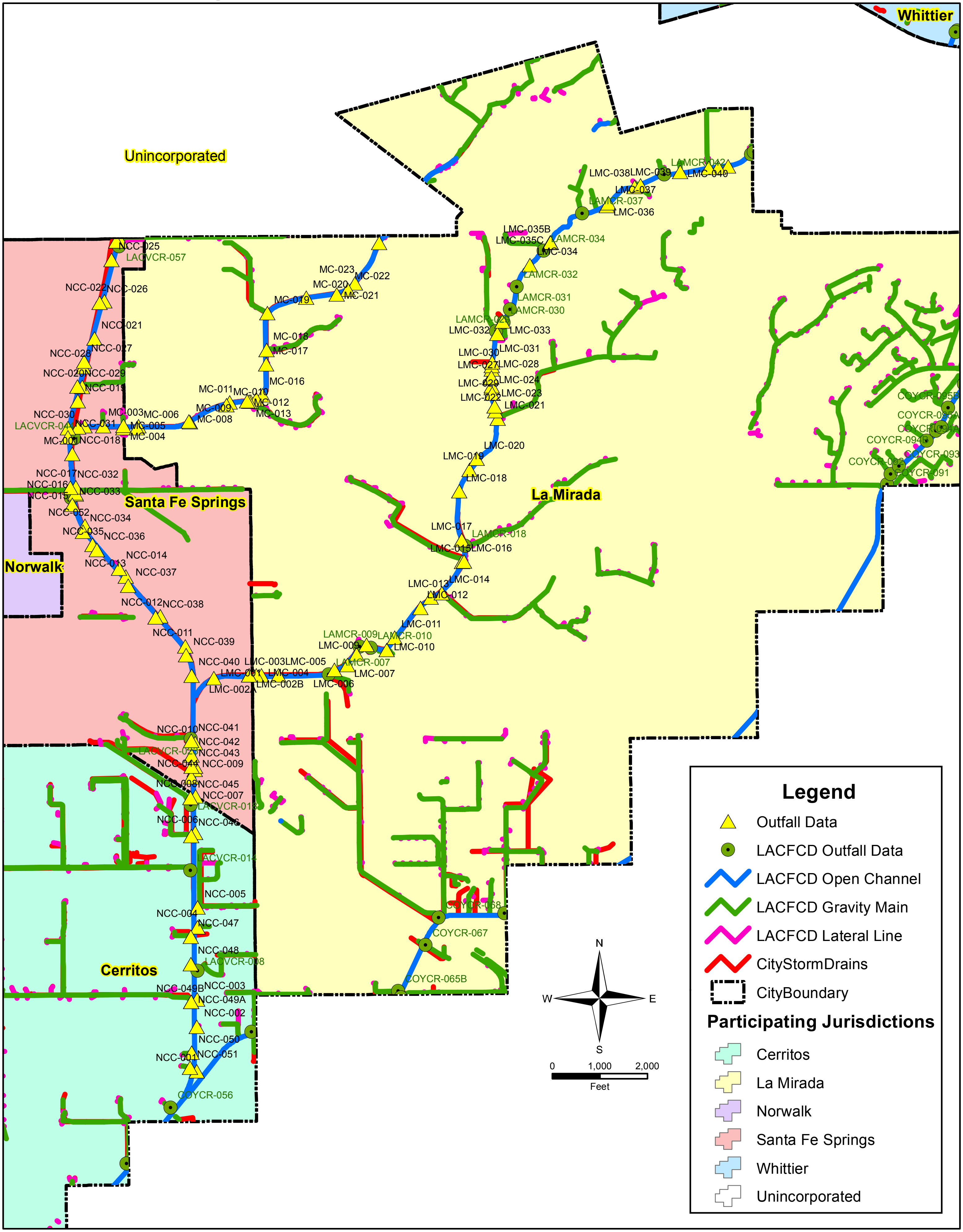
San Gabriel River



Coyote Creek Channel



North Coyote Creek Channel and Tributaries



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APPENDIX I

GENERAL FIELD SAMPLING PROCEDURES

FOR

COMPOSITE AND GRAB SAMPLES

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GENERAL FIELD SAMPLING PROCEDURE FOR:

Composite Samples

1.0 SCOPE

This Standard Operating Procedure (SOP) describes the procedures for the compositing and sub-sampling of non-point source (NPS) "composite" sample bottles. The purpose of these procedures is to ensure that the sub-samples taken are representative of the entire water sample in the "composite" bottle (or bottles). In order to prevent confusion, it should be noted that the bottles are referred to as "composite" bottles because they are a composite of many small samples taken over the course of a storm; in this SOP the use of "compositing" generally refers to the calculated combining of more than one of these "composite" bottles.

2.0 APPLICATION

This SOP applies to all laboratory activities that comprise the compositing and sub-sampling of NPS composite sample bottles.

3.0 HEALTH AND SAFETY CONSIDERATIONS

The compositing and sub-sampling of composite sample bottles may involve contact with contaminated water. Skin contact with sampled water should be minimized by wearing appropriate protective gloves, clothing, and safety glasses. Avoid hand-face contact during the compositing and sub-sampling procedures. Wash hands with soap and warm water after work is completed.

4.0 DEFINITIONS

4.1 **"Composite" sample bottle:** A borosilicate glass bottle that is used to collect multiple samples over the course of a storm (a composite sample).

4.2 **Large-capacity stirrer:** Electric motorized "plate" that supports composite bottle and facilitates the mixing of sample water within the bottle by means of spinning a pre-cleaned magnetic stir-bar which is introduced into the bottle.

4.3 **Stir-bar:** Pre-cleaned teflon-coated magnetic "bar" approximately 2-3 inches in length which is introduced into a composite bottle and is spun by the stirrer, thereby creating a vortex in the bottle and mixing the sample.

4.4 **Sub-sampling hose:** Two pre-cleaned ~3-foot lengths of Teflon tubing connected by a ~2-foot length of silicon tubing. Used with a peristaltic pump to transfer sample water from the composite sample bottle to sample analyte containers.

4.5 **Volume-to-Sample Ratio (VSR):** A number that represents the volume of water that will flow past the flow-meter before a sample is taken (usually in liters but can also be in kilo-cubic feet for river deployments). For example, if the VSR is 1000 it means that every time 1000 liters passes the flow-meter the sampler collects a sample (1000 liters of flow per 1 sample taken). Note: The VSR indicates when a sample should be taken and is NOT an indication of the sample size.

5.0 EQUIPMENT

5.1 Instrumentation: Not applicable

5.2 Reagents: Not applicable.

5.3 Apparatus:

1) Large capacity stirrer.
2) Stir bar.
3) Sub-sampling hose.
4) Peristaltic pump.

5.4 Documentation: Information from the field logbook should include the volume-to-sample ratio for each composite sample bottle, each bottle's ID number, and the time of the last sample taken at a particular sampling site (for purposes of holding times). Previous documentation should exist for the cleaning batch numbers for the 20-L bottles and the sub-sampling hoses.

6.0 COMPOSITING AND SUB-SAMPLING PROCEDURES

Compositing sample water prior to sub-sampling may be necessary if more than one composite sample bottle was filled (or partially filled) during the course of a storm at a particular sampling site. Care must be taken to ensure that no contaminants are introduced at any point during this procedure. If the compositing is not performed with this in mind, the possibility for the introduction of contaminants (i.e., from dust, dirty sub-sampling hose tips, dirty fingers/gloves, engine emissions, etc.) is increased significantly.

6.1 Determining the Fraction of Each Sample Bottle to be Composited: This is essential to producing a composite that is representative of the entire storm sampled and is not biased/weighted toward the first part of the storm (Bottle 1) or the last part of the storm (last bottle). In general, either the bottles have been sampled using the same volume-to-sample ratio (VSR), <u>OR</u> the VSR has been increased for the Bottle 2 in order to prevent over-filling of another bottle; this happens when the amount of rainfall and resulting runoff volume was underestimated.

6.1.1 Consult the field logbook and confirm that the bottles are from the same sampling station. Inspect the bottles' "ID" tags and confirm that the volume-to-sample ratio (VSR) numbers are the same as in the logbook.

6.1.2 If both bottles have the same VSR then equal parts of each sample should be mixed.

6.1.3 If the VSR of Bottle 2 is double that of Bottle 1 then 2-parts from Bottle 2 should be mixed with 1-part from Bottle 1. This is because Bottle 1 is, in a sense, twice as concentrated as Bottle 2, having sampled half as much flow per sample aliquot.

6.1.4 If there are more than two bottles to composite simply follow the rules above but apply it to all three bottles. For example, if Bottles 1, 2, and 3 had VSRs of 100, 200, and 400, respectively, then the composite would be composed of 4-parts from Bottle 3, 2-parts from Bottle 2, and 1-part from Bottle 1.

6.1.5 Volume-to-Sample Ratios are typically multiples of each other and are rarely fractions of each other. This is simply to make compositing bottles with different VSRs easier.

6.1.6 Rarely does an instance occur in which the VSR of Bottle 1 is HIGHER than that of Bottle 2. The only reason for this would be if the runoff was grossly overestimated and "Sample Control" instructed a field crew to pull Bottle 1 early and lower the VSR for Bottle 2.

6.2 **Determining Water Volume Needed and the Fate of Any Excess Water:** Compositing multiple composite bottles can often be done using only those bottles, or may require "dirtying" or "sacrificing" a clean composite bottle. The different reasons are described below.

6.2.1 **Determine sample volume needed:** The minimum volume of sample water needed for filling the numerous sample analyte containers must be known, or calculated on the spot. This is done by simply adding up the volumes of all sample containers to be filled. If there is not enough sample water (after compositing) to fill all the containers then consult with the project manager to determine what the order of priority is for the analyses (i.e., in what order to fill the containers). It is also useful to know the absolute minimum sample volumes needed by the laboratory to perform each analysis; some sample containers may not need to be filled completely.

6.2.2 **Determine if excess water is to be saved:** If the composite bottles are mostly full then it is likely that much of the sample water will be left over from the sub-sampling process. In this case it is sometimes prudent to save the left over sample water (on ice) for several days in case problems occur with the laboratory and more water is needed. Always check with the project manager on this point because it may require dirtying (sacrificing) a clean composite bottle to make the composite in. If any excess water is not to be saved then compositing can always be done in the existing composite sample bottles: while being homogenized on a stir plate the excess sample water is simply discarded (pumped out in a calculated fashion), making room for the final composite.

6.2.3 **Plan on making as large a composite as possible:** If, for example, only 8 liters of sample water are needed but there is enough water to make a higher volume composite then it is prudent to do so. This is to account for any accidental spills and, if required, to the save enough excess water for possible re-analysis. There generally will never be a need to make a composite greater than a single 20-L composite bottle.

6.2.4 **If only one composite bottle exists from a station:** Simply follow the procedures for sub-sampling into numerous sample containers described in Section 6.5.

6.3 Compositing Without Saving Excess Water:

This procedure also applies to instances in which there may not be excess water. For the sake of clarity an example will be used to explain the following steps. In this example three 20-L composite bottles are involved in creating a composite: Bottle 1 has 20 liters of sample water and was filled at a Volume to Sample Ratio (VSR) of 100; Bottle 2 has 20 liters and a VSR of 200; Bottle 3 has 20 liters and a VSR of 400. Sample water will be composited in Bottle 3. Most bottles have 1 liter graduations; if some don't then sample depth must be used to figure the fraction of water to be transferred.

6.3.1 Carefully place Bottle 3 on a large spin plate and gently drop a pre-cleaned stir-bar into the bottle and adjust the speed of the spin plate to optimize the mixing of the sample water throughout the bottle. The speed at which the stir-bar is spun should be adjusted so that even mixing is achieved. Speeds that are too fast will create a large vortex within the composite bottle that can actually concentrate heavier particles and should be avoided. Settling on a particular speed is based on a subjective visual assessment of what speed produces the most even, random mixing throughout the composite bottle.

6.3.2 Install a pre-cleaned sub-sampling hose into a peristaltic pump. Carefully remove the plastic cover which protects the approximately 18 inches of its exterior surface which has been cleaned. Insert this end into Bottle 3. Uncap the other end of the sub-sampling hose and ready it over a waste bucket.

6.3.3 While being mixed on the stir plate pump 10 liters into the waste bucket, leaving 10 liters in Bottle 3. This is best performed by two people. One person is responsible for filling the waste bucket and one person is responsible for moving the intake tubing up and down in the water column of the composite sample and controlling the pump. Based on experimental evidence, this up and down movement of the intake helps obtain (or, in this case discard) a more representative sample. This is because there can still be some stratification of heavier particles in the sample bottle despite the mixing created by the stirrer. The up and down movement of the intake tubing should be limited to 80-90 percent of the water depth and should never touch the bottom of the sample bottle.

6.3.4 Remove Bottle 3 from the stir plate and replace with Bottle 2 and insert a new stir-bar and mix as described in Section 6.3.1. Keeping the sub-sampling hose clean (avoid setting it down or bumping it into objects), insert the intake end into Bottle 2. Using the methods described in Section 6.3.3 pump only 5 liters from Bottle 2 into Bottle 3, making a total of 15 liters. **NEVER INSERT THE "DIRTY" EFFLUENT END OF THE HOSE INTO ANY BOTTLE.**

6.3.5 Repeat the actions in Section 6.3.4 with Bottle 1, pumping only 2.5 liters of Bottle 1 into Bottle 3, making a total of 17.5 liters of composited water.

6.3.6 Note that this process cannot generate any excess composite water because there is none left from Bottle 3 that has not been contaminated in the waste bucket.

6.4 **Compositing While Also Saving Excess Water:** This is identical to the procedures described in Section 6.3 with one difference: the first 10 liters of Bottle 3 is pumped into a clean 20-L bottle instead of into a waste bucket. This "dirties" a fourth bottle but ensures that excess sample water can be kept and composited again, if desired.

6.5 **Sub-sampling Composited Water into Sample Containers:** This is the final stage in successfully filling a suite of sample analyte containers with composited water that is representative of an entire sampling event.

6.5.1 Place the composite bottle containing the composited water on the stir plate and achieve proper mixing.

6.5.2 Uncap and arrange all the sample containers to be filled in such a way that they can be easily filled. Due to the vibration of the peristaltic pump on the sub-sampling hose it takes a very steady hand to efficiently guide the stream of sample water into the containers. **NEVER INSERT THE "DIRTY" EFFLUENT END OF THE HOSE INTO THE SAMPLE CONTAINERS.** It is often necessary to steady the sample containers with a second hand so they do not fall over.

7.0 PERSONNEL

Only personnel that have been trained in the use of the proper safety equipment, as per the are allowed to complete this task. . The Laboratory Supervisor is responsible for training personnel in the proper procedures in composite sample bottle, teflon sample hose and silicon peristaltic tubing, and stir bar cleaning.

8.0 QUALITY ASSURANCE REQUIREMENTS

The composite sample bottles and sub-sampling hoses must have been evaluated ("blanked") for contaminants after their initial decontamination procedure.

GENERAL FIELD SAMPLING PROCEDURE FOR:

Grab Samples

1.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the procedures involved in the discrete manual sampling (grab sampling) of storm water for a nonpoint source (NPS) monitoring program. The purpose of these procedures is to ensure contaminant free samples, and to ensure the safety of the personnel involved.

2.0 DEFINITIONS

2.1 **Sample Containers** – any EPA or laboratory specified clean container that is used to collect sample water.

2.2 **Grab Pole** – used to obtain grabs from locations where it is impossible or too dangerous (fast current, storm drain pipe, etc.) to manually obtain a sample.

3.0 PERSONNEL

Only personnel that have been trained in the use of the proper safety equipment are allowed to complete this task. Training needs to include the proper sampling techniques and station hazards that will be encountered while performing this task. The Project Manager is responsible for training personnel in these procedures.

4.0 EQUIPMENT

4.1 **Instrumentation** – see section 12.0 Physical Parameters

4.2 **Reagents** – preservatives will be supplied by the laboratory that supplies the sample bottles. Usually, the preservative is a concentrated acid (HNO_3, H_2SO_4, HCl or other).

4.3 **Apparatus** – a telescoping grab pole with a bottle holding device secured to one end. The bottle holding device is made of plastic and Velcro. It is designed to hold in place sample bottles of various sizes and types.

4.4 **Documentation** – time, date, location, number of containers and type of grab (whether for chemical analysis or physical parameters) must be noted in the station log book for that station.

5.0 PROCEDURES

Grab sampling methods will be discussed for the following analytes:

Metals and Total Cyanide

Oil and Grease

Fecal Coliform and Fecal Streptococci

Volatile Organic and Aromatic Compounds (VOA's)

Organic Compounds (Pesticides, PAHs, PCBs, SVOCs, etc.)

Physical Parameters

6.0 GRAB SAMPLING TECHNIQUES

6.1 Grab sampling may be conducted at any time during the storm event, depending upon the specific project requirements. The type of grab study might vary as the storm season progresses and the scope requirements deem necessary. These might include:

6.1.1 **Discrete Grabs** – Taken once during the storm event at a predetermined time, usually at peak flow.

6.1.2 **Persistent Grabs** – A schedule of discrete grabs which continue through the end of the storm to show a rate of change over time.

6.1.3 **First Flush** – A type of discrete grab to be taken within the first thirty minutes of the storm event.

For the majority of grab sample studies, discrete grabs will be required. Grabs will be taken on the rising hydrocurve of the storm event and as close to peak stage as is feasible. The times of these grabs will be decided by the Storm Control and/or Shift Leader and will be relayed to the field crews.

6.2 Depending upon then type of analyte being sampled, the technique may vary but all sampling **MUST** follow these general rules to minimize contamination:

6.2.1 Grab bottles are to be filled as near to the intake as is safely possible.

6.2.2 When unable to obtain a sample near the intake, take one as near to the center of flow as possible or in an area of sufficient velocity to ensure good mixing

6.2.3 The field personnel taking grab samples must be standing downstream from the sample bottle when filling.

6.2.4 The mouth of the bottle must be facing into the current.

6.2.5 Raise and lower the bottle through the water column so the sample is not biased with only one level sampled.

6.2.6 Manhole sites and inaccessible stream sites are best sampled with a grab pole.

7.0 METALS AND TOTAL CYANIDE

Samples to be analyzed for metals and cyanide are grabbed in a plastic or Teflon® container. Metals and total cyanide will require a preservative in the container (see Section 4.2). These grabs require extra care so as to not overfill the container and spill out any of the preservative, or allow the preservative to come into contact with the skin.

Metals sample bottles contain an acid preservative (HNO_3) and total cyanide sample bottles contain a base (NaOH) for a preservative. When the grab container is being filled manually, the level of water can be watched so the container is not overfilled. When the sample cannot be taken by hand and must be taken with a grab pole, the filling becomes a bit more difficult. Lower the container with the grab pole and watch for escaping air bubbles when submerged. Pull the sample bottle out frequently to check the water level accumulated and quit filling when that level has reached the "shoulder" of the bottle. Be sure **NOT TO OVERFILL THE SAMPLE BOTTLE**; this would spill the preservative compromising the sample and possibly endangering the person sampling.

8.0 OIL AND GREASE

Oil and grease samples are very similar to metals in that the bottles contain preservative and **MUST NOT BE OVERFILLED**. Oil and grease analysis requires that the sample be taken in glass containers, usually amber and usually in duplicate (in case of breakage). Fill these containers in the same exact way as mentioned above for metals analysis.

9.0 FECAL COLIFORM AND FECAL STREPTOCOCCI

Fecal coliform and fecal streptococci are usually grabbed in bacteria bottles or urine analysis cups. They contain a residual chlorine removal preservative tablet and should be filled to the sample container fill line when sampling. Wear protective gloves so that there is no skin contact with the interior of the container. The main precaution is not to contaminate the sample when opening the cup. Fill each cup completely and secure the cap.

10.0 VOLATILE ORGANIC AND AROMATIC COMPOUNDS (VOA'S)

Collecting water for Volatile Organic Compounds (VOA) requires extreme care. VOA's volatilize (enter the gaseous phase very quickly), thus, sample vials are designed to prevent this. These vials will leave no headspace (air bubbles) in a properly filled container because they have a septa cap , thereby minimizing loss of analyte to the atmosphere.

To fill a VOA vial, lower it into the water column and allow it to **FILL UP COMPLETELY** (until a water dome is formed over the top of the vial). VOA's must be preserved with HCl so take extra care not to spill any of this preservative. Very carefully place the septa cap onto the vial so no air is introduced, start with the cap tilted to one side and gently lower it until it is seated onto the threads of the vial and secure. Make sure there is no air in the vial by inverting the sample. If air bubbles show, a new sample must be taken using a new vial and the bad container and sample must be returned to the lab for proper disposal. **See Section 13.0 for additional precautions to be taken with VOA vials.**

11.0 ORGANIC COMPOUNDS (PESTICIDES, PAHs, PCBs, SVOCS, etc.)

Organic compound samples are collected in glass containers, usually amber. These samples generally do not require preservatives but should be filled in the same way as those collected for metals, and oil and grease analyses.

12.0 PHYSICAL PARAMETERS

Each time a station is visited during a storm event, certain physical parameters must be measured. Generally, at a minimum, pH and temperature are measured. Follow the instructions that are included with the field instrumentation used for the best results. There are many different brands of meters that require different techniques.

Take the measurements as close to the grab sampling point as possible while keeping safety a priority. A grab sample may be taken and analyzed somewhere more convenient and safe than the stream edge. Remember that the analysis on a grab sample should be performed "as soon as possible" to ensure as accurate measurements (pH, temperature, etc.) as possible. Record all results in the log book for that station and be sure to write in the units of measurement.

13.0 QUALITY CONTROL LIMITS

Grab sample containers must come from a reputable distributor and be certified clean for the analyte to be sampled. They must also be properly preserved and labeled prior to sampling. Transport the bottles in clean coolers accompanied with any required paperwork or instructions.

Immediately upon completion of sampling, return the sample bottles to a clean cooler and ice them down to 4°C. Recheck to be certain that all the information on the label is correct (date, time, location, analysis, preservative, etc.). Fill out the required paperwork and station log book sheets and transfer the samples to a predetermined pick-up location for the Analytical Laboratory.

13.1 For some storm sampling events, different Quality Assurance and Quality Controls (QA/QC) will be implemented. These will include:

13.1.1 Field Duplicates – Additional set of sample bottles grabbed at the same location and time as the actual sample. This sample may be given its own mock station identification and be submitted to the Analytical Laboratory blind.

13.1.2 Field Blanks – This is a full set of sample bottles (usually minus TSS and turbidity) containing reagent grade analyte free water provided by the Analytical Laboratory that will be doing the analysis. These samples are poured by hand from clean bottles containing the blank water into a labeled sample container. These sample bottles may be given a mock station identification and submitted blind as well.

13.1.3 Trip Blanks – Usually required for very sensitive samples (VOA's). The Analytical Laboratory will provide sample bottles already filled with reagent grade analyte free water that will make the full "trip" from the lab, out into the field and back into the lab. **THESE CONTAINERS ARE NOT TO BE OPENED**.

Trip blanks are only analyzed if contamination is suspected. If analyzed and contamination is found, they usually warrant further investigation and subsequent sampling.

13.1.4 **Matrix Spiking and Lab Replicates** – These analyses can usually be taken from a sample bottle already sent into the field and do not require extra bottles, however, extra volume may be required at these stations.

13.2 While performing or preparing for grab sampling, be sure that no "outside" contamination will occur:

13.2.1 No engines are running in the general vicinity of sampling.

13.2.2 Sample containers are clean and intact.

13.2.3 Sample containers are properly labeled and meet bottle requirements for that analyte (size, type, preservative, type of cap liners, etc.).

13.2.4 Sample techniques are proper and safe.

13.3 **Volatile Organic and Aromatic Compounds (VOA's)** – require very special handling.

13.3.1 VOA vials are very fragile. Protect with adequate foam packing material.

13.3.2 VOA bottles should have no headspace (see Section 10.0). This means that they are subject to freezing. **Prevent direct contact of VOA vial with ice by using additional packaging.**