COORDINATED INTEGRATED MONITORING PROGRAM FOR THE LOWER LOS ANGELES RIVER WATERSHED MONITORING GROUP

Participants

Downey
Lakewood
Long Beach
Lynwood
Pico Rivera
Signal Hill
South Gate
Paramount
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ALERT	Automatic Local Evaluation in Real Time
AMEL	Average Monthly Effluent Limitation
Basin Plan	*Water Quality Control Plan for the Coastal Watersheds of Los Angeles and Ventura Counties*
BMP	Best Management Practices
BOD	Biochemical Oxygen Demand 5-day @ 20 °C
CASQA	California Stormwater Quality Association
CD	Compact Disc
CFR	Code of Federal Regulations
CIMP	Coordinated Integrated Monitoring Program
CL	Control Limit
COD	Chemical Oxygen Demand
CTR	California Toxics Rule
CV	Coefficient of Variation
CWA	Clean Water Act
CWC	California Water Code
CWP	Center for Watershed Protection
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
Discharger	Los Angeles County MS4 Permittees
DNQ	Detected But Not Quantified
EFA	Effective Filtration Area
EIA	Effective Impervious Area
ELAP	California Department of Public Health Environmental Laboratory Accreditation Program
Facility	Los Angeles County MS4s
FIB	Fecal Indicator Bacteria
GIS	Geographical Information System
gpd	gallons per day
HUC	Hydrologic Unit Code
IC50	Concentration at which the organism is 50% inhibited
IC/ID	Illicit Connection and Illicit Discharge Elimination
LA	Load Allocations
LACFCD	Los Angeles County Flood Control District
LARWQCB	Regional Water Quality Control Board, Los Angeles
LCC	Los Cerritos Channel
LID	Low Impact Development
LOEC	Lowest Observed Effect Concentration
MAL	Municipal Action Limits
MBAS	Methylene Blue Active Substances
MCM	Minimum Control Measure
ME	Mass Emission
mg/L	milligrams per Liter
MDEL	Maximum Daily Effluent Limitation
MDL	Method Detection Limit
µg/L	micrograms per Liter
MGD	Million Gallons Per Day
ML	Minimum Level
MRP	Monitoring and Reporting Program

MS4	Municipal Separate Storm Sewer System
MTBE	Methyl tertiary-butyl ether
ND	Not Detected
NOEC	No Observable Effect Concentration
NPDES	National Pollutant Discharge Elimination System
NSW	Non-Stormwater
NTR	National Toxics Rule
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
Ocean Plan	Water Quality Control Plan for Ocean Waters of California
ORI	Outfall Reconnaissance Inventory
PCB	Polychlorinated Biphenyls
PES	Polyester-reinforced polysulfone
RAP	Reasonable Assurance Program
Regional Water Board	California Regional Water Quality Control Board, Los Angeles Region
RPA	Reasonable Potential Analysis
RWL	Receiving Water Limitations
SIP	State Implementation Policy (Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California)
SMC	Stormwater Monitoring Coalition
SQO	Sediment Quality Objective
SSC	Suspended Sediment Concentration
State Water Board	California State Water Resources Control Board
SVOC	Semivolatile Organic Compounds
SWAMP	State’s Water Ambient Monitoring Program
TAC	Test Acceptability Criteria
TIE	Toxicity Identification Evaluation
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
TRE	Toxicity Reduction Evaluation
TSS	Total Suspended Solid
TU_c	Chronic Toxicity Unit
USEPA	United States Environmental Protection Agency
USGS	U.S. Geological Survey
WDR	Waste Discharge Requirements
WET	Whole Effluent Toxicity
WLA	Waste Load Allocations
WMA	Watershed Management Area
WMG	Waste Management Group
WMMS	Watershed Management Modeling System
WMP	Watershed Management Program
WQBELs	Water Quality-Based Effluent Limitations
WQS	Water Quality Standards
%	Percent

COORDINATED INTEGRATED MONITORING PROGRAM (CIMP)

FOR THE

LOWER LOS ANGELES RIVER WATERSHED GROUP

1 INTRODUCTION

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 included 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).

The Permit allows development of a Coordinated Integrated Monitoring Program (CIMP) to specify approaches for addressing the objectives of the MRP. The Lower Los Angeles River (LLAR) Watershed Management Area (WMA) chose to develop and implement a CIMP to address the unique conditions of this region.

The entire Los Angeles River Watershed drains a watershed of 824 square miles. The Los Angeles River WMA is one of the largest in the region and is also one of the most diverse in terms of land use patterns. Approximately 324 square miles of the watershed are covered by forest or open space land including the area near the headwaters, which originate in the Santa Monica, Santa Susana, and San Gabriel Mountains. The remainder of the watershed is highly developed. The river flows through the San Fernando Valley past heavily developed residential and commercial areas. From the confluence with the Arroyo Seco, north of downtown Los Angeles, to the confluence with the Rio Hondo, the river flows through industrial and commercial areas and is bordered by rail yards, freeways, and major commercial and government buildings.

The LLAR Watershed (Figure 1-1) extends from Pico Rivera on the Rio Hondo to the Pacific Ocean. The LLAR Watershed Group encompasses approximately 43.7 square miles (27,981 acres) within Los Angeles County and comprises 5.3% of the drainage area of the Los Angeles River Watershed From the Rio Hondo to the Pacific Ocean, the river flows through industrial, residential, and commercial areas, including major refineries and petroleum products storage facilities, major freeways, rail lines, and rail yards serving the Ports of Los Angeles and Long Beach. The Los Angeles River tidal prism/estuary begins in Long Beach at Willow Street and runs approximately three miles before joining with Queensway Bay. The channel has a soft bottom in this reach with concrete-lined sides.

The CIMP is required to integrate requirements of the current Los Angeles County Municipal Separate Storm Sewer System (MS4) Permit (LARWQCB, 2012), the City of Long Beach MS4 permit and TMDL monitoring requirements. 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 CIMP is structured to support the WMP'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 which include:

- 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.

The Monitoring and Reporting Plan (MRP; Sections I.C and I.D) provides for development of a CIMP to provide Permittees the flexibility to coordinate monitoring efforts on a watershed or subwatershed basis, leverage monitoring resources to increase cost-efficiency and effectiveness and to closely align monitoring required for TMDLs with monitoring required to support the Watershed Management Program.

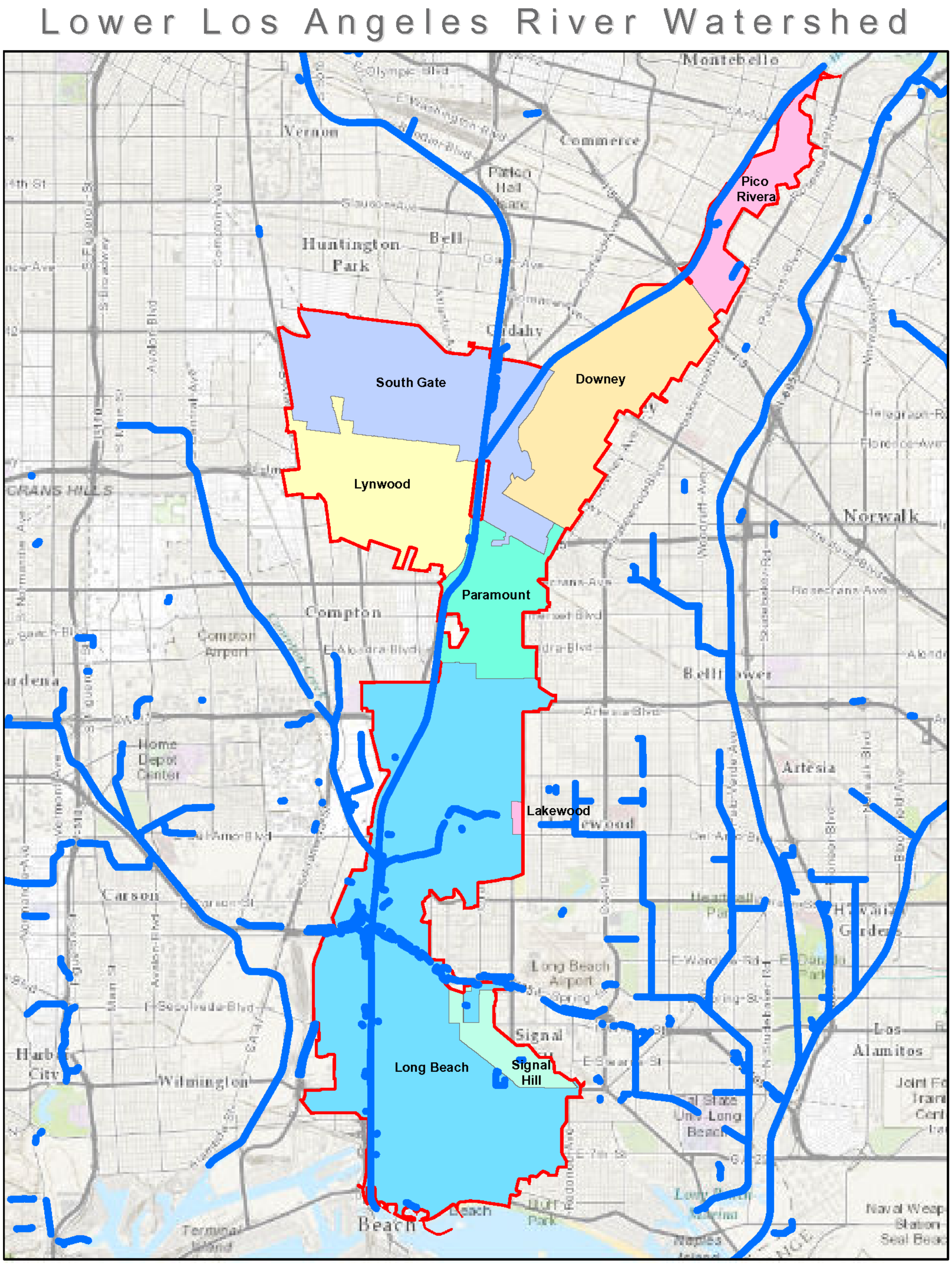

Lower Los Angeles River Watershed

Figure 1-1. Lower Los Angeles River Watershed Group Boundaries.

2 Water Body-Pollutant Classification

Development of a Watershed Management Program (WMP) requires Permittees to develop water quality priorities within each WMA [Section C.5.a (page 58) of the Permit] that will be used 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.

The CIMP was developed to focus on existing water quality conditions. With more than 10 years of monitoring, data has shown that 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 any RWLs. This new program is designed to target constituents that have been identified as constituents of concern in the receiving waters. Water body-pollutant combinations were used to classify segments of the LLAR WG 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 for both wet and dry weather conditions while reviewing data potential impairment of the receiving waters (Table 2-1, Table 2-2). These included the Los Angeles River Estuary (LARE), Reaches 1 and 2 of the Los Angeles River (LAR1 and LAR2), Compton Creek (CC) and Reach 1 of the Rio Hondo (RH1). Each of these segments is defined in the *Water Quality Control Plan for the Coastal Watersheds of Los Angeles and Ventura Counties* (Basin Plan).

Table 2-1. Wet Weather Water Body/ Pollutant Classifications for the Lower Los Angeles River WG.

			WATER BODY				
CATEGORY	**POLLUTANT**	**CLASS**	**LARE**	**LAR1**	**LAR2**	**CC**	**RH1**
1	Cadmium	Metal		**X**	**X**	**X**	**X**
	Copper	Metal	**X**	**X**	**X**	**X**	**X**
	Lead	Metal	**X**	**X**	**X**	**X**	**X**
	Zinc	Metal	**X**	**X**	**X**	**X**	**X**
	Trash[1]	Other		**X**	**X**	**X**	**X**
	Nitrogen Compounds[2]	Nutrient		**X**	**X**	**X**	**X**
	DDT	OC Pest	**X**				
	PCBs	OC Pest	**X**				
	PAHs	SVOC	**X**				
	E. coli	Micro		**X**	**X**	**X**	**X**
	Coliform & Enterococcus	Micro	**X**				
2	Chlordane (sediment)	OC Pest	**X**				
	Coliform Bacteria	Micro		**X**	**X**	**X**	**X**
	Aluminum	Metal		**X**			
	Diazinon	OP Pest		**X**			
	Oil	General			**X**		
	Trash	Other	**X**				
	Toxicity	Bioassay					**X**
	Sediment Toxicity	Bioassay	**X**				
	Cyanide	General		**X**			
	MBAS	General		**X**	**X**		
3	Chloride	General					**X**
	Mercury	Metal		**X**			
	Diazinon	OP Pest					**X**
	PAHs	SVOC		**X**	**X**		
	Bis(2-ethylhexylphthalate	SVOC		**X**			
	Cyanide	General					**X**
	pH	General					**X**
	Dissolved Oxygen	General		**X**	**X**		

LAR1= Los Angeles River Reach 1
LAR2= Los Angeles River Reach 2
LARE= Los Angeles River Estuary
CC= Compton Creek
RH1=Rio Hondo Reach 1

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

1. Trash will be addressed by Annual Reports of compliance with the installation of full capture systems.
2. Ammonia was listed in category 2 for LAR1 and LAR2 – included in nitrogen compounds for category 1
3. Nutrients (algae) by nitrogen compounds for category 1.

Table 2-2. Dry Weather Water Body/ Pollutant Classifications for the Lower Los Angeles River WG.

			WATER BODY				
CATEGORY	**POLLUTANT**	**CLASS**	**LARE**	**LAR1**	**LAR2**	**CC**	**RH1**
1	Copper	Metal	**X**	**X**	**X**	**X**	**X**
	Lead	Metal	**X**	**X**	**X**	**X**	**X**
	Zinc	Metal	**X**				**X**
	Trash[1]	Other		**X**	**X**	**X**	**X**
	Nitrogen Compounds[2]	Nutrients		**X**	**X**	**X**	**X**
	DDT	OC Pest	**X**				
	PAHs	SVOC	**X**				
	PCBs	OC Pest	**X**				
	E. coli	Micro		**X**	**X**	**X**	**X**
	Coliform & Enterococcus	Micro	**X**				
2	Chlordane (sediment)	OC Pest	**X**				
	Coliform Bacteria	Micro		**X**	**X**	**X**	**X**
	Aluminum	Metal		**X**			
	Selenium	Metal		**X**	**X**		
	Cyanide	General		**X**			
	Oil	General			**X**		
	Trash	Other	**X**				
	Toxicity	Bioassay					**X**
	Sediment Toxicity	Bioassay	**X**				
3	Chloride	General		**X**	**X**		
	Cyanide	General					**X**
	pH	General					**X**
	Mercury	Metal		**X**			
	Nickel	Metal		**X**			
	Thallium	Metal		**X**	**X**		
	Chlorpyrifos	OP Pest				**X**	
	PAHs	SVOA		**X**	**X**		
	Bis(2-ethylhexylphthalate	SVOA		**X**			

LAR1= Los Angeles River Reach 1
LAR2= Los Angeles River Reach 2
LARE= Los Angeles River Estuary
CC= Compton Creek
RH1=Rio Hondo Reach 1

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

1. Trash will be addressed by Annual Reports of compliance with the installation of full capture systems.
2. Ammonia was listed in category 2 for LAR1 and LAR2 – included in nitrogen compounds for category 1
3. Nutrients (algae) by nitrogen compounds for category 1.

3 Monitoring Sites and Approach

This CIMP addresses monitoring activities required by the Monitoring and Reporting Program (MRP) - No. CI-6948 for Order R4-2012-0175, NPDES Permit No. CAS004001 for the Lower Los Angeles River (LLAR) Watershed Management Group (WMG). Development of this CIMP focused on improving the overall effectiveness of the monitoring program by coordination of sampling efforts.

Final approval of the CIMP is expected in early 2015. Existing monitoring will continue to be conducted and beginning summer of 2014, the dry weather screening of major outfalls will commence. For planning purposes, the monitoring described in this CIMP is intended to commence on July 1, 2015 or 90 days after the approval of the CIMP, whichever is later. Majority of the elements will start in the summer of 2015 and the following wet weather season, and the program will be phased in over a three-year period. Non-stormwater (NSW) outfall monitoring efforts are currently underway in order to complete an inventory of all outfalls and allow the program to meet the first major deadline established by the Permit. The Permit requires that source identification surveys be completed 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. Information on sampling methods, cleaning protocol and QAQC are provided in Appendices B, C and D. 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 LLAR WMG (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.

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 as well as 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.

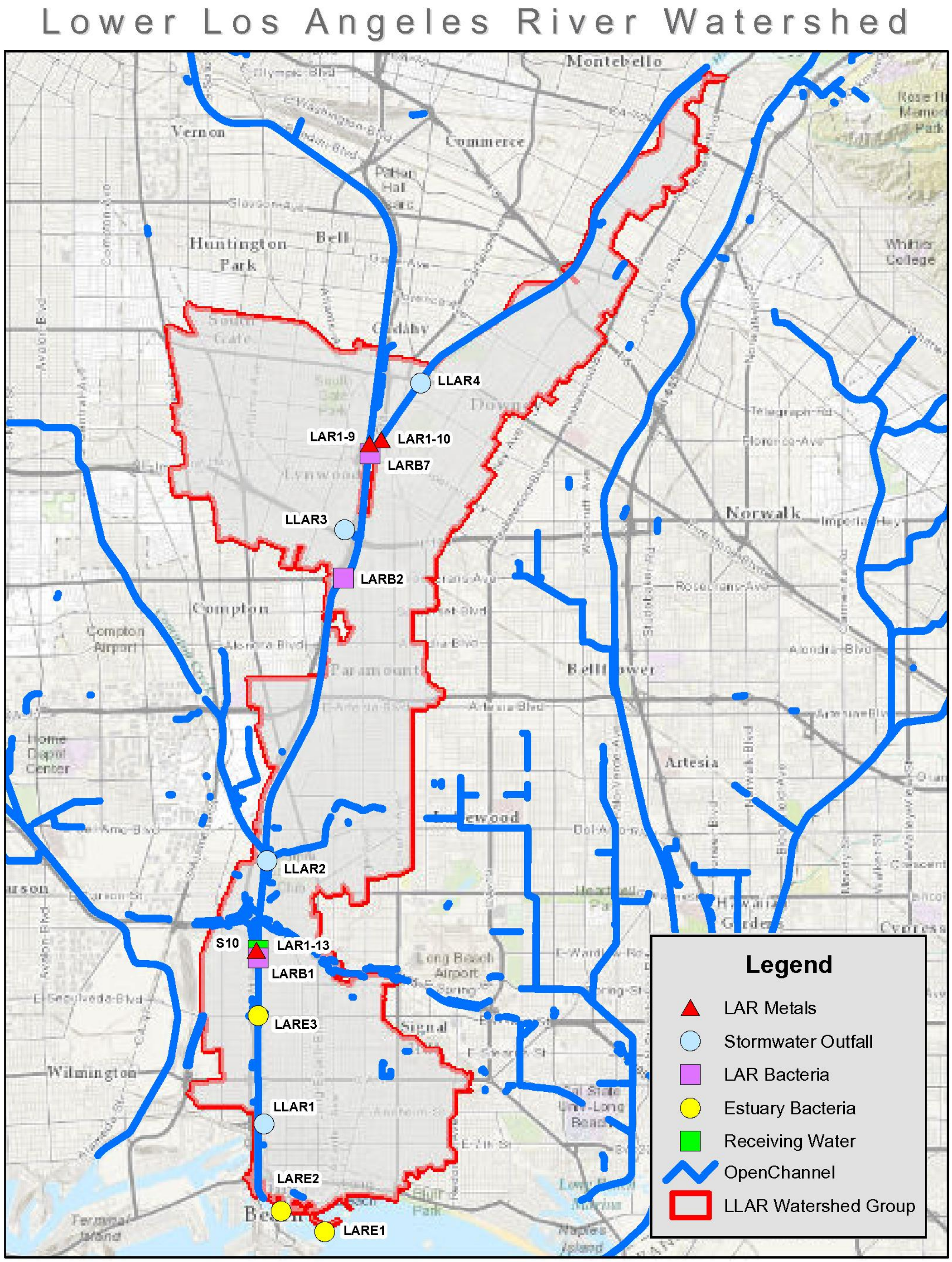


Figure 3-1. **Monitoring Locations in the Lower Los Angeles River Watershed**

Table 3-1. Consolidated List of Monitoring Sites in the Lower Los Angeles River WMG.

SITE CODE	SITE TYPE/PURPOSE	NAME	PRIMARY SAMPLING[2]	LATITUDE[3] (°N)	LONGITUDE (°W)
S10[1]	Receiving Water/TMDL	Wardlow Street	Auto	33.81900	118.20556
LLAR1	Stormwater Outfall	Cerritos Pump Station	Auto	33.77951	118.20380
LLAR2	Stormwater Outfall	Dominguez Gap Pump Station	Auto	33.83945	118.20320
LLAR3	Stormwater Outfall	Lynwood	Auto	33.91469	118.18214
LLAR4	Stormwater Outfall	Firestone	Auto	33.94812	118.16146
LARB1[1]	LAR Bacteria TMDL	Segment A (Wardlow)	Grab	33.81735	118.20551
LARB2	LAR Bacteria TMDL	Segment B (Rosecrans)	Grab	33.90374	118.18240
LARB7	LAR Bacteria TMDL	Rio Hondo	Grab	33.93202	118.17523
LARE1	Estuary Bacteria TMDL	LARE Mouth of Estuary	Grab	33.75506	118.18727
LARE2	Estuary Bacteria TMDL	LARE Queensway	Grab	33.75976	118.19910
LARE3	Estuary Bacteria TMDL	LARE Willow	Grab	33.80416	118.20547
LAR1-13[1]	LAR Metals TMDL	Wardlow - Main Channel	Auto/Grab	33.81900	118.20556
LAR1-10	LAR Metals TMDL	Rio Hondo - Trib	Grab	33.93510	118.17218
LAR1-9	LAR Metals TMDL	I710 - Main Channel	Grab	33.93421	118.17548

- S10, LARB1, and LAR1-13 are all located at the same location in the Los Angeles River near Wardlow Ave. This site is the final compliance location for the Metals TMDL
- Auto=Primarily sampled with automated stormwater monitoring equipment, Grab= Samples primarily taken as grab samples.
- All site locations are based upon the NAD 83 datum.

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

- Mass Emission (ME) Receiving Water Monitoring - The mass emission station will serve to provide a long-term measure of compliance with receiving water quality criteria and allow for assessment of trends in pollutant concentrations.
- TMDL Receiving Water Monitoring Sites – These sites are intended to evaluate compliance or progress towards attainment of Waste Load Allocation (WLAs) 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 Mass Emission (ME) Monitoring Site

The Los Angeles River monitoring station (S10) will continue to serve as the ME monitoring station for the LLAR. This site is located in the Los Angeles River at the existing stream gauge station (i.e., Stream Gauge F319-R) between Willow Street and Wardlow Road. This site is located near the bottom of Reach 1 in the City of Long Beach and was originally selected to avoid tidal influences. This site has been monitored by the Los Angeles County Flood Control District (LACFCD) since 1998 and this site will continue to be monitored by LACFCD.

Although S10 serves as the only mass emission monitoring site within the LLAR WMG, it also serves (and has previously served) as a TMDL monitoring site since it is at the base of the watershed and is the last monitoring location for most contaminants of concern before water is discharged to the Estuary (Figure 3-1, Table 3-1).

3.1.2 Total Maximum Daily Load (TMDL) Monitoring Sites

Permittees within the LLAR WMG are required to conduct monitoring required under the Los Angeles County NPDES MS4 permit and comply with any monitoring requirements associated with six separate TMDLs (Table 3-2). TMDL monitoring sites were selected by reviewing requirements of each TMDL applicable to the LLAR and monitoring sites previously selected or recommended in two previous TMDL compliance plans:

- *Los Angeles River Metals TMDL Coordinated Monitoring Plan* (Metals CMP) – March 25, 2008
- *Coordinated Monitoring Plan for Los Angeles River Watershed Bacteria TMDL – Compliance Monitoring – Draft* (Bacteria CMP). - March 23, 2013

The Metals CMP included monitoring of four sites within the LLAR but, based upon the results of initial monitoring and the minimal distances between sites (about 2 miles), monitoring at one site (referred to as the Del Amo site, LAR1-11) will be discontinued. Further discussion is found in section 8.2. Monitoring will continue as per the initial Metals CMP at the remaining three sites within the LLAR watershed.

The Bacteria CMP was not implemented due to the fact the CIMP was anticipated to address monitoring of ambient bacteria within each WMG. Nevertheless, this document provided a comprehensive approach that addressed ambient bacteria monitoring throughout the watershed and monitoring approaches for ambient monitoring at 16 sites. The CMP provides the framework for bacteria monitoring at the four sites located within the LLAR.

Table 3-2. Summary of TMDLs applicable to the Lower Los Angeles River Watershed (LLAR) Management Group.

TMDL	REGIONAL BOARD RESOLUTION #	REGIONAL BOARD APPROVAL EFFECTIVE DATE
Nitrogen Compounds and Related Effects TMDL (Nutrient TMDL)	2003-009 2012-010	March 23, 2004 August 7, 2014
Los Angeles River and Tributaries Metals TMDL (Metals TMDL)	2007-014 2010-003	October 29, 2008 November 3, 2011
Los Angeles River Watershed Bacteria TMDL (LAR Bacteria TMDL)	2010-007 Monitoring Plan: March 23, 2013	March 23, 2012
Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL (Harbor Toxics TMDL)	2011-008 Monitoring Plan: November 23, 2013 or the CIMP.	March 23, 2012
Los Angeles River Watershed Trash TMDL (Trash TMDL)	2007-012 Monitoring Plan not required.	September 23, 2008
Long Beach City Beaches and Los Angeles River Estuary Bacteria TMDL (Beaches/Estuary TMDL)	USEPA Established TMDL	March 26, 2012

Additional TMDL monitoring is required for the Long Beach City Beaches and Los Angeles River Estuary TMDLs for Indicator Bacteria (Estuary Bacteria TMDL). The LAR Estuary is the only portion of this TMDL addressed by this CIMP. The Long Beach City Beaches will be addressed as part of a separate WMP and IMP being developed to address portions of the City of Long Beach not addressed by the three plans being developed the Lower Los Angeles River, the freshwater portion of the Los Cerritos Channel and the Lower San Gabriel River watersheds.

Protection of the recreational beneficial uses of the City of Long Beach open beaches includes both the open waters used by wind surfers and boaters but emphasizes the shoreline and swash-zone where bathers are directly impacted by exposure to potentially contaminated water. In the Los Angeles River Estuary, swimmers do not typically access waters directly from the shoreline and therefore concerns are more directed towards assessment of bacterial concentrations in open waters of the Estuary and the potential for bacteria in this wind-driven surface plume to impinge upon the recreational beaches of the City of Long Beach after leaving the Estuary. Interim monitoring points were selected to allow determination of whether bacteria are subject to simple dilution by mixing as the water passes through the estuary or if areas within the Estuary serve as sources or sinks for indicator bacteria.

The Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL (Harbor Toxics TMDL) also requires that monitoring be conducted to quantify the loads of pollutants from the Los Angeles River. This program will require additional monitoring at the S10 site to quantify metals, DDT, PCBs, and PAHs associated with suspended particulates. This program will complement monitoring within the Harbor waters and the Los Angeles River Estuary that is already funded by members of the LLAR group that are included in the Greater Harbor Waters Regional Monitoring Coalition. Four of the LLAR group are active participants (including funding thereof) in the Harbor RMC effort. These members ensure close coordination between the Harbor RMC's TMDL monitoring and the LLAR. In addition, the LLAR has actively been offered the opportunity for voluntary cooperation of all Los Angeles River cities and agencies in establishing a toxics monitoring station at the River/estuary interface. In accordance with Table C of Attachment E of the Permit, this CIMP fulfills the requirement for the submission of a Monitoring and Reporting Plan and Quality Assurance Project Plan.

3.2 Stormwater Outfall Monitoring

Stormwater outfall monitoring is the one element of the program that will be phased in over the course of two years. Stormwater outfall sampling sites (Table 3-3 and Figure 3-2) will be initiated at two sites during the first year of the program. Additional sites will be added in the following year to bring the total number of stormwater outfall monitoring sites up to four. A detailed implementation schedule is provided in the following Section 4.

The stormwater outfall monitoring program was designed to ensure that selected monitoring locations provided representative data by:

- Monitoring at least one major outfall per subwatershed (HUC 12) drainage area, and
- The drainage area of the selected outfalls shall be representative of the land uses within the Permitee's jurisdiction, and
- Selected outfalls must be configured to facilitate accurate flow measurements and safety of monitoring personnel.

Table 3-3. Stormwater Outfall Monitoring Sites

Stormwater Outfall Monitoring Sites	Jurisdiction Area								Land Use				HUC Equivalent		
	Long Beach	Signal Hill	Lakewood	Paramount	Lynwood	Downey	South Gate	Pico Rivera	Residential	Industrial	Commercial	Other	Cmpt Crk/LAR	Alhm/RioHondo	C R/ LAR
LLAR1 - Cerritos Pump Station	x	x							x				x		By others*
LLAR2 - Dominguez Gap	x		x						x				x		
LLAR3 - Lynwood				x	x		x		x	x			x		
LLAR4 - Firestone						x		x	x	x	x			x	
LAR1-11 Del Amo site (discontinued)															

* The Los Angeles River Upper Reach 2 Subwatershed Group.

A significant portion of Pico Rivera drains to areas with existing significant infiltration and outfall sampling would not provide representative samples. The outfall monitoring locations account for all significant land uses in the watershed. The land uses for the individual outfall sampling are shown on Figure 3-2 and described in Table 3-4. Monitoring site designations and monitoring functions are shown in Table 3-5.

Table 3-4. Land Use for the outfall monitoring sites for the Lower Los Angeles River Watershed

Drainage Area	Land Use %						
	Residential	Commercial	Industrial	Mixed Use	Open Space	Other	Area occupied by LA River
LLAR 1	75.30%	2.94%	0.65%	14.72%	1.95%	4.43%	-
LLAR 2	75.49%	3.68%	0.00%	2.78%	10.88%	7.17%	-
LLAR 3	73.36%	7.59%	3.62%	9.35%	0.00%	6.08%	-
LLAR 4	66.50%	5.37%	5.51%	5.65%	11.95%	5.02%	-
Total LLAR Watershed provided for comparison	63.18%	2.86%	3.03%	20.94%	4.81%	4.87%	0.31%
Average of 4 outfalls	72.66%	4.89%	2.44%	8.13%	6.20%	5.68%	

HUC units are shown in Figure 3-3. There are three HUC 12 equivalents within the LLAR. The Compton Creek-Los Angeles River is by far the largest of the three HUC units. Three of the proposed outfalls monitoring sites are within this HUC. The second largest HUC within the LLAR is the Alhambra Wash-Rio Hondo. One outfall monitoring site, LLAR 4, will be established within the Alhambra Wash-Rio Hondo HUC in the first year of monitoring so that monitoring data will be collected from both principal HUC-12 areas in the first year. The third HUC is the Chavez Ravine-Los Angeles River HUC of which the LLAR only occupies a minimal portion. It is the LLAR's understanding that the adjoining WMP group, the LA River Reach 2 Group, will be placing a monitoring station within that area, therefore the LLAR will not duplicate that effort.

3.3 Non-Stormwater Outfall Monitoring

NSW outfall based monitoring will be conducted for outfalls discharging to receiving waters of the LLAR Watershed. Initially, all pipes exceeding 12 inches and discharging directly into the LLAR receiving waters will be identified. During the first cycle of the permit, the database will be refined to determine which of the 12-inch to 36-inch pipes include discharges from areas with industrial land uses. Regardless of land use, all outfalls, including those between 12 and 36 inches, will be screened. A screening program will be implemented to initially document sites with persistent and significant non-stormwater flows. The screening program will utilize a combination of field tests and may incorporate 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.

3.4 New Development/Redevelopment Effectiveness Tracking

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.

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.

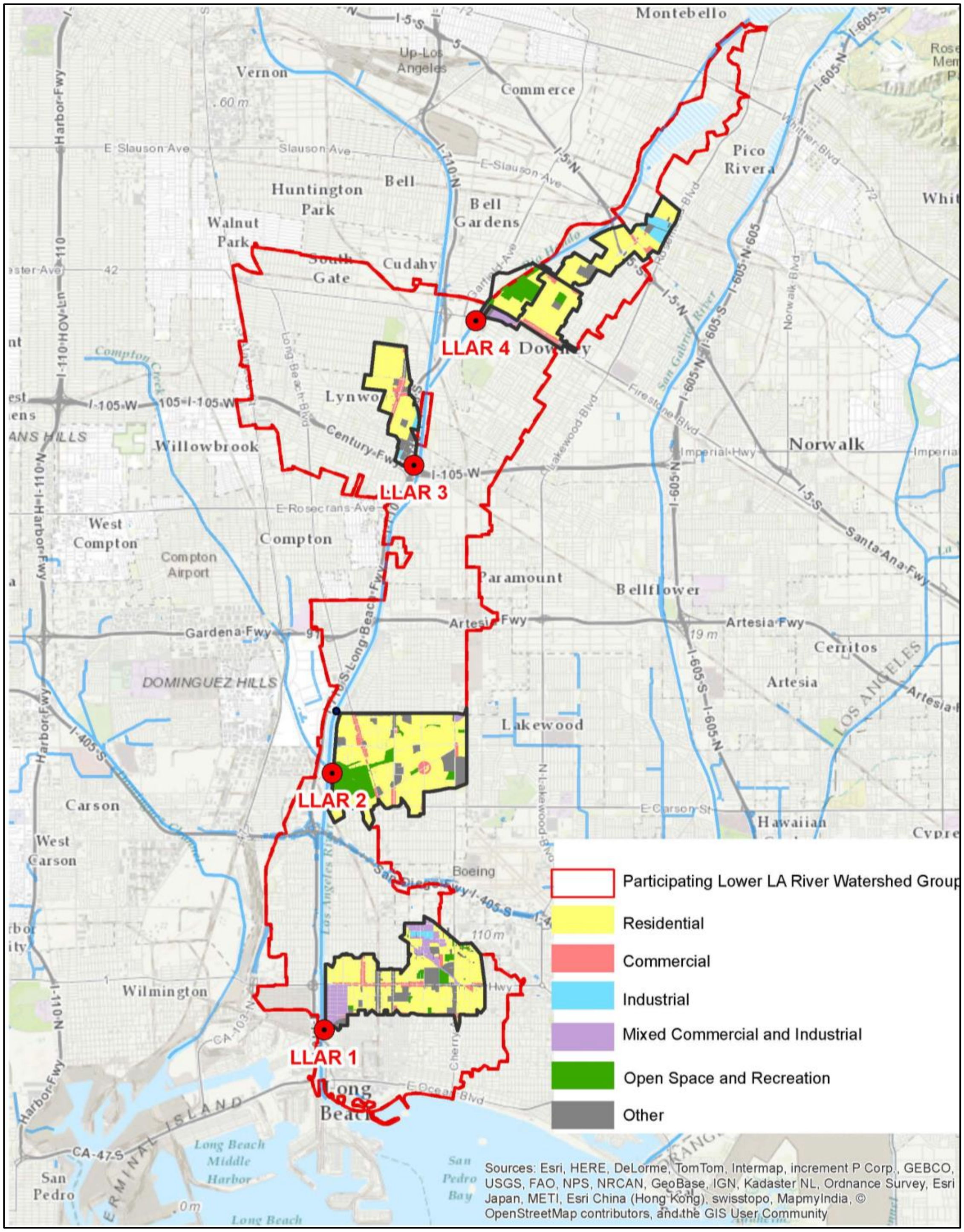
3.5 Regional Studies

On behalf of the participating agencies, the LACFCD will continue to provide financial and/or monitoring resources to the Southern California Stormwater Monitoring Coalition Regional Watershed Monitoring Program, also known as the Regionally Consistent and Integrated Freshwater Stream Bioassessment Monitoring Program (Bioassessment Program). The Bioassessment Program was initiated in 2009 and is structured to occur in cycles of five years. Sampling under the first cycle concluded in 2013. The next five-year cycle is scheduled to begin in 2015, with additional special study monitoring scheduled to occur in 2014.

Permittee representatives will also participate in the Southern California Stormwater Monitoring Coalition (SMC) meetings and assist in development and implementation of selected and appropriate regional studies designed to improve stormwater characterization and impact assessment.

Table 3-5. Monitoring Site Designation and Monitoring Function.

Site Name	Site Description	Datum NAD83		Type of Site					
		Latitude (N)	Longitude (W)	Receiving Water	Stormwater Outfall	Harbor Toxics TMDL	Metals TMDL	Bacteria TMDL	
								River	Estuary
S10	Wardlow Street	33.81900	118.20556	X		X			
LLAR1	Cerritos Pump Station	33.77951	118.20380		X				
LLAR2	Dominguez Gap Pump Station	33.83945	118.20320		X				
LLAR3	Lynwood	33.91469	118.18214		X				
LLAR4	Firestone	33.94812	118.16146		X				
LARB1	Segment A (Wardlow)	33.81900	118.20556					X	
LARB2	Segment B (Rosecrans)	33.90374	118.18240					X	
LARB7	Rio Hondo	33.93202	118.17523					X	
LARE1	LARE Mouth of Estuary	33.75506	118.18727						X
LARE2	LARE Queensway	33.75976	118.19910						X
LARE3	LARE Willow	33.80416	118.20547						X
LAR1-13	Wardlow - Main Channel	33.81900	118.20556				X		
LAR1-10	Rio Hondo - Trib	33.93510	118.17218				X		
LAR1-9	I710 - Main Channel	33.93421	118.17548				X		



Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Figure 3-2. **Lower Los Angeles River Land Use**

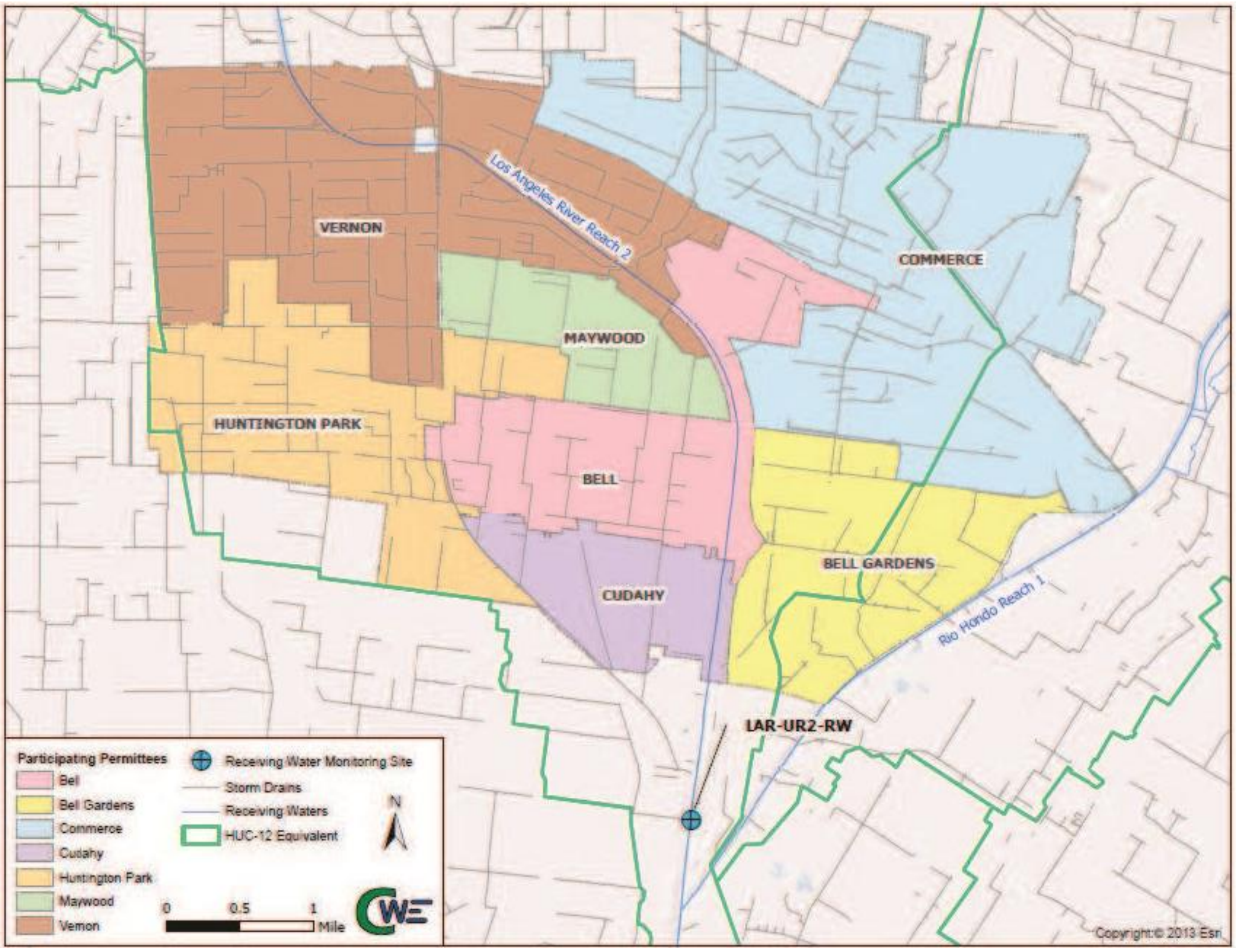


Figure 3-3. HUC 12 equivalents within the LLAR

4 Summary of Sampling Frequencies for each CIMP Element

It is anticipated that the CIMP will be implemented in a phased process (Table 4-1). The Receiving Water Quality Monitoring program will start at S10 (Wardlow) during the 2015 dry season. This site will continue to be monitored by the LACFD. This site will be sampled during two dry weather events and three stormwater events each year. During two surveys, water quality testing will 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). This full set of analytes will be analyzed in water collected during the first major storm event of the year and during a critical, low flow dry season survey. July is considered to have the lowest historical flows based upon long-term flow monitoring. If these 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 being 303(d)-listed or part of an ongoing TMDL, the analyte will not be further analyzed. Parameters exceeding the lowest applicable water quality objective (Appendix G) will continue to be analyzed for the remainder of the Order during at the receiving water monitoring station where it was detected. Acceleration of the Receiving Water Quality Monitoring Program will also include the Aquatic Toxicity Monitoring.

Two Stormwater Outfall Monitoring sites will also start sampling during the 2015/16 wet season. These will include LLAR2 (Dominguez Gap) and a new station, LLAR4 (Firestone). The remaining Stormwater Outfall Monitoring sites will be installed in the following year. LLAR3 (Lynwood) and LLAR1 (Cerritos Pump Station) will be installed and operable for the 2016/17 season. Once the Stormwater Outfall Monitoring sites are installed they will each be monitoring during three storm events each year. If running average concentrations of pollutants exceed the Municipal Action Limits (MALs – Attachment G of the MRP) by more than 20%, expanded monitoring will be required to identify the sources of the increased loads.

Monitoring in the main stem of the Los Angeles River and the Rio Hondo tributary for the Los Angeles River Bacteria TMDL, Los Angeles River Metals TMDL and the Los Angeles River Estuary Bacteria TMDL all start in the summer of 2015. Monitoring data will be collected from both principal HUC-12 areas in the first year. Sampling for these three programs is based upon collection of grab samples.

Monitoring of non-stormwater discharges to the receiving waters of the Lower Los Angeles River started in the summer of 2014 in order to meet the first target of completion of 25% of the source investigations by December 2015.

Table 4-1. Schedule for Implementation of Monitoring Activities in the Lower Los Angeles River Watershed.

Task	Dry 2014	Wet 2014-15	Dry 2015	Wet 2015-16	Dry 2016	Wet 2016-17	Dry 2017	Wet 2017-18	Dry 2018
Receiving Water/TMDL									
S10 –Wardlow									
Harbor Toxics			1	2	1	2	1	2	1
Chemistry[1]			2	3	2	3	2	3	2
Aquatic Toxicity			1	2	1	2	1	2	1
Outfall Monitoring Site									
LLAR1 (Cerritos Pump)						3		3	
LLAR2 (Dominguez Gap)				3		3		3	
LLAR3 (Lynwood)						3		3	
LLAR4 (Firestone)				3		3		3	
Los Angeles River Metals[5]									
LAR1-13 (Wardlow)			4	4	4	4	4	4	4
LAR1-10 (Rio Hondo)			4		4		4		4
LAR1-9 (I710-LA River)			4		4		4		4
Los Angeles River Bacteria									
Pre-LRS – all Segment A outfalls			6						
LARB1 (Wardlow)			4		4		4		4
LARB2 (Rosecrans)			4		4		4		4
LARB7 (Rio Hondo)			4		4		4		4
Los Angeles River Estuary (bacteria only)									
LARE1 (Mouth of Estuary)			4		4		4		4
LARE2 (Queensway Br.)			4		4		4		4
LARE3 (Willow)			4		4		4		4
Non-Stormwater Outfall									
Inventory & Screen[2]	3								
Source ID[3]		Ongoing	Ongoing		Ongoing		Ongoing		Ongoing
Monitoring[4]					2		2		2

1. Table E-2 chemical analyses will be performed once during the first wet weather event and once during the first critical dry weather monitoring event. Constituents that exceed MDLs and available water quality objectives will continue to be monitored along with all constituents with TMDLs or 303(d) listing. Wet and dry weather chemical constituents will be separately assessed for purposes of continued monitoring.
2. 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.
3. Investigations designed to track and classify discharges will start during the 2015 dry season. Source tracking and classification work depend upon the number of sites categorized as Suspect outfalls with evidence of significant flow.
4. 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. Currently serviced by the City of Los Angeles, but transition to the LLAR watershed Group is expected prior to June 30, 2016

5 Chemical/Physical Parameters

This section provides a summary of chemical parameters required to be analyzed at the receiving water mass emission monitoring station a minimum of two times during the first year of the monitoring program and once during the critical dry weather period. Results of this screening process will be used to initially determine constituents that will continue to be analyzed at the mass emission site and those that will be further considered for inclusion as part of ongoing monitoring at 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 5-2 through Table 5-8 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 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. The Reasonable Assurance Analysis (RAA)[1] conducted an assessment of long-term rainfall records and found that the least amount of rainfall occurs in August yet very little difference exists between May and September.

Initial monitoring of Table E-2 constituents during one wet and one dry weather event is intended to serve as a cross-check and/or verification that these pollutants have not become an issue in the receiving waters since the last time they were measured. This screening process is intended to be conducted one time at the receiving water mass emission site during each five-year permit cycle. If a parameter is not detected at the Method Detection Limit (MDL) for its respective test method or the result is below the lowest applicable water quality objective, and is not otherwise identified as a basic monitoring requirement, a TMDL analyte or a 303(d) listing, it is not required to be analyzed again during the current five-year permit cycle. If, during either the wet or dry weather screening, a parameter is detected exceeding the lowest applicable water quality objective then the parameter is to be analyzed for the remainder of the five-year cycle at the receiving water monitoring station where it was detected during the respective conditions (wet or dry).

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[1] Draft Reasonable Assurance Analysis for Lower Los Angeles River, Los Cerritos Channel, and Lower San Gabriel River. May 2014.

In addition, any additional constituents found to commonly exceed receiving water limitations at the ME site will also be incorporated into stormwater outfall monitoring program in order to help identify watershed sources of the pollutants.

Justification for adding and deleting constituents from the stormwater outfall monitoring program will follow the process established in the Los Angeles River Metals CMP. Any Table E-2 constituents incorporated into ongoing monitoring program at the ME receiving water monitoring site will be added to the stormwater outfall monitoring requirements 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 and/or are not found at concentrations that would contribute to exceedances of water quality criteria in the receiving waters. Constituents will be removed from the list if they are not detected at levels of concern for two consecutive stormwater monitoring events.

Comprehensive monitoring of priority pollutants in the receiving waters at the ME site is intended to assure that all constituents with potential to impact water quality are incorporated into the monitoring program. In addition, any Table E-2 constituents incorporated into the ongoing monitoring program at the ME receiving water monitoring site, will also be added to the stormwater outfall monitoring requirements if they exceed RWLs at the ME site after two consecutive wet weather monitoring events.

Table 5-1. Summary of Constituents to be Monitored on a Regular Basis at the S10 Mass Emission Monitoring Site.

CLASS OF MEASUREMENTS	MASS EMISSION SITE (S10)	
	Wet[2]	Dry
Flow	4	2
Field Measurements Dissolved oxygen, pH, temperature, and specific conductivity	4	2
MRP Table E-2 Constituents[1] (other than those specifically listed below)	1	1
Aquatic Toxicity	2	1
General and Conventional Pollutants (Table 5-2) All except total phenols, turbidity, BOD_5, MTBE, and perchlorate, and fluoride.	4	2
Microbiological Constituents[3] (Table 5-3) *E. coli*	4	8
Nutrients (Table 5-4) Nitrogen compounds only	3	2
Metals (Table 5-6) Al**,** Cd, Cu, Pb, Ni, Sb, Zn, Total Se & Hg	4	2
Organophosphate Pesticides (Table 5-7) Diazinon	3	2
Semivolatile Organic Compounds (Table 5-8) Bis(2-ethlyhexylyphthalate	3	2

1. 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 the first year of the CIMP. The Los Angeles County Flood Control District owns and operates S10. Upon concurrence of the Executive Office of the Regional Board, the Flood Control District may reduce testing for pollutants listed on E2 if past monitoring has shown a history of non-detects or detection well below applicable WQO.
2. The fourth storm event is only for the purpose of fulfilling the TMDL requirements. Only metals, TSS, SSC, and hardness will be analyzed.
3. The wet and dry weather sampling frequency may change so long as one sample per month is collected in freshwater.

5.1 General and Conventional Pollutants

Many of the general and conventional pollutants listed in Table 5-2 will continue to be analyzed as part of the base monitoring requirements. Total phenols, turbidity, BOD$_5$, fluoride, perchlorate, and MTBE will not be part of the base monitoring requirements unless these constituents are 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.

Table 5-2. 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[1]	**METHOD**	**mg/L**
pH-field instrumentation	*In-situ*, 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] Field measurements will be taken *In-situ* during dry weather surveys and in grab samples during wet weather monitoring.

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

5.2 Microbiological Constituents

All four microbiological constituents used as fecal indicator bacteria (FIB) will continue to be monitored at the S10 (Wardlow) Receiving Water monitoring site. Bacteria used as fecal indicators in marine waters will continue to be analyzed during wet and dry weather surveys due to being situated just above the Los Angeles River Estuary.

All four FIBs will also be analyzed during stormwater outfall monitoring at the only site (LAR1) that discharges to the Estuary. Only *E. coli* will be monitored at the remaining three stormwater outfall sites (LAR2, LAR3, and LAR4) since each located in freshwater portion of the watershed.

Escherichia coli will also be analyzed at the three Bacteria TMDL monitoring sites in the LLAR WG and will be measured as part of the bacteria load assessment required for in all dry discharges to Segment A of the Los Angeles River. Table 5-3 provides both upper and lower quantification limits for each FIB established to assure that quantifiable results are obtained. Upper quantification limits are only identified to assure that measurements result in quantitative values.

Table 5-3. 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 and fecal coliform and enterococcus will be measured only in marine waters or at locations where either the discharge point or receiving water body will impact marine waters. These includes the mass emission site, S10, and LLAR1, the only stormwater outfall site discharging to the Estuary. *E. coli* will be analyzed at sites within the freshwater portion of the watershed.

5.3 Nutrients

Nitrogen compounds (Table 5-1 and Table 5-4) are required as part of the base requirements for both the ME (S10) and stormwater outfall monitoring sites (LAR1 through LAR4). Analysis of nitrogen compounds is required due to the Nitrogen TMDL. Phosphorus compounds have not been identified as constituents of concern in the watershed and will therefore only be analyzed during the two events where all Table E-2 constituents are analyzed.

Table 5-4. 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 S10 between 2006 and 2013. None of these compounds were detected in any samples taken during this time period. In recognition of this issue, 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 S10 using the same frequency as sampling being conducted in the Harbor waters and in the Los Angeles River Estuary.

The Harbor Toxics TMDL requires monitoring during two storm events and one dry weather event. Monitoring during the two storm events will use methods detailed in Section 8.5. Monitoring during dry weather will utilize conventional methods (Table 5-5) being used in the Harbor receiving waters and the estuary. During dry weather flows, suspended sediment concentrations will be too low to allow for direct assessment of chlorinated pesticides and PCBs in the suspended particulate fraction. Sampling will be coordinated with the "*Coordinated Compliance Monitoring, and Reporting Plan Incorporating Quality Assurance Project Plan Components: Greater Los Angeles and Long Beach Harbor Waters*", (Anchor QEA, 2013).

Monitoring for PCBs will be reported as the summation of aroclors and a minimum of 50 congeners, using EPA Method 8270 without the use of High Resolution Mass Spectrometry for routine monitoring, due to the extreme high cost involved.

Table 5-5. 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[1]	**EPA 8270**	**0.005**
Aroclor-1016	EPA 608	0.5
Aroclor-1221	EPA 608	0.5
Aroclor-1232	EPA 608	0.5
Aroclor-1242	EPA 608	0.5
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, without the use of High Resolution Mass Spectrometry 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.

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 5-6. 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.

Dissolved mercury has not been detected in any wet or dry weather sampling conducted at the Los Angeles River Mass Emission Site (S10) since 2006 and total mercury has only been detected on two occasions. Total mercury will be analyzed as part of the base program since it was detected during two wet weather events approximately 10 years ago and it remains one of the municipal action limits (MALs) included in the MRP. Automated stormwater samplers are not suitable for sampling stormwater at the low mercury detection limits (0.5 nanograms/liter). Grab samples will be taken for analysis of mercury in order to augment composite samples, which will be analyzed by EPA method 245.1. These 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 the other grab samples required by the monitoring program. Additional QA/QC will be specified to support the extremely low detection limits required by the program.

Table 5-6. 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)	1631E	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 5-7. Due to the fact that diazinon and chlorpyrifos are no longer available for residential use, these constituents are now rarely detected and none of the organophosphate pesticides/herbicides have been detected at the Los Angeles River Mass Emission monitoring site in the past 10 years.

Two compounds in this list, atrazine and simazine, are not organophosphate pesticides, they can be analyzed by EPA Method 8141a. Both are triazine herbicides which are used for control of broadleaf weeds. Based upon historical data, herbicides such as these and the three additional separately listed compounds are unlikely to require continued analysis after completion of initial screening of Table E-2 constituents. Alternative analytical methods may be used as long as the established reporting limits can be met.

Diazinon remains on the 303(d) list but has detected at much lower frequencies and concentrations. Although this analyte remains on the list to be analyzed at the ME station, we recommend reevaluation after the first year of monitoring. If concentrations remain below the updated California Department of Fish and Game criteria, this analyte should be removed from the list for the ME site.

Table 5-7. 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 5-8 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 part of the base program at S10.

Table 5-8. 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

SEMIVOLATILE ORGANIC COMPOUNDS	METHOD	Reporting Limit
Fluoranthene	EPA625	0.05
Fluorene	EPA625	0.1
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 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.

6.1 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 Los Angeles 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 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).

6.2 Testing Period

The following describes the testing periods to assess toxicity in samples collected in the LCC 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.

6.3 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.

6.4 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 Section6.4. 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 6-1. 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).

Table 6-1. 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 Stormwater 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)

The Watershed Group will identify the cause(s) of toxicity using a selection of treatments in Table 6-1 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.

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.

6.5 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 6.3 and 6.4, 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.

6.6 Summary of Aquatic Toxicity Monitoring

The approach to conducting aquatic toxicity monitoring as described in the previous sections is summarized in detail in Figure 6-1. 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.

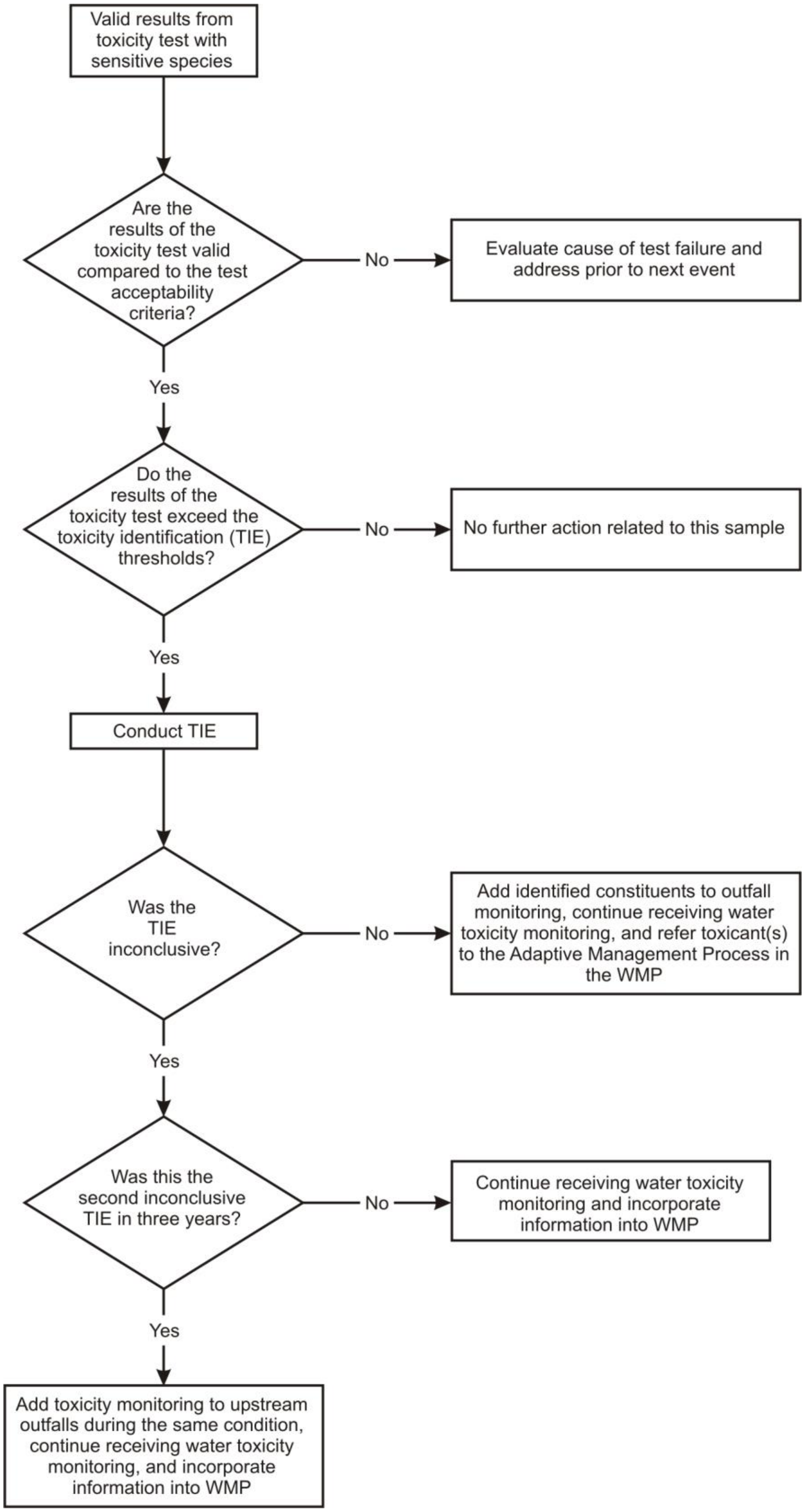

Figure 6-1. Detailed Aquatic Toxicity Assessment Process

7 Receiving Water Monitoring Mass Emission Monitoring

All receiving water quality monitoring at the Los Angeles River mass emission monitoring site, S10 (Figure 7-1), will continue to be conducted by the Los Angeles County Flood Control District (LACFCD). Flow-weighted composite samples will be collected during each monitoring event and will be analyzed for analytes in Table 5-1.

7.1 Sampling Frequency and Mobilization Requirements

Monitoring of receiving water quality at S10 will be performed three times a year during the wet season and two times a year during dry weather conditions. Screening for Table E-2 constituents listed in the MRP will be conducted during the first significant storm of the year and during a critically dry weather period. 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.

Wet weather conditions are defined in the MRP as when the receiving waterbody has flow that is at least 20 percent greater than its base flow or, in the case of an estuary, during a storm event of greater than or equal to 0.1 inch of precipitation.

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 and
- Maximum flow rates greater than 500 cfs measured at the Wardlow Road gaging station associated with the S10 mass emission monitoring site.

The MRP provides defines dry weather as (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.

7.2 Sampling Constituents

Chemical analysis are scheduled to be conducted for all analytes listed in Table 5-2 through Table 5-8 during the first significant rainfall of the season and again during a period of critical low flow. Chemical constituents not detected in excess of their respective Method Detection Limits (MDLs) or that do not exceed available water quality standards will be considered for removal during subsequent surveys. Adjustments to the list of analytical tests will be assessed separately for wet and dry weather sampling requirements.

Constituents to be sampled at the ME site during all other sampling events are listed in Table 5-1. Sampling requires focus on constituents that are currently part of a TMDL, are 303(d) listed or that have exceeded RWL but data are not sufficient for listing. This approach is designed to target constituents of concern in the watershed. In addition, an extensive sampling of all constituents is scheduled for two time periods during the first year of the permit when contaminants are expected to have the greatest potential for being detected. Additional constituents from the Table E-2 list that are detected at levels of concern during those two time periods will be added to the monitoring list at the ME site.

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 7-1 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 7-1. Toxicity Test Volume Requirements for Aquatic Toxicity Testing as part of the Lower Los Angeles 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.

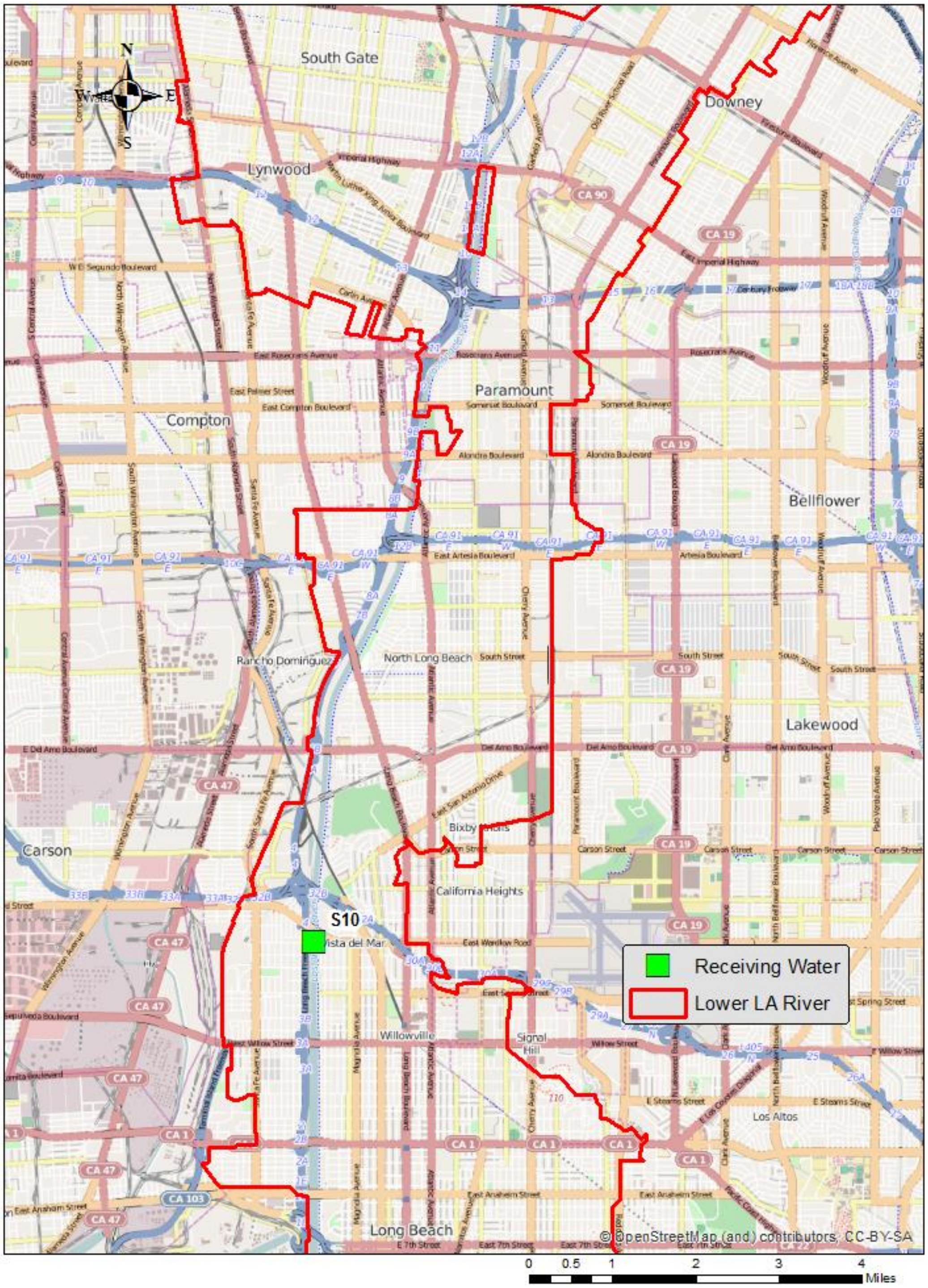

Figure 7-1. Lower Los Angeles River Receiving Water Monitoring and TMDL Compliance Site.

8 Receiving Water TMDL Monitoring

The following sections provide a summary of TMDLs applicable to the LLAR, any interim or final Waste Load Allocations applicable to each TMDL, and monitoring requirements required to evaluate compliance.

8.1 Nitrogen Compounds and Related Effects TMDL

Attachment A to Resolution No. R12-010

This TMDL identifies Water Reclamation Plants (WRP) as the major sources of nitrogen compounds to the Los Angeles River. These facilities include the Donald C. Tillman Water Reclamation Plant, the Los Angeles-Glendale WRP, and the Burbank WRP. All are located upstream of the LLAR WMG. During dry weather periods, these major POTWs contribute 84.1% of the total dry weather nitrogen load. Urban runoff, stormwater, and groundwater discharges also contribute nitrogen loads. The TMDL classifies discharges from MS4s as minor point sources of nitrogen compounds.

Waste Load Allocations (WLAs) are established for segments of the Lower LAR watershed (Table 8-1). A review of water quality measurements taken at the Wardlow (S10) Mass Emission monitoring site between 2006 and 2013 indicated that individual nitrate and nitrite-nitrogen concentrations never exceeded the 30-day WLAs. In addition, three single sample ammonia-nitrogen measurements taken in late 2006 and 2007 were found to exceed the 30-day geometric mean standard of 2.4 mg/L for ammonia-nitrogen.

Low concentrations of nitrogen compounds have been consistently reported in both wet and dry weather discharges monitored at the City of Long Beach Dominguez Gap Mass Emission Monitoring Site between 2008 and 2013 (Kinnetic Laboratories, Inc., 2013). Concentrations of ammonia-nitrogen are reported to be less than 0.7 mg/L during both dry and wet weather monitoring. Concentrations of nitrate-N in dry weather discharges have never exceeded 1.9 mg/L and all wet weather discharges have had concentrations of less than 1.4 mg/L.

Based upon the low concentrations of nitrogen reported in receiving waters of the Los Angeles River and recognition that POTWs are the major contributors of nitrogen to the River during dry weather, the existing mass emission monitoring site located at Wardlow Road (S10) will be used to assess compliance with the Nitrogen Compounds and Related Effects TMDL for the LLAR WMG. Monitoring of nitrogen compounds will be included with each of the three wet weather events and for two dry weather events.

Table 8-1. Summary of 30-day WLAs for Nitrogen Compounds in the Lower Los Angeles River Watershed Management Group.

Segment	Ammonia-N (mg/L)	Nitrate-N (mg/L)	Nitrite-N (mg/L)	Nitrate+Nitrite-N (mg/L)
Los Angeles River Reach 1	2.4	8.0	1.0	8.0
Los Angeles River Reach 2	2.4	8.0	1.0	8.0
Los Angeles River Tributaries excluding the Whittier Narrows	2.3	8.0	1.0	8.0

In addition, the highest four-day average within the 30-day period shall not exceed 2.5 times the 30-day average waste load allocation.

8.2 Los Angeles River and Tributaries Metals TMDL

Attachment A to Resolution No. R2007-014

The Los Angeles River Metals TMDL became effective on October 29, 2008. In order to address compliance with this TMDL (Table 8-3), a Coordinated Monitoring Plan (CMP) was developed and implemented jointly by the responsible Los Angeles River Watershed MS4 permittees in October 2008. Wet and dry weather monitoring began at 13 locations in the LA River and major tributaries. Four of the monitoring sites were located within the LLAR WMG area. Grab sampling was conducted at all four monitoring sites on a monthly basis during dry weather conditions. Two sites were equipped with autosamplers which were used to collect stormwater runoff samples. A summary of the results of this monitoring effort is presented in Section 2 of the WMP.

Automated sampling equipment was used at LAR 1-13[2] near Wardlow Rd. and at LAR 1-11 located just north of Del Amo Blvd. The LAR 1-13 site is located at the same site as the Los Angeles River mass emission monitoring site S10. Both are associated with at Los Angeles County gaging station F319-R. This location has been used as the final compliance point for the Metals TMDL and is also effectively the lower end of Reach 1 of the Los Angeles River. LAR 1-11 is located just 3300 meters (just over two miles) to the north. This site is also north of the location where Compton Creek discharges to the Los Angeles River and marks the lower end of Reach 2. Monitoring results from these two closely spaced sites were typically difficult to differentiate. The location of LAR 1-11 is an artifact of the prior Reach 1/Reach 2 segmenting under the TMDL, which is now being superseded by the watershed approach. The location of site LAR 1-11 was well suited for differentiating Reach 2 and Reach 1, but does not provide significant information for watershed implementation activities.

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[2] LAR1-13 is located at the same site as S-10.

The river segment between stations LAR1-11 and LAR1-13 is nearly an order of magnitude less than any of the other stations.

Table 8-2. Approximate percentage of River Length Served by Automated Sampling Stations

Monitoring Site	Percent* (%)
LLAR1-1	16.4
LLAR1-4	16.0
LARB1-7	21.4
LAR1-11	35.3
LAR1-13	02.6

* Percentage does not add to 100 due to the length of the estuary not being included

Historical monitoring at LAR1-11 and LAR1-13 do not show significant differences in pollutant trends (When a pollutant increases or decreases at one station, it also increases or decreases at the other stations) as is shown in in Figures 8-1 and 8-2 using copper and zinc levels for the 2013-14 CMP sampling results. The zinc levels parallel each other, the copper level are almost indistinguishable at the two monitoring stations.

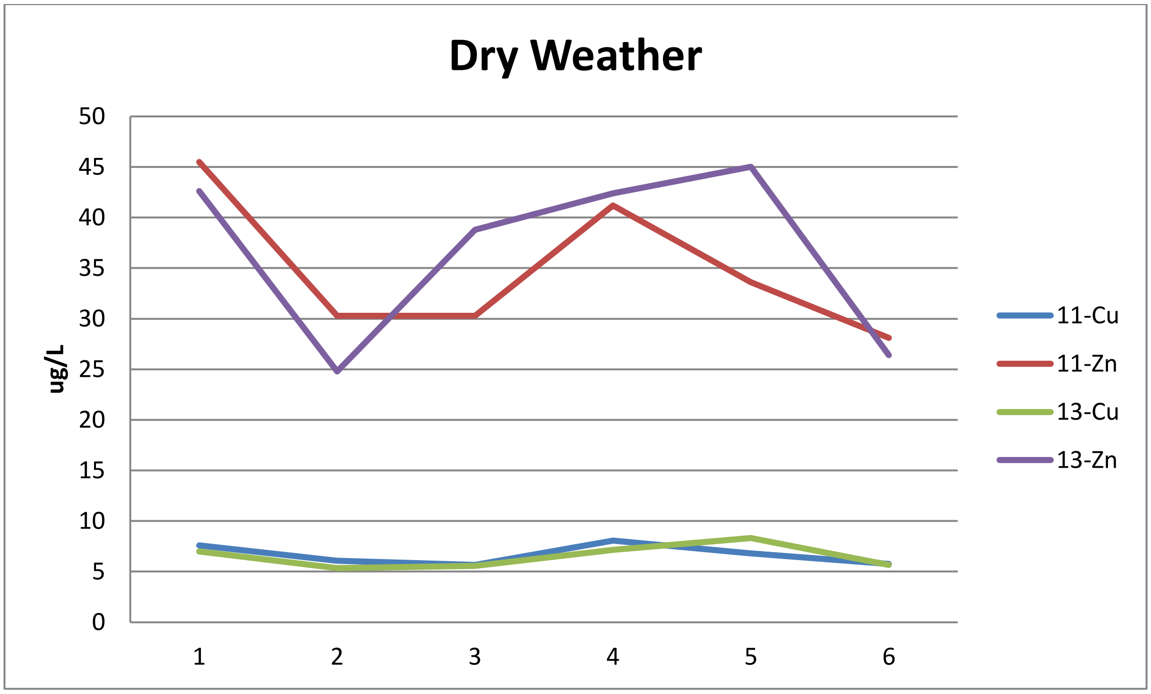


Figure 8-1. Comparison of copper and zinc levels for Monitoring Stations LAR1-11 and LAR1-13 in dry weather

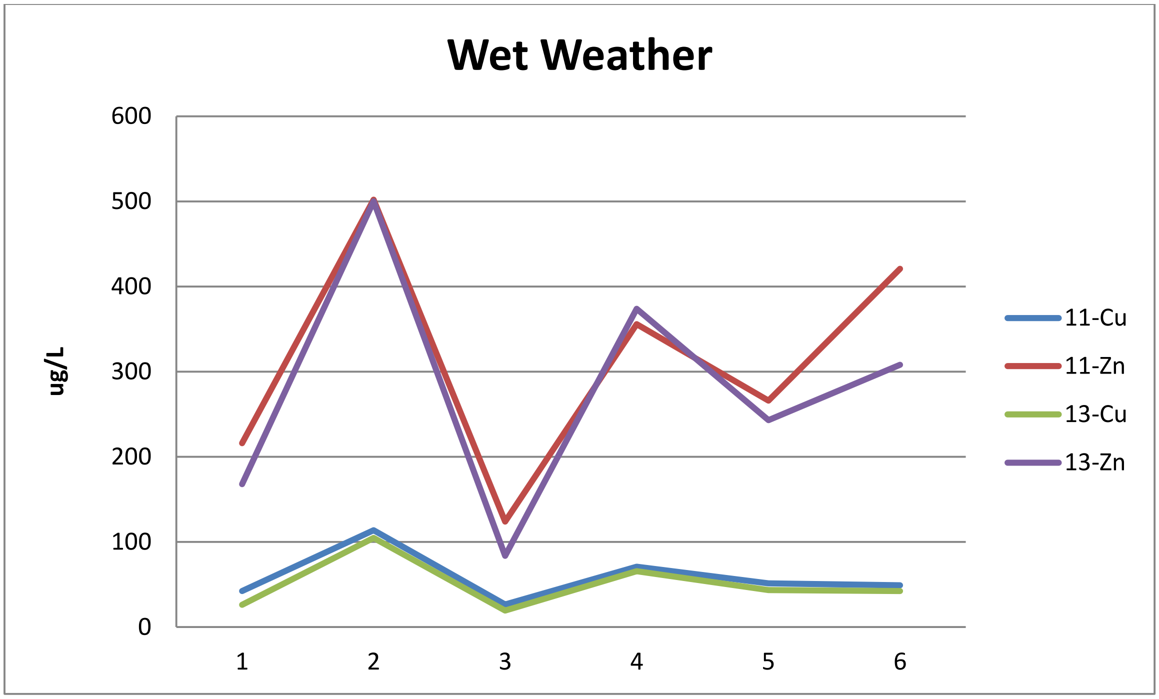


Figure 8-2. **Comparison of copper and zinc levels for Monitoring Stations LAR1-11 and LAR1-13 in wet weather**

For the past several years, the CMP Metals TMDL monitoring programs and the mass emission station have represented the only structural monitoring stations in the Los Angeles River. With the advent of the CIMP and IMPs, the number of sampling locations for the Los Angeles River and its tributaries, including Compton Creek is markedly increasing.

As a result, continued monitoring at LAR1-11 was redundant and not providing useful information for wet and dry weather monitoring. Thus three sites (Figure 8-3) will continue to be monitored for the LAR metals TMDL.

The LAR1-13 monitoring site will continue to be used for collection of flow-weighted stormwater composite samples since (1) this site also serves as the final compliance point for the metals TMDL, (2) is the furthest downstream and is near the interface of the river/estuary interface and (3) the LLAR groups has already indicated the Harbor Toxics TMDL would be situated at this site. Three storm events will be monitored at this location to be consistent with receiving water quality monitoring requirements at this site.

Dry weather monitoring data from the Los Angeles River Metals CMP has shown metals to be in compliance during dry weather. As a result of the high level of compliance, dry weather monitoring at each of the three sites (Figure 8-3) is scheduled be conducted on a quarterly basis. No dry weather sampling will be conducted during months when a storm event is sampled at LAR1-13. Scheduling of monitoring activities will be coordinated with the Upper Los Angeles River Watershed Management Group (ULARWMG).

Table 8-3. Numeric Targets for Trace Metal in the Lower Los Angeles River WG.

TMDL Target	Waterbody	Metal (µg/L)			
		Cadmium	Copper [3,5,6]	Lead [3,5,6]	Zinc [4,5]
Dry Weather Total Recoverable Metals Targets[1,2]	Reach 1	-	23	12	-
	Tributary - Compton Cr.		19	8.9	
	Reach 2	-	22	11	-
	Arroyo Seco	-	22	11	-
	Tributary - Rio Hondo Reach 1	-	13	5	131
Wet Weather Total Recoverable Metals Target [7,8]	Reach 1 and 2, Compton Creek, Arroyo Seco, Rio Hondo Reach 1	3.1	17	62	159

Notes:

1. Dry weather targets apply to days when maximum daily flow in the river is less than 500 cfs at Wardlow gage.
2. Dry weather conversion factors used to convert total recoverable to dissolved fraction: copper = 0.96; lead = 0.79; zinc = 0.61
3. Dry weather targets for copper and lead are based on chronic California Toxic Rule (CTR) criteria.
4. Dry weather targets for zinc are based on acute CTR criteria using the 10 percentile hardness value.
5. Copper, lead and zinc targets dependent on water hardness.
6. Copper and lead targets based on 50th percentile hardness values.
7. CF Wet weather conversion factors for copper, lead, and zinc to convert total recoverable to dissolved based on regression of data collected at Wardlow gage: copper = 0.65; lead = 0.82; zinc = 0.61. Conversion factor for cadmium taken from CTR = 0.94.
8. Wet weather targets for cadmium, copper, lead and zinc based on acute CTR criteria and the 50th percentile hardness values for stormwater collected at Wardlow gage station.

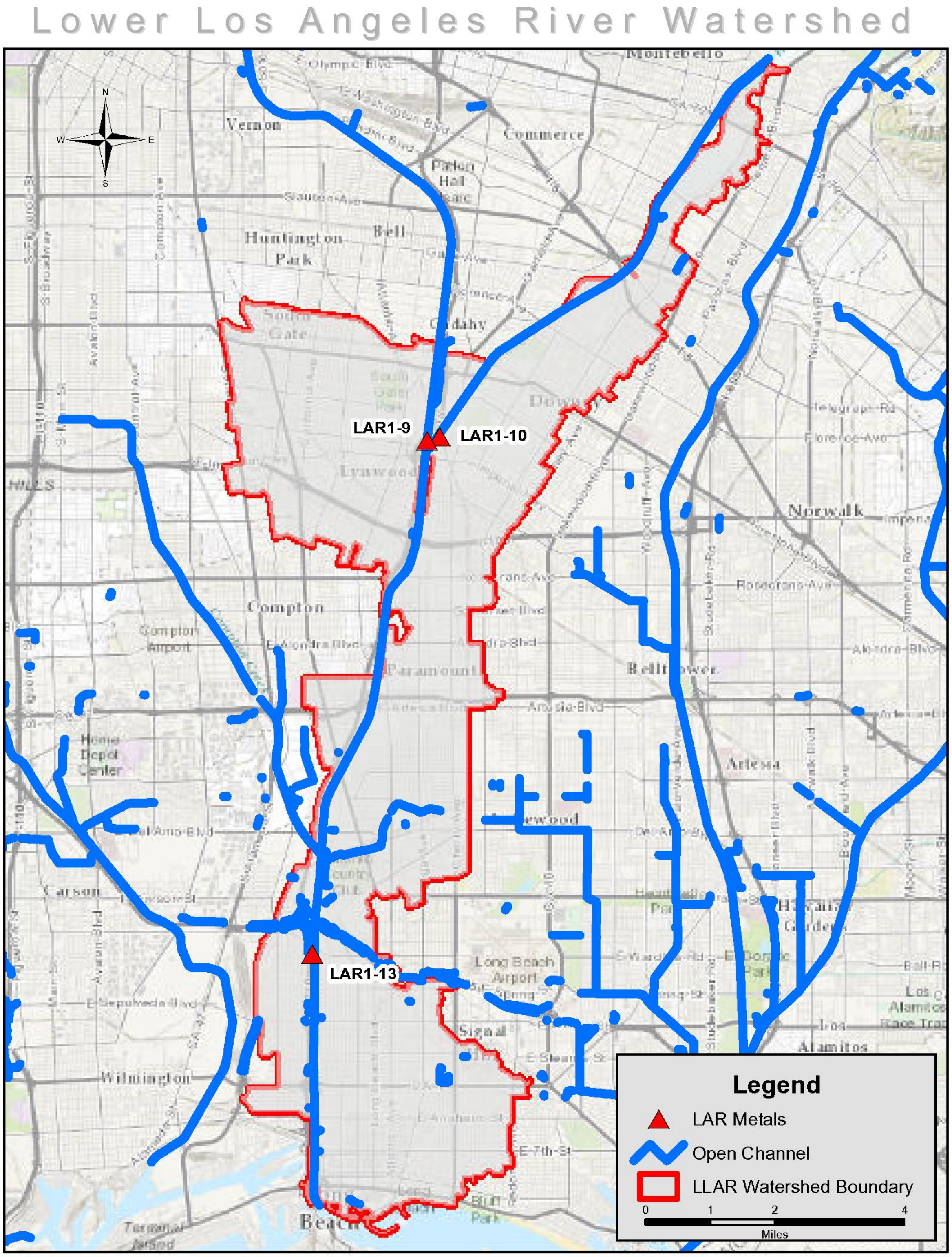


Figure 8-3. Monitoring Sites for the Los Angeles River Metals TMDL

8.3 Los Angeles River Watershed Bacteria TMDL

Attachment A to Resolution No. R10-007

The Basin Plan Amendment (Resolution No. R10-007) describes three categories of compliance monitoring:

> 1) ***Ambient (River) Monitoring*** is to occur on a monthly basis in each river segment and tributary addressed under the TMDL, until the subject river segment or tributary is at the end of the execution part of its first implementation phase, at which time, it will transition to weekly monitoring.
>
> 2) ***Load Reduction Strategy*** (LRS) Monitoring is required for parties pursing an LRS, in which intensive outfall monitoring will be conducted before and after implementation of the LRS. Pre-LRS monitoring will be used to estimate bacteria loading from MS4 Outfalls and to identify appropriate implementation actions to meet Waste Load Allocation (WLAs). Post-LRS monitoring will be used to evaluate compliance with interim WLAs and to plan for additional implementation actions to meet final WLAs during a second implementation phase, if necessary.
>
> 3) Wet Weather monitoring is to be addressed by Wet Weather Implementation Plans due in 2022.

This Coordinated Integrated Monitoring Plan (CIMP) is limited to 1) quarterly surveys necessary for the Ambient Monitoring program and 2) LRS surveys needed to first develop LRS Plans and later evaluate effectiveness of BMP implementation actions in meeting WLAs within defined reaches and tributaries within the LLAR WMG. Weekly Ambient Monitoring of receiving waters is not scheduled to occur until 7 years after a given reach or tributary has begun the first implementation phase. Given that timeline, it is expected that weekly ambient monitoring will be addressed by a future addendum to the CIMP.

River monitoring will be conducted quarterly at each of the three monitoring sites located within the LLAR WMG (Figure 8-4). Monitoring will be conducted during dry weather conditions and will consist of collection of water samples for analysis of *E. coli* and concurrent flow measurements to allow for calculation of loads. The timing of each survey will be coordinated with the upper Los Angeles River WMGs. Sampling methods are detailed in Appendix C.

LRS Monitoring will be conducted to support development of the Phase 1 LRS Plans and evaluate compliance with interim dry weather WLAs (Table 8-4). LRS monitoring for the first phase will require six synoptic surveys of all MS4 storm drains within a targeted River Segment or Tributary. Water samples will be collected from all flowing storm drains and analyzed for *Escherichia coli* (*E. coli*). Concurrent flow measurements will be necessary to allow for load calculations. The LLAR WMG includes all of Los Angeles River Segment A but only portions of River Segment B, Compton Creek and Rio Hondo. In cases where a segment or defined tributary is not fully encompassed within the LLAR WMG, the group plans to work cooperatively with adjoining WMGs to develop both the initial bacterial loading data and to later evaulate compliance with interim dry weather

WLAs after implementation. LRS monitoring will not be conducted for the initial LRS planning effort for Segment B since data were previously collected as part of the CREST program. The first LRS surveys will be conducted for River Segment A and Rio Hondo Reach 1 since the LRS plan is due by September 30, 2016 and March 23, 2016 (Table 8-6).

The LRS process is outlined in Figure 8-5. LRS monitoring is required as part of **Step 1** to provide the data necessary to develop the LRS plan and again in **Step 6** when it is necessary to evaluate effectiveness of the strategy.

8.3.1 Interim Dry Weather Limits for Bacteria

The Basin Plan Amendment (Resolution No. R10-007) established Interim Dry Weather WLAs for all segments of the Los Angeles River and the major tributaries. Table 8-4 summarizes WLAs for segments and tributaries located within the LLAR WMG.

Table 8-4. Interim Dry Weather Waste Load Allocations for LLAR Segments and Tributaries (Expressed as Load, 10^9 MPN/day).

River Segment or Tributary	*E. coli* Load (10^9 MPN/day)
Los Angeles River Segment A	301
Los Angeles River Segment B	518
Compton Creek	7
Rio Hondo	2

Source: Resolution No. R10-007, Amendment to the *Water Quality Control Plan for the Los Angeles* Region

8.3.2 Final In-stream Targets and Allowable Exceedances

The final in-stream numeric targets for this TMDL are as follows:

- Geometric Mean Target: *E. coli* density shall not exceed 126 MPN/100 mL.
- Single Sample Target: *E. coli* density shall not exceed 235 MPN/100 mL.

It is important to note that these Final In-stream Targets *do not* apply to monthly ambient monitoring results. They are included here for reference only. These targets only apply to weekly monitoring results, which will be initiated after a given river segment or tributary has completed the first phase of implementation of its Load Reduction Strategy. The single sample targets are assigned an allowable number of exceedance days for dry weather and wet weather. If the Regional Board adopts new bacterial standards, the CIMP, including any monitoring reports, shall be updated to incorporate the changes.

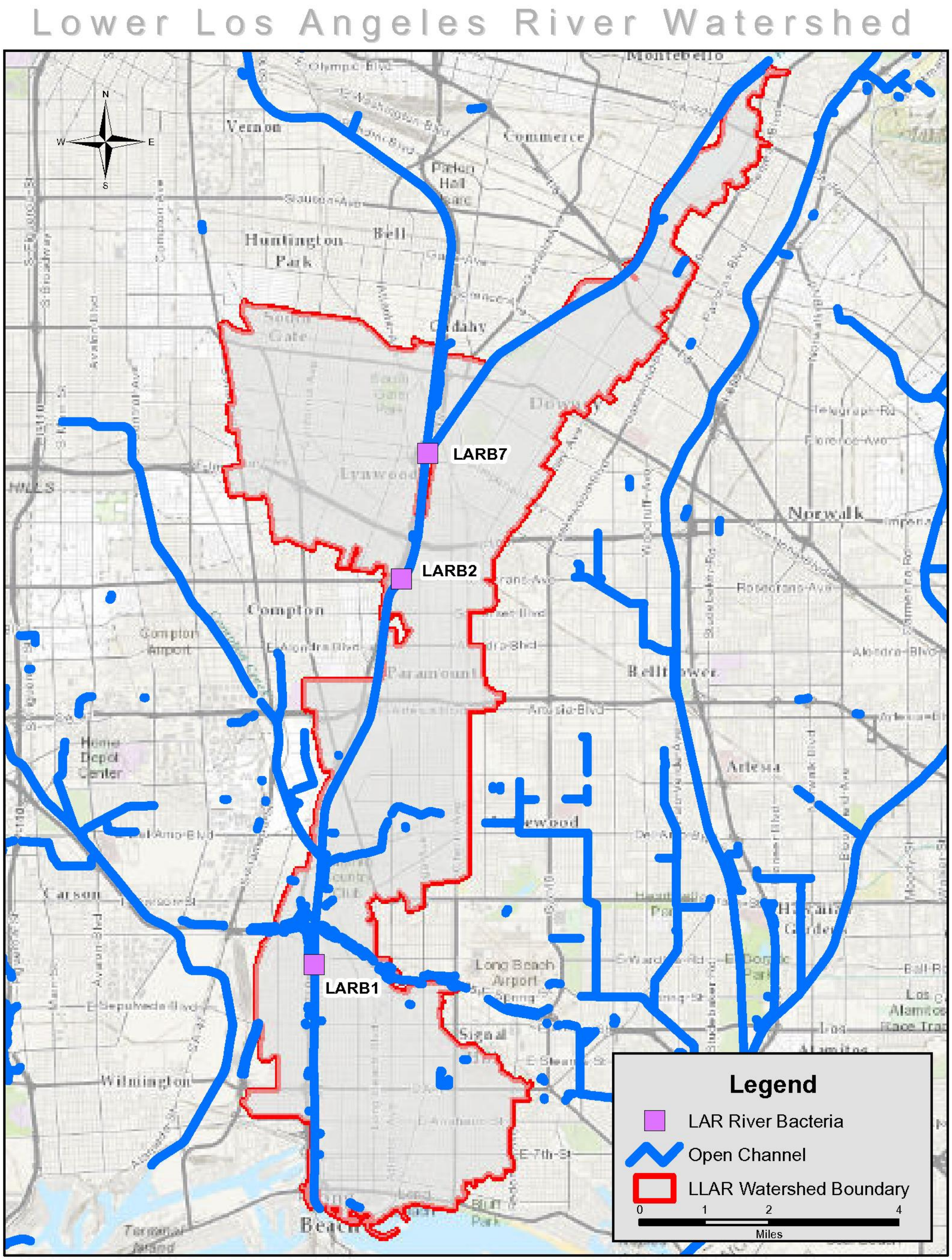
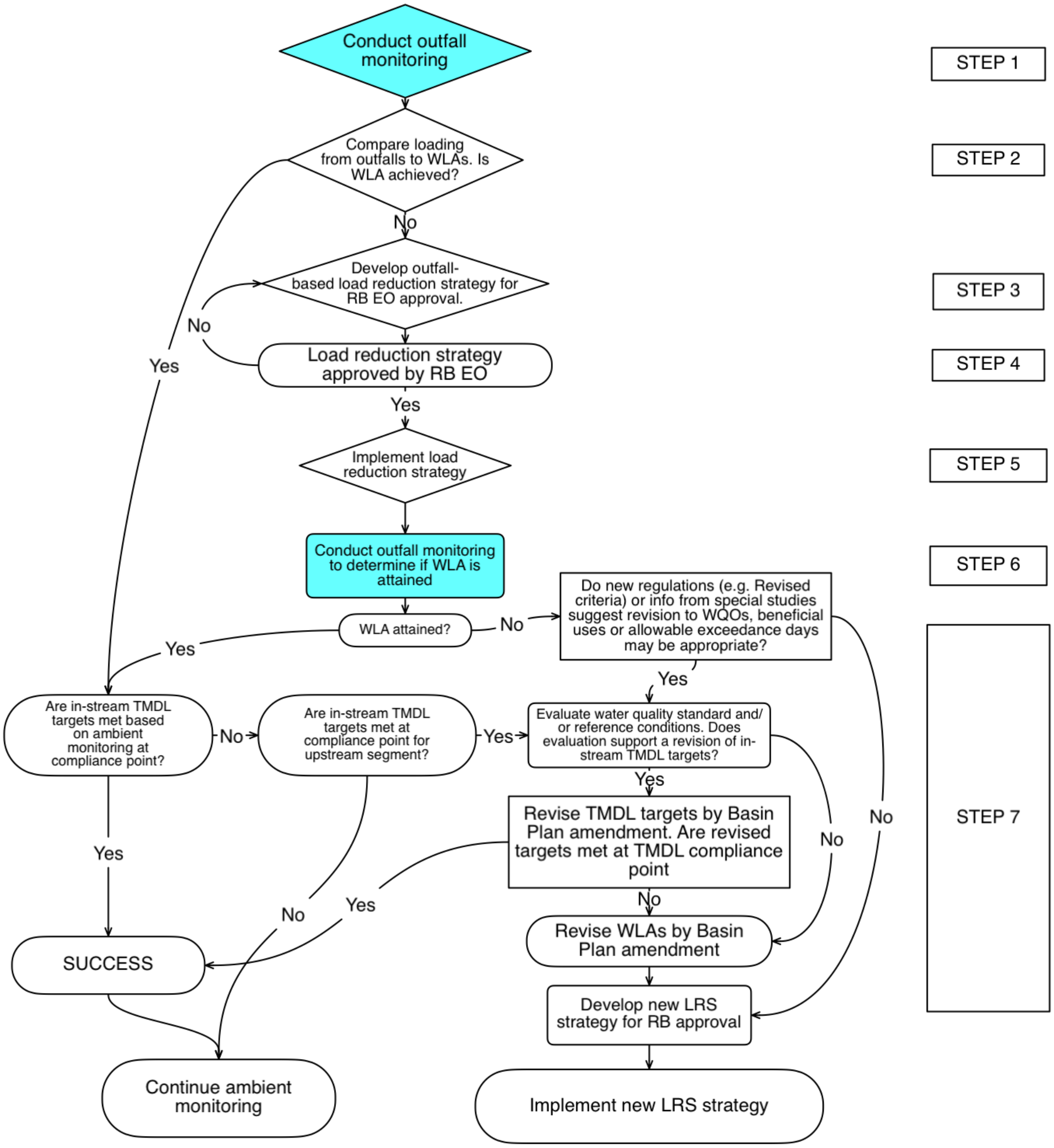


Figure 8-4. **River Monitoring Sites for the Los Angeles River Bacteria TMDL.**



Based Upon the Los Angeles River Bacteria TMDL Staff Report.

Figure 8-5. Outline of LRS Sampling and Assessment Process

8.3.3 High Flow Suspension

Certain reaches and tributaries of the Los Angeles River are subject to a High Flow Suspension (HFS) of the recreational beneficial uses. All segments and tributaries located within the LLAR WMG would be subject to suspension of recreational beneficial uses for time periods when rainfall is greater than or equal to 0.5 inches over a 24-hour time period and a 24-hour time period following the event (Board Resolution No. 2003-010). Since this CIMP only includes sampling scheduled to be conducted during dry weather, HFS days are not likely to apply to the results obtained through this monitoring program and are included here for reference purposes only. Table 8-5 shows the final dry and wet weather allowable exceedances based on daily and weekly sampling.

Table 8-5. Allowable Number of Exceedances of Final In-stream Numeric Targets in Dry and Wet Weather Conditions.

Allowable Number of Exceedance Days	Daily Sampling	Weekly Sampling
Dry Weather	5	1
Wet Weather(Non-HFS[1] Water bodies)	15	2
Wet Weather (HFS Water bodies)	10 (not including HFS days)	2 (not including HFS days)

1. HFS= High Flow Suspension

The River Bacteria sampling program will be based upon the March 2013 *Coordinated Monitoring Plan for Los Angeles River Watershed Bacteria TMDL – Compliance Monitoring* developed by the LA River Watershed Bacteria TMDL Technical Committee with the exception that monitoring in the estuary will be conducted quarterly rather than monthly and freshwater bacteria monitoring will be conducted monthly. The frequency of sampling will be reevaluated by Regional Board staff after the end of the permit term. In the 2016-17 Annual Report, the LLAR Group will evaluate estuary bacteria monitoring frequency and provide reasoning why the monitoring frequency is (or is not) adequate. Regional Board staff will then review this information. As final compliance dates approach, it is expected that this frequency will become weekly. This plan established 16 sites throughout the Los Angeles River Watershed to characterize ambient water quality conditions. Four of these sites are located in the LLAR WMG. Quarterly water samples will be collected at each site for analysis of the fecal indicator, *Escherichia coli (E. coli).* Quarterly monitoring is considered to initially be sufficient to determine a segment or tributary is in compliance with interim WLAs. Since interim WLAs are expressed as a load, flow measurements will be taken at or near the time of each sample collection so that the *E. coli* MPN/day can be calculated. Quarterly monitoring will only be conducted during dry weather conditions. Sampling must be preceded by a minimum of 72 hours without rainfall within the watershed.

LRS sampling is initially required to evaluate bacterial loads associated with each defined River Segment or Tributary in the LAR Bacteria TMDL. Sampling conducted to support development of bacteria reduction plan requires six sampling events where water samples and flow measurements are taken in all outfalls discharging to the defined area. Effectiveness monitoring is scheduled to be conducted after all actions have been taken to control bacterial loads to levels below established Waste Load Allocations (WLAs). Effectiveness monitoring is expected to require three additional synoptic surveys of the target segment. If this monitoring does not demonstrate that WLAs are being met, a second phase of testing is required to evaluate further actions necessary to meet the dry weather WLAs. Initial LRS monitoring was completed for Segment B of the Los Angeles River as part of the CREST studies (CREST 2010a, b). Appendix 1 of the CREST report provided example calculations and recommendations for reducing dry weather loads. A final LRS plan is required to be submitted by September 30, 2014. This plan may utilize recommendations provided in the CREST report or recommend alternative strategies for reducing bacterial loads.

Table 8-6 provides a schedule for the first two cycles of the Permit for development of initial LRS plans and completing effectiveness monitoring River Segments A and B and tributaries that discharge to these River Segments. It is currently intended that an LRS plan be completed for outfalls discharging to the Los Angeles Estuary (LAR). In order to provide consistency with the Los Angeles River Bacteria TMDL, an LRS plan for the LAR is scheduled to be completed by September 2021 when LRS plans are due for River Segments C and D.

Table 8-6. Schedule for Completion of LRS Outfall Monitoring for Bacterial Loads under the Los Angeles River Bacterial TMDL.

	Segment B	**Segment A**	**Segment B Tributaries Rio Hondo**	**Segment A Tributaries Compton Creek**
First Phase				
Monitoring for Development of LRS – 6 outfall surveys	***Sept 23, 2014***, 2.5 years after effective date of the TMDL	***Sept 23, 2016,*** 4.5 years after effective date of the TMDL	***March 23, 2016,*** , 4 years after effective date of the TMDL	***March 23, 2018***, 6 years after effective date of the TMDL
Monitoring for Effectiveness of LRS – 3 outfall surveys	***March 23, 2022***, 10 years after effective date of the TMDL	***March 23, 2024***, 12 years after effective date of the TMDL	***September 23, 2023***, 11.5 years after effective date of the TMDL	***Sept 23, 2025,*** 13.5 years after effective date of the TMDL
Second Phase				
Submit a new LRS -6 new outfall surveys	***March 23, 2023***, 11 years after effective date of the TMDL	***March 23, 2025***, 13 years after effective date of the TMDL	***March 23, 2024***, 12.5 years after effective date of the TMDL	***September 23, 2026,***, 14.5 years after effective date of the TMDL

1. This schedule is limited to activities during the first two permit cycles (10 years) that require data collection efforts.

8.4 Long Beach City Beaches and Los Angeles River Estuary TMDLs for Indicator Bacteria

The Lower LAR Watershed Group includes drainages to the Los Angeles River Estuary, but not Long Beach City Beaches. A robust monitoring program was to be developed for the LAR Estuary. Existing data includes bi-weekly monitoring from May through September of 2009, and 2010. Monitoring was to be expanded to include year round monitoring requirements, and at least three monitoring locations within the Estuary. It was recognized that adequate data to establish a reference estuary approach was not available at the time when TMDLs were developed for indicator bacteria along the City beaches and in the Los Angeles River Estuary. It was also recognized that, as adequate data from reference estuary studies becomes available, it may be appropriate to consider a reference estuary approach to evaluate compliance with these TMDLs.

The Long Beach City Beaches and Los Angeles River Estuary Bacteria TMDL was developed by USEPA and therefore did not incorporate an Implementation Plan. The Regional Board developed a separate TMDL for bacteria in the Los Angeles River that has been incorporated into the Basin Plan Amendment with a schedule to meet compliance in 25 years (Resolution Number R10-007, approved by the State Board on November 1, 2011). The USEPA recognized that waste load allocations and load allocations (expressed as allowable exceedance days) were appropriate to implement in a timeline consistent with the lower segments of the Los Angeles River Bacteria TMDL, and that the Regional Board should consider options that provide time to comply, absent a state-adopted implementation schedule, and consistent with the State Water Board's compliance schedule policy. Interim milestones were recommended to be linked to localized efforts to reduce bacteria loading in the direct drainage areas included in these TMDLs, and should consider the influence of upstream bacteria sources to the LAR Estuary and the LBC Beaches.

The LLAR WMG only includes the LAR Estuary portion of this TMDL but the salinities can be expected to range from a freshwater to a marine environment. Receiving water quality objectives for the LAR Estuary for REC-1[3] beneficial uses are summarized in Table 8-7. The TMDL estimated direct loads to the Estuary during dry weather solely on the basis of *E. coli.* While they recognized that the different indicator bacteria were not directly comparable, it was assumed that sources were similar for indicator bacteria applicable to the marine environment. Due to the transition from a freshwater to a marine environment, all four indicator bacteria will be considered.

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[3] uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing or use of natural hot springs.

Table 8-7. Marine and Freshwater Receiving Water Quality Objectives applicable to the Los Angeles River Estuary.

Water Quality Objectives	Marine REC-1	Freshwater REC-1
SINGLE SAMPLE		
E. coli	NA	235 CFU/100 mL
Fecal coliform	400 CFU/100 mL	
Enterococcus	104 CFU/100 mL	
Total Coliform[1]	10,000 CFU/100 mL	
30-DAY GEOMETRIC MEAN		
E. coli	NA	126 CFU/100 mL
Fecal coliform	200 CFU/100 mL	
Enterococcus	35 CFU/100 mL	
Total Coliform	1,000 CFU/100 mL	

1. Total coliform shall not exceed 1,000/100 mL, if the ratio of fecal to total coliform exceeds 0.1 (this is an additional single sample limit for REC-1 marine waters; presented in the Basin Plan).

The purpose of conducting a monitoring program in the Los Angeles River Estuary is to:

- develop an understanding of bacterial loading rates to the estuary and
- determine if bacteria undergo simple dilution as the freshwater passes through the estuary mixing with marine waters or if areas of the estuary serve as either sources or sinks for bacteria that can ultimately be transported to Long Beach City Beaches.

Three monitoring sites (Figure 8-6) will be monitored within the estuary. Sampling locations are located at the upstream and downstream limits of the estuary, and near the Queensway Bridge. During each survey, samples will be taken for each of the marine and freshwater bacteria indicators in due to the range of conditions within the estuary. In addition, *in-situ* measurements will be taken for salinity, temperature and turbidity using field instrumentation. Sampling points will be selected at the center of the brackish surface plume (lowest salinity) resulting from freshwater flows from the Los Angeles River. This will assure that conditions reflect the center of surface flows passing through the estuary. Sampling is intended to be completed in the morning within a 2-hour interval in order to assure that sampling represents a synoptic view of conditions within the estuary that is unimpacted by differential exposure to sunlight.

Table 8-8. Ambient Monitoring Sites within the LLAR WMG for the Los Angeles River Watershed Bacterial TMDL.

Site ID	Site Name	Water Body	GPS Coordinates		Description
			Latitude (N)	Longitude (W)	
LARB1	Segment A (Wardlow)	Los Angeles River(Reach 1)	33.81735	118.20551	Located at Wardlow Rd Mass Emission station (S10)
LARB2	Segment B (Rosecrans)	Los Angeles River (Reach 2)	33.90374	118.18240	Located at Rosecrans Ave
LARB7	Rio Hondo	Tributary: Rio Hondo	33.93202	118.17523	Located above with Confluence with the LA River

Based upon a simple estuarine mixing model, a linear change in bacteria concentrations in response to changes in salinity would indicate that the Los Angeles River is either the only bacterial source or at least the dominant source of bacteria to the Estuary. Increasing concentrations of bacteria relative to a linear dilution line will be indicative of a source along the Estuary. If measured concentrations of bacteria decrease faster than expected based upon simple dilution of the River water would indicate that the estuary serves as a sink. The latter case would occur if estuarine mixing creates conditions where bacteria would tend to be removed by coagulation and settling of particulate matter.

This monitoring is expected to provide information to assess the major sources of bacteria to the estuary and assist in determining where efforts would be best directed to reduce bacteria within recreational waters of the Los Angeles River Estuary and at beaches impacted by the freshwater plume as it leaves the mouth of the Estuary.

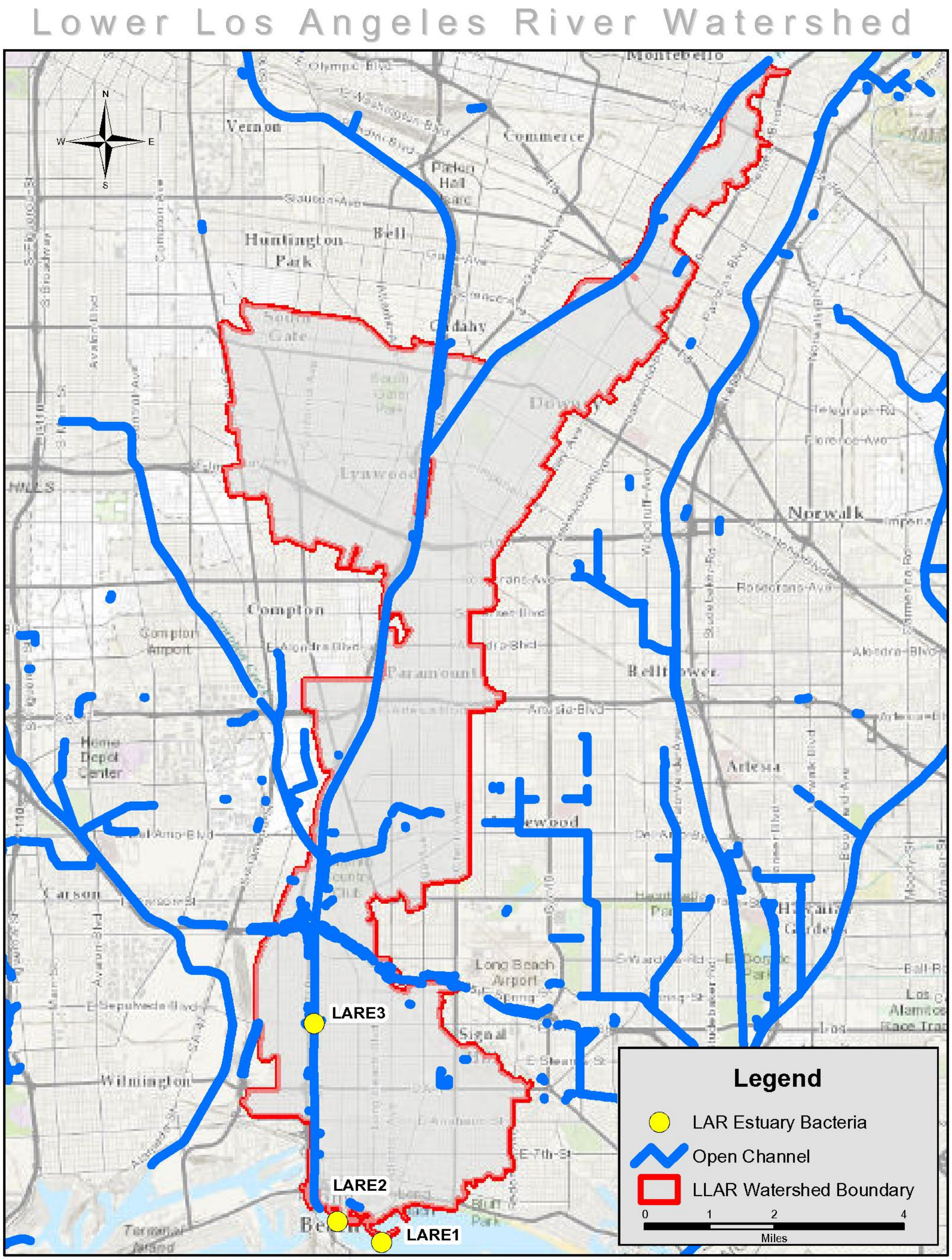

Figure 8-6. Monitoring Sites for Bacteria in the Los Angeles River Estuary.

8.5 Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL (Harbor Toxics TMDL)

Attachment A to Resolution No. R11-008

The Basin Plan Amendment (Resolution No. R11-008) indicates that responsible parties identified in the existing metals TMDLs for Los Angeles River Watershed are responsible for conducting water and sediment monitoring above the Los Angeles 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 are also 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.

- **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 has been incorporated into the Coordinated Compliance, Monitoring, and Reporting Plan for the Greater Los Angeles and Long Beach Harbor Waters (Anchor QEA, 2013) and therefore will not be addressed in this CIMP.

The Harbor Toxics Monitoring Program includes two monitoring sites within the Queensway Bay portion of the Los Angeles River Estuary that will be monitored every two years for both general sediment quality and all chemical constituents specified for SQO Part 1 testing. Permittees located in the nearshore areas as defined by the Harbor Toxics TMDL are contributing to Harbor Toxics monitoring performed in both receiving waters and sediments of the Los Angeles River Estuary, San Pedro Bay and the Port of Long Beach.

8.5.1 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 that will substantially reduce the amount of sample handling and potential for introduction of error. 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.

The frequency of monitoring for the Harbor Toxics TMDL (Table 8-9) will be consistent for dry and wet weather monitoring requirements specified in the TMDL however, the HRMS method will be used for the two wet weather monitoring events and conventional analytical methods will be used for the dry weather monitoring event.

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 direct analysis of the filtered suspended sediments are necessary to improve load assessments. If deemed necessary, a modified approach will be evaluated based upon use of HRMS methods for analysis of filtered suspended sediments. Use of HRMS for analysis of the filtered sediment will reduce sediment mass requirements down to one gram per analytical method, but this still requires collection and transport of large volumes of water for laboratory filtration. It is currently not clear whether the process of filtering large samples and direct analyzing target toxics in suspended sediments will result in any significant improvements in our ability to assess loads of the toxics being addressed in the Harbor TMDL. In fact, collecting, transporting and processing the high volumes of stormwater necessary for this approach may result in a decrease in our ability to obtain useful data and will likely result in a decrease in our ability to assess pollutant loads from all watersheds.

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).

Table 8-9. Summary of Constituents to be Monitored at the S10 Mass Emission for the Harbor Toxics Monitoring Program.

CLASS OF MEASUREMENTS	MASS EMISSION SITE (S10)	
	Wet[5]	Dry
Flow	4	2
Field Measurements Dissolved oxygen, pH, temperature, and specific conductivity	4	2
Organochlorine Pesticides and PCBs (Table 5-5) Chlordane[1], DDTs[2], PCBs[3]	2	1
Metals (Table 5-6) Al, Cd, Cu, Pb, Ni, Sb, Zn, Total Se & Hg	4	1
Semivolatile Organic Compounds (Table 5-8) PAHs[4]	2	1

1. Chlordane components are based upon sum of chlordane-alpha, chlordane-gamma, nonachlor-alpha, nonachlor-gamma, and oxychlordane consistent with the Harbor Toxics TMDL.
2. DDT compounds include: 2,4'-DDD, 2,4'-DDE, 2,4'-DDT, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT. Only the 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT are included in routine monitor as part of Table E-2 constituents.
3. PCBs includes the seven aroclors listed in Table 5-5 or the following 54 PCB congeners: 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.
4. PAHs include the 18 compounds used to evaluate sediment quality ERLs and ERMs: acenaphthene, anthracene, biphenyl, naphthalene, 2,6-dimethylnaphthalene, fluorene, 1-methylnaphthalene, 2-methylnaphthalene, 1-methylphenanthrene, phenanthrene, benzo(a)anthracene, benzo(a)pyrene, benzo(e)pyrene, chrysene, dibenz(a,h)anthracene, fluoranthene, perylene, and pyrene. PAHs will be quantified as part of the Harbor Toxics Monitoring requirements –two wet season and one dry season event. Methods in the referenced table will only be used for dry weather testing.
5. The fourth storm event is only for the purpose of fulfilling the TMDL requirements. Only metals, TSS, SSC, and hardness will be analyzed.

8.5.2 Sampling and Analytical Procedures-Wet Weather

Stormwater samples for the Harbor Toxics Monitoring Program will be collected using automated stormwater sampling methods specified in Appendix 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 8-10 and 8-11), 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.

- 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 8-12 and Table 8-13) 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 8-12 and Table 8-13 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 8-12 and Table 8-13. 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 8-14 examines the possible limitations of this approach if trace metal concentrations are extremely low, approaching detection limits.

- For OC pesticides (Table 8-12), estimated detection limits in the suspended sediment are comparable or lower than Harbor Toxics TMDL targets limits for bed sediments

- For PCBs (Table 8-12), 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 8-13), 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 8-14 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 8-15). 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.

8.5.3 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 surface grab samples. Each sample will be collected directly into the laboratory sample containers using clean sampling techniques outlined in the section of grab sampling. 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 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. 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).

8.5.4 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:

$$EDL_x = 2.5 * \frac{(Na)*(Qis)*(Rah)}{(Ais)*(RRF)*(wv)}$$

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.

8.5.5 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 sediments 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 8-10. 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 8-11. 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	S14	33	55	117
Ballona Creek	S01	NA	158	NA
Los Cerritos Channel	LCC1	96	155	260

NA = not available

Table 8-12. 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 8-13. 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 8-14. 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 8-15. 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

Four outfall monitoring sites (Figure 9-1) have been assessed and selected for monitoring within the LLAR Watershed Management Group in order to meet the requirements of the Order for stormwater outfall monitoring. Appendix A provides a summary of the selected sites and two alternative monitoring sites. These sites were selected to provide good spatial representation of the watershed in terms of HUC12 boundaries, jurisdictional boundaries and land uses within the WMG. The Dominguez Gap Pump Station (LLAR2) and the Firestone (LLAR4) stormwater outfall monitoring sites will be the first sites to be monitored. These will be followed by the Lynwood (LLAR3) outfall and the Cerritos Pump Station (LLAR1) outfalls that will be installed in the following year (Table 4-1). Detailed information on the monitoring equipment, field sampling procedures, protocol for cleaning all materials that come into contact with the water samples, and quality assurance/quality control procedures are provided in Appendices B through E.

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 will include analytes measured at S10 with the exception of Aquatic Toxicity. Any constituents detected at levels of concern from Table E-2 will be considered for addition to monitoring requirements for the stormwater outfall sites after being detected twice during storm events monitored at S10.

Monitoring data will be reviewed annually to determine if adjustments to the water body/pollutant categories. Category 3 constituents will be considered for removal from the monitoring program if no exceedances are identified over a period of two consecutive years. Constituents currently classified as category 2 priorities will be considered for removal from the monitoring requirements when sufficient data are available to support delisting under the State's listing/delisting policy. Any adjustments to the monitoring requirements will be implemented during the subsequent monitoring year.

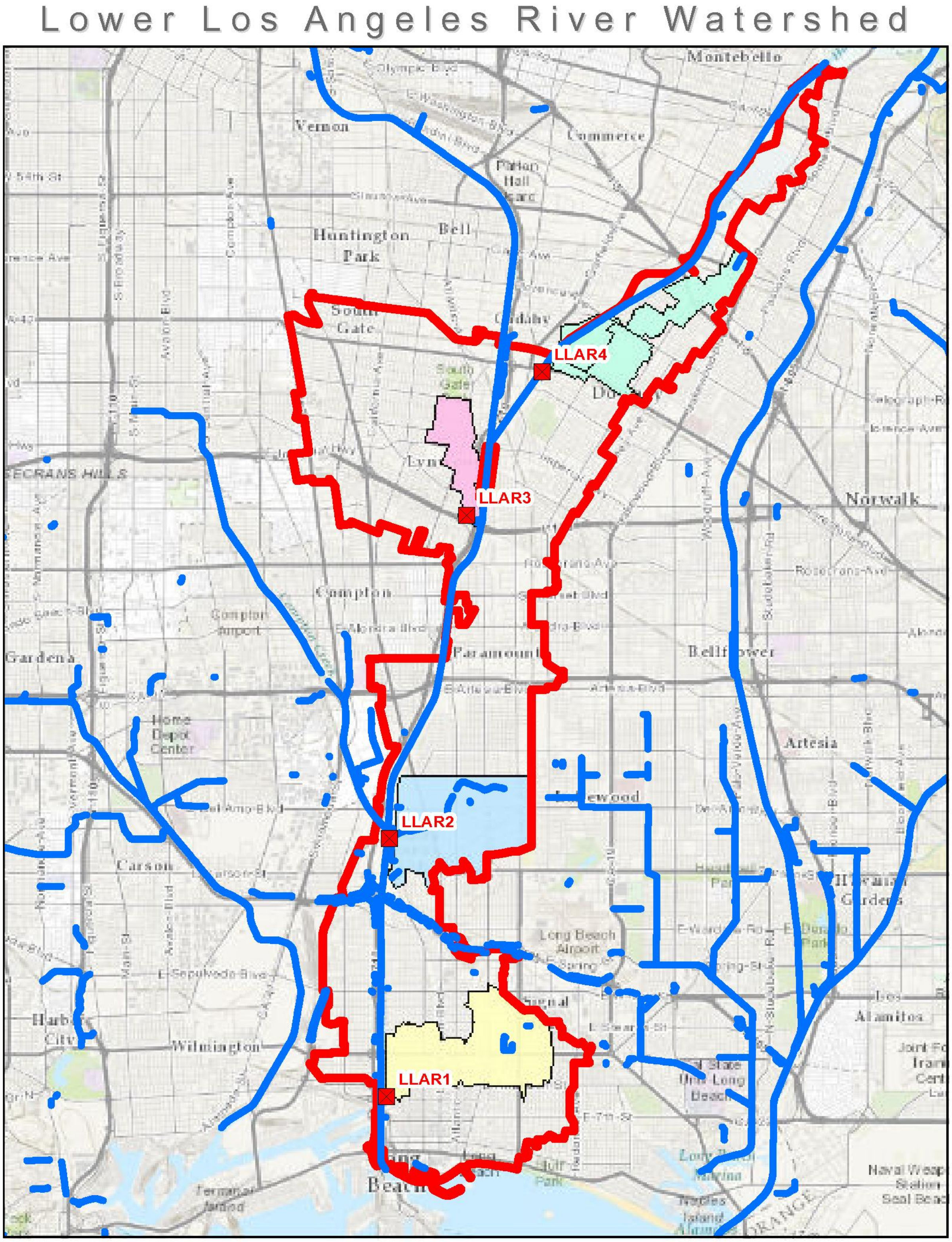

Figure 9-1. **Locations of the Four Stormwater Outfall Monitoring Sites in the LLAR WMG.**

Table 9-1. Summary of Constituents to be Monitored on a Regular Basis at Stormwater Outfall Monitoring Sites.

CLASS OF MEASUREMENTS	STORMWATER OUTFALL SITES Wet Only[2]			
	LAR1	LAR2	LAR3	LAR4
Flow	4	4	4	4
Field Measurements				
Dissolved oxygen, pH, temperature, and specific conductivity	4	4	4	4
General and Conventional Pollutants (Table 5-2)				
All <u>except</u> total phenols, turbidity, BOD_5, MTBE, and perchlorate, and fluoride.	4	4	4	4
Microbiological Constituents[3] (Table 5-3)				
E. coli, Total & Fecal Coliform, enterococcus	4[1]			
E. coli	4	4	4	4
Nutrients (Table 5-4)				
Nitrogen compounds only	3	3	3	3
Metals (Table 5-6)				
Al**,** Cd, Cu, Pb, Ni, Sb, Zn, Total Se & Hg	4	4	4	4
Semivolatile Organic Compounds (Table 5-8)				
Bis(2-ethlyhexylyphthalate	3	3	3	3

1. Analysis of all FIBs will only be included for LLAR1 that discharges directly to the Los Angeles River Estuary.
2. The fourth storm event is only for the purpose of fulfilling the TMDL requirements. Only metals, TSS, SSC, and hardness will be analyzed.
3. The wet and dry weather sampling frequency may change so long as one sample per month is collected in freshwater.

9.1 Sampling Frequency and Mobilization Requirements

The sampling frequency and mobilization requirements for Stormwater Outfall Monitoring sites will be consistent with monitoring conducted at the S10 (Wardlow) Receiving Water Monitoring Site. A total of three events will be monitored at each outfall site once they are installed. Monitoring will be concurrent with S10 monitoring in order to allow for comparison of pollutant loading rates associated with each segment relative to ultimate pollutant loads measured at the S10 site.

Stormwater monitoring at the Stormwater Outfall Monitoring Sites will be conducted by LLAR staff while monitoring at S10 will be performed by LACFCD staff. Monitoring will require coordination among both groups to increase the likelihood of sampling being conducted concurrently at both the ME site in receiving waters and at the stormwater outfalls. Although this may not always be possible due to equipment failures or other factors, concurrent sampling will enhance the ability to interpret the data.

Monitoring at the outfalls will therefore be restricted to the same wet weather definitions as used for the S10 mass emission station. 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 and
- Maximum flow rates greater than 500 cfs measured at the Wardlow Road gaging station associated with the S10 mass emission monitoring site.

Because a significant storm event is based on predicted rainfall, it is recognized that this monitoring may be triggered without 0.25 inches of rainfall actually occurring. In this case, the monitoring event will still qualify as meeting this requirement provided that sufficient sample volume is collected to perform all required analyses. Documentation will be provided showing data used to determine that a storm event was expected to yield sufficient rain to be considered a significant storm event that justified mobilizing field crews and preparation of autosamplers for collection of water samples.

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 assess existing monitoring data to determine the impact of non-stormwater discharges on the receiving water.
7. Conduct monitoring or other investigations to identify the source of pollutants in non-stormwater discharges.
8. 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.
9. Maximize the use of Permittee resources by integrating the screening and monitoring process into existing or planned CIMP efforts.

Specific methods given in the MRP will be followed. 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, conditionally exempt but 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 but non-essential or unknown also require ongoing monitoring.

The Lower Los Angeles River Watershed group will reassess non-stormwater outfall- based screening and monitoring once during the permit term, likely during the 2016-2017 period, and follow MRP methods for sampling of non-stormwater discharges.

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 either the open channels or 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. Only major outfalls, including outfalls 12-inch-diameter or greater within industrial areas will be evaluated for significant flows. Regardless of land use, all outfalls, including those between 12 and 36 inches, will be screened. 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.

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 (Appendix F).	Commencing in the summer of 2014 and completing by 2015.
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 28, 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 28, 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

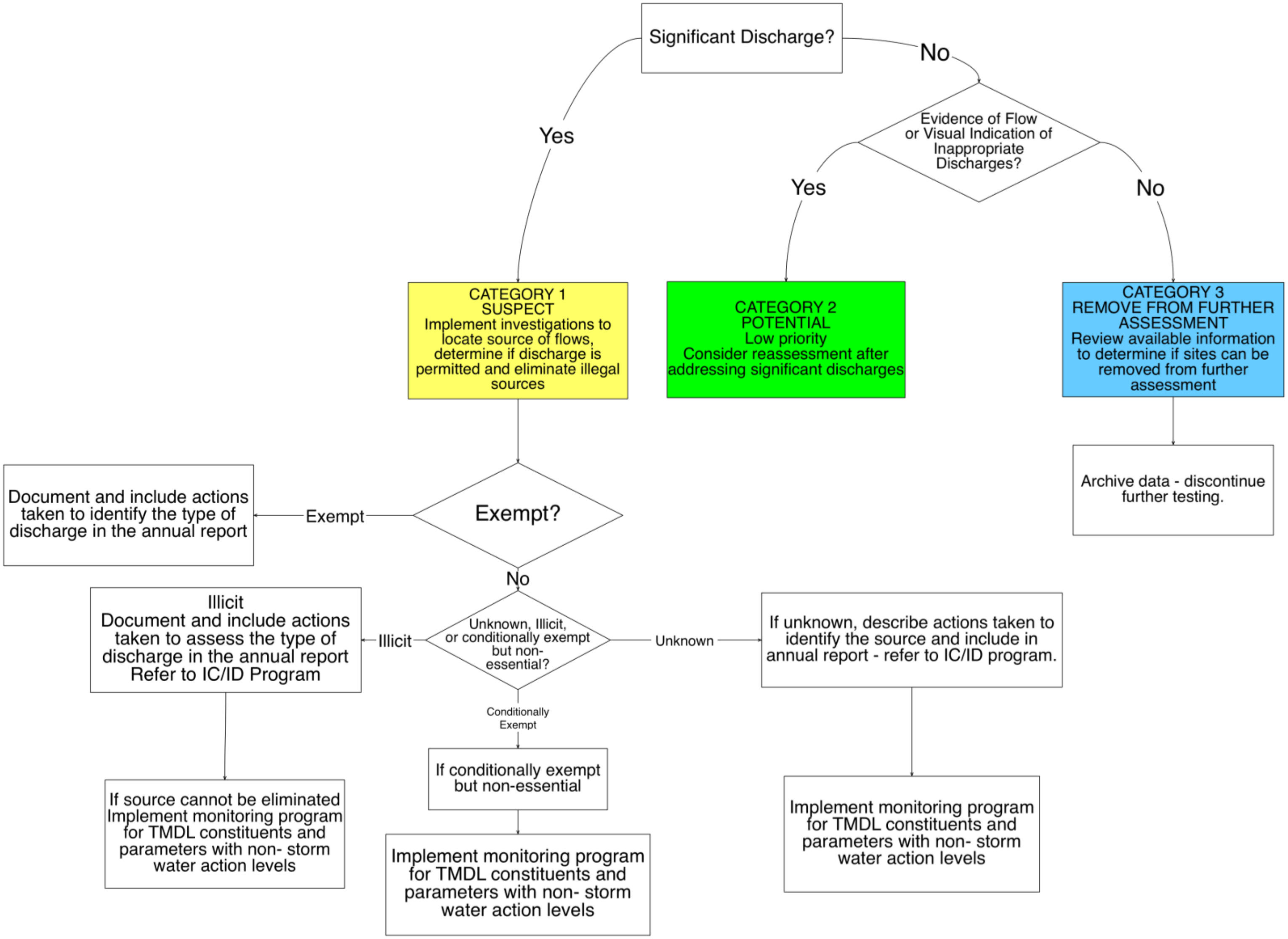

Figure 10-1. **Flow Diagram of NSW Outfall Program after Classifying Outfalls during Initial Screening.**

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. The agencies of LLAR are committed to updating the inventory of outfalls with significant non-storm water discharges. Maps of existing stormwater outfalls are attached as Appendix H.

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	X	
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.

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 (Appendix F) 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 F but may be modified as the parameters and database are modified to provide different information more relevant to the NSW program. Maps of existing stormwater outfalls are attached in Appendix H.

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 Potential 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 LCC WMP, 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:

a. Flow,

b. 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,

c. Other pollutants identified on the CWA section 303(d) List for the receiving water or downstream receiving waters,

d. Pollutants identified in a TIE conducted in response to observed aquatic toxicity during dry weather at the nearest downstream receiving water monitoring station (LCC1) 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.

e. 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 LCC WMG 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[5] 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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[5] 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 – CEDEN Files

Analytical data reports are required to be submitted on a semi-annual basis in formats consistent with CEDEN. 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 30 for the mid-year report and July 1- June 30 for the end of year report. These data reports should include verification of having be submitted and accepted through the SCWRPP Regional Data Center. 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.

13 References

Bonin, Jennifer L. and Timothy P. Wilson (2006). Organic Compounds, Trace Elements, Suspended Sediment, and Field Characteristics at the Heads-of-Tide of the Raritan, Passaic, Hackensack, Rahway, and Elizabeth Rivers, New Jersey, 2000-03,Prepared in cooperation with the New Jersey Department of Environmental Protection. Data Series 123. U.S. Geological Survey.

Clark, S. E., C. Y. S. Siu, et al. 2009. "Peristaltic Pump Autosamplers for Solids Measurement in Stormwater Runoff." Water Environment Research 81: 192-200.

Cleaner Rivers through Effective Stakeholder-led TMDLs (CREST), 2009a. Draft Los Angeles River Watershed Bacteria TMDL – Technical Report Section 4: Bacteria TMDL Source Assessment. July 2009.

Cleaner Rivers through Effective Stakeholder-led TMDLs (CREST), 2009b. Draft Los Angeles River Watershed Bacteria TMDL – Technical Report Section 4: Bacteria TMDL Source Assessment Appendix. July 2009.

Cleaner Rivers through Effective Stakeholder-led TMDLs (CREST), 2010. Draft Appendix 3: Additional Details on Costs and Project Timelines for Los Angeles River Watershed Bacteria TMDL Dry Weather Implementation Plan. February 2010.

Cleaner Rivers through Effective Stakeholder-led TMDLs (CREST). 2008. Los Angeles River Bacteria Source Identification Study: Final Report, November 2007.

Council for Watershed Health (CWH) and ABC Laboratories, Inc. 2013. 2011 San Gabriel River Regional Monitoring Program, 2011 Annual Report.

Cowgill, U.M. and D.P. Milazzo. 1990. The sensitivity of two cladocerans to water quality variables, salinity and hardness. Arch. Hydrobiol. 120:185–196.

Gilbreath, A. N., Pearce, S. P. and McKee, L. J. (2012). Monitoring and Results for El Cerrito Rain Gardens. Contribution No. 683. San Francisco Estuary Institute, Richmond, California.

Gilinsky, Ellen (2009). TMDL Guidance Memo No. 09-2001. Guidance for monitoring of point sources for TMDL development using low-level PCB method 1668. Commonwealth of Virginia Department of Environmental Quality, Water Division.

Harwood, A.D, J. You, and M.J. Lydy. 2009. Temperature as a toxicity identification evaluation tool for pyrethroid insecticides: toxicokinetic confirmation. *Environmental Toxicology and Chemistry* 28(5):1051-1058

Horowitz, A.J. 1995. The use of suspended sediment and associated trace elements. in Water quality studies: Wallingford, Oxfordshire, IAHS Press, IAHS Special Publication no. 4, 58 p.

Kayhanian, M., C. Stransky, S. Bay, S. Lau, M.K. Stenstrom. 2008. Toxicity of urban highway runoff with respect to storm duration. Science of the Total Environment 389:109-128.

Lee, G. F. and A. Jones-Lee. "Review of the City of Stockton Urban Stormwater Runoff Aquatic Life Toxicity Studies Conducted by the CVRWQCB, DeltaKeeper and the University of California, Davis, Aquatic Toxicology Laboratory between 1994 and 2000," Report to the Central Valley Regional Water Quality Control Board, G. Fred Lee & Associates, El Macero, CA, October (2001).

Los Angeles River CMP report February 13, 2014

Los Angeles River Watershed Bacteria Technical Committee. 2013. Coordinated Monitoring Plan for Los Angeles River Watershed Bacteria TMDL – Compliance Monitoring.

Mahler, B.J., P.C. Van Metre, J.T. Wilson, A.L Guilfoyle and M.W. Sunvison 2006. Concentrations, loads, and yields of particle-associated contaminants in urban creeks, Austin, Texas, 1999–2004: U.S. Geological Survey Scientific Investigations Report 2006–5262, 107 p.

McCarty, Harry B., J. Schofield, K. Miller, R. N. Brent, P. Van Hoof, and B. Eadie. 2004. Results of the Lake Michigan Mass Balance Study:Polychlorinated Biphenyls and trans-Nonachlor Data Report. Prepared for US EPA Great Lakes National Program, EPA 905 R-01-011.

Palumbo, A., Fojut, T., Brander, S., and Tjerdeema, R. 2010b. Water Quality Criteria Report for Bifenthrin. Prepared for the Central Valley Regional Water Quality Control Board by the Department of Environmental Toxicology, University of California, Davis. March.

Palumbo, A., Fojut, T., TenBrook, P. and Tjerdeema, R. 2010a. Water Quality Criteria Report for Diazinon. Prepared for the Central Valley Regional Water Quality Control Board by the Department of Environmental Toxicology, University of California, Davis. March.

Rantz, S.E and others. 1982. Measurement and Computation of Streamflow: Volume 1. Measurement of Stage and Discharge. Geological Survey Water-Supply Paper 2175.

Regional Water Quality Control Board (RWQCB), 2010. Los Angeles River Watershed Bacteria Total Maximum Daily Load.

Regional Water Quality Control Board, Los Angeles (LARWQCB). 2012. Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County, except those Discharges Originating from the City of Long Beach MS4. Order No. R4-2012-0175, NPDES Permit No. CAS004001.

Regional Water Quality Control Board, Los Angeles (LARWQCB). 2014 Waste Discharge Requirements for Municipal Separate Storm Sewer System Discharges from the City of Long Beach. Order No. R4-2014-0024, NPDES Permit No. CAS004003

State of California's Surface Water Ambient Monitoring Program September 1, 2008 http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/qapp/qaprp082209.pdf

State Water Resources Control Board (SWRCB). 2012. Policy of Toxicity Assessment and Control. Public Review Draft, June 2012.

State Water Resources Control Board (SWRCB). 2000. Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (Phase 1 of the Inland Surface Waters Plan and the Enclosed Bays and Estuaries Plan). SWRCB Resolution 2000-15.

Stenstrom, Michael K., I.H. (Mel) Suffet and Victor Vasquez. 2009. Final Data Evaluation Report, Field Studies for the Development of Total Maximum Daily Loads for Organochlorine Pesticides and Polychlorinated Biphenyls in Three Los Angeles Count Lakes. Institute of the Environment, UCLA. Report to Los Angeles Regional Water Quality Control Board, March 15, 2009.

Texas Commission on Environmental Quality (TCEQ). 2012. Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Method. RG415

United States Environmental Protection Agency (EPA). 1991. Methods for Aquatic Toxicity Identification Evaluations: Phase I. Toxicity Characterization Procedures. 2nd Edition. EPA-600-6-91-003. National Effluent Toxicity Assessment Center, Duluth, MN.

United States Environmental Protection Agency (EPA). 1992. Toxicity Identification Evaluation: Characterization of Chronically Toxic Effluents, Phase I. EPA/600/6-91/005F. May 1992. National Effluent Toxicity Assessment Center, Duluth, MN.

United States Environmental Protection Agency (EPA). 1993a. Methods for Aquatic Toxicity Identification Evaluations- Phase II Toxicity Identification Procedures for Samples Exhibiting Acute and Chronic Toxicity. EPA-600-R-92-080. National Effluent Toxicity Assessment Center, Duluth, MN.

United States Environmental Protection Agency (EPA). 1993b. Methods for Aquatic Toxicity Identification Evaluations- Phase III Toxicity Confirmation Procedures for Samples Exhibiting Acute and Chronic Toxicity. EPA-600-R-92-081. National Effluent Toxicity Assessment Center, Duluth, MN.

United States Environmental Protection Agency (EPA). 1996. Method 1669 Sampling Ambien Water for Trace Metals at EPA Water Quality Criteria Levels.

United States Environmental Protection Agency (EPA). 1996. The Metals Translator: Guidance for Calculating a Total Recoverable Permit Limit from a Dissolved Criterion. EPA823-B-96-007, June 1996

United States Environmental Protection Agency (EPA). 2002a United States Environmental Protection Agency (EPA). 2002a. Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. Fourth Edition. October. EPA-821-R-02-013.

United States Environmental Protection Agency (EPA). 2007. Aquatic Life Ambient Freshwater Quality Criteria – Copper. February. EPA-822-R-07-001.

United States Environmental Protection Agency (EPA). 2010. National Pollutant Discharge Elimination System Test of Significant Toxicity Technical Document. EPA/833-R-10-004, U.S. Environmental Protection Agency, Office of Environmental Management, Washington, DC.

Walkowiak, D. K., Ed. 2008. Isco Open Channel Flow Measurement Handbook.

Weston, D.P. and E.L. Amweg. 2007. Whole sediment toxicity identification evaluation tools for pyrethroid insecticides: II. Esterase addition. Environmental Toxicology and Chemistry 26:2397-2404.

Wheelock, C., Miller, J., Miller, M., Gee, S., Shan, G. and Hammock, B. 2004. Development of Toxicity Identification Evaluation (TIE) procedures for pyrethroid detection using esterase activity. *Environmental Toxicology and Chemistry* **23**:2699-2708.

Wilson, Timothy P. 2006. Results of Cross-Channel Monitoring During the Lower Passaic River Environmental Dredging Pilot Program on the Lower Passaic River, December 1 to 12, 2005. USGS Report, West Trenton, New Jersey

APPENDIX A

SITE SELECTION
STORMWATER OUTFALL MONITORING SITES
AND ALTERNATIVES

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1 Stormwater Outfall Monitoring Sites

Four outfall monitoring sites (**Error! Reference source not found.**) have been assessed and selected for monitoring within the LLAR Watershed Management Group in order to meet the requirements of the Order for stormwater outfall monitoring.

1.1 Cerritos Pump Station (LLAR1)

The Cerritos Pump Plant (Figure 1) discharges into the Los Angeles River Estuary south of Anaheim Street at 980 N. DeForest Avenue in Long Beach. This site has a large concrete forebay that receives all the water from a single 72-inch gravity storm drain. The pump station contains four pumps which discharge into the river through four culverts equipped with tide gates.

Figure 1. Concrete Forebay of Cerritos Pump Station

Instrumentation would be done by installing a monitoring station within the confines of the pump plant boundaries, with the flow measuring sensors and sample intake inserted approximately 25 feet up inside the main storm drain as it enters the forebay. Flow monitoring would be conducted using a Doppler flow sensor to measure water velocity and a water level sensor to monitor water levels within the pipe. A FEP (Fluorinated Ethylene Propylene) intake hose fitted with a stainless steel/Teflon strain would be fastened along the side of the inlet pipe so as not to interfere with flow into the station forebay. A small instrument enclosure would be placed within the confines of the station fence at street level above the storm drain discharge. This would contain the autosampler, datalogger and communications equipment. The monitoring station would powered by deep cycle batteries with a solar panel to maintain the battery power. A rain gauge will also be installed at the site in order to measure local rainfall. The monitoring equipment will be connected by use of an IP modem to allow monitoring and control of the site by the internet. This monitoring approach would not require access to the interior of the pump plant building.

Alternatively, instrumentation could be installed inside the pump station with access to AC power and hardwire telephone lines. This would require a pressure sensor to monitor water levels within the sump and head differentials for the pumps. Each pump would need to be fitted with optical tachometers to monitor pump revolutions per minute (RPM) and enable estimation of flow rates based upon pump discharge curves. Although this would provide better security, typical storm water discharges would be more accurately estimated from the recommended installation at the head of the forebay

1.2 Dominguez Gap Pump Station (LLAR2)

The Dominguez Gap Pump Station (Figure 2 and Figure 3) is located on the east bank of the Los Angeles River just south of Del Amo Blvd. The City of Long Beach first established a monitoring site at the Dominguez Gap Pump Station during the 2000/2001 wet season. This site was originally collected runoff from 3,374 acres of land that comprised the City's Drainage Basin 14. As part of the Dominguez Gap/DeForest Wetland Project, this drainage basin was modified so that runoff from north of Market Street would be directed the Market Street Pump Station and DeForest Wetlands. Runoff from the portion of Basin 14 located south of Market Street continued to drain to the Dominguez Gap Pump Station and Wetlands. The two areas were further separated by elimination of a previous connection between the two infiltration basins at Del Amo. The former detention/infiltration basin at this site underwent major modifications to establish a wetland system that now serves as a treatment system for waters diverted from the Los Angeles River and stormwater the remaining 2,082 acre urban watershed comprised of 70% residential, 12% commercial, 17% open space and 1% mixed urban land use. Much of the open space is a golf course that borders the infiltration basin.

Figure 2. Dominguez Gap Pump Station

The Dominguez Gap Pump Station and adjacent infiltration/detention basin started undergoing major renovations during the summer of 2006 and work extended through most of the 2007/2008 wet season. During that time period, land disturbances associated with development of the wetland system resulted in elevated levels of sediment. By late 2009 the wetland vegetation had become well established and the water quality changes observed during the construction phase were no longer evident.

Figure 3. Dominguez Pump Station discharge to the Los Angeles River.

Because of this infiltration basin, the actual pumped discharge to the Los Angeles River is measured and sampled from the sump within the pump station. The discharge volume is determined by use of optical tachometers that monitor pump shaft rotation. The tachometers monitor reflective tape placed on the pump shaft to measure RPM. Discharge rates are estimated by monitoring head differentials between the sump and the discharge point and the pump curves associated with each pump. This estimate of discharge rates are used to pace the autosampler to enable collection of a flow-rated composite sample of stormwater discharges. This site has AC power but still requires use of cellular phone connections for communications. A rain gauge installed on the roof of the pump station provides a continuous record of rainfall at this site.

1.2.1 BI 0551 Line E –Lynwood at Intersection of I105 and I710 (LLAR3)

This site is located on the north side of Highway I105 at the end of Louise St.(Figure 4). The storm drain accesses a rectangular box culvert measuring 6 feet in height and 12 feet in width. This storm drain crosses under the I710 where it opens up into a 250 feet channel before entering a 54-inch RCP that runs under the I105 and discharges by gravity to the Los Angeles River. High flows are able to overflow the open channel into spreading grounds that also receive localized runoff from Caltrans drainages. This spreading ground exists on both the north and south side of the I105 freeway. A small pump station on the south side of the I105 allows overflows to be discharged to the Los Angeles River.

The monitoring site appears to be located on property owned by Caltrans and will require access through a gate located off of Wright Street. Easements will be required to install and monitor stormwater discharges at this location. Flow monitoring will be conducted using a Doppler flow sensor to measure water velocity and a water level sensor to monitor water levels within the box culvert. A small security enclosure will be placed next to the manhole to house the monitoring equipment. Equipment will include an autosampler, flow meter, datalogger and communications equipment. The monitoring station will be powered by deep cycle batteries with a solar panel to maintain the battery power. A rain gauge will also be installed at the site in order to measure local rainfall. The monitoring equipment will be connected by use of an IP modem to allow monitoring and control of the site by the internet.

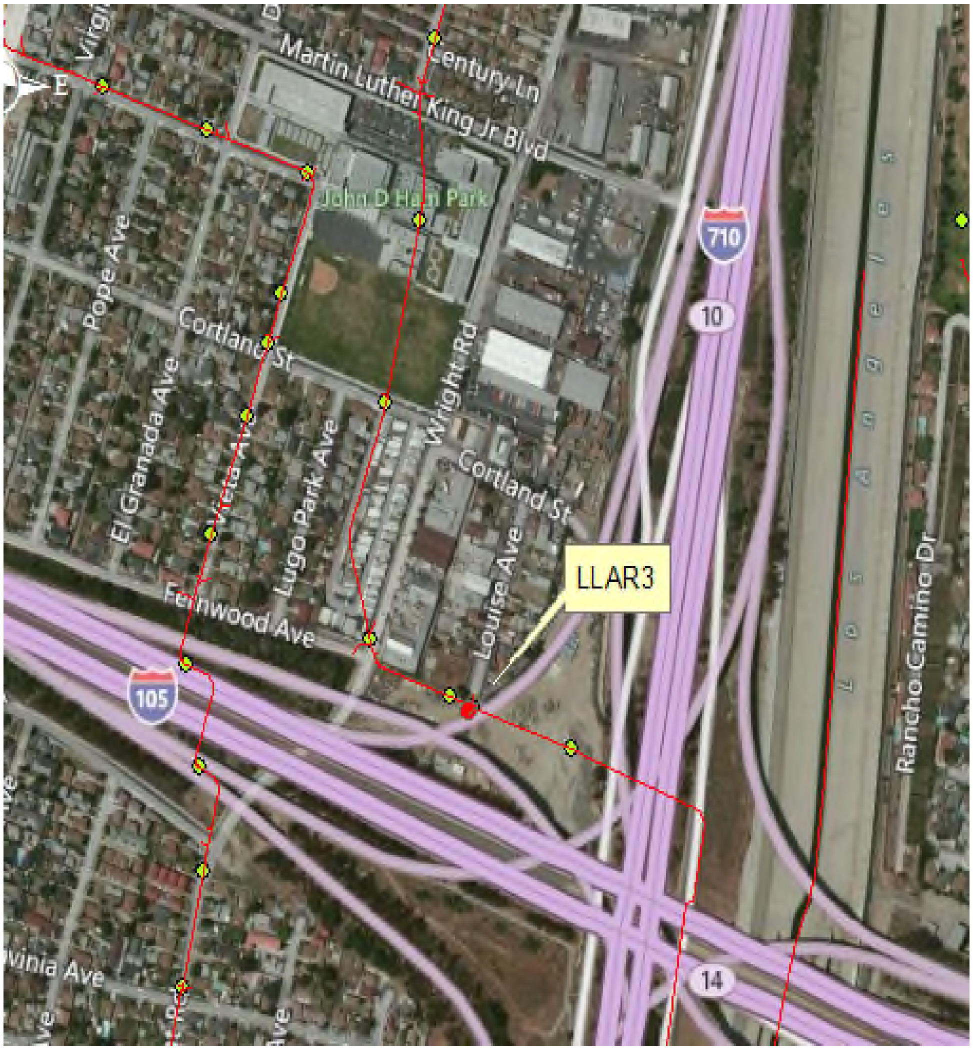

Figure 4. **Location of outfall monitoring site LLAR3 at the end of Louise St. near the I710 and I105 Freeways.**

1.2.2 BI 0018 Firestone - Firestone Boulevard Gravity Discharge to Rio Honda River (LLAR4)

A large gravity outfall into the Rio Honda River is located at Firestone Boulevard just downstream of the bridge that crosses the Rio Honda. Access is off of Firestone Boulevard westbound immediately after crossing the bridge via a small turnout and gate.

The outfall is a larger box culvert separated into two channels at the mouth as it passes under the levee but becomes one larger box culvert immediately upstream. This culvert discharges above the elevation of the Rio Honda Channel as it has a 5 foot ramp up to the invert of the box culvert (Figure 5).

Access for installation of instrumentation is through a small auxiliary drain located immediately above the box culvert but on the landward side of the levee road. This small local drain provides direct access to the box culvert below. Instrumentation would be housed in a small security enclosure placed at the side of the levee road. The installation would be similar to the other outfall monitoring sites. An area velocity (Doppler) flow meter would be used to monitor and record flow. The monitoring site would have a rain gauge to provide local rainfall information, a solar panel to maintain deep cycle marine batteries to power the equipment and cellular communications to allow for remote operation and monitoring of conditions at the site. The flow data will be used to pace sampling by an autosampler to enable collection of a flow-rated composite sample of stormwater discharges.

Small Drain is visible up on levee side that drops into the large stormwater channel.

Figure 5. Gravity Outfall to Rio Honda River at Firestone Boulevard

1.3 Alternative Outfall Monitoring Sites

Four alternative monitoring sites were reviewed as potential outfall monitoring locations in the case that unknown problems are encountered at one or more of the preferred locations. Of the four alternative sites, two are considered to best meet the objectives of the monitoring program if one or more of the primary sites become unsuitable. These include the Market Street and Paramount Pump Stations. The Market Street Pump Station would likely provide the most useful information due to the large drainage area, land use characteristics and the potential to provide both infiltration and settling prior to discharging stormwater to the Los Angeles River. The stormwater treatment potential for this site is addressed by other stormwater outfalls. The Paramount Pump Station is also a preferred alternative. Although this pump station collects water from a relatively small catchment, industrial land uses represent a significant portion of this area. The relative abundance of industrial land use in this catchment is higher than encountered at most other potential outfall monitoring sites.

1.1.1 Market Street Pump Station

The Market Street Pump Station is located on the east bank of the Los Angeles River at 229 Market Street in Long Beach. A large infiltration basin (DeForest Basin) extends along the inside of the levee from near Artesia Blvd to Del Amo Blvd. where it was once connected to the Dominguez Gap infiltration basin. This connection was eliminated when the wetland system was constructed in the Dominguez Gap infiltration/settling basin. Improvements to the DeForest Basin were initially planned as a second stage to work completed in the Dominguez Gap basin.

The DeForest Basin receives stormwater and dry weather discharges from several major storm drains. A 15 foot wide by 10.5 foot tall box culvert discharges from Market Street directly across from the pump station. Four additional gravity stormwater outfalls discharge to the northern end of the infiltration basin in the region of 59th Street. Low flows follow a channel towards the Market Street Pump Station. (

Installation of monitoring equipment at this site could only be installed within the Market Street Pump Station using the same approach as used at the Dominguez Gap Pump Station. Water sampling would be from the sump inside the plant, and discharge volumes to the river would be measured by optical tachometers fitted on each pump shaft to monitor the RPMs. Estimates of discharge rates would be calculated by the published pump discharge rating curve and the measured head differential between water levels in the sump and at the discharge point to the Los Angeles River. Stormwater discharge rates estimated in this manner would be used to pace autosamplers to obtain flow-rated composite sample.

Figure 6. **Market Street Pump Station and Forebay.**

1.1.2 LA County Flood Control District, Paramount Pump Station

The Paramount Pump Station is located at the end of East 72nd Street just south of E. Alondra Boulevard and discharges into the Los Angeles River. This pump station has no forebay.

A manhole located near the back corner of the pump station concrete apron provides access to the stormdrain that is the inlet to the pump station. Depth in this manhole to the top of the stormdrain inlet pipe is 8 feet and it is 16 feet down to the bottom of this inlet.

Flow instrumentation and sampling could be accomplished at this inlet manhole site. A Doppler velocity sensor, a water depth sensor, and a sampling tube would be fastened to the invert of this channel in a manner that could not impede flow. A small instrument enclosure could be placed near the wall of the plant site or near the wall of the building near the manhole as vehicles cannot drive through this area.

Figure 7. Paramount Pump Station showing access point to storm drain.

APPENDIX B

AUTOMATED STORMWATER MONITORING EQUIPMENT

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1 Automated Stormwater Monitoring Equipment

Monitoring of stormwater runoff at the stormwater outfall monitoring sites will require use of automated stormwater sampling equipment. This section addresses the equipment and sampling procedures that will be used for collection of composite sample of stormwater runoff.

Flow-weighted composite samples will be collected at most sites however, time-weighted sampling may be conducted at some locations where equipment is deployed on a short-term basis and sampling is conducted to screen for contaminants. 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 C

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), OR 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.**

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APPENDIX D

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 **<u>before</u>** applying the next rinse. Rinse the item in this fashion **<u>a minimum</u>** of three times. **Numerous rinses of relatively small volumes are <u>much better</u> 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%) HNO3, thoroughly rinse the interior and exterior of the connectors and caps thoroughly OR, roll/agitate them in a shallow layer of 2N (10%) HNO3

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 E

QUALITY ASSURANCE/QUALITY CONTROL

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	608	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

Metals (Total and Dissolved)

Analyte	EPA Method Number	Holding Time	Container Size	Container Type	Preservation	Minimum Level/ Resolution	Units
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

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 will be based upon SWAMP QAPP (2008) and the associated 2013 Quality Control and Sample Handling Tables for water (http://www.swrcb.ca.gov/water_issues/programs/swamp/mqo.shtml).

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.

APPENDIX F

NON-STORMWATER IC/ID AND OUTFALL TRACKING

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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 LA RIVER 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 ☐ CMP ☐ PVC ☐ HDPE ☐ Steel ☐ Other: __________	☐ 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 G

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

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	Minimum Level		Water Quality Objective/Criterion			Notes	
Constituent	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.			
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.	mg/L		
				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.			

	Minimum Level		Water Quality Objective/Criterion			Notes	
Constituent	Value	Units	Source	Value	Units		
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			
			LAR Estuary Bacteria TMDL	Total Coliform: 10,000/100 mL			
				Fecal Coliform: 400/100 mL			
				Enterococcus: 104/100 mL			
E. coli (fresh waters)	1	MPN/100 ml	LAR Bacteria TMDL	235/100 ML	MPN/100 ml	Daily Maximum	
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		
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			

Constituent	Minimum Level		Water Quality Objective/Criterion			Notes	
	Value	Units	Source	Value	Units		
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	LAR Nitrogen Compounds TMDL	1 hour Average: Los Angeles River below Los Angeles-Glendale WRP 8.7	mg/L		
				30 Day Average: Los Angeles River below Los Angeles-Glendale WRP 2.4			
				1 Hour Average: Los Angeles Tributaries 10.1			
				30 Day Average: Los Angeles Tributaries 2.3			
			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	LAR Nitrogen Compounds TMDL	30 Day Average: All 8.0	mg/L		
			MS4 MAL	1.85			
			Basin Plan	10 as NO3-N + NO2-N			
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			

	Minimum Level		Water Quality Objective/Criterion			Notes	
Constituent	Value	Units	Source	Value	Units		
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			
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			

	Minimum Level		Water Quality Objective/Criterion			Notes	
Constituent	Value	Units	Source	Value	Units		
Cadmium	0.25	μg/L	LAR Metals TMDL	Wet Weather: All WER x 2.8 x 10-9 x daily volume (L) – 1.8	kg/day	Mass based WQBEL	WER(s) have a default value of 1.0 unless site-specific WER(s) are approved via the Basin Plan Amendment process.
			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			

Constituent	Minimum Level		Water Quality Objective/Criterion			Notes	
	Value	Units	Source	Value	Units		
Copper	0.5	µg/L	LAR Metals TMDL	Dry Weather: LA River Reach 1 WER x 23 Dry Weather: LAR Reach 2 and Arroyo Seco: WER x 22 Dry Weather: Compton Creek WER x 19 Dry Weather: Rio Hondo Reach 1 WER x 13	ug/L	Concentration based WQBELs	WER(s) have a default value of 1.0 unless site-specific WER(s) are approved via the Basin Plan Amendment process.
				Dry Weather: LA River Reach 1 WER x 0.14 Dry Weather: LA River Reach 2 WER x 0.13 Dry Weather: Arroyo Seco WER x 0.01 Dry Weather: Compton Creek WER x 0.04 Dry Weather: Rio Hondo Reach 1 WER x 0.01	kg/day	Mass based WQBELs	
				Wet Weather: All WER[1] x 1.5 x 10-8 x daily volume (L) – 9.5			
			Dominguez Channel and Greater LA and LB Harbor Toxics TMDL	LAR Estuary 35.3	kg/yr	Annual mass based loading in sediment deposited to LAR Estuary	
			CTR Freshwater (1 hr avg.) dissolved	5.7	ug/L		
			CTR Freshwater (4 day avg.) dissolved	4.1			
Iron	100	µg/L	USEPA National Recommended Water Quality Criteria 4-day average (freshwater)	1,000	ug/L		
Lead	0.5	µg/L	LAR Metals TMDL	Dry Weather: LA River Reach 1 WER x 12 Dry Weather: LA River Reach 2 and Arroyo Seco WER x 11 Dry Weather: Compton Creek WER x 8.9 Dry Weather: Rio Hondo Reach 1 WER x 5.0	ug/L	Concentration based WQBELs	WER(s) have a default value of 1.0 unless site-specific WER(s) are approved via the Basin Plan Amendment process.
				Dry Weather: LA River Reach 1 WER x 0.07 Dry Weather: LA River Reach 2 WER x 0.07 Dry Weather: Arroyo Seco WER x 0.01 Dry Weather: Compton Creek WER x 0.02 Dry Weather: Rio Hondo Reach 1 WER x 0.006	kg/day	Mass based WQBELs	
				Wet Weather: All WER[1] x 5.6 x 10-8 x daily volume (L) – 3.85			

	Minimum Level		Water Quality Objective/Criterion			Notes	
Constituent	Value	Units	Source	Value	Units		
			Dominguez Channel and Greater LA and LB Harbor Toxics TMDL	LAR Estuary 65.7	kg/yr	Annual mass based loading in sediment deposited to LAR Estuary	
			CTR Freshwater (1 hr avg.) dissolved	24	ug/L		
			CTR Freshwater (4 day avg.) dissolved	0.92			
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			
			CTR Freshwater (4 day avg.) dissolved	5			
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	LAR Metals TMDL	Dry Weather: Rio Hondo Reach 1 WER[1] x 131	ug/L	Concentration based WQBEL	WER(s) have a default value of 1.0 unless site-specific WER(s) are approved via the Basin Plan Amendment process.
				Dry Weather: Rio Hondo Reach 1 WER[1] x 0.16	kg/day	Mass based WQBEL	
				Wet weather: All WER[1] x 1.4 x 10-7 x daily volume (L) – 83			
			Dominguez Channel and Greater LA and LB Harbor Toxics TMDL	LAR Estuary 2.31	kg/yr	Annual mass based loading in sediment deposited to LAR Estuary	

	Minimum Level		Water Quality Objective/Criterion			Notes	
Constituent	Value	Units	Source	Value	Units		
			CTR Freshwater (1 hr avg.) dissolved	54	ug/L		
			CTR Freshwater (4 day avg.) dissolved	54			
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		
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		

	Minimum Level		Water Quality Objective/Criterion			Notes	
Constituent	Value	Units	Source	Value	Units		
			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		
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		

	Minimum Level		Water Quality Objective/Criterion			Notes	
Constituent	Value	Units	Source	Value	Units		
			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		
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		

	Minimum Level		Water Quality Objective/Criterion			Notes	
Constituent	Value	Units	Source	Value	Units		
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		
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		

	Minimum Level		Water Quality Objective/Criterion			Notes	
Constituent	Value	Units	Source	Value	Units		
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	Dominguez Channel and Greater LA and LB Harbor Toxics TMDL	LAR Estuary 0.100	g/yr	Annual mass based loading in sediment deposited to LAR Estuary	
			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			
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		

Constituent	Minimum Level		Water Quality Objective/Criterion			Notes	
	Value	Units	Source	Value	Units		
			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	Dominguez Channel and Greater LA and LB Harbor Toxics TMDL	LAR Estuary 0.324	g/yr	Annual mass based loading in sediment deposited to LAR Estuary	
			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		
Prometryn	2	µg/L	None	None	N/A		

Constituent	Minimum Level		Water Quality Objective/Criterion			Notes	
	Value	Units	Source	Value	Units		
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.

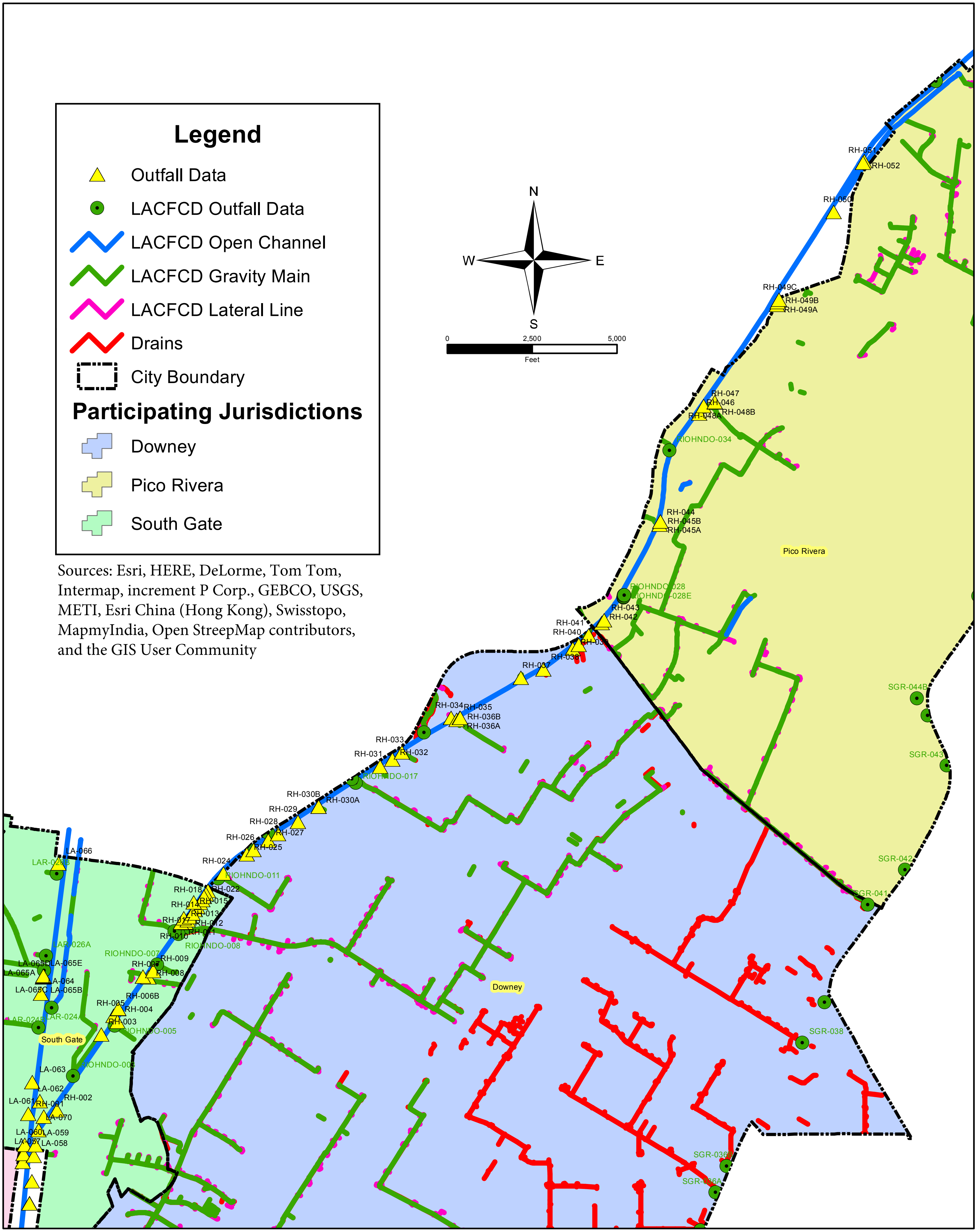
APPENDIX H

Outfall Identification

Per Section VII, Attachment E

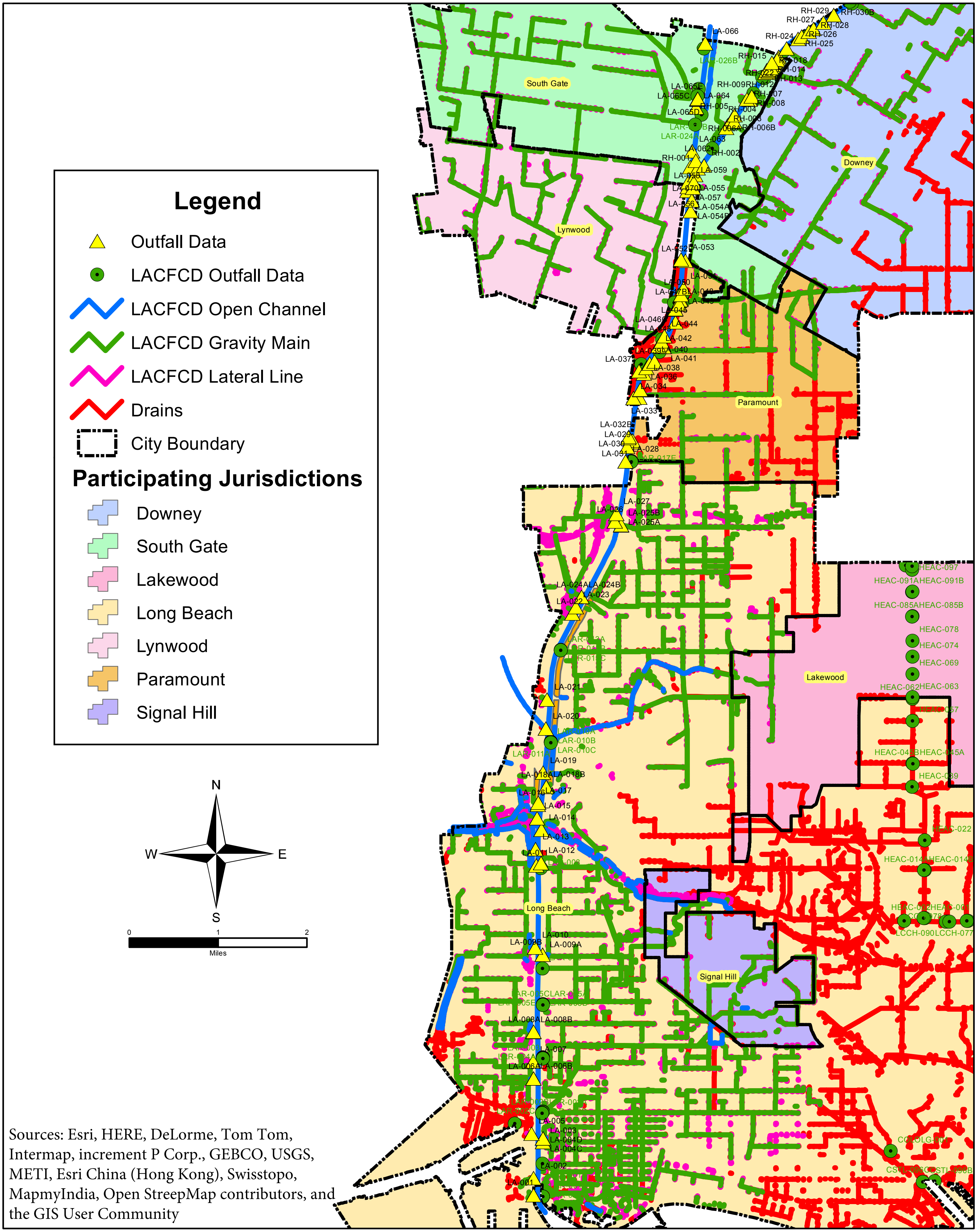
Outfalls 12 inches and greater were surveyed. Maps showing the location of these outfalls are contained in this Appendix. Photographs collected during the survey and a database with outfall attributes is available upon request.

Rio Hondo Channel



Sources: Esri, HERE, DeLorme, Tom Tom, Intermap, increment P Corp., GEBCO, USGS, METI, Esri China (Hong Kong), Swisstopo, MapmyIndia, Open StreepMap contributors, and the GIS User Community

Los Angeles River



Sources: Esri, HERE, DeLorme, Tom Tom, Intermap, increment P Corp., GEBCO, USGS, METI, Esri China (Hong Kong), Swisstopo, MapmyIndia, Open StreepMap contributors, and the GIS User Community