CITY COUNCIL
STAFF REPORT

TO: **SOLVANG CITY COUNCIL MEMBERS**

FROM: Bridget Elliott, Associate Engineer, and
Matt van der Linden, Public Works Director/City Engineer

MEETING DATE: November 9, 2015

DATE PREPARED: October 30, 2015

SUBJECT: **STORMWATER MANAGEMENT PROGRAM ANNUAL REPORT, FISCAL YEAR 2014-15 (YEAR 2)**

I. RECOMMENDATION:

Receive and file report.

II. BACKGROUND:

The Municipal Regional Stormwater NPDES Permit (Stormwater Permit) specifies actions necessary to reduce the discharge of pollutants in stormwater to the maximum extent practicable and effectively prohibit non-stormwater discharges into the municipal storm drain system to protect local creeks and the Santa Ynez River. Given that the storm drain system leads directly to local waterways and the river without any treatment, it is critical to prevent pollutants from entering the system in the first place.

The Federal Clean Water Act requires the City to operate under a National Pollutant Discharge Elimination System (NPDES) municipal stormwater permit for the discharge of stormwater to surface waters (i.e., creeks, rivers, the ocean) via the City's storm drain collection system. On February 5, 2013, the Phase II Small MS4 General Permit (Order No. 2013-001 DWQ) was adopted by the Water Board. The 5-year Stormwater Permit became effective July 1, 2013, and remains in effect until the next Stormwater Permit becomes effective, which is currently projected to occur in July 1, 2018.

The Stormwater Permit is organized into 15 sections that include requirements to reduce the discharge of pollutants to storm drains from routine municipal operations; ensure appropriate site design and treatment measures to manage stormwater runoff quality and quantity from new and redevelopment project sites; inspect construction sites, and industrial and commercial facilities that could potentially contribute to stormwater pollution; prohibit and ensure that illicit discharges are detected, controlled and eliminated; implement control methods for pollutants of concern such as total suspended solids (TSS), nutrients, hardness and pesticides; and conduct monitoring to track water quality status and trends.

III. DISCUSSION:

The City of Solvang is required each year to use the State Water Boards Storm Water Multiple Application and Report Tracking System (SMARTS) to submit a summary of the past year activities for each program element and certify compliance with all requirements of the Permit. To help keep program cost down the Cities of Solvang and Buellton comply with certain aspects of the Permit as "Co-Permittees". Agencies covered under the Permit as Co-Permittees may submit a single joint Annual Report. Both Cities share equally in the net consultant cost associated with the preparation and submittal of the joint Annual Report. However, The City of Buellton is the lead agency on the Memorandum of Understanding (MOU) and is ultimately responsible for preparing and submitting the joint Annual Report on behalf of both parties.

The compliance schedule for the Permit is five years with interim deadlines each year to give the jurisdictions time to reach the expected level of effort. The Permit is structured this way to allow time to ramp-up the program so we can eventually meet the full set of Permit requirements. The Permit has over 70 permit requirements. Year two of the Permit required the maintenance of 11 requirements established in year 1 and the creation of an additional 44 requirements. As you can see, a significant amount of the program requirements were created in 2015. We now have over 75% of the requirements created and will be responsible for their ongoing maintenance plus the implementation and creation of 15 more requirements in year 3 (FY 2015-16). Refer to Table 1 in the appendix for a complete list of requirements managed and developed in Year 2 (FY 2014-15).

IV. ALTERNATIVES:

This Annual Report documents the City of Solvang's compliance with the State Water Resources Control Board Order No. 2013-0001. Alternatives are not applicable.

V. FISCAL IMPACT:

All costs associated with preparation and submittal of the Annual Report, NPDES Permit compliance, and payment of annual Permit fee are included in the approved Fiscal Year 2014-15 Budget. The current year's Stormwater Management Program costs are summarized in the table below.

SWMP Component	**FY 2015-16 Costs ($)**
Completion of Storm Drain Atlas Map Update	$3,100
SWRCB Stormwater Permit Fee	$6,200
Annual Report	$7,500
SWMP General Compliance Activities	$43,000
Community Based Social Marketing (with SB County)	$10,000
Stormwater Modeling Plan (with SB County)	$6,000
Stormwater Monitoring & Lab Testing (with SB County)	$14,000
Plus approximately 500 hours of staff time	+/- $25,000
Total:	**$114,800**

VI. ATTACHMENTS:

- Table 1: Stormwater Permit Requirements for Year 1 and 2
- SMARTS website print out of City of Solvang's Phase II Small MS4 Permit Annual Report 2014-2015
- Screen Shot of the MS4 Representative Certification
- Screen Shot of Report Attachments List
- Annual Report Attachments Relevant to the City of Solvang

Note: The State is experiencing problems with their SMARTS database causing the Attachments List and Certification Page to not print. A screen shot of both items have been provided in lieu of the missing report pages.

TABLE 1: STORMWATER PERMIT REQUIREMENTS FOR YEAR 1 & 2			
PERMIT SECTION AND ELEMENT		Permit Compliance Year (June 30th unless otherwise noted)	Permit Year
E.6	**PROGRAM MANAGEMENT ELEMENT**		
E.6.a	Legal Authority (update or create ordinance)	2015	2
E.6.b	Certification	2015	2
E.7	**EDUCATION AND OUTREACH PROGRAM**		
E.7.a	**Public Outreach and Education**		
	Select outreach option. If regional program, develop agreements	2014	1
	(a) Develop and implement comprehensive education and outreach program	2015	2
	(d)Disseminate education materials to target audiences and translate as appropriate	2015	2
	(e)Utilize public input in developing outreach program	2015	2
	(g)Provide water efficient/ stormwater friendly landscaping information	2015	2
	(h)Promote reporting of illicit discharges	2015	2
	(i)Provide pesticide/fertilizer application information		2
	(j)Provide materials to school children	2015	2
	(k,l,m)Develop messaging to reduce discharges from organized car washes, mobile cleaning and pressure washing	2015	2
E.7.b.2	**Construction Outreach and Education**		
	(a) Annual Permitee Staff Training	2015	2
E.7.b.3	**Pollution Prevention and Good Housekeeping Staff Traning**		
	Biennial employee training	2015	2
E.8	**PUBLIC INVOLVEMENT AND PARTICIPATION PROGRAM**		
	Develop program with input of the public and implement	2015	2
	(a) Develop Public Involvement strategy	2015	2
	(b) Consider Citizen Advisory Group	2015	2
	(c) Create Involvement Opportunities	2015	2
	(d) Ensure public can access info about program	2015	2
	(f) Engage in IRWMP or equivalent	2015	2
E.9	**ILLICIT DISCHARGE DETECTION AND ELIMINATION**		
E.9.a	**Outfall Mapping**		
	Create and maintain accurate outfall map including a site visit to each outfall	2015 (Summer 2014)	2
E.9.b	**Ilicit Discharge Source/Facility Inventory**		
	Create inventory of all industrial/commercial facilities and update annually	2015	2
E.9.c	**Field Sampling to Detect Illicit Discharges**		
	Sample any flowing outfalls while conducting E.9.a	2015 (Summer 2014)	2
	Conduct follow up investigation within 72 hours if action levels exceeded	2015 (Summer 2014)	2
E.9.d	**Illcit Discharge Detection and Elimination Source Investigations and Corrective Actions**		
	Develop written proceedures for investigations and corrective actions	2015 (Summer 2014)	2
	Once source of discharge is identified, require responsible party to correct within 72 hours of notification and verify with follow-up investigation	2015 (Summer 2014)	2

	Conduct follow up investigation within 72 hours if action levels exceeded	2015 (Summer 2014)	2
E.9.e	**Spill Response Plan**		
	Develop plan	2014	1
E.10	**CONSTRUCTION SITE STORM WATER RUNOFF CONTROL PROGRAM**		
E.10.a	**Construction Site Inventory**		
	Create inventory of all projects subject to local stormwater ordinance	2014	1
E.10.b	**Construction Plan Review and Approval Procedures**		
	Develop procedures to review and approve construction plan documents (i.e., erosion and sediment contol plans)	2014	1
E.10.c	**Construction Site Inspection and Enforcement**		
	Inspect construction sites	2015	2
E.11	**POLLUTION PREVENTION/GOOD HOUSEKEEPING FOR PERMITTEE OPERATIONS PROGRAM**		
E.11.a	**Inventory of Permittee-Owned and Operated Facilities**		
	Develop and maintain inventory of all permittee owned or operated facilities that are a potential threat to water quality	2015	2
E.11.b	**Map of Permitte-owned or Operated Facilities**		
	Develop a map of inventoried facilities	2015	2
E.11.f	**Storm Drain System Assessment and Prioritization**		
	Implement proceedures to assess and prioritize maintenance of storm drain system infrastructure. Assign a priority to each facility based on accumulation of sediment, trash and/or debris	2015	2
E.11.j	**Landscape Design and Maintenance**		
	Implement a landscape design and maintenance program to reduce the amount of water, pesticides and fertilizers used by Permittees	2015	2
	Evaluate use of pesticides, herbicides and fertilizers	2015	2
	Implement best practices to reduce pesticides and fertilizers	2015	2
	Proper dispoal of unused chemicals	2015	2
	Evapo-based irrigation and rain sensors	2015	2
	Record amount of chemical usage	2015	2
E.12	**POST CONSTRUCTION STORMWATER MANAGEMENT PROGRAM**		
E.12.a	**Post-Construction Treatment Measures**		
	Regulate development to comply with the following sections, E.12.b through E.12.l	2015	2
E.12.b	**Site Design Measures**		
	Require implementation of site design measures on projects that create or replace 2,500-5,000 SF impervious area (incl single family homes)	2015	2
E.12.c	**Regulated Projects**		
	Implement standards on projects that create or replace >5,000 SF impervious area, aka Regulated Projects	2015	2
	Road and Utility Projects creating 5,000 sf or more that are public or fall under planning authority of a city shall comply with LID except 85th % can follow EPA Guidance on green infrastructure	2015	2
E.12.d.	**Source Control Measures -** Regulated Projects shall implement source control measures	2015	2

E.12.e	**LID Standards -** all Requlated Projects shall implement LID standards to treat storm water and provide baseline hydromod mgmt to meet numeric sizing criteria under E.12.e(ii)c	2015	2
E.12.g	**Enforceable Mechanisms**		
E.12.h	**Operation and Maintenance of Post-Construction Stormwater Management Measures**		
	Implement an O&M verification program for stormwater treatment and baseline hydromod (defined in E.12.e.ii.f) on all regulated projects	2015	2
E.12.i	**Post-Construction BMP Condition Assessment**		
E.12.j	**Planning and Development Review Process**		
	Conduct review using an existing guide such as Municipal Regulatory Update Assistance Program	2016	1-3
	Conduct an analysis of the landscape code to correct gaps hindering post construction requirements	2014	1
	Complete any changes to landscape code to administer post-construction req	2015	2
E.12.k	**Post Construction Storm Water Management Requirements Based on Assessment and Maintenance of Watershed Processes**	TBD	
E.12.l	**Alternative Post-Construction Storm Water Management Program**		
	For multiple benefit projects a permittee may propose alternative Post Const. Requirements (address water quality, supply, flood control, habitat enhancement, open space presery, recreation, climate change)	No date provided - permittee may propose if desired	
E.13	**WATER QUALITY MONITORING**		
E.13.a.	**ASBS Monitoring -** MS4s that discharge to ASBS and are covered by an Ocean Plan exception comply with Attachment C	2014	1
E.13.b.	**TMDL Monitoring -** MS4s w TMDLs must comply with Attachment G and consult with Regional Board within 1 year of effective date to determine monitoring requirements and schedule. And shall implement TMDL monitoring as specified by RB Executive Officer	2014	1
E.13.c.	**303(d) Monitoring -** MS4s discharging to 303(d) listed waterbodies shall consult with Regional Board within 1 year of effective date to determine whether monitoring is necessary.	2014	1
E.13.d.	**Receiving Water Monitoring and Special Studies (Select either Receiving Water Monitoring or Special Studies, if not already conducting E.13.a, b or c monitoring)**	N/A	
E.13.d.1	**Receiving Water Monitoring**	2014	1
	Select one urban/rural site and one urban area site to monitor	2014	1
	Monitor urban/rural and urban area sites	2015	2
	Complete and have available a report that includes a summary of baseline data collections and discussion of monitoring program results	2015	2
E.13.d.2	**Special Studies**		
	Develop and implement special study monitoring program and submit to Regional Board for review and approval	2014	1
	Implement approved special study plan	2015	2

	Complete and have available a report that includes a summary of baseline data collections and discussion of monitoring program results	2015	2
E.14	**PROGRAM EFFECTIVENESS ASSESSMENT**		
E.14.a	**Program Effectiveness Assesment and Improvement Plan (PEAIP)**		
	Submit PEAIP	2015	2
E.15	**TOTAL MAXIMUM DAILY LOADS COMPLIANCE REQUIREMENTS**		
E.15.a	Comply with all approved TMDLs (Attachment G)	2014	1
E.15.b	Waste load allocations are incorporated herein by reference as enforceable parts of this Order	2014	1
E.15.c	Regional Board reviews TMDLs within one year of effective date and may propose modifications to requirements	2014	1
E.15.d	Report status of implementation via SMARTS	2014	1
E.15.e	Comply with Clean Water Act Sections 303d,306b and 314	2014	1
E.16	**ANNUAL REPORTING PROGRAM**		
E.16.a	**Use SMARTS to report and certify**	2014-2018	all years
E.16.b	**Complete and retain annual reports and make available to RWQCB during working hours**	2014-2018	all years
E.16.c	**Submit detailed written or oral report to RWQCB if directed.**	2014-2018	all years
E.16.d	**May coordinate reporting if regional programs**	2014-2018	all years

2014-2015

Phase II Small MS4 Annual - Report

REPORTING PERIOD:07/01/2014 - 06/30/2015

WDID No: 3 42M2000150

Permittee Information

City of Buellton

Marc Bierdzinski

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PO Box 1819

Buellton CA 93427

Phase II Small MS4 Annual - Report - 2014-2015

Questions & Answers

Q No.	Text	DropDown Answer	CheckBoxAnswer	DescriptiveAnswer	Date Answer	Number Answer
	GENERAL					
1	Per Section E.1., did you continue to implement your previously approved storm water management plan? If 'No', please provide a brief explanation in the comments section. (Years 1 - 5) (Please note: This question is for renewal permittees only. If you are a new permittee, please select 'NA')	Yes				
2	If you relied on another entity (co-permittee or SIE) to implement one or more of the permit requirements did the co-permittee or SIE meet the permit requirements that were implemented on your behalf? (Years 1 - 5) If 'Yes', please attach a copy of the agreement that you may have with the other entity. If 'No', please provide a brief explanation.	Yes				
	PROGRAM MANAGEMENT					

3	Reviewed and/or revised any relevant ordinances or other regulatory mechanisms, or adopted any new ordinances or regulatory mechanisms to obtain adequate legal authority as specified by Section E.6.a.(ii)(a-j)? (pgs. 20-22, Year 2) If 'No', please provide a brief explanation in the comments section.	No		No. The City of Buellton did not revise Buellton's Municipal Code Title 1 General Provisions Chapter 1.28 (Code of Violations, Penalties and Enforcement) and Chapter 1.20 (Administrative Citations), or Title 15 Stormwater (also known as Ordinance 13-05 Stormwater Quality Management and Discharge Control) or any relevant ordinances or adopt any new ordinances or regulatory mechanisms to obtain adequate legal authority as specified by Section E.6.a.(ii)(a-j). Buellton's Municipal Code Title 1 General Provisions Chapter 1.28 (Code of Violations, Penalties and Enforcement) and Chapter 1.20 (Administrative Citations) provide administrative and legal procedures to mandate compliance with Ordinance No. 13-05 Buellton Municipal Code Chapter 15 Stormwater Quality and Management and Discharge Control. No. The City of Solvang did not revise Solvang's Municipal Code Title 1 Administration, Chapter 3 (General Penalty), Chapter 6 (Appeal Procedures), Title 6 Police Regulations, Chapter 5 (Administrative Remedies Process) or Title 14 Stormwater Management (also known as the Stormwater Management Ordinance) or any relevant ordinances or adopt any new ordinances or regulatory mechanisms to obtain adequate legal authority as specified by Section E.6.a.(ii)(a-j). Solvang's Municipal Code Title 1 Administration, Chapter 3 (General Penalty), Chapter 6 (Appeal Procedures), and Title 6 Police Regulations, Chapter 5 (Administrative Remedies Process) provides administrate and legal procedures to mandate compliance with Solvang Municipal Code Title 14 Stormwater Management.		
4	Certified legal authority, as specified by section E.6.b.? (page 22, Year 2) If 'Yes", attach required statement signed by an authorized signatory certifying adequate legal authority to comply with all Order requirements. (E.6.b.(ii)(a-e), page 22). (Year 2) If "No", please provide a brief explanation.	Yes				
5	Developed and began implementation of Enforcement Response Plan as specified by Section E.6.c.(ii)(a-f)? (pgs. 22-24, Year 3) If 'No', please provide a brief explanation.	N/A				
	EDUCATION AND OUTREACH					
6	Selected one or more of the Public Education and Outreach options? (E.7.a, page 25.) (Year 1) If yes, which option was selected to comply with section E.7.? Provide answer in comments section. (Year 1) For countywide/regional collaborative option selection, upload required attachment: agreement confirming collaboration with other MS4s. (Year 1)	N/A				

7	Developed and began implementation of storm water public education and outreach program as specified by section E.7.a.(ii)(a - m)? (pgs. 25-27, Year 2); OR Continued implementation of storm water public education and outreach program as specified by section E.7.a.(ii)(a - m)? (pgs. 25-27, Year 3-5) If 'No', please provide a brief explanation.	Yes				
8	Developed and began implementation of a public education strategy that established education tasks based on water quality problems, target audiences and anticipated task effectiveness? (E.7.a.(ii)a, page26) (Year 2); OR Continued implementation of a public education strategy that established education tasks based on water quality problems, target audiences and anticipated task effectiveness? (Years 3-5) If 'No', please provide a brief explanation.	Yes				
9	Developed and implemented a training program for all staff who, as part of their normal job responsibilities, may be notified of, come into contact with, or otherwise observe an illicit discharge or illegal connection to the storm drain system, as specified by section E.7.b.1.(ii)(a-g), page 27) (Year 3) If 'NA', please provide a brief explanation.	N/A				
10	Provided construction outreach and education training for staff implementing construction site storm water runoff control program, as specified by section E.7.b.2.a(ii)(a-c), page 28 (Year 2) If 'NA', please provide a brief explanation.	Yes				
11	Developed and distributed educational materials to construction site operators, as specified by section E.7.b.2(b)(ii)(a-d), pgs. 28 - 29) (Year 3) If 'NA', please provide a brief explanation.	N/A				
12	Updated existing storm water website, as necessary, to include information on appropriate selection, installation, implementation and maintenance of BMPs? (E.7.b.2.(b)(ii)(d), page 29) (Year 3) If 'No', please provide a brief explanation.	N/A				
13	Trained employees on how to incorporate pollution prevention/good housekeeping techniques into Permittee operations, as specified by section E.7.b.3.(ii)(a-d), pages 29-30 (Years 2-5) If 'NA', please provide a brief explanation.		Yes			
	PUBLIC INVOLVEMENT AND PARTICIPATION PROGRAM					
14	Involved the public in the development and implementation of activities related to the program, as specified by section E.8.(ii)(a-e)? (Years 2-5) If 'No', please provide a brief explanation.	Yes				
	ILLICIT DISCHARGE DETECTION AND ELIMINATION					

15	Created and/or maintained outfall map? (E.9.a., page 31) (Years 2-5) If 'No', please provide a brief explanation.	Yes				
16	Included in the outfall map, location of all outfalls that are operated by the Permittee within the urbanized area, drainage areas, and land use(s) contributing to those outfalls that are operated by the Permittee, and that discharge within the Permittee's jurisdiction to a receiving water? (E.9.a(ii)(a), page 31) (Year 2) If 'No', please provide a brief explanation.	Yes				
17	Included in the outfall map, the location (and name, where known to the Permittee) of all water bodies receiving direct discharges from those outfall pipes? (E.9.a(ii)(b), page 31) (Year 2) If 'No', please provide a brief explanation.	Yes				
18	Included in the outfall map, priority areas, as specified in E.9.a.(ii)(c)(1-8), pages 31 -32. (Year 2) If 'No', please provide a brief explanation.	Yes				
19	Included in the outfall map, field sampling stations? (E.9.a(ii)(d), page 32) (Year 2) If 'No', please provide a brief explanation.	Yes				
20	Included in the outfall map, the permit boundary? (E.9.a(ii)(e), page 32) (Year 2) If 'No', please provide a brief explanation.	Yes				
21	Maintained inventory of all industrial/commercial facilities/sources within the Permittee's jurisdiction (regardless of ownership) that could discharge storm water pollutants to the MS4? (E.9.b., page 32) (Year 2) If 'No', please provide a brief explanation.	Yes				
22	Included in the inventory, the facility name, address, nature of business/activity, physical location of storm drain receiving discharge, name of receiving water and if the facility/source is tributary to a Clean Water Act Section 303(d) listed water body segment or water body segment subject to a TMDL? (E.9.b(ii)(a), page 32) (Year 2) If 'No', please provide a brief explanation.	Yes				
23	Included in the inventory: vehicle salvage yards, metal and other recycled materials collection facilities, waste transfer facilities, vehicle mechanical repair, maintenance or cleaning; building trade central facilities or yards; corporation yards; landscape nurseries and greenhouses; building material retailers and storage; plastic manufacturers; other facilities designated by the Permittee or Regional Water Board to have reasonable potential to contribute to pollution of storm water runoff? (E.9.b(ii)(b), page 33) (Year 2) If 'No', please provide a brief explanation.	Yes				

24	Determined if facilities that are required to be covered under the Statewide Industrial General Permit (IGP) have done so and notified Regional Water Board of any non-filers? (E.9.b(ii)(c), page 33) (Year 2) Attached copies of the notification of non-filers to the Regional Water Board (E.9.b(ii)(c)page 33) (Year 2) If 'No', please provide a brief explanation.	No		No. Both the City of Buellton and Solvang created an Illicit Discharge Source/Facility Inventory based on the types of industrial and commercial facilities/sources specified in E.9.b as well as the types of facilities covered list within the new NPDES General Permit for Stormwater Discharges Associated with Industrial Activities Order NPDES No. CAS00001 Appendix A. E.9 did not requiring documentation of SIC Codes, the City did not have the resources to determine the SIC Codes of each facility listed within the inventory. The City did conduct a search within the Storm Water Multiple Application and Report Tracking System (SMARTS) Database for facilities with active coverage under the Statewide Industrial General Permit through submission of a Notice of Intent (NOI). In consultation with the Central Coast Regional Water Quality Control Staff, it was deemed acceptable and in compliance with E.9.b(ii)(c) to provide the Inventory with the NOI status that indicate which facilities may require further review to determine if they meet the requirements for filing under the new Statewide Industrial General Permit. The City inventories were submitted electronically to the Central Coast Regional Water Quality Control Board Staff on June 30, 2015.		
25	Updated the inventory annually? (E.9.b(ii)(d), page 33) (Years 2-5) If 'No', please provide a brief explanation.	Yes				
26	Developed and implemented procedures to proactively identify illicit discharges originating from priority areas identified in Section E.9.a.(ii)(c), at least once over the length of the permit term. OR, established a self-certification program where Permittees require reports from authorized parties demonstrating the prevention and elimination of illicit discharges at their facilities in priority areas at least once over the length of the permit term? (E.9.b(ii)(e), page 33) (Year 2) OR Implemented the procedures established per E.9.b.(ii).(e).? (Years 3-5) If 'No', please provide a brief explanation.	Yes				
27	Conducted field sampling of any outfalls that were flowing or ponding when it had been more than 72 hours after the last rain event (i.e., were suspected of illicit discharges) during outfall inventory mapping (under section E.9.a., page 31)? (E.9.c., page 34) (Year 2) If 'No', please provide a brief explanation.	No		No. The City of Solvang did not have any outfalls flowing or ponding more than 72 hours after a rain event, and therefore, the City did not conduct any field sampling. Yes. The City of Buellton conducted field sampling of River View Park West (Outfall ID 1A) and East (Outfall ID 2A) Outfall Structures that had ponded more than 72 hours after a rain event.		

28	Conducted monitoring for the parameters listed in Table 1 (page 34), or for parameters selected by Permittee based on local knowledge of pollutants of concern in priority areas? (E.9.c(ii)(a), page 34) (Years 2-5) If tailored parameter action levels, attach justification and modifications to parameters If 'No', please provide a brief explanation.	No		No. The City of Solvang did not have any outfalls flowing or ponding more than 72 hours after a rain event, and therefore, the City did not conduct any field sampling. Yes. The City of Buellton conducted field sampling of River View Park West (Outfall ID 1A) and East (Outfall ID 2A) Outfall Structures that had ponded more than 72 hours after a rain event and conducted monitoring for parameters listed within Table 1 (page 34) with the exception of fluoride. The City of Buellton does not fluoridate their tap water but adds chlorine to disinfect their tap water. The City of Buellton substituted total chlorine (field test) as an alternative indicator parameter than fluoride to help identify tap or irrigation water from natural water sources.		
29	Verified that indicator parameter action levels in Table 2 (page 35), or tailored parameter action levels were not exceeded? (E.9.c.(ii)(b), page 35) (Years 2-5) If tailored parameter action levels, attach justification and modifications to parameter action levels. If 'No', please provide a brief explanation.	No		No. The City of Solvang did not have any outfalls flowing or ponding more than 72 hours after a rain event, and therefore, the City did not conduct any field sampling. Yes. The City of Buellton verified if indicator parameter action levels within Table 2 or tailored parameter action levels were exceeded. The City also consulted with the Central Coast Regional Water Quality Control Board Staff regarding Sample Results/Action Levels for the following indicator parameters: Outfall ID 1A - Specific Conductivity 2450 umhom/cm and Total Chlorine 0.1 mg/L; Outfall ID 2A - Total Chlorine 0.1 mg/L.		
30	Conducted follow-up investigations per Section E.9.d. if the action level concentrations were exceeded? (E.9.c(ii)(c), page 35) (Years 2-5) If 'No', please provide a brief explanation.	No		No. The City of Solvang did not have any outfalls flowing or ponding more than 72 hours after a rain event, and therefore, the City did not conduct any field sampling; and therefore did not conduct any monitoring or follow-up investigations. No. Based on discussion with the Central Coast Regional Water Quality Control Board, City of Buellton did not conduct any additional follow-up investigations The local geology can contribute to the exceedances of specific conductivity and are most likely background levels. The total residual chlorine is lower than domestic water source and would be investigated if over 1 ppm.		
31	Developed written procedures for conducting investigations into the source of all suspected illicit discharges? (E.9.d.ii(a-e), page 36) (Year 2) If 'No', please provide a brief explanation.	Yes				
32	Investigated within 24 hours, non-storm water discharges suspected of being sanitary sewage and/or significantly contaminated? (E.9.d.(ii)(a), page 36) (Years 2-5) If 'No', please provide a brief explanation.	Yes				

33	Prioritized investigations of suspected sanitary sewage and/or significantly contaminated discharges over investigations of non-storm water discharges suspected of being cooling water, wash water, or natural flows? (E.9.d.(ii)(b), page 36) (Years 2-5) If 'No', please provide a brief explanation.	Yes				
34	Reported immediately the occurrence of any flows believed to be an immediate threat to human health or the environment to local Health Department? (E.9.d.(ii)(c), page 36? (Years 2-5) If 'No', please provide a brief explanation.	Yes				
35	Determined and documented through investigations the source of all non-storm water discharges? (E.9.d.(ii)(d), page 36) (Years 2-5) If 'No', please provide a brief explanation.	Yes				
36	Implemented corrective actions to eliminate illicit discharges as specified in section E.9.d.(ii)(e), page 36. (Years 2-5) If 'No', please provide a brief explanation.	Yes				
37	Developed and began implementing a spill response plan? (E.9.e., page 36) (Year 1); OR Continued to implement a spill response plan (Years 2 -5) If 'No', please provide a brief explanation.	Yes				
	CONSTRUCTION SITE STORM WATER RUNOFF CONTROL PROGRAM					
38	Developed an enforceable construction site storm water runoff control ordinance for all projects that disturb less than one acre of soil? (E.10., page 37) (Year 2) If 'No', please provide a brief explanation.	Yes				
39	Created, maintained, and continuously updated an inventory of all projects subject to local construction site storm water runoff control ordinance according to the minimum requirements listed in section E.10.a(ii)(a-h) ? (E.10.a., page 37) (Years 1-5) If 'No', please provide a brief explanation.	Yes				
40	Developed procedures that include the minimum requirements listed in section E.10.b(ii)(a-e) to review and approve construction plan documents? (i.e., erosion and sediment control plans). (E.10.b., page 38) (Year 1) If 'No', please provide a brief explanation.	Yes				
41	Used legal authority to implement procedures for inspecting public and private construction projects and conducted enforcement as necessary? (E.10.c, page 39). (Years 2-5) If 'No', please provide a brief explanation.	Yes				
42	Conducted inspections, at a minimum, at priority construction sites prior to land disturbance, during active construction and following active construction? (E.10.c.(ii), page 39) (Years 2-5) If 'No', please provide a brief explanation.	Yes				

43	Included in inspection, an assessment of compliance with the Permittee's construction site storm water control ordinance and other applicable ordinances? (E.10.c.(ii), page 39) (Years 2-5) If 'No', please provide a brief explanation.	Yes				
44	Active site inspections included inspections of BMP maintenance, BMP effectiveness and verification of no pollutant of concern discharge? (E.10.c.(ii), page 39) (Years 2-5) If 'No', please provide a brief explanation.	Yes				
45	Based inspection prioritization criteria on project threat to water quality (includes soil erosion potential, site slope, project size and type, sensitivity of receiving water bodies, proximity to receiving water bodies, non-storm water discharges, projects more than one acre that are not subject to the CGP and past record of non-compliance)? (E.10.c.(ii), page 39) (Years 2-5) If 'No', please provide a brief explanation.	Yes				
	POLLUTION PREVENTION/GOOD HOUSEKEEPING FOR PERMITTEE OPERATIONS PROGRAM					
46	Developed and maintained an inventory of Permittee-owned or operated facilities within your jurisdiction that are a threat to water quality, as specified in E.11.a(ii), page 40. (Years 2-5) If 'No', please provide a brief explanation.	Yes				
47	Developed and submitted a map that identifies the location of inventoried Permittee-owned/operated facilities, storm drainage system corresponding to the each of the facilities and the receiving water, facility name and management including contact information? (E.11.b., page 41) (Year 2) If 'No', please provide a brief explanation.	Yes				
48	Developed and implemented SWPPPs for hotspots as specified in section E.11.d.(ii)(a-c), page 42-43)? (Year 4) If 'No', please provide a brief explanation.	N/A				
49	Conducted quarterly visual inspection of hotspots and hotspot discharge locations? (E.11.e.(ii)(a and c), page 43) (Year 5) If 'No', please provide a brief explanation.	N/A				
50	Conducted annual comprehensive hotspot inspection? (E.11.e(ii)(b), page 43) (Year 5) If 'No', please provide a brief explanation.	N/A				
51	Inspected each inventoried facility that is not a hotspot once during permit term? (E.11.e(ii)(d), page 44) (Year 5) If 'No', please provide a brief explanation.	N/A				

52	Implemented procedures to assess and prioritize maintenance of storm drain system infrastructure and assigned a high priority to each catch basin meeting any of the criteria listed in section E.11.f(ii)(1-5), page 44? (Year 2) If 'No', please provide a brief explanation.	No		No. The City of Buellton has developed a draft Storm Drain System Assessment, Prioritization, Maintenance Standard Operation Procedure that is in process of being finalized and implemented through a Request For Proposal. When assessing catch basins and drop inlets to assign a priority level (high, medium or low) the City determined that each City owned and operated catch basin and drop inlet would be assigned a high priority level. The City has also updated the Storm Drain System Inventory that includes public and private structures and verified GPS coordinates for each structure. No. The City of Solvang is the process of developing and implementing a Storm Drain System Assessment, Prioritization, Maintenance Standard Operation Procedure but this effort is not yet completed. Therefore, for this year, the City assigned an initial high priority level for all City owned and operated catch basin and drop inlets, and inspected and cleaned all City owned and operated catch basin and drop inlets. Next year with completion of the Storm Drain System Assessment, Prioritization, Maintenance Standard Operation Procedure, all City owned and operated catch basins and drop inlets will be assigned a priority level (high, medium or low). The City has also updated the Storm Drain System Inventory that includes public structures and verified GPS coordinates for each structure.		
53	Began maintenance of storm drain systems according to the procedures and priorities developed according to section E.11.g.(ii)(a-e), page 45? (Year 3) If 'No', please provide a brief explanation.	N/A				
54	Developed and implemented a strategy to inspect storm drain systems, based on the priorities assigned in section E.11.f.(ii), page 44. (E.11.g.(ii)(a), page 45). (Year 3) If 'No', please provide a brief explanation.	N/A				
55	Developed and implemented a schedule to clean high priority catch basins and other systems? (E.11.g.(ii)(b), page 45) (Year 3) If 'No', please provide a brief explanation.	N/A				
56	Ensured that each catch basin in high foot traffic areas includes a legible storm water awareness message? (E.11.g.(ii)(c), page 45) (Year 3) If 'No', please provide a brief explanation.	N/A				
57	Reviewed and maintained high priority facilities and removed trash and debris from high priority areas prior to the rainy season? (E.11.g.(ii)(d), page 45). (Year 3) If 'No', please provide a brief explanation.	N/A				

58	Developed and maintained a procedure to dewater and dispose of materials extracted from catch basins that ensures that water removed during the catch basin cleaning process and waste material will not reenter the MS4? (E.11.g.(ii)(e), page 45). (Year 3) If 'No', please provide a brief explanation.	N/A				
59	Developed program to assess O&M activities for potential to discharge pollutants and inspected all O&M BMPs quarterly as specified in section E.11.h.(ii)(a-d), page 45-46? (Year 3) If 'No', please provide a brief explanation.	N/A				
60	Developed and implemented a program that includes activities listed in section E.11.h.ii(a)(1-8), page 46, to assess O & M activities and subsequently developed applicable BMPs? (E.11.h(ii)(a), page 46) (Year 3) If 'No', please provide a brief explanation.	N/A				
61	Identified all materials that could be discharged from each of these O&M activities, and which materials contain pollutants? (E.11.h(ii)(b), page 46) (Year 3) If 'No', please provide a brief explanation.	N/A				
62	Developed and identified a set of BMPs that, when applied during Permittee O&M activities, will reduce pollutants in storm water and non-storm water discharges? (E.11.h(ii)(c), page 46) (Year 3) If 'No', please provide a brief explanation.	N/A				
63	Evaluated all BMPs implemented during O&M activities quarterly? (E.11.h(ii)(d), page 46) (Year 3) If 'No', please provide a brief explanation.	N/A				
64	Developed and implemented a process for incorporating water quality and habitat enhancement into new and rehabilitated flood management projects? (E.11.i, page 46-47) (Year 3) If 'No', please provide a brief explanation.	N/A				
65	Implemented a landscape design and maintenance program to reduce the amount of water, pesticides, herbicides and fertilizers used by Permittee? (E.11.j., page 47) (Years 2-5) If 'No', please provide a brief explanation.	Yes				
66	Evaluated pesticides, herbicides and fertilizers used and application activities performed and identified pollution prevention and source control opportunities? (E.11.j(ii)(a), page 47) (Year 2) If 'No', please provide a brief explanation.	Yes				
67	Implemented practices that reduced the discharge of pesticides, herbicides and fertilizers as specified in section E.11.j(ii)(b)(1-4), page 47-48)? (Years 2-5) If 'No', please provide a brief explanation.	Yes				

68	Implemented educational activities for municipal applicators and distributors? (E.11.j(ii)(b)(1), page 47) (Years 2-5) If 'No', please provide a brief explanation.	Yes				
69	Implemented landscape management measures that rely on non-chemical solutions, including the measures specified in section E.11.j.(ii)(b)(2)(a-i), page 47? (Years 2-5) If 'No', please provide a brief explanation.	Yes				
70	Collected and properly disposed of unused pesticides, herbicides and fertilizers? (E.11.j(ii)(b)(3), page 48)(Years 2-5) If 'No', please provide a brief explanation.	Yes				
71	Minimized irrigation runoff by using an evapotranspiration-based irrigation schedule and rain sensors? (E.11.j(ii)(b)(4), page 48), (Years 2-5) If 'No', please provide a brief explanation.	Yes				
72	Recorded the types and amounts of pesticides, herbicides and fertilizers used in the permit area? (E.11.j(ii)(c), page 48) (Years 2-5) If 'No', please provide a brief explanation.	Yes				
	POST CONSTRUCTION STORMWATER MANAGEMENT PROGRAM					
73	Regulated development to comply with sections E.12.b. through E.12.l of permit? (E.12.a., page 48) (Years 2-5) If 'No', please provide a brief explanation.	NA		N/A. These requirements are superseded by the Central Coast adopted Post-Construction Requirements (PCRs). The Cities shall comply with the adopted and approved Stormwater Management Requirements for Development Projects in the Central Coast Region dated July 12, 2013.		
74	Required implementation of site design measures for all projects that create and/or replace 2,500- 5,000 square feet of impervious surface (including single family homes, that are not part of a larger plan of development)? (E.12.b., page 48-49) (Years 2-5) If 'No', please provide a brief explanation.	NA		N/A. hese requirements are superseded by the Central Coast adopted Post-Construction Requirements (PCRs). The Cities shall comply with the adopted and approved Stormwater Management Requirements for Development Projects in the Central Coast Region dated July 12, 2013.		
75	Implemented standards, including measures for site design, source control, runoff reduction, storm water treatment and baseline hydromodification management, on projects that create and/or replace more than 5,000 square feet of impervious surface (Regulated Projects)? (E.12.c., pages 49 -51) (Years 2-5) If 'No', please provide a brief explanation.	No		N/A. These requirements are superseded by the Central Coast adopted Post-Construction Requirements (PCRs). The Cities shall comply with the adopted and approved Stormwater Management Requirements for Development Projects in the Central Coast Region dated July 12, 2013.		
76	Required Regulated Projects to implement source control measures? (E.12.d., page 51-52) (Years 2-5) If 'No', please provide a brief explanation.	NA		N/A. These requirements are superseded by the Central Coast adopted Post-Construction Requirements (PCRs). The Cities shall comply with the adopted and approved Stormwater Management Requirements for Development Projects in the Central Coast Region dated July 12, 2013.		

77	Required Regulated Projects to implement LID standards designed to reduce runoff, treat storm water, and provide baseline hydromodification management to the extent feasible, to meet the Numeric Sizing Criteria for Storm Water Retention and Treatment under section E.12.e(ii)c., page 53. (E.12.e., page 52-56)? (Years 2-5) If 'No', please provide a brief explanation.	NA		N/A. These requirements are superseded by the Central Coast adopted Post-Construction Requirements (PCRs). The Cities shall comply with the adopted and approved Stormwater Management Requirements for Development Projects in the Central Coast Region dated July 12, 2013.		
78	Developed and implemented hydromodification management procedures for Regulated Projects that created and/or replaced one acre or more of impervious surface as specified by section E.12.f? (pgs. 56 - 57, Year 3) If 'No', please provide a brief explanation.	N/A				
79	Developed and/or modified enforceable mechanisms to implement E.12.b and E.12.f. (E.12.g., page 58) (Year 3) If 'No', please provide a brief explanation.	N/A				
80	Implemented an O&M verification program for storm water treatment and baseline hydromodification structural controls measures on all Regulated Projects, as specified by section E.12.h.(ii)(a-e), page 58-60? (Years 2-5) If 'No', please provide a brief explanation.	NA		N/A. These requirements are superseded by the Central Coast adopted Post-Construction Requirements (PCRs). The Cities shall comply with the adopted and approved Stormwater Management Requirements for Development Projects in the Central Coast Region dated July 12, 2013.		
81	Inventoried and assessed the maintenance condition of structural post-construction BMPs within your jurisdiction? (E.12.i., page 60) (Year 3) If 'No', please provide a brief explanation.	N/A				
82	Developed and maintained a plan to inventory, map and determine the relative maintenance condition of structural post-construction BMPs as specified by section E.12.i(ii)(a-d), page 60-61? (Year 3) If 'No', please provide a brief explanation.	N/A				
83	Conducted an analysis of the landscape code to correct gaps and impediments impacting effective implementation of post-construction standards? (E.12.j(ii)(a), page 61) (Year 1) If 'No', please provide a brief explanation.	N/A				
84	Completed any changes to the landscape code to effectively administer post-construction requirements? (E.12.j(ii)(b), page 61) (Years 2-5) If 'No', please provide a brief explanation.	No		No. The City of Buellton and the City of Solvang did not find any impediments with administering the post construction requirements during the Municipal Landscape Gap Analysis but the Cities are considering future opportunities to improve that were identified during the analysis and/or adopt a new ordinance to align with the Department of Water Resource's Model Water Efficient Landcape Ordinance (MWELO).		
85	Implemented post-construction storm water management requirements based on a watershed-process approach as specified by section E.12.k, page 62? (Years 1 - 5)	NA		N/A. These requirements are superseded by the Central Coast adopted Post-Construction Requirements (PCRs), The Cities shall comply with the adopted and approved Post-Construction Stormwater Management Requirements for Development Projects (including Watershed Protection) in the Central Coast Region dated July 12, 2013		

86	Proposed alternative post-construction requirements that achieved multiple-benefits as specified by section E.12.l., page 62? (Years 1 - 5)	No		No. Neither the City of Buellton or the City of Solvang submitted a proposal to the Regional Water Board or the Executive Officer to obtain approval for alternative post-construction measures for multiple-benefit projects.		
	WATER QUALITY MONITORING					
87	Indicate which water quality monitoring approach applies to your jurisdiction. Check all that apply.		303(d) Monitoring			
88	If you selected TMDL Monitoring or 303(d) Monitoring, did you consult with your Regional Water Board within Year 1 of the permit to determine monitoring study design and implementation schedule? (Year 1) If 'No', please provide a brief explanation.	N/A				
89	Indicate if you are or will be conducting water quality monitoring individually or as part of a regional program. (Years 1 and 2) If regional program, list the name of the program in the text box below. If a Permittee has a population less than 50,000 AND is not required to conduct ASBS, TMDL or 303(d) Monitoring (Sections E.13.(a)-(c)), then enter N/A		Regional Program	Regional Program. Both the City of Buellton and the City of Solvang are participating in the Santa Barbara County Public Works Department's regional water quality monitoring program. The draft "Urban Storm Water Monitoring Plan 2015-2018 For the NPDES Phase II Small MS4 General Permit Sections E.13.c 303(d) Monitoring and E.14.a Program Effectiveness Assessment and Improvement Plan" (previously titled Receiving Water Monitoring Plan FY 2015-2018) was submitted to the Central Coast RWQCB on December 29, 2014 and is pending approval.		
90	Provide a status update regarding the development (including consultation with Regional Boards, if applicable), submittal and/or approval of the monitoring study design and implementation schedule. (Year 1)					
91	Upload the Monitoring Study Design and any available results for the monitoring option that applies to your jurisdiction. (Year 2)					
92	Provide a summary of the implementation of the water quality monitoring program and related results. (Year 3 - 5) Upload the Monitoring Study Results.					
	PROGRAM EFFECTIVENESS ASSESSMENT					
93	Developed and implemented a Program Effectiveness Assessment and Improvement Plan (PEAIP) that includes the minimum requirements listed in section E.14.a(ii)(a-f), page 70-72)? (Year 2) If 'No', please provide a brief explanation. If 'Yes', upload required PEAIP as attachment.	Yes				
94	Provide a description of implementation of the Program Effectiveness and Implementation Plan, a summary of data obtained through effectiveness assessment measures and the short and long-term progress of the storm water program and an analysis of the data as described on page 72 of the permit. Upload as an attachment. (Years 3 - 5)					

95	Identified and summarized BMP and/or program modification identified in priority program areas that will be made in next permit term? (E.14.b.(ii)(a-d), page 72-73) (Year 5) If 'No', please provide a brief explanation. If 'yes', upload required PEAIP as attachment.	N/A				
	TOTAL MAXIMUM DAILY LOADS COMPLIANCE REQUIREMENTS					
96	Attached TMDL implementation status report that includes the information listed in section E.15.d(i-iv), page 74 of permit? (Years 1-5) If 'No', please provide a brief explanation.	NA		N/A. Although the Santa Ynez River is a 303(d) impaired water body, it was not identified within "Phase II Permit Traditional Small MS4 Attachment G-Region Specific Requirements" that outlines Regional Water Board Approved TMDL's.		
	ADDITIONAL INFORMATION					
97	Optional: If you have any additional information, reports or attachments that you would like to provide to describe your storm water program please use the text box and/or the upload attachment button below. (Years 1 - 5)					

Phase II Small MS4 Annual - Report - 2014-2015

ATTACHMENTS

Attachment Title	Description	Date Uploaded	Attachment Type	Attachment Hash	Doc Part No/Total Parts

Report Summary Text File - Auto-generated by SMARTS on 10/15/2015 09:31:28

Name of Report: Phase II Small MS4 Annual Report - Traditionals 2014 - 2015 Annual

Certifier User Account Name: COBPWDirector

Certifier Title: Director of Public Works

Certifier User Party Name: Rose Hess

Certifier Password Hash:
a10e876ae140c6da45a7344aca1eea66b98ab4dc22ae66f262972b88282e1818

Certifier Name: Rose Hess

Certification Computer IP: 50.254.137.145

Certification Executed On: 10/15/2015 09:31:10

Confirmation Number: 626600-50.254.137.145-20151015093110

Attachment Hash List:

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1537372-34a37dd66f5f85982ff337dab2df3da382753f4561368207f54cec0c74c30d1

1538526-b3dd6bb5abff81954c3384b2f1206347deeffd9c359a4cbf9449b1f1b6f78

1538527-5f36d6b12cb5f38299a9e23c79e7dc6ee71a598760ae10c8b6211eafb8e38b

1536889-67ef2c28866931b064195c7b995e636e8864f8f594772f84da3da31d84f

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2014-2015

Phase II Small MS4 Annual - Report

REPORTING PERIOD:07/01/2014 - 06/30/2015

WDID No: 3 42M2000150

Permittee Information

City of Buellton

Marc Bierdzinski

marcb@cityofbuellton.com

PO Box 1819

Buellton CA 93427

Phase II Small MS4 Annual - Report - 2014-2015

Questions & Answers

Q No.	Text	DropDown Answer	CheckBoxAnswer	DescriptiveAnswer	Date Answer	Number Answer
1	Did the Permittee upload the Central Coast Post-Construction Stormwater Requirements annual reporting form and all other documents required in the form? Access form here. If the form does not open, right click on the hyperlink and chose the option, 'Save Target As'. To get full utilization of the form, the form must be viewed and completed using Adobe software. Adobe Reader can be downloaded for free.	Yes				

Phase II Small MS4 Annual - Report - 2014-2015

ATTACHMENTS

Attachment Title	Description	Date Uploaded	Attachment Type	Attachment Hash	Doc Part No/Total Parts

Report Summary Text File - Auto-generated by SMARTS on 10/15/2015 09:30:22

Name of Report: Central Coast Post-Construction Stormwater Requirements Annual Reporting 2014 - 2015 Annual

Certifier User Account Name: COBPWDirector

Certifier Title: Director of Public Works

Certifier User Party Name: Rose Hess

Certifier Password Hash:
a10e876ae140c6da45a7344aca1eea66b98ab4dc22ae66f262972b88282e1818

Certifier Name: Rose Hess

Certification Computer IP: 50.254.137.145

Certification Executed On: 10/15/2015 09:30:01

Confirmation Number: 626600-50.254.137.145-20151015093001

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Water Boards Storm Water Multiple Application & Report Tracking System

Help Logout

You are logged-in as: **Mary Zepeda - City of Buellton.**
If this account does not belong to you, please log out.

Navigate To:

Storm Water Report Monitoring

Owner Name:	City of Buellton	**WDID:**	3 42M2000150	**Report Period:**	2014-15
Report Status:	Submitted	**Report Title:**	Phase II Small MS4 Annual Report - Traditionals 2014 - 2015 Annual		

General Info Questions Attachments Certification Notes Back To NOI Summary

Your electronic event Report has been succesfully received by the State Water Resources Control Board's database and is hereby certified. Your confirmation information for this certification is as follows:

WDID	3 42M2000150
Report Period	2014-15
Certifier Name	Rose Hess
Date Certified	10/15/2015
Certification ID	829902

All records must be retained for 5 years from the date of the report or monitoring activity.

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Water Boards Storm Water Multiple Application & Report Tracking System

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Storm Water Report Monitoring

Owner Name:	City of Buellton	**WDID:**	3 42M2000150	**Report Period:**	2014-15
Report Status:	Submitted	**Report Title:**	Phase II Small MS4 Annual Report - Traditionals 2014 - 2015 Annual		

General Info Questions Attachments Certification Notes Back To NOI Summary

Please click on the "Upload Attachment" button to upload the corresponding files. Upload

Attached files: The following are the current documents related to the SWARM Report. Click on the Attachment ID to view them.

Attachment	File Type	File Title	Date Attached	File Description	Part No	Delete

Question Attachments

Attachment	File Type	File Title	Date Attached	File Description	Part No
Phase II Small MS4 Annual Report 2014-2015-Permittee Owned or Operated Facilities Map-Solvang-092515.pdf	Report Question Attachment	Permittee Owned or Operated Facilites Map-Solvang	10/14/2015	Phase II Small MS4 Annual Report 2014-2015-Permittee Owned or Operated Facilities Map-Solvang-092515	1/1
Phase II Small MS4 Annual Report 2014-2015-Permittee Owned or Operated Facilities Map-Buellton-061615.pdf	Report Question Attachment	Permittee Owned or Operated Facilites Map-Buellton	10/14/2015	Phase II Small MS4 Annual Report 2014-2015-Permittee Owned or Operated Facilities Map-Buellton-061615	1/1
Phase II Small MS4 Annual Report 2014-2015-USWMP 2015-2018-101315.pdf	Report Question Attachment	USWMP 2015-2018	10/14/2015	Phase II Small MS4 Annual Report 2014-2015-USWMP 2015-2018-101315	1/1
Phase II Small MS4 Annual Report 2014-2015-QAPP for USWMP 2015-2018-101315.pdf	Report Question Attachment	QAPP for USWMP 2015-2018	10/14/2015	Phase II Small MS4 Annual Report 2014-2015-QAPP for USWMP 2015-2018-101315	1/1
Phase II Small MS4 Annual Report 2014-2015-QAPP for USWMP 2015-2018-Appendix A-101315.pdf	Report Question Attachment	QAPP for USWMP 2015-2018-Attachment A	10/14/2015	Phase II Small MS4 Annual Report 2014-2015-QAPP for USWMP 2015-2018-Appendix A-101315	1/1
Phase II Small MS4 Annual Report 2014-2015-QAPP for USWMP 2015-2018-Appendix B-101315.pdf	Report Question Attachment	QAPP for USWMP 2015-2018-Attachment B	10/14/2015	Phase II Small MS4 Annual Report 2014-2015-QAPP for USWMP 2015-2018-Appendix B-101315	1/1
Phase II Small MS4 Annual Report 2014-2015-QAPP for USWMP 2015-2018-Appendix D-101315.pdf	Report Question Attachment	QAPP for USWMP 2015-2018-Attachment D	10/14/2015	Phase II Small MS4 Annual Report 2014-2015-QAPP for USWMP 2015-2018-Appendix D-101315	1/1
Phase II Small MS4 Annual Report 2014-2015-QAPP for USWMP 2015-2018-Appendix E-101315.pdf	Report Question Attachment	QAPP for USWMP 2015-2018-Attachment E	10/14/2015	Phase II Small MS4 Annual Report 2014-2015-QAPP for USWMP 2015-2018-Appendix E-101315	1/1
Phase II Small MS4 Annual Report 2014-2015-QAPP for USWMP 2015-2018-Appendix C-101315.pdf	Report Question Attachment	QAPP for USWMP 2015-2018-Attachment C	10/15/2015	Phase II Small MS4 Annual Report 2014-2015-QAPP for USWMP 2015-2018-Appendix C-101315	1/1
Phase II Small MS4 Annual Report 2014-2015-Stormwater Program Management Certification Statement-Buellton-120814.pdf	Report Question Attachment	City of Buellton Stormwater Program Management Certification	10/12/2015	Certified Legal Authority-Stormwater Program Management Certification	1/1
Phase II Small MS4 Annual Report 2014-2015-Stormwater Program Management Certification Statement-Solvang-120214.pdf	Report Question Attachment	City of Solvang Stormwater Program Management Certification	10/12/2015	Certified Legal Authority-Stormwater Program Management Certification	1/1
Phase II Small MS4 Annual Report 2014-2015-PEAIP-Buellton and Solvang-101315.pdf	Report Question Attachment	PEAIP Buellton and Solvang	10/13/2015	Phase II Small MS4 Annual Report 2014-2015-PEAIP-Buellton and Solvang-101315	1/1
Phase II Small MS4 Annual Report 2014-2015-PEAIP-Buellton and Solvang-GeoSyntec Consultants Modeling Approach Memorandum-101215.pdf	Report Question Attachment	PEAIP-GeoSyntec Consultants Modeling Approach Memorandum	10/13/2015	Phase II Small MS4 Annual Report 2014-2015-PEAIP-Buellton and Solvang-GeoSyntec Consultants Modeling Approach Memorandum-101215	1/1
Phase II Small MS4 Annual Report 2013-2014-Attachment 1-Item 2-Buellton and Solvang MOU-112513.pdf	Report Question Attachment	Memorandum of Understanding Between the Cities of Solvang and Buellton	10/12/2015	Phase II Small MS4 Annual Report 2013-2014 Attachment 1, Item 2 Buellton and Solvang Memo of Understanding	1/1
Phase II Small MS4 Annual Report 2014-2015-QAPP for USWMP 2015-2018-Appendix F-101315.pdf	Report Question Attachment	QAPP for USWMP 2015-2018-Attachment F	10/14/2015	Phase II Small MS4 Annual Report 2014-2015-QAPP for USWMP 2015-2018-Appendix F-101315	1/1

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Central Coast Post-Construction Stormwater Management Requirements (PCRs)

Resolution No. R3-2013-0032
Annual Reporting Form
August 2014 Version

Due Date: By October 15, 2014 and October 15 annually thereafter, Permittees must submit this reporting form.

Instructions: Complete form electronically. Answer questions and supply requested information for the Reporting Period only. Upload completed form to Storm Water Multiple Application and Report Tracking System (SMARTS) and name the file, "*PCRs Annual Report [insert reporting period]".* Also, upload requested attachments to SMARTS using specified nomenclature.

SECTION I: GENERAL PERMITTEE INFORMATION

WDID# and Permittee Name: 3 42M2000036 - City of Solvang

County: Santa Barbara

SECTION II: REPORTING PERIOD

Reporting Period: 7/1/2014 - 6/30/2015

SECTION III: COMPLETED PROJECTS

How many projects, that received occupancy completion documentation (e.g., Certificate of Occupancy) during the Reporting Period, created and/or replaced ≥ 2,500 square feet of impervious surface? 0

SECTION III: CONTINUED ...

Project categories based on created and/or replaced impervious surface area		Number of Projects in each category that received occupancy completion documentation (e.g., Certificate of Occupancy) during the Reporting Period and had an approval per PCRs Provision B.1.c
Lower Bound	**Upper Bound**	
≥ 2,500 square feet	<5,000 square feet Net Impervious Area (all projects except single-family homes) and <15,000 square feet Net Impervious Area (only single-family homes)	0
≥5,000 square feet Net Impervious Area (all projects except single-family homes) and ≥15,000 square feet Net Impervious Area (only single-family homes)	<15,000 square feet (all projects except single-family homes) and <15,000 square feet Net Impervious Area (only single-family homes)	0
≥15,000 square feet (all projects except single-family homes) and ≥15,000 square feet Net Impervious Area (only single-family homes)	<22,500 square feet	0
≥22,500 square feet	N/A	0
Total		0

SECTION IV: PROJECTS SUBJECT TO POST-CONSTRUCTION REQUIREMENTS

Performance Requirements*	Number of Projects subject to Performance Requirements that received completion documentation during the Reporting Period	Number of Projects with structural Water Quality Treatment, Runoff Retention, and/or Peak Management controls	Number of Projects where field verification of Site Design, Water Quality Treatment, Runoff Retention, and/or Peak Management controls was completed	Number of Projects where field verification confirmed ALL Site Design, Water Quality Treatment, Runoff Retention, and/or Peak Management controls were implemented in accordance with PCRs
Only No. 1	0	N/A		
Only Nos. 1 and 2		0		
Only Nos. 1, 2, and 3			0	
Only Nos. 1, 2, 3, and 4				0
Total	0	0	0	0

* Only include projects once in table. For example, if a project triggers all four performance requirements, only address that project in the, “Only Nos. 1, 2, 3, and 4” row. Do not also count the project in the cells for the above three rows.

SECTION V: SPECIAL CIRCUMSTANCES AND ALTERNATIVE COMPLIANCE

Note: If the Permittee did not grant any Special Circumstances and/or Alternative Compliance for Projects that received completion documentation during the Reporting Period, skip Section V.

To add another Project, click 'Add Row'

Add Row | Delete Row

	Alternative Compliance type (Select all that apply)								
Names of Projects that received completion documentation during the Reporting Period and the Permittee granted Special Circumstances and/or Alternative Compliance	Watershed or Regional Plan	Urban Sustainability Area	Highly Altered Channel Special Circumstance	Intermediate Flow Control Facility Special Circumstance	Historic Lake or Wetland Special Circumstance	Technical Infeasibility Performance Requirement No. 2	Technical Infeasibility Performance Requirement No. 3	Technical Infeasibility Performance Requirement No. 4	**If technical infeasibility is rationale for Alternative Compliance, does Project's Stormwater Control Plan adequately demonstrate basis for infeasibility?**
	☐	☐	☐	☐	☐	☐	☐	☐	N/A

SECTION V: CONTINUED ...

To add another Project, click 'Add Row'

Add Row | Delete Row

Names of Projects that received completion documentation during the Reporting Period and the Permittee granted Special Circumstances and/or Alternative Compliance	Alternative Compliance type (Select all that apply)								If technical infeasibility is rationale for Alternative Compliance, does Project's Stormwater Control Plan adequately demonstrate basis for infeasibility?
	Watershed or Regional Plan	Urban Sustainability Area	Highly Altered Channel Special Circumstance	Intermediate Flow Control Facility Special Circumstance	Historic Lake or Wetland Special Circumstance	Technical Infeasibility Performance Requirement No. 2	Technical Infeasibility Performance Requirement No. 3	Technical Infeasibility Performance Requirement No. 4	
	☐	☐	☐	☐	☐	☐	☐	☐	N/A

SECTION VI: MITIGATION PROJECTS CONSTRUCTED FOR ALTERNATIVE COMPLIANCE

Were there any mitigation projects constructed for Alternative Compliance during the Reporting Period? ○ Yes ◉ No

If yes, did the Permittee upload to SMARTS the below information?

- A summary description of mitigation projects constructed during the Reporting Period comparing the expected aggregate results of Alternative Compliance projects to the results that would otherwise have been achieved by meeting the numeric Performance Requirements on-site. The summary should quantitatively compare results. For example, if the Alternative Compliance project is mitigating for a project that could not fully meet Performance Requirement No. 3 onsite, then the summary should quantify the following: 1) onsite retention volume required by Performance Requirement No. 3, 2) volume of runoff actually retained on site, and 3) volume of runoff retained at the Alternative Compliance project site.
- For public offsite mitigation projects, a summation of total offsite mitigation funds raised to date and a description (including location, general design concept, volume of water expected to be retained, and total estimated budget) of all pending public offsite mitigation projects

SMARTS upload title: "*PCRs Annual Report [insert reporting period] – Mitigation Projects*"

SECTION VII: LONG-TERM OPERATION AND MAINTENANCE

Did the Permittee upload to SMARTS a copy (e.g., screenshot) of the structural Stormwater Control Measure Operation and Maintenance database that shows all entries from the Reporting Period (see PCRs Provision E.3)? ○ Yes ◉ No

SMARTS upload title: "*PCRs Annual Report [insert reporting period] – Long-Term Operation and Maintenance*"

SECTION VIII: ADDITIONAL UPLOADS

Did the Permittee upload to SMARTS information to demonstrate Performance Requirement No. 1 was applied to all applicable projects during the Reporting Period (including sample checklist)? ○ Yes ◉ No

SMARTS upload title: "*PCRs Annual Report [insert reporting period] – Performance Req No1 Implementation*"

MEMORANDUM OF UNDERSTANDING
BETWEEN THE CITIES OF SOLVANG AND BUELLTON

Regarding the status of the Cities of Buellton and Solvang as Co-Permittees, and preparation and submittal of Annual Reports required by the Phase II Small MS4 NPDES Municipal Stormwater General Permit

This Memorandum of Understanding (MOU or Agreement) is entered into between the City of Buellton and the City of Solvang, referred to herein as the **"Parties,"** for the purpose of defining agency roles, responsibilities, and commitments in connection with the Parties functioning as Co-Permitees under their respective Phase II Small MS4 NPDES Municipal Stormwater General Permits, and the preparation and submittal of Annual Reports required by the Permits. In consideration of the mutual covenants and conditions contained herein, the Parties agree as follows:

1. Description

The new Phase II Small MS4 NPDES Municipal Stormwater General Permit, adopted by the State Water Resources Control Board on February 5, 2013, includes a provision for agencies regulated under the Permit to comply with certain aspects of the Permit as "Co-Permittees". Agencies covered under the Permit as Co-Permittees may submit a single joint Annual Report. It is the intent and purpose of this MOU to define the roles and responsibilities of the Parties for the purpose of preparing and submitting joint Annual Reports. The Parties agree that upon execution by both Parties this MOU is to be effective beginning Fiscal Year 2013-14.

2. Lead Agency

The City of Buellton shall be the Lead Agency and sole administrator of the joint Annual Report, and shall be responsible for preparing and submitting the joint Annual Report on behalf of the Parties. The City of Buellton shall also be responsible for contracting with a qualified stormwater consultant, as may be necessary, to prepare the joint Annual Report, and shall be the sole administrator of said consultant contract.

3. Insurance Coverage and Indemnification

The Parties agree to maintain liability insurance in an amount sufficient to protect against claims that may be filed against the Parties for the services they provide. The Parties may elect to self-insure against such claims as provided by their respective government policies, or procure third party insurance coverage.

In lieu of and notwithstanding the pro rata risk allocation which might otherwise be imposed between the parties pursuant to Government Code Section 895.6, the parties agree that all losses or liabilities incurred by a party shall not be shared pro rata but instead the Parties agree that pursuant to Government Code Section 895.4, each of the parties hereto shall fully indemnify and hold each of the other parties, their officers, board members, employees and agents, harmless from any claim, expense or cost,

damage or liability imposed for injury (as defined by Government Code Section 810.8) occurring by reason of the negligent acts or omissions or willful misconduct of the indemnifying party, its officers, board members, employees or agents, under or in connection with or arising out of any work, authority or jurisdiction delegated to such party under this Agreement. No party, nor any officer, board member, employee or agent thereof shall be responsible for any damage or liability occurring by reason of the negligent acts or omissions or willful misconduct of other parties hereto, their officers, board members, employees or agents, under or in connection with or arising out of any work, authority or jurisdiction delegated to such other parties under this Agreement.

4. Funding

It is anticipated that the City of Buellton, as the Lead Agency, will utilize Consultant services to prepare and submit the joint Annual Reports. The Parties will share equally in the net Consultant costs associated with the preparation and submittal of the joint Annual Reports. Staff time costs and incidental costs incurred by each Party in connection with preparation of the joint Annual Report shall be borne separately by each Party.

The Parties agree to annually budget for and commit sufficient funds to complete the preparation and submittal of joint Annual Reports. The funding allocation is subject to final budget approval by the respective city councils. The City of Buellton will bill the City of Solvang annually for its share of the joint Annual Report by approximately October 31. The City of Solvang agrees to make payment to the City of Buellton within 30 days of receipt of invoice.

All other aspects of each Parties stormwater management program shall be administered and funded separately unless identified otherwise in this MOU.

5. Term of Agreement

The Agreement will remain in effect until such time as one of the Parties so chooses to terminate the Agreement. The party choosing to terminate the Agreement shall give the other party a minimum of 6 months advanced notice prior to terminating the Agreement.

6. Annual Reporting

On an annual basis, the City of Buellton shall prepare and submit, or have Consultant prepare and submit Annual Report for both agencies as Co-Permittees to the Regional Water Quality Control Board (RWQCB). The City of Buellton shall be responsible for addressing any comments from RWQCB, and prepare and submit revised Annual Report as may be required.

7. Records

The Parties shall keep such records as may be necessary to assist in completion of Annual Reports. In addition, the City of Buellton shall keep records comprising the

Annual reports, and shall maintain such records for a period of five (5) years. All accounting records shall be kept in accordance with generally accepted accounting principles. Either Party shall have the right to review all such documents and records at any time during City of Buellton's regular business hours upon reasonable notice.

8. Cooperation and Coordination Meetings

Staff of the Parties agree to communicate regularly and cooperate with each other to the full extent as may be required for successful completion of Annual Reports. Staff of the Parties agree to meet at least once annually to discuss implementation of the MOU, and other stormwater management issues of common interest.

9. Contracting for Consultant Services

In March of each year the City of Buellton shall solicit a fee proposal(s) from its qualified Consultant(s) specifically to prepare and submit the joint Annual Report for the purposes of budgeting and cost sharing. The fee amount shall be communicated by the City of Buellton to the City of Solvang by April 15 allowing the Parties to incorporate the appropriate amount in their draft fiscal budgets.

10. Consultant Insurance

The City of Buellton shall require any Consultant performing work in connection with the preparation and submittal of joint Annual Reports to maintain general liability insurance, professional liability insurance, automobile liability insurance, and workers compensation insurance each in amount not less than $1,000,000 while performing work, and for a period of two years following completion of such work. The insurance certificate shall include the City of Solvang as additional insured. Consultant shall provide both Parties with copies of the Certificates of Insurance, including the endorsement(s) naming the Parties as additional insured. The insurance certificate shall require the insurance carrier to provide 30 days written notice to the Parties in the event of cancellation.

11. Amendment

This MOU may only be amended in writing with consent of both Parties.

12. Termination

Either Party to this MOU may terminate its participation under this Agreement by giving 6 months written notification to the other Party.

13. Points of Contact

All notices referenced in this Agreement shall be in writing and shall be given by first class mail addressed as follows, or at such other address or to such person that the parties may from time to time designate in writing:

City of Buellton
Public Works Director
107 West Highway 246
Buellton, CA 93427

City of Solvang
Public Works Director
411 Second Street
Solvang, CA 93463

Signatures

CITY OF BUELLTON

Mark Bierdzinski, City Manager

11-14-2013
Date

Approved as to Form:
Ralph Hanson
City Attorney

By: _____

Ralph Hanson, City Attorney for City of Buellton

CITY OF SOLVANG

Brad Vidro, City Manager

11-25-13
Date

Approved as to Form:
Roy Hanley
City Attorney

By: _____

Roy Hanley, City Attorney for City of Solvang

Program Effectiveness Assessment and Improvement Plan (PEAIP) Framework for Traditional MS4s

JUNE 2015

CITY OF BUELLTON AND CITY OF SOLVANG

Program Effectiveness Assessment and Improvement Plan

Prepared by

MNS ENGINEERS, INC.

This *Program Effectiveness Assessment and Improvement Plan* uses the California Stormwater Quality Association (CASQA) guidance document, *A Strategic Approach to Planning for and Assessing the Effectiveness of Stormwater Programs* (February 2015), as its basis and is consistent with the approach described therein. Much of the text in this document is directly from the CASQA guidance document.

Collaborative Project Partners

The Program Effectiveness Assessment and Improvement Plan (PEAIP) were developed by the following agencies involved in this multi-agency PEAIP:

- City of Buellton
- City of Solvang

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As shown in Figure 3 above, the COB and COS recognizes other pollutants based on 303(d) listed water bodies where urban runoff has been listed as the source of the pollutant (Table 2). Other sources and factors contribute to these impairments. The 303(d) list does not attribute magnitude to any single one of the various sources. Table 2. PERMITTEE-Listed Water Bodies 9

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1. Introduction

The Phase II Small Municipal Separate Storm Sewer System (MS4) General Permit[1] (Phase II Permit) requires the development and implementation of a *Program Effectiveness Assessment and Improvement Plan* (PEAIP). The PEAIP must address each of the elements outlined in Provision E.14 (traditional small MS4s). The PEAIP must include the strategy that the City of Buellton (COB) and City of Solvang (COS) will use to track the short- and long-term effectiveness of the stormwater program, the specific measures that will be used to assess the effectiveness of the prioritized best management practices (BMPs), groups of BMPs, and/or the stormwater program as a whole, and a description of how the COB and COS will use the information obtained through the PEAIP to improve the stormwater program.

The COB and COS's stormwater program addresses many pollutants of concern (POCs) and implements a wide range of BMPs; however, consistent with Provision E.14 requirements, the PEAIP will present a plan for assessing the effectiveness of a subset of prioritized BMPs that are focused on high- and medium-priority POCs. This approach provides a manageable assessment program that can be improved, targeted, and refined.

The COB and COS has developed this PEAIP as a guide for its stormwater staff to assist them in conducting program effectiveness assessments (EAs). The PEAIP is modeled after the methodology described within the California Stormwater Quality Association (CASQA) document, *A Strategic Approach to Planning for and Assessing the Effectiveness of Stormwater Programs* (February 2015).[2] The PEAIP outlines the approach that the COB and COS will use to adaptively manage its stormwater program to improve its effectiveness at reducing the identified high- and medium-priority POCs, thereby achieving the maximum extent practicable (MEP) standard and protecting water quality.

The PEAIP is focused on the *impact* that the stormwater program is having rather than the strict *implementation* of the program. By focusing the EA in this manner, the COB and COS will increase their ability to understand if its stormwater program is achieving the intended outcomes and can identify necessary modifications to the program to make it more effective.

This PEAIP addresses the requirements in Provision E.14, as summarized in **Table 1**.

[1] Order No. 2013-0001-DWQ, effective July 1, 2013

[2] Language from the 2015 CASQA Guidance Document is used as the basis for much of the PEAIP.

Table 1. Phase II Permit PEAIP Provisions and Corresponding PEAIP Sections (Traditional MS4s)

Phase II Permit Provision(s)	PEAIP Section
E.14.a.(i-iii)	1. Introduction
E.14.a.(i) E.14.a.(ii)(b)(5)	2.1. Identification of Sources and Impacts 2.1.2. Urban Runoff and MS4 Contributions[3]
E.14.a.(i) E.14.a.(ii)(b)(1)	2.3. Identification of the Stormwater Program Activities
E.14.a.(i) E.14.b.(i) and (ii)	5. Program Reporting and Modifications
E.14.a.(ii)(a)(1)	1.1. Stormwater Program Goals and Objectives
E.14.a.(ii)(a)(2-9)	2. Program Effectiveness Assessment Approach and Development
E.14.a.(ii)(b)(2)	2.2. Identification of the Key Target Audiences 2.2.2. Barriers and Bridges to Action[4]
E.14.a.(ii)(b)(3)	2.2. Identification of the Key Target Audiences 2.2.1. Target Audience Actions[5]
E.14.a.(ii)(b)(4)	2.1. Identification of Sources and Impacts 2.1.3. Source Contributions[6]
E.14.a.(ii)(b)(6)	2.1. Identification of Sources and Impacts 2.1.1. Receiving Water Conditions
E.14.a.(ii)(c-d)	4. Data Assessment and Collection
E.14.a.(ii)(e-f)	3. Management Questions

The schedule for the implementation of the PEAIP is as follows:

- Year 2 Annual Report (October 15, 2015): Submit the PEAIP
- Year 3 and Year 4 Annual Reports (October 15, 2016 and October 15, 2017): Describe the implementation of the PEAIP, summarize the data obtained, and provide an analysis of the data (i.e., the EA)
- Year 5 Annual Report (October 15, 2018): Describe the implementation of the PEAIP, summarize the data obtained, provide an analysis of the data (i.e., the EA), and describe any program modifications identified

[3] Provision E.14.a.(ii)(b)(5) uses the term "MS4 Discharge Quality" for Outcome Level 5; however, the 2015 CASQA Guidance Document and this PEAIP use the term "Urban Runoff and MS4 Contributions" for Outcome Level 5 to reflect the new approach that has been developed.

[4] Provision E.14.a.(ii)(b)(2) uses the term "Awareness" for Outcome Level 2; however, the 2015 CASQA Guidance Document and this PEAIP use the term "Barriers and Bridges to Action" for Outcome Level 2 to reflect the new approach that has been developed.

[5] Provision E.14.a.(ii)(b)(3) uses the term "Behavior" for Outcome Level 3; however, the 2015 CASQA Guidance Document and this PEAIP use the term "Target Audience Actions" for Outcome Level 3 to reflect the new approach that has been developed.

[6] Provision E.14.a.(ii)(b)(4) uses the term "Pollutant Load Reductions" for Outcome Level 4; however, the 2015 CASQA Guidance Document and this PEAIP use the term "Source Contributions" for Outcome Level 4 to reflect the new approach that has been developed.

1.1. STORMWATER PROGRAM GOALS AND OBJECTIVES

Stormwater programs are inherently complex due to a number of factors such as: the number of pollutant sources (construction, industrial, commercial, residential, new development, etc.), the limited ability to directly control the behaviors of target audiences, the extensive geographic coverage of the programs, the number of constituents that must be addressed, the co-mingling of flows within the drainage system, and the potential impacts to water quality from other sources (wind-blown materials, groundwater seepage, aerial deposition, etc.).

The overall goals of the COB and COS's stormwater management program are to a) reduce the potential impact(s) of pollution from urban areas on waters of the State and waters of the United States (U.S.) and protect their beneficial uses; and b) develop and implement an effective stormwater program that is well-understood and broadly supported by stakeholders.

The core objectives of the stormwater program are to:

1. Identify and make a reasonable effort to control those pollutants in urban runoff that exceed water quality objectives (WQOs), as measured in the waters of the State and waters of the U.S., and protect the beneficial uses of the receiving waters;
2. Comply with the federal and State regulations to eliminate or control, to the MEP, the discharge of pollutants associated with urban runoff from the COB and COS's stormwater drainage system;
3. Develop a cost-effective program which focuses on the prevention of pollution in urban stormwater;
4. Seek cost-effective alternative solutions where prevention is not a practical solution for exceedances of WQOs; and
5. Coordinate the implementation of control measures with other agencies.

The PEAIP supports these stormwater program goals and objectives by providing a framework for the implementation and assessment of prioritized BMPs focused on the high- and medium-priority POCs, as well as a feedback loop for the adaptive management of the COB and COS's stormwater program. When considered as part of a larger program planning process, assessment principles and approaches can help to guide managers toward implementation strategies with the greatest opportunity for long-term success.

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2. Program Effectiveness Assessment Approach and Development

This PEAIP was developed to implement a focused evaluation of priority program elements and BMPs, ensuring that they are well-targeted and determining whether intended results are being achieved.

Stormwater program management[7] can be described by a cycle divided into three phases of activity (**Figure 1**):

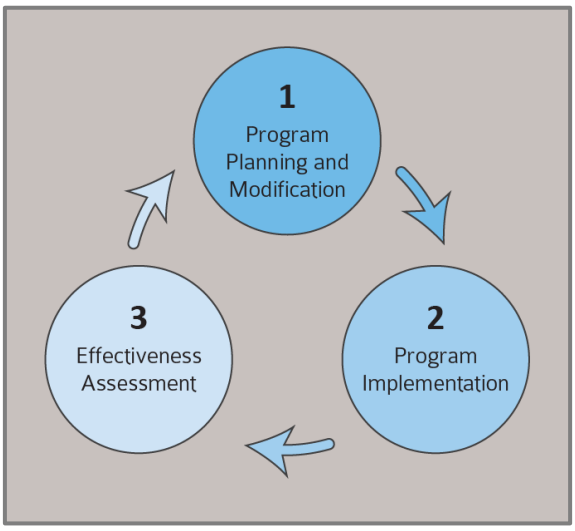

Figure 1. The Program Management Cycle (CASQA, 2015)

- Program Planning and Modification – In this phase, the COB and COS is identifying the critical components and POCs for its stormwater program, as well as developing an EA approach and associated management questions to assist in determining if the program is achieving the intended results.
- Program Implementation – In this phase, the COB and COS is implementing the program and obtaining the assessment data needed to answer the management questions.
- Effectiveness Assessment – In this phase, the COB and COS is conducting EAs, reviewing the results, and determining if any program modifications are necessary. This is typically conducted as a part of the Annual Reports and/or Report of Waste Discharge, but may also be a part of other regulatory requirements such as 303(d) Monitoring or Total Maximum Daily Loads (TMDLs) when proposed or established. Once identified, the COB and COS can make the program modifications and initiate the next round of implementation, leading again to renewed assessment and planning (see **Section 5**).

This process is applied repeatedly over time in order to focus the stormwater program in on the most effective BMPs and the achievement of the desired results.

The CASQA EA approach[8] utilizes a general model that aggregates three primary components from the six outcome levels and associated, general outcome types (**Figure 2**). The three primary components are:

[7] See 2015 CASQA Guidance Document, Section 3.0: Introduction to Strategic Planning for Stormwater Management Programs

[8] See 2015 CASQA Guidance Document, Section 2.0: Stormwater Management Approach

- Sources and Impacts (Outcome Levels 4-6) – This component addresses the generation, transport, and fate of urban runoff pollutants. It includes sources (sites, facilities, areas, etc.), stormwater conveyance systems, and the water bodies that ultimately receive the source discharges (receiving waters). This component is typically assessed on a long-term basis.
- Target Audiences (Outcome Levels 2-3) – This component focuses on understanding the behaviors of the people responsible for source contributions. It explores the factors that determine existing behavioral patterns and looks for ways to replace polluting behaviors with non-polluting behaviors. This component is typically assessed on a short- and/or long-term basis.
- Stormwater Programs (Outcome Level 1) – Stormwater programs are the road map for the improvements that managers wish to attain in receiving waters. Their immediate purpose is to describe programs that will facilitate changes in the behaviors of key target audiences. This component is typically assessed on a short-term basis.

The six categories of outcome levels establish a logical and consistent organizational scheme for assessing and relating individual outcomes.

This PEAIP will focus primarily on the Target Audiences (Outcome Levels 2 and 3) and the Sources and Impacts (Outcome Level 4 and 5) and will provide a plan to collect data that can be used to improve the stormwater program and protect water quality. Assessment at Outcome Level 6 may be undertaken once program implementation has progressed to a point that improvements in outfall and receiving water quality are statistically significant. The timeframe for this level of change to be realized will vary based on a variety of factors.

The approach to be used for each of the outcome levels is described in more detail within this section.

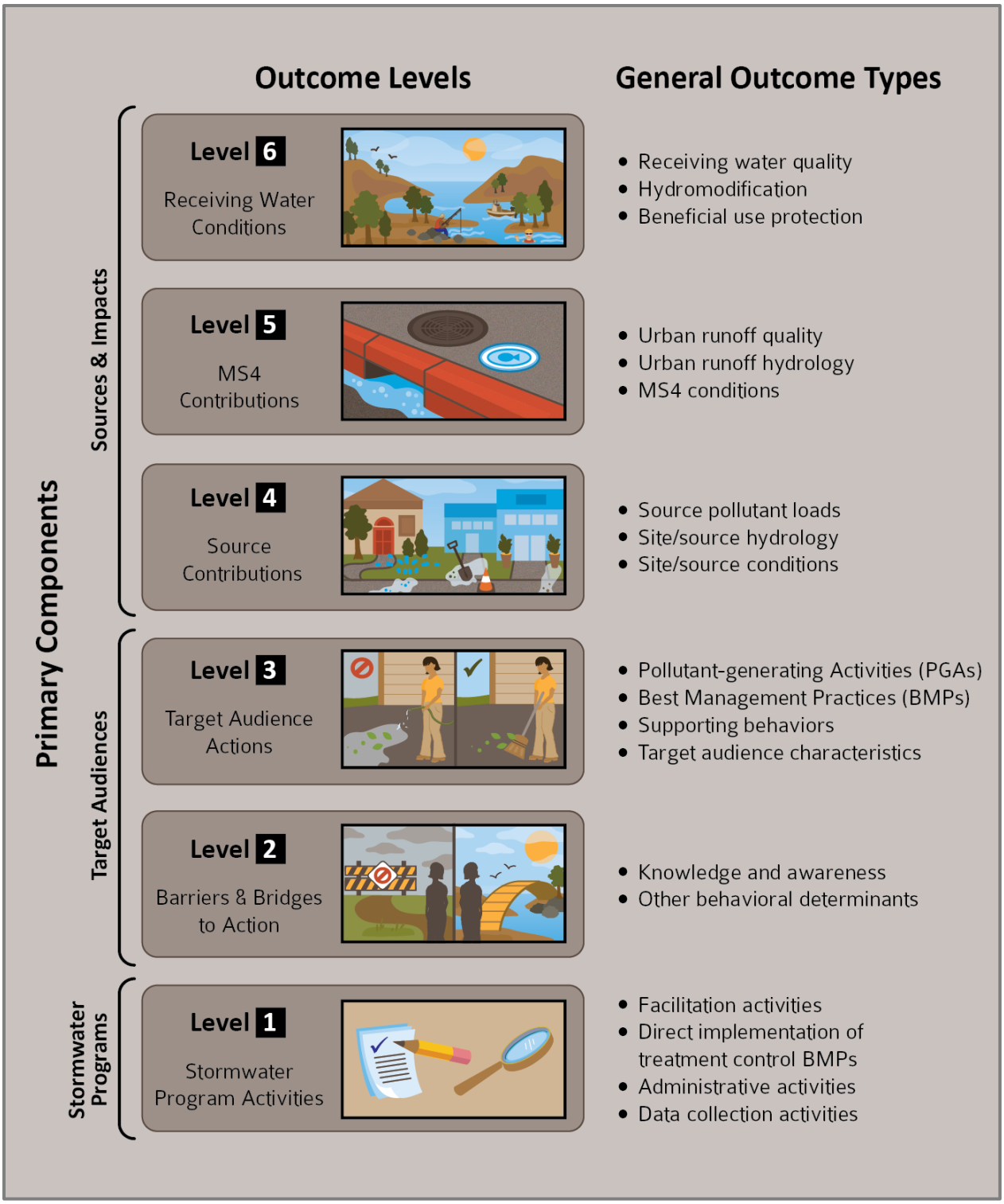

Figure 2. General Stormwater Management Model (CASQA, 2015)

2.1. IDENTIFICATION OF SOURCES AND IMPACTS[9]

2.1.1. Receiving Water Conditions (Outcome Level 6)[10]

One of the primary objectives of the stormwater program is the protection of the beneficial uses of the receiving waters. The Phase II Permit recognizes that there is a need to conduct the EA based on prioritized POCs. The number of POCs ultimately selected may be determined by established TMDLs, other known pollutants present in 303(d) listed waterbodies and/or regional issues identified by COB and COS.

This PEAIP will focus on high- and medium POCs (see **Section 2.1.2**) and will, over time and to the extent feasible, assess protection of the beneficial uses of the receiving waters through attainment of the water quality objectives (WQO's).

Although Outcome Level 6 assessments (i.e. instream monitoring of receiving water conditions) may occur in future as a part of this effort or as part of a regional effort, COB and COS used current receiving water conditions to focus this PEAIP, and in the selection of key metrics to assess the effectiveness of the stormwater program.

In order to identify the POCs for the PEAIP, the COB and COS reviewed the a) proposed TMDLs by the Central Coast Regional Water Quality Control Board, b) 2010 303(d) List of Impaired Waterbodies, c) Central Coast Regional Water Quality Control Board (CCRWQCB) April 24th, 2014 Consultation Handout "Solvang – Buellton Urban Water Quality Profile", d) Central Coast Ambient Monitoring Program's (CCAMP) Ambient Water Quality Data, e) COB and COS Storm Water Management Plan's (SWMP) Guidance Document's List of POCs, and f) proposed regional Urban Storm Water Monitoring Plan. Best professional judgment, knowledge of local and/or regional water quality issues and common urban pollutants were also factors in the identification of POCs and summarized in Attachment B. The category of receiving water impairment that was identified and considered to be for prioritization is in **Appendix B** and summarized and ranked below in **Figure 3**.

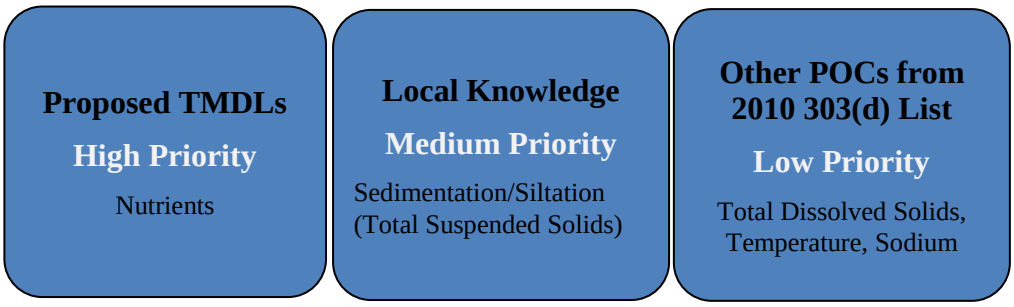

Figure 3. Prioritized POCs for the PEAIP

[9] See 2015 CASQA Guidance Document, Section 4.0: Source and Impact Strategies

[10] See 2015 CASQA Guidance Document, Section 4.2 Outcome Level 6: Receiving Water Conditions.

The highest priority POC was selected because of the proposed TMDL under development by the Central Coast Regional Water Quality Control Board and in consideration of known steelhead habitat sensitivity. Medium-priority POCs continue to be addressed through implementation of the stormwater management program / Guidance Document. Low-priority POCs are also addressed through the stormwater management program, although urban runoff contributions are considered minor, and will not be addressed in this PEAIP.

2.1.2. Urban Runoff and MS4 Contributions (Outcome Level 5)[11]

Level 5 Outcomes may be measured either within the MS4 or within discharges from the MS4. In either case, evaluation typically focuses on pollutant concentrations or loads, or both. Level 5 Outcomes provide a direct linkage between upstream sources and receiving waters and, as such, are a critical expression of stormwater program success. However, due to the temporal and spatial variability of water quality data, it is extremely challenging and takes many years and a significant amount of data to establish linkages between pollutants in MS4 discharges and the conditions within the receiving waters.

The COB and COS used known urban runoff and MS4 contributions were used to focus the PEAIP and select the key metrics that will be used to assess the effectiveness of the stormwater programs The COB and COS will focus its evaluation of Outcome Level 5 on the high- and medium-priority POCs and by doing so will help direct the COB and COS's efforts and provide the basis for the management questions outlined in **Section 3**.

Since TMDLs will have a significant influence on the stormwater program, nutrients are considered to be a high-priority for this PEAIP.

As shown in Figure 3 above, the COB and COS recognizes other pollutants based on 303(d) listed water bodies where urban runoff has been listed as the source of the pollutant (Table 2). Other sources and factors contribute to these impairments. The 303(d) list does not attribute magnitude to any urban runoff.

Table 2. PERMITTEE-Listed Water Bodies

Watershed	Water Body[1]	Pollutant	Source Category
Santa Ynez (314)	Santa Ynez River	Sedimentation/Siltation	Agriculture Resource Extraction Urban Runoff / Storm Sewers
Santa Ynez (314)	Santa Ynez River	Sodium	Agriculture Flow Regulation / Modification Grazing-Related Sources Natural Sources Other Urban Runoff

[11] See 2015 CASQA Guidance Document, Section 4.3 Outcome Level 5: MS4 Conditions

Santa Ynez (314)	Santa Ynez River	Temperature, water	Agriculture Disturbed Sites (Land Develop.) Flow Regulation / Modification Grazing-Related Sources Other Urban Runoff
Santa Ynez (314)	Santa Ynez River	Total Dissolved Solids	Agriculture Municipal Point Sources Natural Sources Other Urban Runoff

Note:
1. 2010 303(d) List

Although nutrients and sediment were selected as the high- and medium-priority POCs, the COB and COS recognize the value of considering other pollutants listed on the 303(d) list as well as common urban pollutants. The COB and COS will continue to assess the 303(d) list to understand which TMDLs may be developed in the future and plan for them as needed. Professional judgment and knowledge of local and regional water quality issues will continue to be factors in the identification of priority POCs. Due to the large size of the watershed compared to the urbanized portion and the very small proportion of urban contribution compared to background, agricultural, and runoff affected by water supply-related flow regulation, these pollutants are currently considered a low priority urban source.

In time, the COB and COS will be able to evaluate the effectiveness of its stormwater program at Outcome Levels 5 using our stormwater discharge monitoring results for the selected POCs. Depending upon data availability, Outcome Level 5 may allow the COB and COS to quantify the pollutant concentrations and/or load reductions achieved by the stormwater program. Given the time and data necessary to assess these Outcome Levels, the COB and COS will incorporate these results into long-term effectiveness assessments.

The POCs identified for the PEAIP for specific COB and COS are summarized in **Table 3.**

Table 3. High- and Medium-Priority POCs[1]

Permittee	PEAIP Pollutants for Concern (POCs)	
	Nutrients	Sedimentation/Siltation (Total Suspended Solids)
COB	✓	✓
COS	✓	✓

Note:
1. This table is current as of June 17, 2015. It is dynamic and subject to change as new information is received.

The POC-specific shading shown in **Figure 4** is used throughout the remainder of the document to visually connect the various figures and tables.

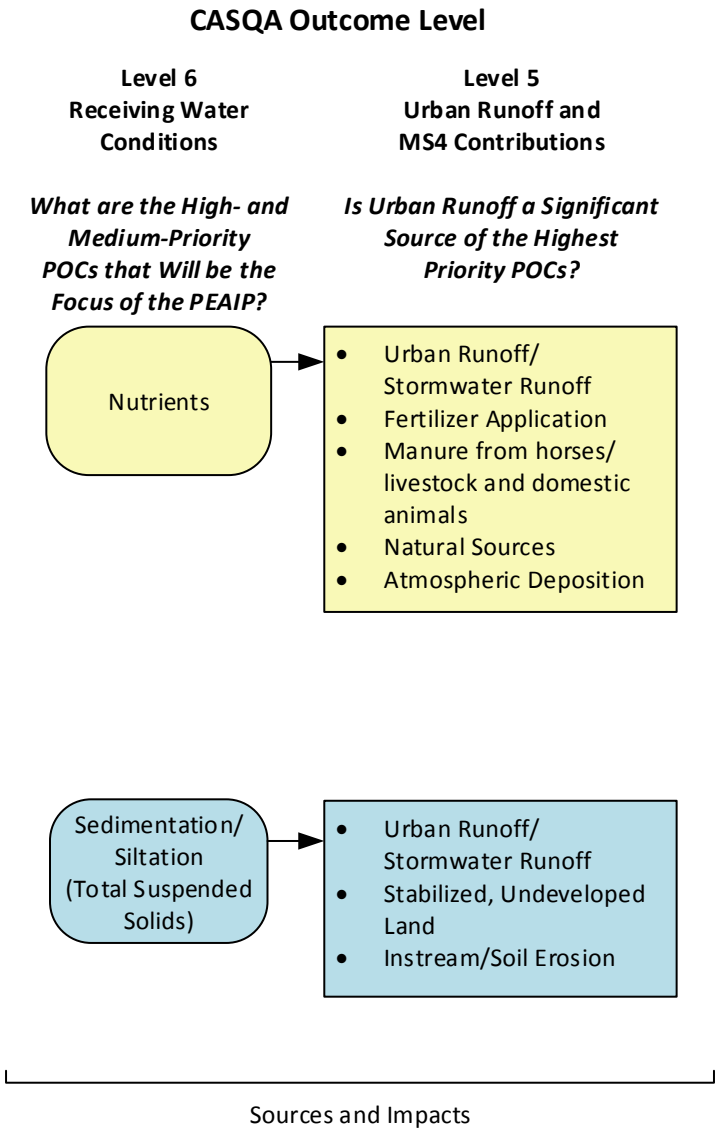

Figure 4. Sources of the High- and Medium-Priority POCs

2.1.3. Source Contributions (Outcome Level 4)[12]

Outcome Level 4 addresses urban sources and the discharges from them. A source is anything with the potential to generate pollutants prior to their introduction to the MS4. Source loadings are the pollutant loadings added by the urban sources to an MS4. Source reductions are the changes in the amounts of pollutants associated with specific sources before and after BMPs are employed. However, it is challenging to measure source loadings and/or reductions achieved by individual and/or groups of BMPs. As a result, the COB and COS will need to rely on direct measurements (where possible) and/or estimates of source reductions.

The COB and COS will focus its evaluation of Outcome Level 4 on the high- and medium-priority POC. Doing so will help direct the COB and COS's efforts and provide the basis for the management questions outlined in **Section 3**.

As management questions are developed, the COB and COS will consider the implementation requirements of future TMDLs, as well as best professional judgment. In order to determine the specific target audiences and the appropriate prioritized BMPs, the COB and COS has evaluated the POCs as they relate to urban land use to identify the primary urban runoff sources of each POC, as shown in **Figure** 5 **5**. The COB and COS expects assessment at this Outcome Level to be included in long-term EAs through a 303(d) water quality monitoring program.

The 303(d) water quality monitoring program will be conducted at two locations in urban areas of the Santa Ynez River watershed: Buellton and Solvang. Data will be incorporated into a pollutant load model to estimate average annual baseline pollutant loads -- from the full watersheds, the jurisdictional MS4 areas, and the storm drain system subcatchments -- using a static average-annual land use based spreadsheet calculation.

The model is a static spreadsheet approach that can estimate pollutant load reductions anticipated from BMPs during wet weather loading. Pollutants that can be modeled are: indicator bacteria, nutrients (total nitrogen, total phosphorus, nitrate, total kjeldahl nitrogen, dissolved phosphorus), metals (total copper, total lead, total zinc), and/or TSS. (Refer to the Geosyntec Consultants Modeling Approach Memorandum "Program Effectiveness Assessment and Improvement Plan Approach to Quantify Pollutant Loads and Pollutant Load Reductions dated October 12, 2015 that was submitted through the Storm Water Multiple Application and Report Tracking System Database).

[12] See 2015 CASQA Guidance Document, Section 4.4 Outcome Level 4: Source Contributions

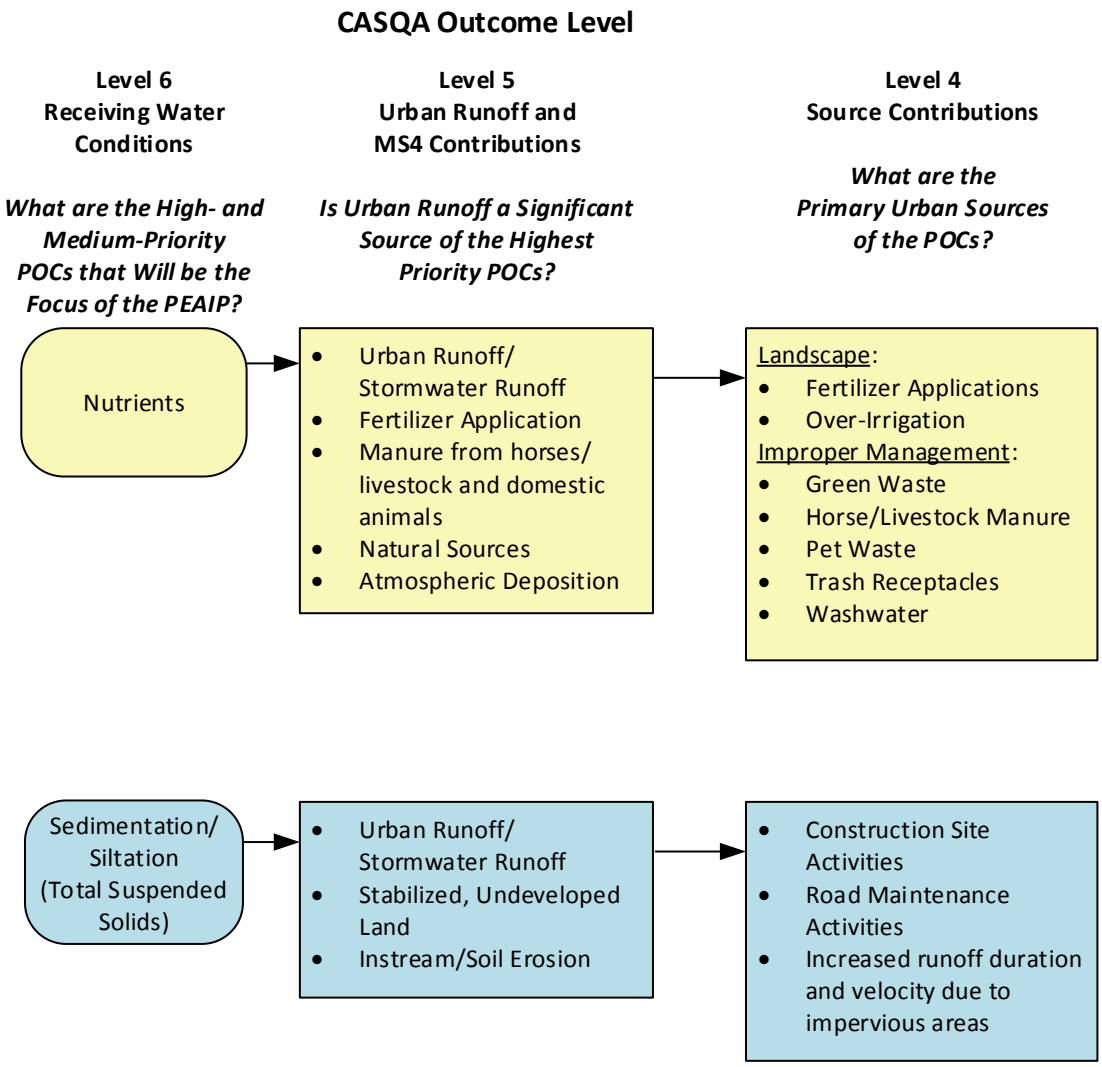

Figure 5. Primary Urban Sources of the High- and Medium-Priority POCs

2.2. IDENTIFICATION OF THE KEY TARGET AUDIENCES (OUTCOME LEVELS 2 AND 3)[13]

This component focuses on the actions of target audiences and the factors that influence them. Target audiences are the individuals and populations that a stormwater program is directed to and may include, but are not limited to, municipal employees, contractors, and the general public. Because source reductions can only be achieved by the people responsible for pollutant loadings, a successful program will be one that is able to induce positive behavioral changes in the target audiences.

Although Outcome Levels 3 (Target Audience Actions) and 2 (Barriers and Bridges to Action) are closely related, they are distinct outcome levels.

- Outcome Level 3 focuses on the identification of target audiences associated with the primary sources of high- and medium priority POCs, as well as the behavioral patterns of these target audiences, with the goal of assessing *behavior change* over time.
- Outcome Level 2 focuses on identification of the factors that influence target audience behaviors, with the goal of using these factors to develop strategies to increase target audience *awareness* of the need to reduce pollutant-generating activities (PGAs) and implement prioritized BMPs. Level 2 Outcomes are often used to gauge progress in, or to refine approaches for, achieving Level 3 Outcomes (see **Section 2.2.2**).

[13] See 2015 CASQA Guidance Document, Section 5.0: Target Audience Strategies

2.2.1. Target Audience Actions (Outcome Level 3)[14]

Level 3 Outcomes address the actions of target audiences and whether or not changes are occurring within these target audiences over time. The major categories of target audience actions are:

- PGAs – behaviors that contribute pollutants to urban runoff (e.g., pressure washing without containment, improper pet waste disposal, spills during materials loading and unloading)
- BMPs – activities or other controls that are implemented to reduce or eliminate discharges of pollutants (e.g., integrated pest management (IPM) practices, implementation of secondary containment)
- Supporting behaviors – include a wide range of potential actions that are distinct from BMP implementation but help support the implementation (e.g., pollution incident reporting, public involvement)

The COB and COS will focus its evaluation of Outcome Level 3 on the actions of target audiences for the high- and medium-priority POCs. The COB and COS has identified the critical target audience(s) for the specific urban runoff source(s) of each high- and medium-priority POC (**Figure 6**), along with management questions that delineate the critical target audience actions (**Section 3**).

The COB and COS will evaluate the effectiveness of its stormwater program at Outcome Level 3 by using the management questions to guide its assessment of target audience implementation of BMPs and reduction of PGAs. It is expected that assessment at this outcome level will be included in the short- and long-term EAs.

[14] See 2015 CASQA Guidance Document, Section 5.2 Outcome Level 3: Target Audience Actions

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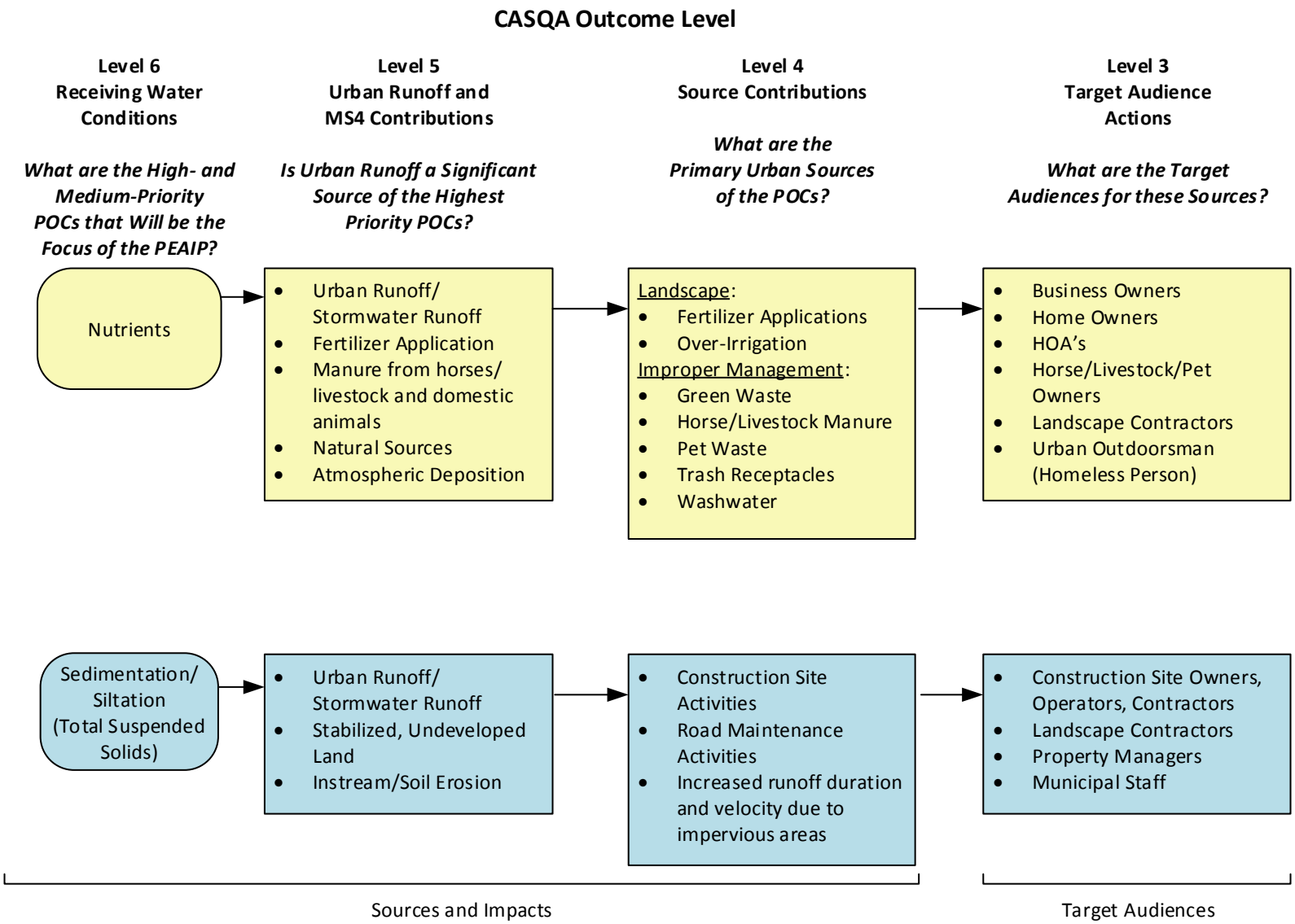

Figure 6. Target Audiences Identified for Urban Runoff Source Contributions of POCs

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2.2.2. Barriers and Bridges to Action (Outcome Level 2)[15]

Outcome Level 2 is critical because it forms the basis for achieving desired behavioral changes and provides a means of gauging progress toward achievement. The term "barriers and bridges" refers to the fact that there are factors that may aid or inhibit a desired behavior and that these need to be understood in order to affect the desired change. The targeted audience won't behave differently unless they understand the problem and are motivated and able to change.

Outcome Level 2 provides a means of gauging whether the prioritized activities (e.g., outreach, municipal staff training) are producing changes in the behavior of the target audiences through increased knowledge, awareness, and changes in attitudes. Examples of Outcome Level 2 range from awareness of basic concepts (e.g., why stormwater pollution is a problem; the difference between storm drains and the sanitary sewer) to specific knowledge (e.g., how to properly dispose of pet waste; how to properly install and maintain a silt fence).

Outcome Level 2 provides a means to gauge progress in, or to refine approaches for, achieving Outcome Level 3. That is, an understanding of whether awareness, knowledge, and/or attitudes have changed will allow the identification of barriers and bridges that may be influencing the desired target audience behavior.

The COB and COS will work to identify barriers and bridges that may be influencing target audience behavior. The COB and COS will assess Outcome Level 2 on an as-needed basis as part of the adaptive management process (**Figure 7**). The COB and COS expects assessment at this Outcome Level to be included in short- and long-term EAs.

[15] See 2015 CASQA Guidance Document, Section 5.3 Outcome Level 2: Barriers and Bridges to Action

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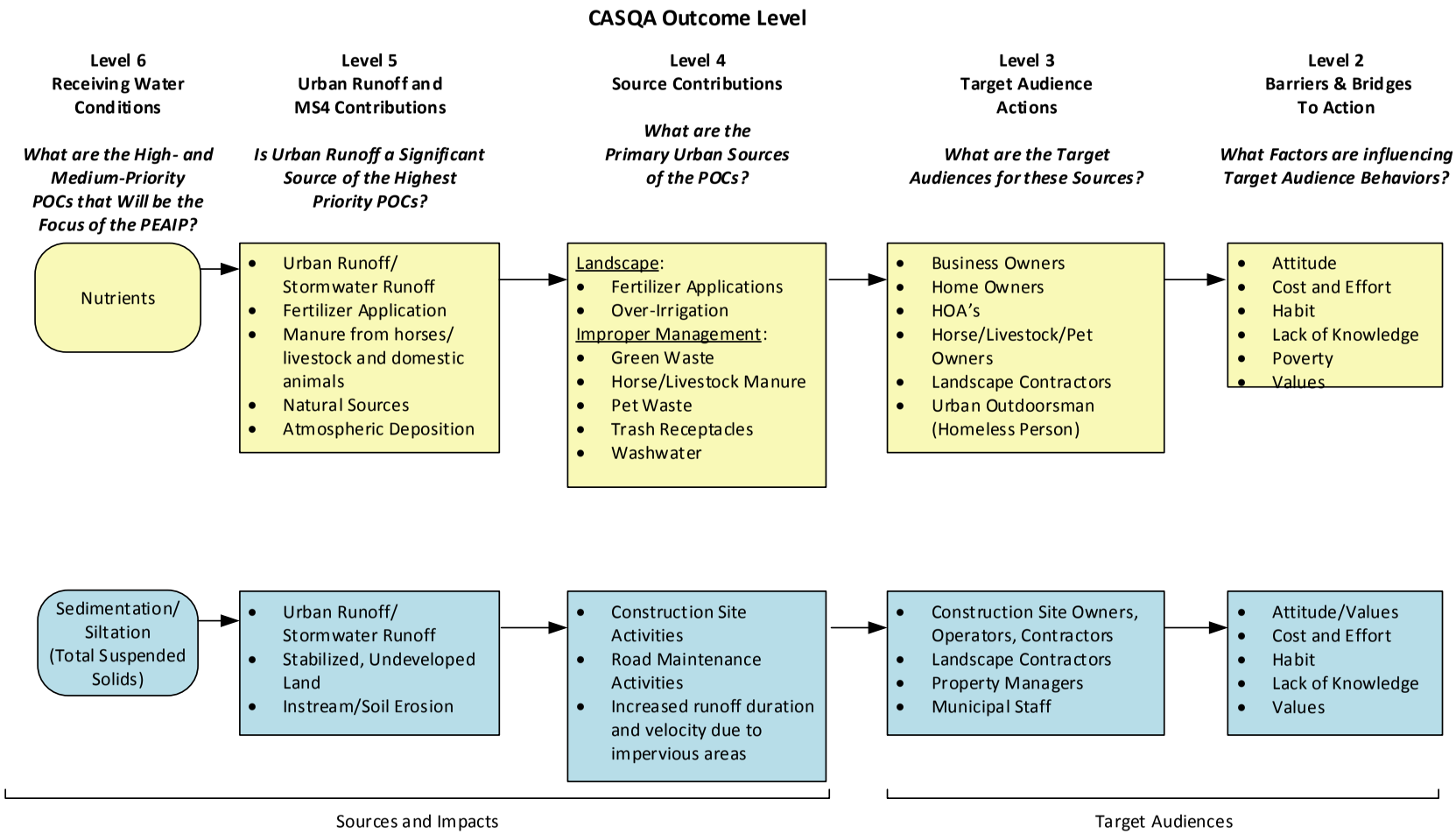

Figure 7. Assessment of Barriers and Bridges to Action

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2.3. IDENTIFICATION OF THE STORMWATER PROGRAM ACTIVITIES (OUTCOME LEVEL 1) [16]

Level 1 Outcomes focus on the various activities that are conducted within a program. Examples of these activities include providing education to residents, inspecting businesses, conducting surveys of target audiences, and conducting monitoring. Outcome Level 1 only measures the *implementation* of the stormwater program, rather than the *impact* of the program is having. The EAs will focus on the impact of the stormwater program by assessing Outcome Levels 2 through 5 as they relate to the high- and medium-priority POCs.

Based on the identification of the high- and medium-priority POCs and their potential sources, target audiences, and key implementation activities (prioritized BMPs), the COB and COS has identified the Program Elements for which the implementation of prioritized BMPs will be assessed (**Table 4**).

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The COB and COs used this as the basis for both the management questions (see **Section 3**) and the identification of prioritized BMPs, or key implementation activities, for specific target audiences.

[16] See 2015 CASQA Guidance Document, Section 6.0 Program Implementation Strategies and Section 6.2 Step 1-A: Program Implementation Activities

Table 4. Program Elements for Which Prioritized BMPs Will Be Assessed through the Identified Management Questions

Program Element	Phase II Permit Provision(s)	Pollutants of Concern (POCs)	
		Nutrients	Sedimentation/Siltation (Total Suspended Solids)
Education and Outreach	E.7	✓	✓
Public Involvement and Participation	E.8	✓	✓
Illicit Discharge Detection and Elimination (IDDE)	E.9	✓	✓
Construction Site Stormwater Runoff Control	E.10	--	✓
Pollution Prevention/Good Housekeeping	E.11	✓	✓
Post Construction Stormwater Management	E.12	--	✓
Water Quality Monitoring	E.13	✓	✓

For each high- and medium-priority POC, a summary of prioritized BMPs for the identified target audiences is provided in **Figure 8**. More detail is provided within the management questions (**Section 3**), as well as the data assessment and collection table(s) within **Section 4**.

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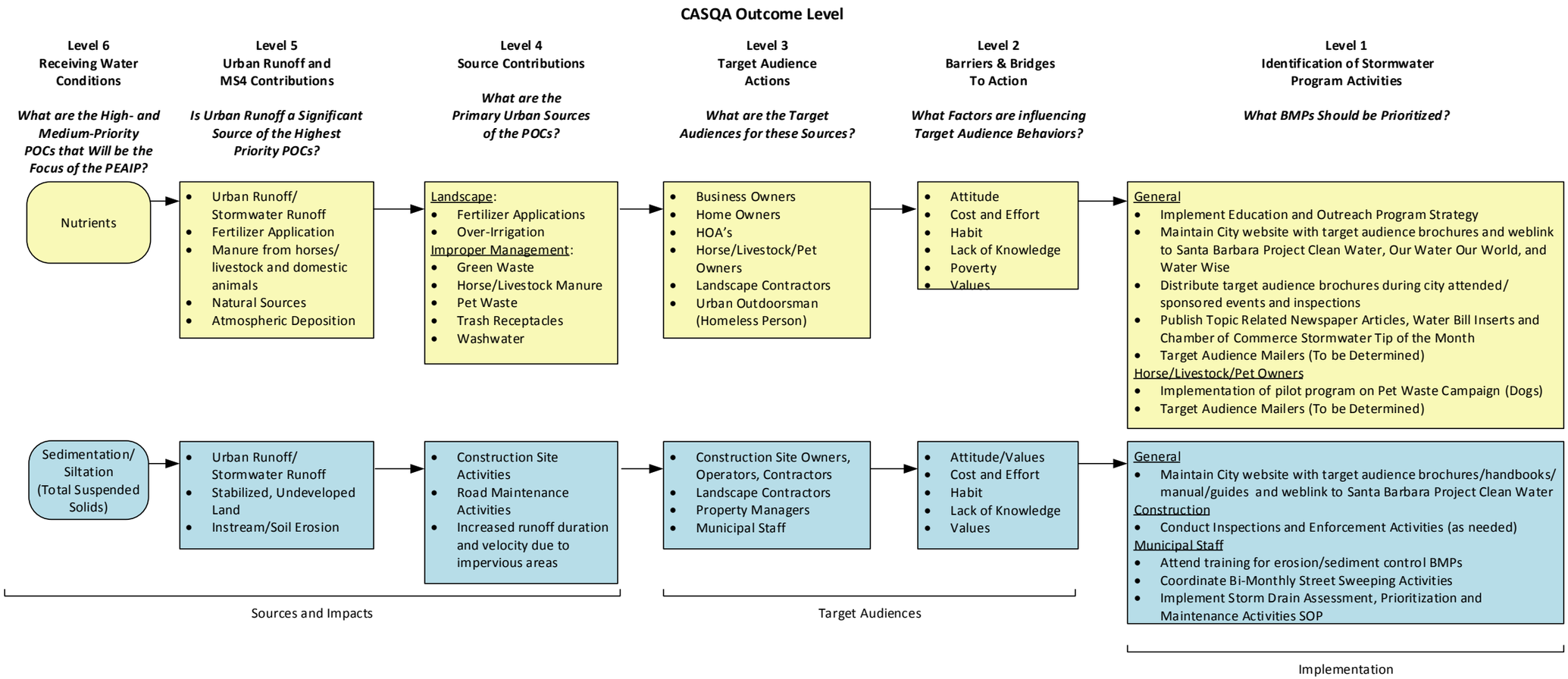

Figure 8. Prioritized BMPs Identified for Target Audiences

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3. Management Questions[17]

In order to focus the EAs, the COB and COS has identified management questions for the prioritized BMPs that may be implemented to address the high- and medium-priority POCs.

The assessment data and information collected by the COB and COS (**Section 4**) are focused on Outcome Levels 2 through 5 and will be used to answer programmatic-based management questions related to the prioritized BMPs.

Pursuant to Provision E.14(a)(ii)(e-f), the types of questions that were considered for this PEAIP include the following:[18]

- To what extent did implementation of the BMPs, group of BMPs, or stormwater program enhance or change the urban runoff and discharge quality?[19] [OL5]
- To what extent did prioritized BMPs or group of BMPs reduce pollutant loads from their sources to the storm drain system?[20] [OL4]
- To what extent did prioritized BMPs or group of BMPs change the target audience's behavior?[21] [OL3]
- What barriers or bridges are influencing or could influence the target audience's ability or desire to implement the prioritized BMPs or group of BMPs? [OL2]

Section 4 summarizes the management questions and CASQA Outcome Level(s) addressed.

[17] See 2015 CASQA Guidance Document, Section 7.3 Assessment Objectives, Attachment B: Sources and Activities Profile Sheets, and Attachment C: Pollutant Profile Sheets

[18] The PEAIP is focused on the *impact* that the stormwater program is having rather than the strict *implementation* of the program. Thus, the question listed in Provision E.14.a.(ii)(e)(1) regarding implementation of the Permit requirements is not included in the PEAIP.

[19] E.14.a.(ii)(f)(1)

[20] E.14.a.(ii)(e)(3)

[21] E.14.a.(ii)(e)(2)

4. Data Assessment and Collection

4.1. DATA ASSESSMENT METHODS[22]

During the EA process, the data collected will be assessed and/or analyzed using a variety of methods, such as:

- **Qualitative assessment** includes confirmation that an activity (e.g., construction site inspections) was conducted and/or that a specific task (e.g., completion of a pet waste brochure) was completed, as well as narrative assessment.
- **Descriptive statistics** are numbers that are used to summarize and describe data. Several descriptive statistics are often used at one time, to give a full picture of the data. Examples of descriptive statistics are counts (includes quantification and tabulation), averages, variance, etc. Other information includes: direct quantitative measurements of pollutant load removal, estimates of pollutant load removal for BMPs where direct measurement of pollutant removal is overly challenging, and direct quantitative measurement of behaviors that serve as proxies of pollutant removal or reduction.
- **Comparisons to established reference points** involve comparing collected data to established targets (targeted outcomes, discharge prohibitions, WQOs, required activity levels, etc.) or other reference points (other programs, previous results, baseline values, visual comparison using photographs over time, etc.].
- **Temporal change** is change over time. This includes variability, trends, and changes due to program implementation (e.g., simple change [absolute or %] or statistical trends).
- **Spatial analysis** allows comparisons between watersheds or other geographic areas. Impacts of runoff and/or control measures can be evaluated based on characteristics of the geographic regions (differences in land use, geology and geomorphology, hydromorphology, etc.).

[22] See 2015 CASQA Guidance Document, 6.3 Step 1-B Data Collection and Analysis Activities and 7.5 Data Analysis

4.2. DATA COLLECTION METHODS[23]

The assessment data will be collected through various means such as:

- **Internal Tracking by Stormwater Program** of internal program data only (e.g., inspection data, public outreach and education efforts)
- **Reporting to Stormwater Program** by third parties only (e.g., BMP maintenance certifications, industrial facility monitoring data)[24]
- **Site Investigations/Inspections** conducted by stormwater programs to directly observe or assess a practice (e.g., inspections, site visits, complaint investigations)
- **Interviews** conducted by stormwater programs to discern awareness and behavior (e.g., of third parties or stormwater program staff, municipal staff, public focus groups)
- **Surveying** by stormwater programs of third parties or stormwater program staff to discern knowledge, attitudes, awareness, behavior of a target audience (e.g., pre-/post-training surveys, public outreach surveys)
- **Monitoring and Sampling** data obtained directly by stormwater programs or contractors (e.g., receiving water or MS4 sampling, industrial facility visual observations during inspections)
- **Review of External Data Sources** by stormwater program staff (e.g., of data or information obtained via literature, the Regional Water Board, other regulatory programs, online databases, third parties)
- **Special Investigations** can encompass any of the categories above, but normally involve a more intensive one-time focus.

[23] See 2015 CASQA Guidance Document, 6.3 Step 1-B Data Collection and Analysis Activities, 7.4 Data Collection, Attachment B: Sources and Activities Profile Sheets, and Attachment C: Pollutant Profile Sheets

[24] The Phase II Permit requires Permittees to identify assessment methods for privately owned BMPs. At this time, the PERMITTEE does not anticipate that these types of BMPs (e.g., structural, treatment control) will need to be evaluated for the high priority POCs that have been identified.

4.3. DATA REQUIREMENTS FOR SELECTED METRICS AND OUTCOME LEVELS

In the table(s) below, the POC-specific management questions representing focused program activities and/or prioritized BMPs are presented by Program Element, along with the assessment methods that will be used during the EA process and the associated assessment data that should be collected for evaluation (**Table 5**). The CASQA outcome levels that may be supported by the EA results are also indicated. Where applicable, the units for the required data are specified.

Although **Table 5** identifies the management questions, data assessment methods, and data collection methods that will initially be used for the EAs, future PEAIPs may modify and/or incorporate other management questions or data assessment/collection methods based on the information gained from the implementation of the PEAIP. Any modifications to the PEAIP will be identified as a part of the Annual Reports.

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Table 5. Nutrients Questions, Data Assessment Methods, and Data Collection Methods, by Program Element

Management Questions	Data Assessment Methods	Data Collection Methods
Education and Outreach [Outcome Level 2-3]		
• Has the City developed education and outreach materials with information regarding proper use and disposal of fertilizers? • Are education and outreach materials being provide at City designated facilities, City sponsored events or thru City website? • Are education and outreach materials available on the City's website? • Is education and outreach materials available during Fats, Oil and Grease (FOG) and/or Industrial Wastewater Discharge (IWD) Inspections?	Descriptive Statistics • Number of education and outreach events participated in and estimated of materials distributed at City designated facilities, City's sponsored event's Stormwater Display Booth or thru City website • Number of education and outreach materials provided during FOG and/or IWD Inspections	Internal Tracking by Stormwater Program • Brochure Distribution at City designated facilities, City sponsored events or thru City website • City SWMP File Views/Hits • Number of Visitors to the City's sponsored event's Stormwater Display Booth Review of External Data Sources • Brochure Distribution during FOG and/or IWD Program Inspection
Public Involvement and Participation [Outcome Level 2-3]		
• Has the City developed opportunities for citizen participation City's sponsored event's Stormwater Display Booth? • Has the City developed opportunities for citizen participation on-line thru the City's Stormwater Webpage or Survey Monkey?	Qualitative Assessment • Confirmation of Stormwater Pollution Prevention Interested Parties Sign-Up List at City's sponsored event's Stormwater Display Booth Descriptive Statistics • Number of Visitors to the City's sponsored event's Stormwater Display Booth • Number of on-line Storm Water Management Program Survey's completed thru the City's Stormwater Webpage or Survey Monkey	Interviews/Surveys Internal Tracking by Stormwater Program • Number of Visitors to the City's sponsored event's Stormwater Display Booth • Number of Interested Parties Sign-ups • Number of Stormwater Survey's Completed via City Stormwater Website or Survey Monkey Review of External Data Sources • Number of Stormwater Survey's Completed via City Stormwater Website or Survey Monkey

Illicit Discharge Detection and Elimination [Outcome Level 4]		
• Has the City developed IDDE procedures? • Are FOG and IWD Program participants operating in a manner that prevents nutrients from leaving the site? • Are green waste and pet waste collection programs in place? • Does City have legal authority to address non-storm water discharges?	Qualitative Assessment • Confirmation of local waste hauler (green waste) and maintenance of City provided Mutt Mitt Stations. • Confirmation of on-going City Staff IDDE Training • Confirmations of establish City Municipal Code and Certification of Legal Authority Descriptive Statistics • Number of IDDE Investigations and/or Inspections and follow-up at facilities with deficiencies • Number of FOG and/or IWD Inspection Reports and/or Violations	Internal Tracking by Stormwater Program • Stormwater Incident Report Form • Mutt Mitt Station Maintenance Logs Site Investigations/Inspections • City IDDE Site Investigations and/or Inspections with direct observation of an IDDE Review of External Data Sources • FOG and/or IWD Inspection Reports and/or Violations • Local Hauler Green Waste Website/Mailers
Pollution Prevention and Good Housekeeping [Outcome Level 2-4]		
• Is City effectively implementing BMPs (e.g. Mutt Mitt Stations) that target nutrient reduction in waterways? • Are FOG and/or IWD Program participants implementing a Pollutant Prevention and Good Housekeeping practices • Are FOG and/or IWD Program participants aware of Cities SWMP requirements • Are FOG and/or IWD Program participants aware of SWMP requirements for their business activity	Qualitative Assessment • Confirmation of on-going City Staff Training • City Maintenance Logs Descriptive Statistics • Number of FOG and/or IWD Inspection Reports	Interviews/Surveying Review of External Data Sources • FOG and/or IWD Inspection Reports • FOG and/or IWD Inspection Report Stormwater Questionnaires

Water Quality Monitoring [Outcome Level 5]		
• Is the urban discharge a significant source of nitrates to receiving water?	Comparisons to established reference points • Comparing modeled data to established targets	Monitoring and Sampling results

Table 6. Sedimentation/Siltation (Total Suspended Solids) Questions, Data Assessment Methods, and Data Collection Methods, by Program Element

Management Questions	Data Assessment Methods	Data Collection Methods
Education and Outreach [Outcome Level 2-3]		
• Are City Grading Inspectors trained to review and inspect erosion and sediment control measures? • Are there educational and outreach materials being provided at City designated facilities, City's sponsored event or thru City website? • Are construction contractors informed of proper erosion and sediment control measures?	Qualitative Assessment • Confirmation of on-going City Grading Staff Training Descriptive Statistics • Number of education and outreach events participated in and estimated of materials distributed at City designated facilities, City's sponsored event or thru City website • Number of connections to construction contractors through grading permits and inspections	Internal tracking by stormwater program • Internal Tracking by City Engineering Department and/or Division • Brochure Distribution at City designated facilities, City sponsored events or thru City website
Illicit Discharge Detection and Elimination [Outcome Level 4]		
• Does City implement field investigation program for complaints and discoveries of illicit discharges? • Does City have legal authority to address non-storm water discharges?	Qualitative Assessment • Confirmation of on-going City Staff IDDE Training • Confirmations of establish City Municipal Code and Certification of Legal Authority Descriptive Statistics • Number of IDDE Investigations and/or Inspections and follow-up at facilities with deficiencies	Internal tracking by stormwater program • Stormwater Incident Report Form Site Investigations/Inspections • City IDDE Site Investigations and/or Inspections with direct observation of an IDDE

Management Questions	Data Assessment Methods	Data Collection Methods
Construction Site Stormwater Runoff Control [Outcome Level 2-3]		
• Are construction sites being managed in compliance with City Municipal Code? • Are Stormwater Pollution Prevention Plans (SWPPP), Erosion and Sediment Control Plans (E&SCP) and/or Stormwater Control Plans (SWCP) reviewed prior to permit issuance? • Are any sites a potential source of significant sediment discharge?	Descriptive Statistics • Number of Construction Sites issued Grading Permits • Number of SWPPP, E&SCP and SWCP reviewed prior to issuance of permit • Number of Construction Sites designated as a Water Quality Threat • Number Construction Site Inspections • Number of Verbal Warnings, Stop Work Order, Letter to Correct, Written Notice of Violation, Code Violations, Construction Bond, Penalties, Enforcement Actions (Administrative, Civil or Criminal Actions)	Internal tracking by stormwater program • SWPPP, E&SCP and SWCP • Construction Site Inspections • Construction Sites with Water Quality Threat • Verbal Warnings, Stop Work Order, Letter to Correct, Written Notice of Violation, Code Violations, Construction Bond, Penalties, Enforcement Actions (Administrative, Civil or Criminal Actions)
Post-Construction Site Stormwater Runoff Control [Outcome Level 2-3]		
• Is development being approved in compliance with Post-Construction Requirements (PCRs) and Low Impact Development (LID) Measures to promote runoff volume and rates?	Descriptive Statistics • Number of projects reviewed in compliance with PCRs and LID measures	Internal tracking by stormwater program • PCR and LID Projects
Pollution Prevention and Good Housekeeping [Outcome Level 2-3]		
• Are City facilities managed to reduce erosion and promote sediment retention?	Descriptive Statistics • Number of Pollution Prevention BMPs implemented at City owned and/or operated facilities	Internal tracking by stormwater program • Pollution Prevention and Good Housekeeping BMPs implemented at City owned and/or operated facilities

5. Program Reporting and Modifications[25]

Beginning in Year 3, the PEAIP will be implemented, and EAs will be conducted each year and submitted along with the Annual Report. The completion of EAs is part of the program management cycle (**Figure 9**) and will, over time, inform program modifications.

During the EA process, the COB and COS will evaluate, assess, and/or analyze data and information collected using the methods in **Section 4.1,** and address specific management questions in **Section 4.3**.

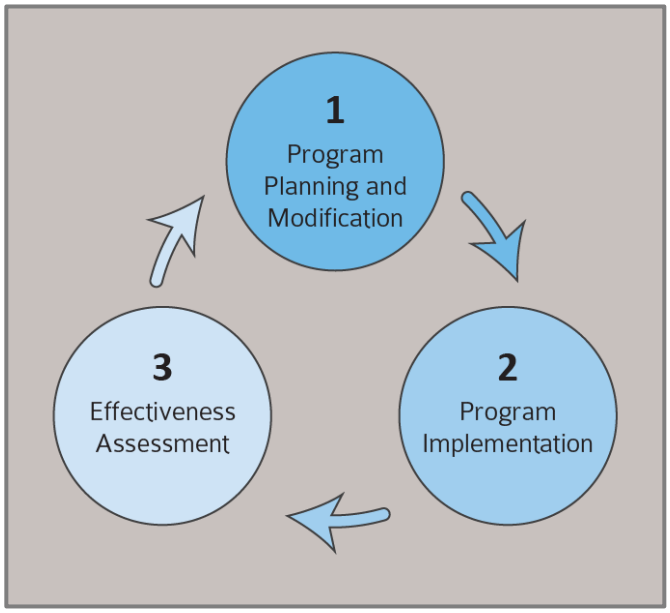

Figure 9. The Program Management Cycle (CASQA, 2015)

The EA may include both written and visual (i.e., tabular, graphical) depictions of the raw data (e.g., inspection data tracked internally by stormwater program) and the analyses that are conducted (e.g., descriptive statistics, qualitative analysis). The COB and COS will consider the results of the analyses along with the POC-specific management questions. Depending on the availability of historical data, the COB and COS expects more complex trends analyses to occur as part of the long-term EAs.

Beginning with the Annual

Beginning with the Annual Report in Year 5, in conjunction with the long-term EAs, the COB and COS will review the EAs and recommendations based on the experience of stormwater staff in implementing the program and identify areas for improvement. The management questions and data collection results will be reviewed and used as the basis for summarizing the short- and long-term progress of the stormwater program towards reducing the potential impacts of urban runoff on receiving waters. The COB and COS will identify modifications that may be necessary to improve program effectiveness at reducing pollutant loads, achieving the MEP standard, and protecting water quality.

The COB AND COS will provide a summary identifying the following types of modifications (as applicable):

[25] See 2015 CASQA Guidance Document, Section 7.0 Assessment Tools and Strategies, Section 7.2 Iterative and Adaptive Management, Section 7.3 Assessment Objectives, and Section 8.2 Program Modifications

- Improving upon the PEAIP by identification of any potential data gaps and/or revisions that may be necessary for the evaluation of the POC-specific management questions;
- Improving upon prioritized BMPs (i.e., key implementation activities) that have not been fully implemented and/or did not achieve the expected result;
- Continuing and expanding upon prioritized BMPs that proved to be effective, including identifying new prioritized BMPs or modifications to existing prioritized BMPs, with the goal of increasing pollutant load reductions;
- Discontinuing BMPs that may no longer be effective; and
- Based upon identification of bridges and barriers, changes in how the COB AND COS intends to provide outreach to target audiences in order to reduce PGAs and increase implementation of prioritized BMPs.

The COB and COS will provide the summary of program modifications with the Year 5 Annual Report and include the identified priority program areas and the schedule to complete the identified modifications during the next permit term. By conducting these assessments and modifying the program as needed, the COB and COS will ensure utilization of the program management cycle.

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List of Appendices

APPENDIX A: GLOSSARY OF TERMS

APPENDIX B: PEAIP IDENTIFICATION OF POLLUTANTS OF CONCERN (POCS)

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Appendix A: Glossary of Terms[26]

Adaptive Management: Adaptive Management is a structured process of directing decision-making with an aim toward achieving identified goals or milestones and addressing/reducing uncertainty over time.

Assessment Methods: Assessment Methods are processes used to obtain or evaluate assessment data or information. Depending on the particular outcome and/or management questions, numerous assessment methods may be used.

Best Management Practice (BMP): Defined in 40 CFR 122.2 as schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce pollutants discharged to waters of the United States.

California Stormwater Quality Association (CASQA): Since 1989 CASQA has been a leader in the stormwater field. CASQA represents a diverse range of stormwater quality management organizations and individuals, including cities, counties, special districts, industries, and consulting firms throughout the state. The Effectiveness Assessment Subcommittee has provided input and guidance on stormwater program effectiveness assessment issues since 2004; developing a standardized conceptual approach to evaluating municipal program elements in 2007 and updating that approach in 2015.

Effectiveness Assessment (EA): Effectiveness Assessment includes the methods and activities that stormwater managers use to evaluate how well their programs are working, and to identify modifications necessary to improve them. EA is the mechanism by which feedback is evaluated to enable ongoing adaptive management.

Program Management Cycle: The Program Management Cycle broadly divides stormwater program management into three phases:

1. Program planning and modification;
2. Program implementation; and
3. Effectiveness assessment.

Over time, the repeated application of this process—each phase continuously informing the next—should result in the improvement of stormwater programs and the achievement of the desired results that they are designed to achieve.

Maximum Extent Practicable (MEP): The technology-based standard established by Congress in CWA section 402(p)(3)(B)(iii) for storm water that operators of MS4s must meet. Technology-based standards establish the level of pollutant reductions that dischargers must achieve, typically by treatment or by a combination of source and/or treatment control BMPs. MEP primarily emphasizes pollution prevention and source control BMPs (as the first line of defense) in combination with treatment methods serving as a backup (additional line of defense). MEP considers economics and is generally, but not necessarily, less stringent than best available technology or best available. A definition for MEP is not provided either in the statute or in the regulations. Instead the definition of MEP is dynamic and will be defined by the following

[26] The Glossary of Terms is primarily based on the Glossary of Acronyms and Terms in the *Strategic Approach to Planning for and Assessing the Effectiveness of Stormwater Programs*, CASQA 2015

process over time: municipalities propose their definition of MEP by way of the programs set forth in their stormwater management plans/programs. Their total collective and individual activities conducted pursuant to the runoff management programs becomes the proposal for MEP as it applies both to overall effort, as well as to specific activities (e.g., MEP for street sweeping, or MEP for MS4 maintenance).

In the absence of a definition, the State Water Resources Control Board defined MEP as set forth in a memo dated 11 February 1993, entitled "Definition of Maximum Extent Practicable," Elizabeth Jennings, Senior Staff Counsel.[27]

Municipal Separate Storm Sewer System (MS4)[28]: An MS4 is a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) that is:

- Owned by a state, city, town, village, or other public entity that discharges to waters of the U.S.;
- Designed or used to collect or convey stormwater;
- Not a combined sewer; and
- Not part of a Publicly Owned Treatment Works (POTW) (sewage treatment plant).

Outcome Level: The CASQA approach utilizes a series of six categories of outcomes to establish a logical and consistent organizational scheme for assessing and relating individual outcomes. The outcome levels represent a general progression of conditions that are assumed to be related in a sequence of causal relationships.

- **Outcome Level 6 (Receiving Water Conditions):** Level 6 Outcomes describe receiving water conditions. They can apply either to existing conditions or to improvements that will be sought over time through program implementation.
- **Outcome Level 5 (MS4 Contributions):** Level 5 Outcomes may be measured within the MS4, or as discharges from it. Evaluation typically focuses on pollutant concentrations and/or loads. Level 5 Outcomes provide a direct linkage between upstream sources and receiving waters and are a critical expression of program success.
- **Outcome Level 4 (Source Contributions):** Level 4 Outcomes measure reductions in the discharge of pollutants from sources.
- **Outcome Level 3 (Target Audience Actions):** Level 3 Outcomes address the actions of target audiences, and whether or not changes are occurring over time. The major categories of target audience actions are pollutant-generating activities (PGAs); best management practices (BMPs) and supporting behaviors.
- **Outcome Level 2 (Barriers and Bridges to Action):** Level 2 Outcomes provide a means of gauging whether activities are producing changes in the awareness, knowledge, or attitudes of target audiences. Level 2 Outcomes are often used to gauge progress in, or to refine approaches for, achieving Level 3 Outcomes.

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[27] http://www.swrcb.ca.gov/water_issues/programs/stormwater/docs/def_mep_bj_21193.pdf

[28] Based on the definition in Title 40 Code of Federal Regulations §122.26 (b)(8)

- **Outcome Level 1 (Stormwater Program Activities):** Level 1 Outcomes, which are often defined by specific stormwater permit requirements, address a variety of stormwater program activities. This outcome level measures the *implementation* of the program, not the *impact* that the stormwater program is having.

Phase II MS4 Permit: The Phase II Permit, issued in 1999, requires regulated small MS4s in urbanized areas, as well as small MS4s outside the urbanized areas that are designated by the permitting authority, to obtain NPDES permit coverage for their stormwater discharges. Each regulated MS4 is required to develop and implement a stormwater management program/approach to reduce and/or eliminate the discharge of pollutants from the MS4 to the maximum extent practicable (MEP) and effectively prohibit discharges of non-stormwater into its MS4, unless such discharges are authorized.

Pollutant of Concern (POC): A pollutant that is reasonably expected to be present in urban runoff and may reasonably be expected to affect the designated uses of the receiving water. Urban runoff pollutants of concern may include sediments, non-sediment solids, nutrients, pathogens, oxygen-demanding substances, petroleum hydrocarbons, heavy metals, floatables, polycyclic aromatic hydrocarbons (PAHs), trash, and/or pesticides and herbicides.

Program Element: Program Elements are distinct components of a stormwater program that focus on reducing pollutants from a particular activity or pollutant source/target audience. The Program Elements for the Phase II municipal stormwater program include the following:

- Program Management
- Education and Outreach
- Public Involvement and Participation
- Illicit Discharge Detection and Elimination
- Construction
- Pollution Prevention/Good Housekeeping
- Post Construction
- Water Quality Monitoring

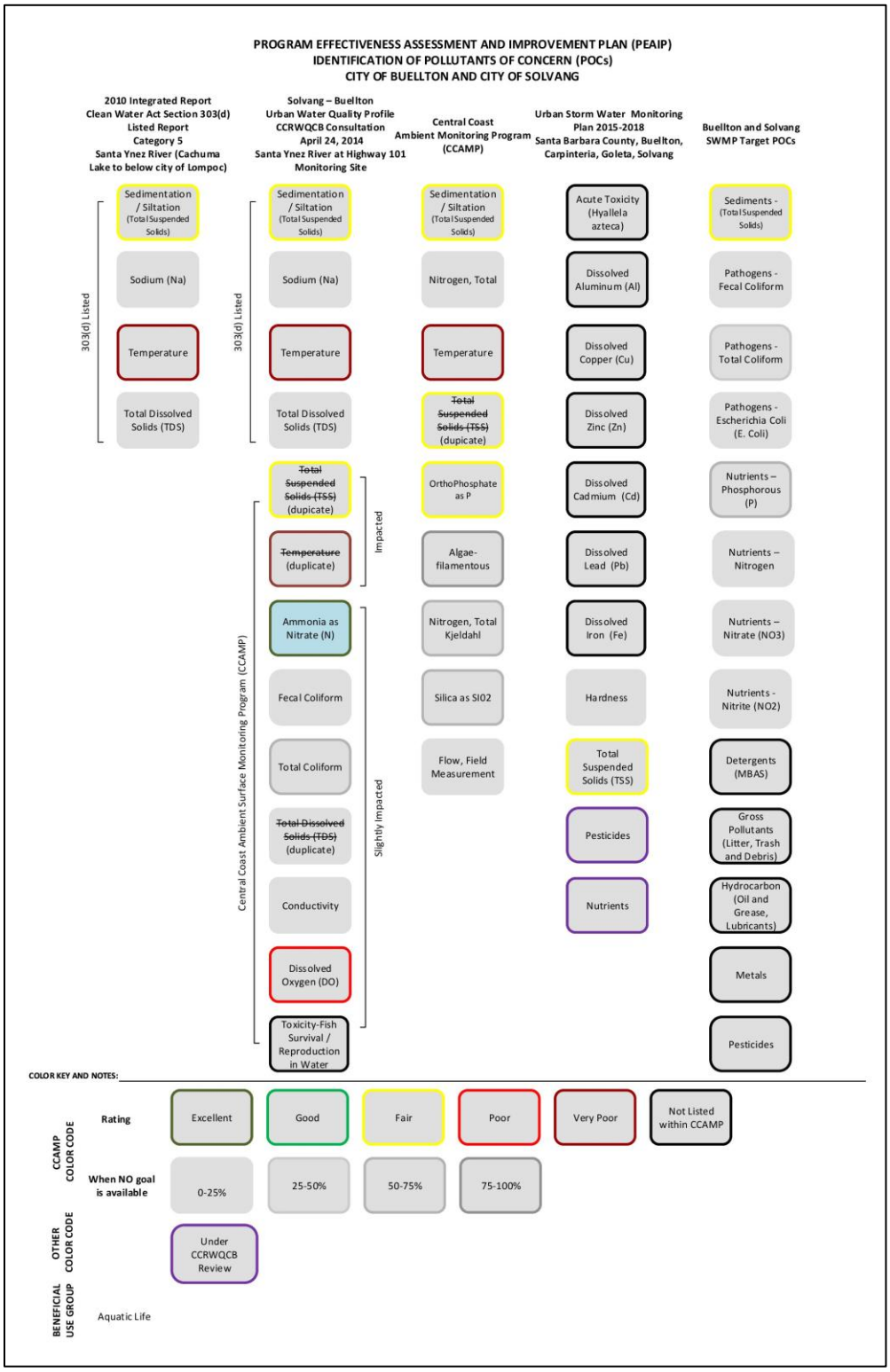
Receiving Water Conditions: Receiving Water Conditions can include any chemical, biological, or physical parameter that can be measured or assessed in receiving waters (i.e., chemical concentrations, dissolved oxygen levels, biological integrity, species diversity, eutrophication, microbiological or toxicological conditions, hydromodification).

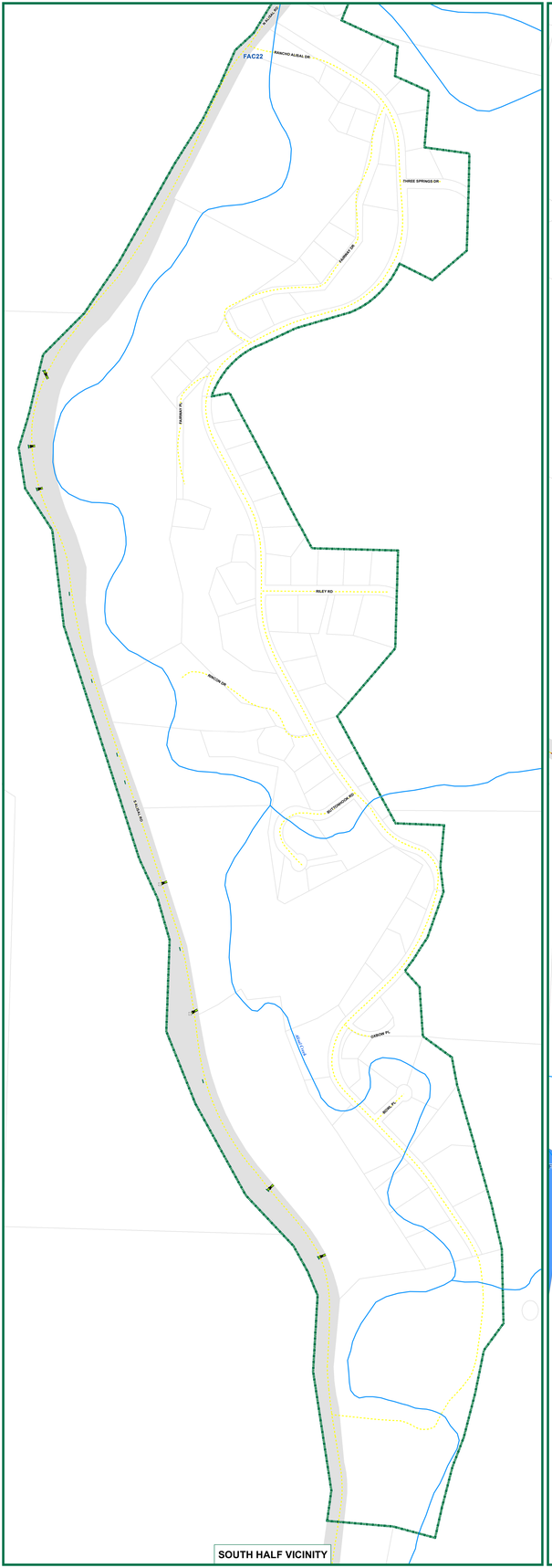
Source: "Source" means anything with the potential to generate pollutants prior to their introduction to the MS4. A typical program broadly addresses the following source categories: residential areas, construction and development sites, commercial and industrial sources, and municipal operations. Sources may alternatively be defined by the populations associated with areas, facilities, or activities, e.g., residents, dog-walkers, mobile car washers, or restaurant employees.

Source Contribution: Source Contribution can refer either to a source loading or to a reduction in that loading. Source loadings are the pollutant loadings added by sources to a MS4. Source reductions are changes in the amounts of pollutants associated with specific sources before and after control measures are employed.

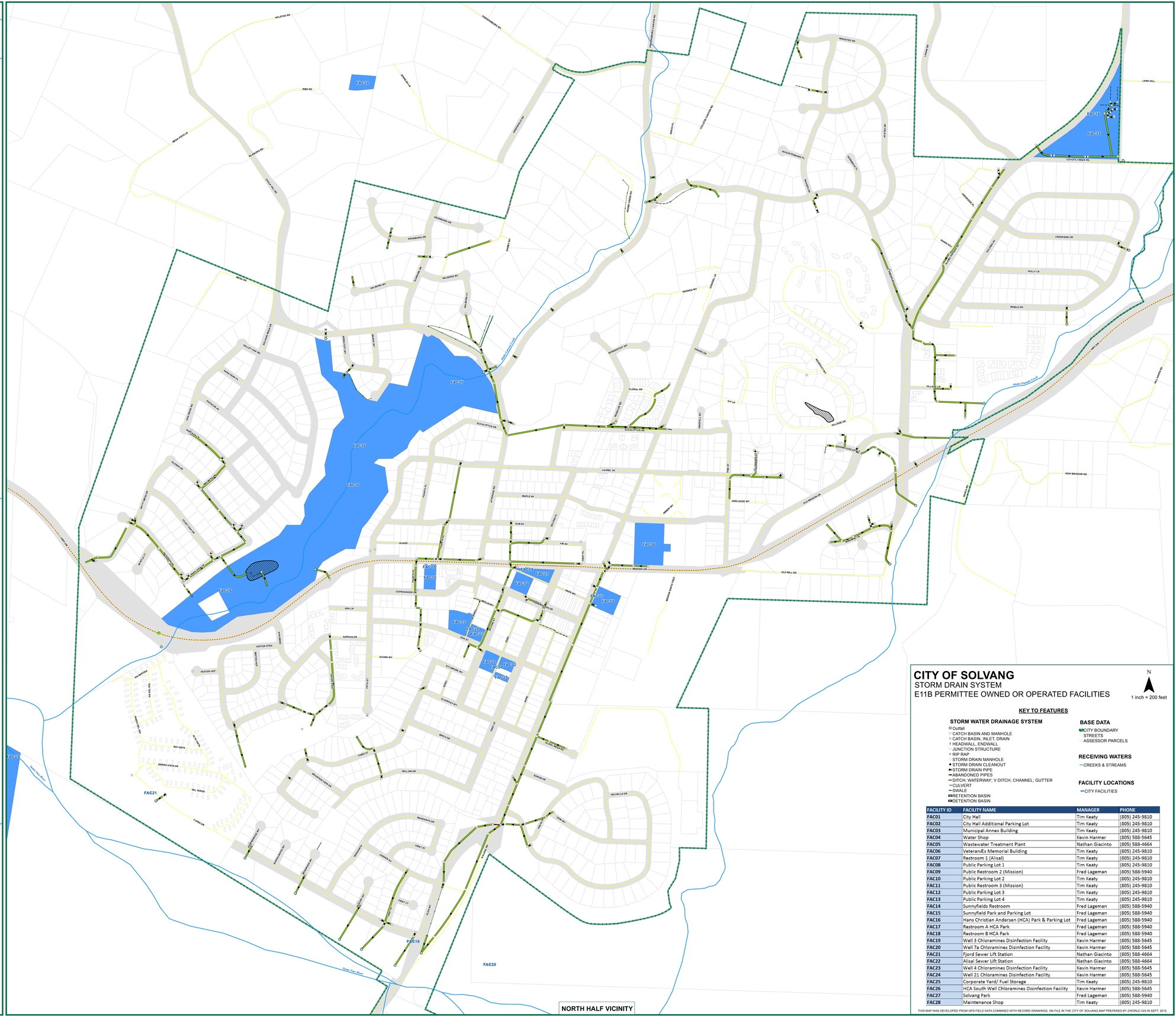
Target Audience: A "Target Audience" consists of the people (individuals and populations) that are expected to gain knowledge or engage in the behaviors that a stormwater program is intended to elicit. BMPs and other controls are implemented by many types of third parties, so the term "target audience" is broadly defined and virtually any group of people could be a target audience, including municipal staff members, the general public, elected and appointed officials, other government agencies, etc.

Appendix B: PEAIP Identification of Pollutants of Concern (POCs)


PROGRAM EFFECTIVENESS ASSESSMENT AND IMPROVEMENT PLAN (PEAIP)
IDENTIFICATION OF POLLUTANTS OF CONCERN (POCs)
CITY OF BUELLTON AND CITY OF SOLVANG
2010 Integrated Report Clean Water Act Section 303(d) Listed Report Category 5 Santa Ynez River (Cachuma Lake to below city of Lompoc)
Solvang – Buellton Urban Water Quality Profile CCRWQCB Consultation April 24, 2014 Santa Ynez River at Highway 101 Monitoring Site
Central Coast Ambient Monitoring Program (CCAMP)
Urban Storm Water Monitoring Plan 2015-2018 Santa Barbara County, Buellton, Carpinteria, Goleta, Solvang
Buellton and Solvang SWMP Target POCs
303(d) Listed
Sedimentation / Siltation (Total Suspended Solids)
Sodium (Na)
Temperature
Total Dissolved Solids (TDS)
303(d) Listed
Sedimentation / Siltation (Total Suspended Solids)
Sodium (Na)
Temperature
Total Dissolved Solids (TDS)
Central Coast Ambient Surface Monitoring Program (CCAMP)
Impacted
~~Total Suspended Solids (TSS)~~ (duplicate)
~~Temperature~~ (duplicate)
Slightly Impacted
Ammonia as Nitrate (N)
Fecal Coliform
Total Coliform
~~Total Dissolved Solids (TDS)~~ (duplicate)
Conductivity
Dissolved Oxygen (DO)
Toxicity-Fish Survival / Reproduction in Water
Sedimentation / Siltation (Total Suspended Solids)
Nitrogen, Total
Temperature
~~Total Suspended Solids (TSS)~~ (dupicate)
OrthoPhosphate as P
Algae-filamentous
Nitrogen, Total Kjeldahl
Silica as SI02
Flow, Field Measurement
Acute Toxicity (Hyallela azteca)
Dissolved Aluminum (Al)
Dissolved Copper (Cu)
Dissolved Zinc (Zn)
Dissolved Cadmium (Cd)
Dissolved Lead (Pb)
Dissolved Iron (Fe)
Hardness
Total Suspended Solids (TSS)
Pesticides
Nutrients
Sediments - (Total Suspended Solids)
Pathogens - Fecal Coliform
Pathogens - Total Coliform
Pathogens - Escherichia Coli (E. Coli)
Nutrients – Phosphorous (P)
Nutrients – Nitrogen
Nutrients – Nitrate (NO3)
Nutrients - Nitrite (NO2)
Detergents (MBAS)
Gross Pollutants (Litter, Trash and Debris)
Hydrocarbon (Oil and Grease, Lubricants)
Metals
Pesticides
COLOR KEY AND NOTES:
CCAMP COLOR CODE
Rating
Excellent
Good
Fair
Poor
Very Poor
Not Listed within CCAMP
When NO goal is available
0-25%
25-50%
50-75%
75-100%
OTHER COLOR CODE
Under CCRWQCB Review
BENEFICIAL USE GROUP
Aquatic Life



SOUTH HALF VICINITY


FAC24
FAC23
HOLSTED RD
RIBE RD
MEKA CREEK LN
SILVERADO DR
CHOLA DR
ARCADIA DR
ARCADIA WY
ALBURNO WY
ALBURNO CT
ALBURNO DR
ALBURNO RD
VALLEY VISTA RD
SILVERADO TRAIL
LAS LOLITAS
LAS AVES
MESA PARK PL
PRESUDA AV
OAK HILL RD
OLIVEIRA DR
MYTT HILL DR
CHATEAU DR
MAIN DR
FAC17
FAC18
FAC16
FAC26
EUCALYPTUS DR
Alisal Creek
FLORAL DR
FLORAL CT
FLORAL RD
FLORAL WY
HAZELWOOD WY
HAZEL LN
ANDREW WY
HAZEL PL
CHURCH ST
ROSEWOOD DR
ROSEWOOD PL
ROSEWOOD CT
ROSEWOOD WY
ROSEWOOD LN
ROSEWOOD TRAIL
ROSEWOOD CIR
ROSEWOOD RD
FAIRVIEW DR
HAZEL DR
HAZEL WY
HILLSIDE DR
HILLSIDE CT
HILLSIDE WY
LAUREL AV
MAPLE AV
ELM AV
FIR AV
ALNOR
FIRST ST
FIRST CT
FIRST WY
FIRST DR
FIRST PL
FIRST LN
FIRST AV
FIRST CY
ALEX AV
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ALEX RD
ALEX LN
ADELGADE WY
ADELGADE CT
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ADELGADE DR
ADELGADE PL
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MISSION DR
MISSION SANTA INEZ
OLD MILL RD
OLD MILL DR
OLD MILL LN
OLD MILL PL
OLD MILL WY
OLD MILL CT
OLD MILL RD
HIGH MEADOW RD
HIGH MEADOW LN
HIGH MEADOW PL
HIGH MEADOW WY
HIGH MEADOW CT
HIGH MEADOW CIR
HIGH MEADOW DR
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FAC21
FAC25
COPENHAGEN CT
COPENHAGEN DR
ASH LN
AARHUS DR
ACORN WY
VESTER STED
VESTER HOF
CHURCH ST
OAK ST
OAK LN
OAK WY
ELM ST
ELM WY
ELM CT
ELM DR
ELM PL
ELM RD
ELM LN
ELM AV
ELM CT
ELVERHOY WY
BIRCH DR
WILLOW DR
MAGNOLIA DR
MAGNOLIA WY
MAGNOLIA PL
MAGNOLIA CT
MAGNOLIA LN
MAGNOLIA CIR
MAGNOLIA RD
MAGNOLIA TRAIL

QUALITY ASSURANCE PROJECT PLAN for URBAN STORM WATER MONITORING PLAN 2015-2018

For the NPDES Phase II Small MS4 General Permit
Sections E.13.c *303(d) Monitoring* and E.14.a *Program Effectiveness Assessment and Improvement Plan*

Version 1.0
October 13, 2015

For the following Regulated MS4s:

City of Goleta
City of Carpinteria
City of Buellton
City of Solvang
Unincorporated Santa Barbara County

Group A. Project Management

A1.Title and Approval Sheet

PROJECT NAME: Urban Storm Water Monitoring Program

DATE: October 13, 2015

NAME OF RESPONSIBLE ORGANIZATION: County of Santa Barbara, Project Clean Water

Quality Assurance Project Plan (QAPP) Revision Number: Version 1.0

APPROVAL SIGNATURES

Permittee Organization – County of Santa Barbara
Project Clean Water

Project Title	Name	Position	Signature	Date
Project Manager	John Karamitzos	Manager	***Signed John Karamitsos***	
Project QA Officer	Cathleen Garnand	Civil Engineering Associate	***Signed Cathleen Garnand***	
Field Technician	Bree Belyea	Engineering Technician Specialist	***Signed Bree Belyea***	

Permittee Organization – Other MS4s

Project Title	Name	Position	Signature	Date
Representative for City of Goleta	Everett King	Environmental Services Coordinator	***Signed Everett King***	
Representative for City of Carpinteria	Erin Maker	Environmental Coordinator	***Signed Erin Maker***	
Representative for City of Buellton	Rose Hess	City Engineer	***Signed Rose Hess***	
Representative for City of Solvang	Bridget Elliot	Associate Engineer	***Signed Bridget Elliot***	

Contract Laboratories

Project Title	Name	Position	Signature	Date
Weck Labs, Inc. QA Officer	Alan Ching	Laboratory Director of Quality Assurance	***Signed Alan Ching***	
ABC Labs, Inc. QA Officer	Michael Machuzak	Laboratory Manager, Senior Scientist	***Signed Michael Machuzak***	

Central Coast Regional Water Quality Control Board

Project Title	Name	Position	Signature	Date
Permit Manager	Dominic Roques	Municipal Coordinator	***Signed Dominic Roques***	

QA Officer	Karen Worcester	Senior Environmental Scientist	***Signed Karen Worcester***	

The presence of a signature on this QAPP is an acknowledgement of Santa Barbara County Project Clean Water's lead role in the Monitoring Program. The names signify willingness to participate in the Monitoring Program, and provide personnel, material, and budgetary support as appropriate.

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A3. Distribution List

All key project participants and regulators will receive copies of this Quality Assurance Project Plan (QAPP) and any approved revisions of this plan as listed below:

County of Santa Barbara
John Karamitsos, Manager
Cathleen Garnand, Civil Engineering Associate
Bree Belyea, Engineering Technician Specialist
City of Goleta
Everett King, Environmental Services Coordinator
City of Carpinteria
Erin Maker, Environmental Coordinator
City of Buellton
Rose Hess, City Engineer
City of Solvang
Bridgett Elliot, Associate Engineer
Geosyntec Consultants
Brandon Steets, Associate
Weck Laboratories, Inc.
Alan Ching, QA Director
Aquatic Bioassay Consulting Laboratories, Inc.
Michael Machuzak, QA Manager
Central Coast Regional Water Quality Control Board
Dominic Roques, Municipal Coordinator
Karen Worcester, QA Officer

A4. Project/Task Organization

County of Santa Barbara
The County will conduct all field sampling and contract management for outsourced analyses. The partner Cities will provide field sampling staff as needed. See **Error! Reference source not found.** for individual personnel esponsibilities.

Water Quality Testing Laboratories
Aquatic Bioassay & Consulting Laboratories, Inc. (ABC Labs) will be the contract laboratory for the acute toxicity screening. Weck Laboratories, Inc. (Weck Labs) will test for metals, TSS, hardness, nutrients, and pesticides.

Table 1. Personnel Responsibilities

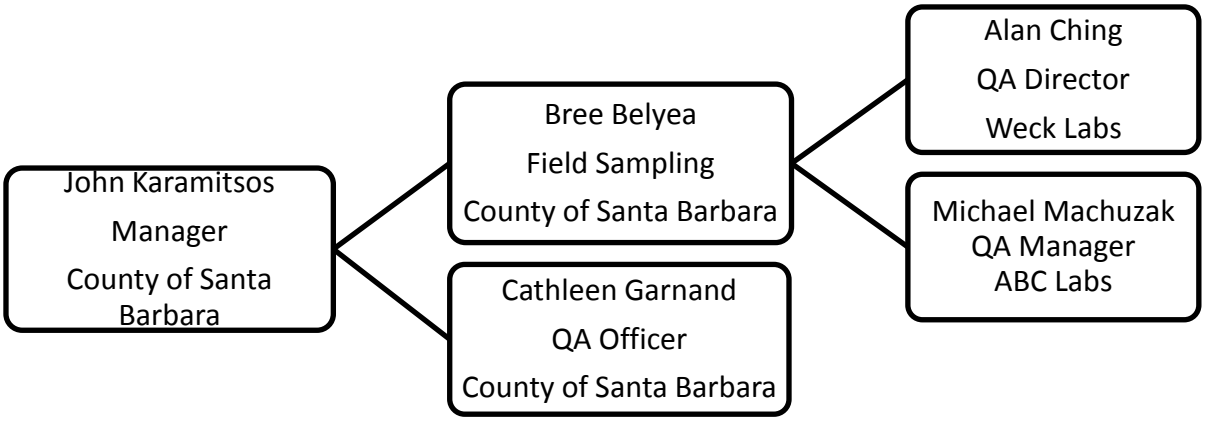
Name	Title	Organization	Project Role	Contact Information
John Karamitsos	Manager	County of Santa Barbara, Project Clean Water	Project Manager	805.568.3373 johnk@cosbpw.net
Cathleen Garnand	Civil Engineering Associate	County of Santa Barbara, Project Clean Water	QA Officer for Project, General Permit Coordinator	805.568.3561 cgarnan@cosbpw.net
Bree Belyea	Engineering Tech Specialist	County of Santa Barbara, Project Clean Water	Field Sampling, Lab Coordinator	805.568.3321 bbelyea@cosbpw.net
Michael	Laboratory	ABC Laboratories, Inc.	QA Manger for Acute	(805)643-5621

Machuzak	Manager		Toxicity Testing	michaelm@aquabio.org
Alan Ching	QA Director	Weck Laboratories, Inc.	QA Director	(626)336-2139 alan.ching@wecklabs.com

Quality Assurance Officer Role and QAPP Maintenance

Cathleen Garnand will review all project data. She is responsible for ensuring that all QA parameters are met, including field sampling and transport, and laboratory testing. Mrs. Garnand plays an advisory role in aspects of data collection and reporting. She will coordinate with the contract labs to ensure appropriate QA measures are upheld. Bree Belyea will maintain and update the approved quality assurance project plan (QAPP) as needed.

Figure 1. Organizational Chart and Responsibilities



A5.Problem Definition/Background

For the purposes of the Urban Storm Water Monitoring Program, the County of Santa Barbara and Partner Cities are required to perform urban catchment-based discharge monitoring and source tracking/source identification. The overall goal of the monitoring is to meet the requirements specified in the NPDES Municipal General Permit E.13.c. 303(d) Monitoring section and to characterize pollutant concentrations and loads from representative MS4 discharge locations within the County. These water quality data can then be used to inform the development of a County-wide pollutant load model.

303(d) Monitoring Requirements

The General Permit E.13.c. 303(d) Monitoring outlines requirements as follows:

> All Permittees that discharge to waterbodies listed as impaired on the 303(d) list where urban runoff is listed as the source, shall consult with the Regional Water Board within one year of the effective date of the permit to assess whether monitoring is necessary and if so, determine the monitoring study design and monitoring implementation schedule. Permittees shall implement monitoring of 303(d) impaired water bodies as specified by the Regional Water Board Executive Officer.

During consultations with the County (August 19, 2014) Regional Water Board staff indicated that instream monitoring was less important than discharge monitoring (specifically, pollutant *loading*). This monitoring program focuses on pollutants typically associated with wet weather MS4 discharges in key watersheds. There are no action limits necessary to the project.

A6. Project/Task Description

Storm water samples will be collected at outfalls representing drainage areas with specific land uses. Samples will be taken at the outfalls discharging into urban waterbodies. As many storms as possible will be monitored each storm season. It is unlikely there will be more than eight suitable storms each year. Two sites will be sampled during each storm. All water samples will be tested for toxicity and will be analyzed for trace metals, total suspended solids, nutrients, and hardness. The outcome of the toxicity screening will dictate which samples will be further analyzed for the presence of pesticides. There will be coordination with Weck Laboratories to archive samples to allow for the delayed pesticide screening within the required hold times.

The pollutants of concern were selected based upon the following criteria:

1. Pollutants are representative of typical MS4 wet weather discharges and impairments to urban receiving waters
2. Pollutants are cost-effective to analyze and don't require special sample collection or handling procedures
3. Pollutants can be addressed through BMPs in the Permittee's stormwater program (and BMP performance data exist in order to model these pollutants)
4. Pollutants are of interest to Regional Water Board staff based on initial discussions.

Table 2. Target Analytes

Analyte	WQS	unit	Method Detection Limits	Method Reporting Limits	Source WQS
TSS			-	5.0 mg/l	
DP	0.3	mg/l			Santa Maria River Nutrient/Bacteria TMDL wet weather WLA for MS4s
Ammonia			0.048 mg/l	0.10 mg/l	
Nitrate, Nitrite, Nitrate+Nitrite	8	mg/l	10 ug/l	100 ug/l	Santa Maria River Nutrient/Bacteria TMDL wet weather WLA for MS4s
Nitrogen, total Kjeldahl			0.050 mg/l	0.10 mg/l	
Phosphorus, Dissolved	0.3	mg/l	0.0014 mg/l	0.010 mg/l	Santa Maria River Nutrient/Bacteria TMDL wet weather WLA for MS4s
Orthophosphate, Total & Dissolved			0.83 ug/l	10 ug/l	
Copper, dissolved	13	ug/l	0.13 ug/l	0.50 ug/l	CTR default value (acute freshwater criteria, hardness -100 mg/l)
Copper, total	14	ug/l	0.13 ug/l	0.50 ug/l	CTR default value (acute freshwater criteria, hardness -100 mg/l)
Iron, Total & Dissolved	1000	ug/l	0.91 ug/l	20 ug/l	USEPA Aquatic Life Criteria, acute freshwater
Lead, Total & Dissolved	82	ug/l	0.031 ug/l	0.20 ug/l	CTR default value (acute freshwater criteria, hardness -100 mg/l)
Zinc,Total & Dissolved	120	ug/l	0.94 ug/l	5.0 ug/l	CTR default value (acute freshwater criteria, hardness -100 mg/l)
Carbamate Pesticides	2.1	ug/l	0.30-0.60 ug/l	2.0 ug/l	USEPA Aquatic Life Criteria, acute freshwater
Pyrethroid Pesticides	0.8	ug/l	0.50-2.4 ng/l	2.0 ng/l	USEPA Aquatic Life Criteria, acute freshwater
Diuron	80	ug/l		0.5 ug/l	USEPA 2003 Aquatic Life Benchmarks, acute freshwater
Acetamiprid	10.5	ug/l		0.5 ug/l	USEPA 2003 Aquatic Life Benchmarks, acute freshwater
Clothianidin	11	ug/l		0.5 ug/l	USEPA 2003 Aquatic Life Benchmarks, acute freshwater
Dinotefuran	6360	ug/l		0.5 ug/l	USEPA 2003 Aquatic Life Benchmarks, acute freshwater
Imidacloprid	34.5	ug/l		0.5 ug/l	USEPA 2003 Aquatic Life Benchmarks, acute freshwater
Thiacloprid	18.9	ug/l		0.5 ug/l	USEPA 2003 Aquatic Life Benchmarks, acute freshwater
Thiamethoxam	17.5	ug/l		0.5 ug/l	USEPA 2003 Aquatic Life Benchmarks, acute freshwater

A Storm Report will be drafted and provided to the partner Cities after each storm sampling event. This report will contain details on the outcome of the sampling event (actual rainfall, timing of the storm, locations sampled) and any deviations from the Monitoring Plan that may have occurred.

Work Schedule

Table 3. Work Schedules

Permit Year	Date	Task
Permit Year 2	November 2014	Submit Monitoring Plan
Permit Year 2	July 2015	Submit QAPP
Permit Year 3-5	July 2015-June 2016 and annually thereafter	Sample all suitable storms, up to 8 per year, and submit storm reports to Partner Cities
Permit Year 3-5	May 2016, and annually thereafter	Review Quality Control data and conduct assessments.
Permit Year 3-5	May 2016-June 2016 and annually thereafter	Compile data for annual reporting process
Permit Year 3-5	October 2016 and annually thereafter	Submit project data to SMARTS

Geographic Location

All sampling sites are located within Santa Barbara County. Figure 2 shows an overview map of the sampling areas within Santa Barbara County and Figure 3-6 show specific sampling locations. Table 4 summarizes site locations and land use.

Figure 2. Overview Map of Project Area

Figure 3. Buellton Monitoring Site

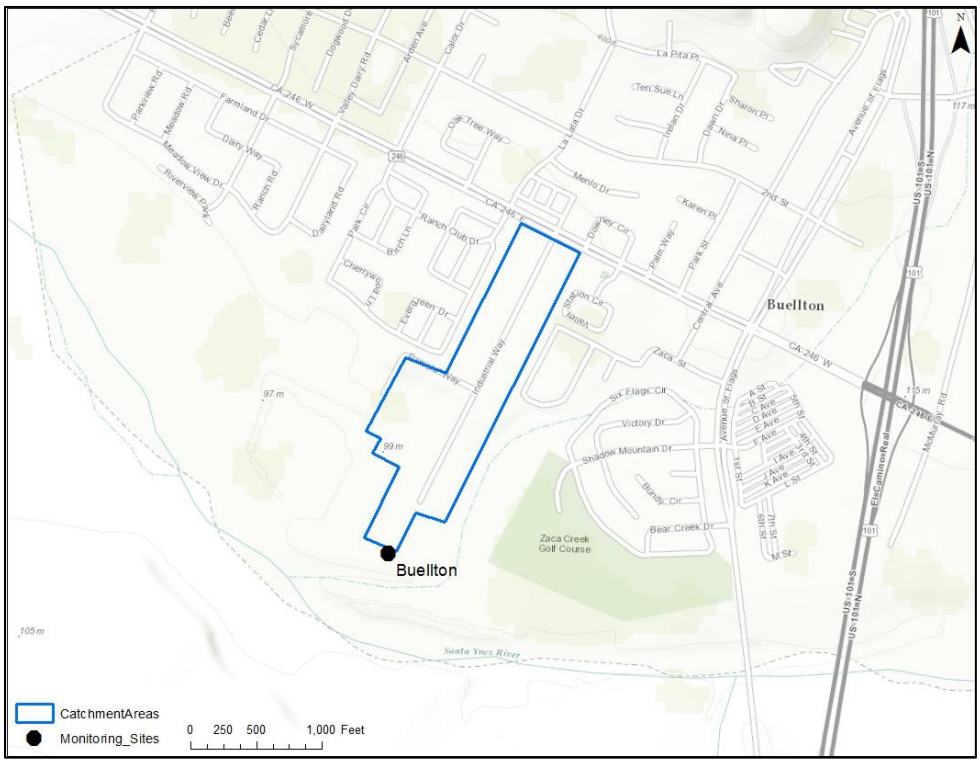


Figure 4. Solvang Monitoring Site

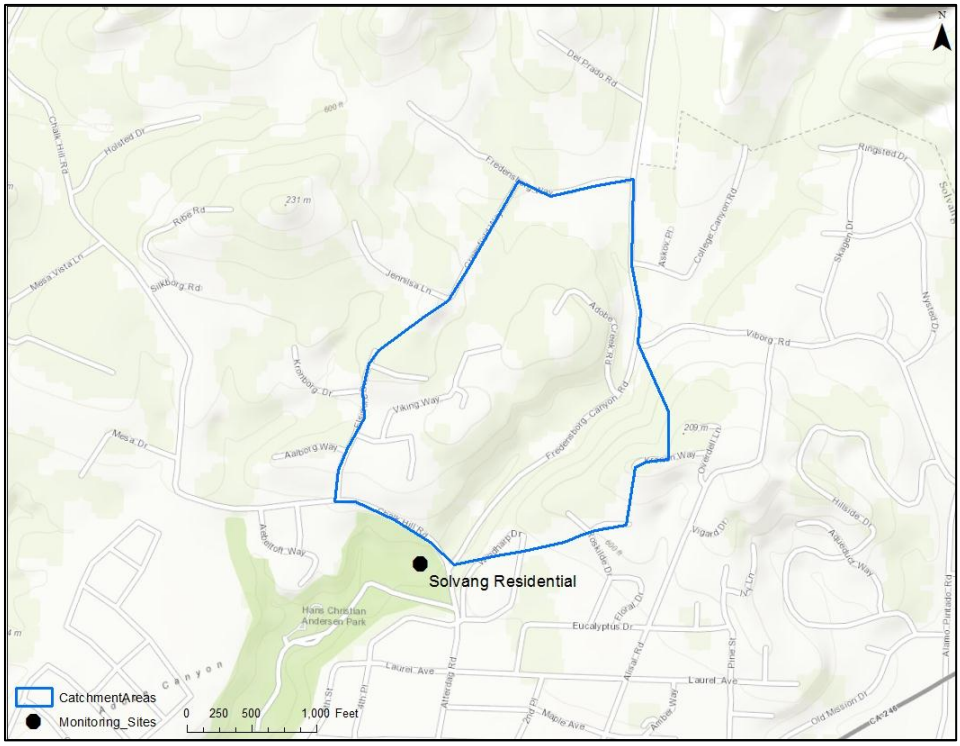


Figure 5. Carpinteria Monitoring Sites

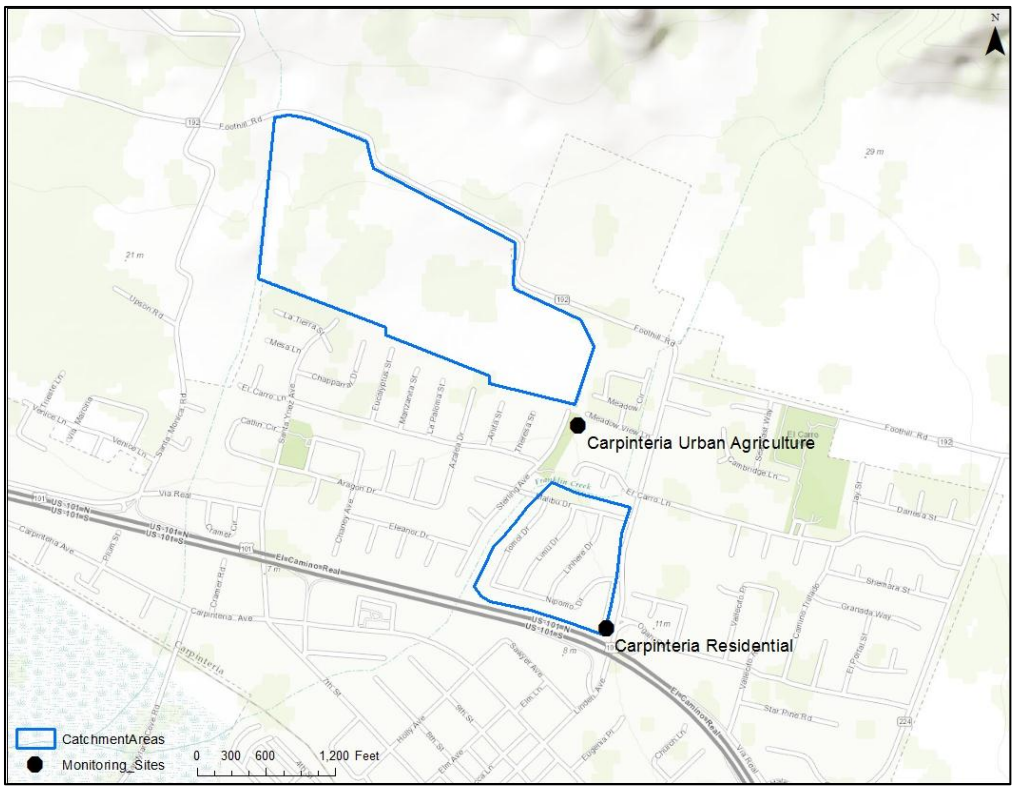


Figure 6. Goleta Monitoring Sites

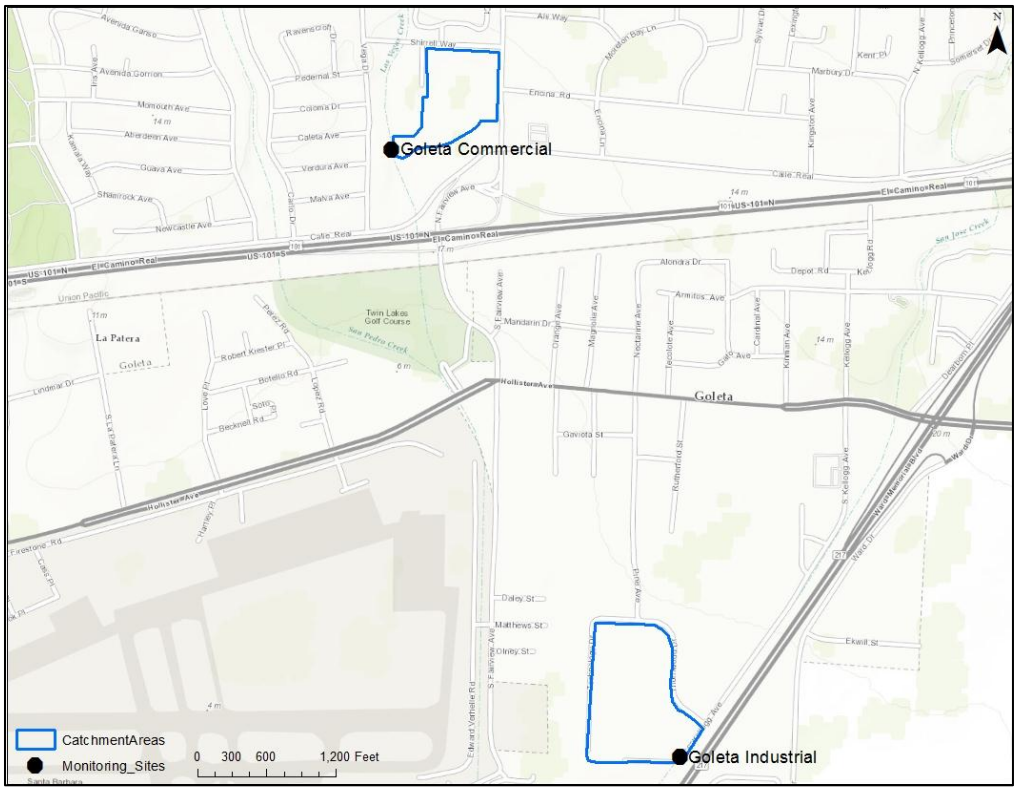


Table 4. Location and Land Use of Sampling Sites

Location	Land Use	Receiving Water	Drainage Acres
City of Solvang	Low density residential	Santa Ynez River	114.8
City of Carpinteria	Medium density residential	Franklin Creek	25.9
City of Goleta	Commercial	Las Vegas	11.8
City of Buellton	Industrial	Santa Ynez River	31.2
City of Goleta	Industrial	San Jose Creek	21.1
City of Carpinteria	Indoor Urban Agriculture	Franklin Creek	82.2

Constraints

Santa Barbara County has received 50% or less of average annual rainfall since 2012. The main foreseeable limitation is the uncertainty of rain events for the duration of the project.

A7.Quality Objectives and Criteria for Measurement Data

Consistency in the collection and analysis of data is achieved through the application of universal Measurement Quality Objectives (MQOs). As defined by the U.S. Environmental Protection Agency (EPA), these are acceptance criteria for data quality attributes such as precision, accuracy, and completeness. Adherence to the MQOs ensures that data generated will be of known and documented quality and support submitting project data to CEDEN. Numerical MQOs for the constituents being sampled are listed in Section B4. All MQOs are taken from SWAMP 2013 tables.

Accuracy is a measure of how closely the analytical result or field measurement represents the true quantity found in the sample and will be determined by measuring recoveries using matrix spikes, laboratory control spikes, and/or reference materials. Method blanks will be utilized to check for contamination.

Precision describes the degree to which repeated measurements under the same conditions produce the same results. Precision will be calculated using relative percent differences (RPD) obtained through duplicate analysis of samples, such as laboratory control spike duplicates and matrix spike duplicates.

Data completeness is a measure of the amount of successfully collected and analyzed data relative to the amount of data planned to be collected for the project. The Monitoring Plan requires every field site to be sampled during each storm season, for a minimum of three datasets per sampling site over the duration of the project. All suitable storms (up to eight per year) will be monitored each year. Any additional sampling events

each year will serve as a buffer in case of human error or equipment failure. These additional data will also help inform the development of the pollutant loading model.

Representativeness is a qualitative measure of the degree to which the environmental data generated by the monitoring program accurately and precisely represent actual environmental conditions. In this study, representativeness is addressed by the overall design of the monitoring program; by selecting appropriate sampling locations, and by maintaining the integrity of the samples after collection.

Bias is the systemic or persistent distortion of a measurement process that causes under or over prediction of sampled or measured values relative to the true value. Bias will be assessed through negative controls (blanks). Detectable quantities in the blanks would indicate positive bias.

There are no previously collected data or action limits for this Project.

A8.Special Training Needs/Certification

Specialized Training or Certifications

No specialized training or certifications are required of Project personnel for this project. Both Weck and ABC labs are ELAP certified.

Training and Certification Documentation

A complete listing of laboratory accreditation certificates is available directly from the contract laboratories. Training records for individual laboratory tasks are maintained at the laboratories and are available upon request from the QA Officer of each facility.

A9.Documents and Records

The following documents, records, and electronic files will be produced:

- Quality Assurance Project Plan
- Monitoring Plan
- Storm Reports (drafted and submitted to partner Cities after each storm sampling event)
- Field Sampling Data Sheets (internal documentation available upon request)
- Chain of Custody (COC) Forms (exchanged for signatures with labs and kept on file)
- Lab Sample Disposition Logs (internal documentation available upon request from contract laboratories)
- Calibration Logs for measurements of water quality standards (internal documentation available upon request Labs)
- Refrigerator Logs (internal documentation available upon request from contract laboratories)
- Equipment Calibration and Maintenance Logs (internal documentation available upon request from permittee and contract laboratories)
- Quality Assurance data (internal documentation available upon request from contract laboratories)

Following each monitoring event, the Field Technician shall provide the Program QA Officer with copies of completed field logs and copies of the chain-of-custody forms for all samples submitted for analysis. At a minimum, the following sample-specific information will be provided for each sample collected.

- Sample ID (unique for each sample and replicate)
- Monitoring location (e.g., latitude/longitude coordinates)
- Number of sub-samples in composite (if appropriate)
- Quality Control (QC) sample type (if appropriate)
- Date and time(s) of collection
- Requested analyses (specific parameters or method references)

In compliance with email guidance from the Regional Board email dated July 25, 2014, monitoring results will be will be reported annually under the Municipal General Permit Report via SMARTs. The Year 3 Annual Report (October 15, 2016) will be the first report to incorporate these results. Data generated under this Monitoring Plan will be entered into the California Environmental Data Exchange Network (CEDEN).

Copies of this QAPP will be distributed by the QA Officer to all parties directly involved in this project. Any future amended QAPPs will be distributed in the same fashion. All originals of the first and subsequent amended QAPPs will be held by the County. Field sampling data sheet and chain of custody forms will be stored at County offices for 5 years. Electronic copies of documents will be stored on the County of Santa Barbara Public Works server network. These servers are backed up daily.

Group B. Data Generation and Acquisition

B1. Sampling Process Design (Sampling Design and Logistics)

The Urban Storm Water Monitoring Program is designed to meet NPDES Phase II Small MS4 Municipal General Permit requirements and produce quality, representative data that can also be used to inform a County-wide pollutant load model.

Composite samples are used to determine average concentrations of pollutants. Storm events with a 50-75% probability of producing 0.2" or greater will trigger a sampling event. The County's Water Resources Division hydrologists will provide updated forecast information and the quantified precipitation forecast for the specific storm event.

Two sites will be monitored per storm. Aliquots will be collected at twenty minute intervals and subsequently combined into one composite sample. The samples will be drawn by hand from the outfall openings. The number of aliquots will vary based off predicted storm characteristics as shown in Table 5, taken from the Caltrans Stormwater Monitoring Protocols. Some estimation is necessary to predict the forecasted storm rainfall depth to determine the number of representative aliquots to draw.

Table 5. Composite Sampling Aliquot Requirements

Total Event Precipitation	Minimum Acceptable Number of Aliquots	Percent Capture Requirement
0-0.25"	6	85
0.25-0.5"	8	80
0.5-1"	10	80
>1"	12	75

Sample collection points were evaluated based on the following criteria: safe access during wet weather conditions, the possibility of reproducing accurate flow monitoring and sample collection, and drainage area representative of a specific land use to the extent possible. Sampling locations have been selected to represent drainages with specific land use. Multiple locations representing the different land use target types were surveyed and primary sample sites were selected. If a site becomes inaccessible, a secondary site with the same land use characteristics will replace the original site.

The project activity schedules are changeable due to the variable nature of the rain events being monitored. Samples will be delivered to the contract lab the day of collection if possible, or held on ice and transferred the next day if sampling occurs outside of normal business hours. A courier service or overnight shipping will be utilized to ensure the laboratory receives the samples with adequate time to meet the sample holding time limits. Hold times are shown in Section B3. All data collected are used to achieve objectives and there are no data that will be collected for informational purposes only.

Natural variability in pollutant concentrations during a rain event is expected. Variability is addressed by taking time-spaced aliquots over the duration of the storm and compositing the samples before laboratory analysis. Bias can be minimized through consistent staff training and emphasis on SOPs for sample collectors.

B2.Sampling (Sample Collection) Methods

A multi-bottle, time-proportional composite sampling protocol will be followed. Time spaced aliquots will be taken every twenty minutes for two to three hours as the characteristics of the individual storms allow. This approach was selected because it offers the most convenience for manual sampling while providing a better representation of the overall event concentration than a single grab sample. Consideration was given to various methods, such as the use of automatic samplers, and it was determined this approach would be representative while practical. Consideration was also given to the various methods of composite sampling such as time-based, time-proportional, and weight-proportional approaches described in the Caltrans Guidance Manual for stormwater monitoring.

Samples are collected in pre-sterilized bottles or containers provided by the contract laboratories. The type and size of the container and any required preservatives will be appropriate for the constituents to be analyzed. The aliquot volume is predetermined based on the total sample volume required by the analyzing laboratories.

The contract laboratories will handle sample and byproduct disposal and decontamination according to their SOPs. The lab can be contacted if additional information is needed. If problems with field sampling are identified, the Field Technician and QA Officer will discuss and implement corrective actions. Corrective actions will be detailed in the Storm Report for the associated sampling event.

Sample bottles will be pre-labeled with site name, laboratory, required analysis and sampler initials prior to collection. Date and time will be recorded at the time of collection. Glass sample bottles will be wrapped with bubble wrap when feasible. Samples will be stored in coolers with ice until received by the laboratories. A courier or shipping service with sample handling experience will be employed by the lab to transport the samples. The Field Technician is responsible for filling out the Chain of Custody form with field sample details and transferring samples and forms to the courier or shipper. The chain-of-custody (COC) form, provided by the laboratory in advance, shall include event name, sample site ID, date and time of sampling, number of bottles, requested analyses, sampler name(s), and relevant comments. See Appendices D and E for Chain of Custody forms. COCs shall travel with the samples until logged in at the laboratory. The laboratory shall verify that samples match those noted on the COC. Any discrepancies or problems shall be documented during the login procedure and be reported to the laboratory QA Officer, who will notify County staff.

Samples for the target parameters will be collected according to the SWAMP SOP in Appendix A: Collections of Water and Bed Sediment Samples with Associated Field Measurements and Physical Habitat in California. Version 1.1 updated March 2014. Sample containers, volumes, preservative, and hold times are provided in Table 6-11.

Table 6. Sample Handling and Custody for Acute Toxicity (From SWAMP 2013 Table)

Sample Handling/Collection	
Test Parameter	*Recommended Conditions*
Relevant Media	Water
Sample Container Type	Amber glass
Sample Preservation	Wet or blue ice in field; 0 - 6 °C refrigeration in laboratory; dark at all times
Sample Receipt Temperature	0 - 6 °C
Holding Time	<48 hours@ 0 - 6 °C; dark

Table 7. Sample Handling and Custody for Metals (From SWAMP 2013 Table)

Analyte	Recommended Container[1]	Recommended Preservation[2,3]	Required Holding Time[4]
Trace Metals[8] (Dissolved)	P	Filter within 15 minutes of collection; HNO_3 to pH<2 within 48 hours and at least 24 hours prior to analysis	6 months at room temperature following acidification
Trace Metals[8] (Total)	P	HNO_3 to pH<2 within 48 hours and at least 24 hours prior to analysis	6 months at room temperature following acidification

[1] "P" is polyethylene; "G" is glass; "PA" is any plastic that is made of a sterilizable material (polypropylene or other autoclavable plastic)

[2] Per 40 CFR 136.3, aqueous samples must be preserved at ≤6 °C, and should not be frozen unless data demonstrating that sample freezing does not adversely impact sample integrity is maintained on file and accepted as valid by the regulatory authority. The preservation temperature does not apply to samples that are analyzed immediately (within 15 minutes).

[3] Per 40 CFR 136.3, an aqueous sample may be collected and shipped without acid preservation. However, acid must be added at least 24 hours before analysis to dissolve any metals that adsorb to the container walls. If the sample must be analyzed within 24 hours of collection, add the acid immediately.

[4] Each "Required Holding Time" is based on the assumption that the "Recommended Preservation" (or a method-mandated alternative) has been employed. If a "Required Holding Time" for filtration, preservation, preparation, or analysis is not met, the project manager and SWAMP Quality Assurance Officer must be notified. Regardless of preservation technique, data not meeting the "Required Holding Time" will be appropriately flagged in the SWAMP database.

[5] If the analytical method doesn't include preservation, analysis must occur within 24 hours.

[6] Methylmercury samples may be shipped to the laboratory unpreserved if they are collected in fluoropolymer bottles, filled to the top with no head space, capped tightly, and maintained at ≤6 °C from the time of collection until preservation. The samples must be acid-preserved within 48 hours of sampling.

[7] Including the species selenite, selenate, and selenocyanate

[8] With the exception of mercury, methylmercury, hexavalent chromium, and selenium speciation

Table 8. Sample Handling and Custody for TSS (From SWAMP 2013 Table)

Parameter	Recommended Container[1]	Recommended Preservation[2]	Required Holding Time[3]
Suspended Sediment Concentration **Total Suspended Solids**	G, P	Cool to ≤6 °C	7 days
Total Dissolved Solids	P	Cool to ≤6 °C	7 days

[1] "P" is polyethylene; "G" is glass

[2] Per 40 CFR 136.3, aqueous samples must be preserved at ≤6 °C, and should not be frozen unless data demonstrating that sample freezing does not adversely impact sample integrity is maintained on file and accepted as valid by the regulatory authority. The preservation temperature does not apply to samples that are analyzed immediately (less than 15 minutes).

[3] Each "Required Holding Time" is based on the assumption that the "Recommended Preservation" (or a method-mandated alternative) has been employed. If a "Required Holding Time" for filtration, preservation, preparation, or analysis is not met, the project manager and SWAMP Quality Assurance Officer must be notified. Regardless of preservation technique, data not meeting the "Required Holding Time" will be appropriately flagged in the SWAMP database.

Table 9. Sample Handling and Custody for Hardness (From SWAMP 2013 Table)

Analyte	Recommended Container[1]	Recommended Preservation[2,3]	Required Holding Time[4]
Hardness (as $CaCO_3$)	P	Cool to ≤6 ˚C; HNO_3 or H_2SO_4 to pH<2	6 months

Table 10. Sample Handling and Custody for Nutrients (From SWAMP 2013 Table)

Analyte	Recommended Container[1]	Recommended Preservation[2]	Required Holding Time[3]
Ammonia (as N)	P	Cool to ≤6 ˚C; samples may be preserved with 2 mL of H_2SO_4 per L	48 hours; 28 days if acidified
Kjeldahl Nitrogen (Total)	P	Cool to ≤6 ˚C; H_2SO_4 to pH<2	7 days; 28 days if acidified
Nitrate (as N)	P	Cool to ≤6 ˚C	48 hours (unless calculated from nitrate + nitrite (as N) and nitrite (as N) analyses)
Nitrate + Nitrite (as N)	P	Cool to ≤6 ˚C; H_2SO_4 to pH<2	48 hours; 28 days if acidified
Nitrite (as N)	P	Cool to ≤6 ˚C	48 hours
Nitrogen (Total)	P	Cool to ≤6 ˚C; H_2SO_4 to pH <2	28 days
Orthophosphate (Dissolved, as P; *Soluble Reactive Phosphorus*)	P	Filter within 15 minutes of collection[4]; cool to ≤6 ˚C	48 hours
Orthophosphate (Total, as P)	P	Cool to ≤6 ˚C	48 hours
Phosphorus (Dissolved, as P)	P	Filter within 15 minutes of collection; cool to ≤6 ˚C; H_2SO_4 to pH <2	28 days
Phosphorus (Elemental)	G	Cool to ≤6 ˚C	48 hours
Phosphorus (Total, as P)	P	Cool to ≤6 ˚C; H_2SO_4 to pH <2	28 days

[1] "P" is polyethylene; "G" is glass

[2] Per 40 CFR 136.3, aqueous samples must be preserved at ≤6 °C, and should not be frozen unless data demonstrating that sample freezing does not adversely impact sample integrity is maintained on file and accepted as valid by the regulatory authority. The preservation temperature does not apply to samples that are analyzed immediately (less than 15 minutes).

[3] Each "Required Holding Time" is based on the assumption that the "Recommended Preservation" (or a method-mandated alternative) has been employed. If a "Required Holding Time" for filtration, preservation, preparation, or analysis is not met, the project manager and SWAMP Quality Assurance Officer must be notified. Regardless of preservation technique, data not meeting the "Required Holding Time" will be appropriately flagged in the SWAMP database.

[4] Per 40 CFR 136.3, the immediate filtration requirement in orthophosphate measurement is to assess the dissolved or bio-available form of orthophosphorus (i.e., that which passes through a 0.45-micron filter), hence the requirement to filter the sample immediately upon collection (i.e., within 15 minutes of collection).

Table 11. Sample Handling and Custody for Pesticides (From SWAMP 2013 Table)

Matrix	Recommended Container[2]	Recommended Preservation[4]	Required Holding Time[2]
Carbamate Pesticides **Organochlorine Pesticides** **Organophosphate Pesticides** **Wastewater Organochlorine Pesticides**	G	Cool to ≤6 °C; pH 5-9	7 days until extraction, 40 days after extraction
Diesel Range Organics **Triazine Pesticides**	G	Cool to ≤6 °C	7 days until extraction, 40 days after extraction
Glyphosate	G	Cool to ≤6 °C; store in the dark; 0.008% $Na_2S_2O_3$ if residual chlorine is present; freeze to ≤-20 °C	18 months (14 days if unfrozen)
Phenols[5]	G	Cool to ≤6 °C; 0.008% $Na_2S_2O_3$ if residual chlorine is present	7 days until extraction, 40 days after extraction
Polychlorinated Biphenyls (as Congeners/Aroclors)	G	Cool to ≤6 °C	1 year until extraction, 1 year after extraction
Polynuclear Aromatic Hydrocarbons	G	Cool to ≤6 °C; store in the dark; 0.008% $Na_2S_2O_3$ if residual chlorine is present	7 days until extraction, 40 days after extraction
Pyrethroids	G	Cool ≤ 6 °C in the dark; samples must be extracted or preserved according to laboratory procedures with suitable preservative or extraction solvent within 72 hours of collection	7 days until extraction, 40 days after extraction
Surfactants	G	Cool to ≤6 °C, store in the dark	7 days until extraction, 40 days after extraction

[1] Pyrethroids information applies to a whole water matrix.

[2] "G" is glass

[3] Per 40 CFR 136.3, aqueous samples must be preserved at ≤6 °C, and should not be frozen unless data demonstrating that sample freezing does not adversely impact sample integrity is maintained on file and accepted as valid by the regulatory authority. The preservation temperature does not apply to samples that are analyzed immediately (less than 15 minutes).

[4] Each "Required Holding Time" is based on the assumption that the "Recommended Preservation" (or a method-mandated alternative) has been employed. If a "Required Holding Time" for filtration, preservation, preparation, or analysis is not met, the project manager and SWAMP Quality Assurance Officer must be notified. Regardless of preservation technique, data not meeting the "Required Holding Time" will be appropriately flagged in the SWAMP database.

[5] This table applies to phenols analysis using gas chromatography. Guidelines for the colorimetric analysis of phenols are located in *Conventional Parameters in Water* Table 2: *Sample Handling*.

B3. Analytical Methods

There are no recommended reporting limits for toxicity in the 2008 SWAMP QAPRP. There is no in situ or continuous monitoring for this project. There are no action limits for this project. No specific method performance criteria are identified.

Laboratory procedures, equipment and instrumentation are described in the supporting document for acute toxicity analysis found in Appendix B. Analytical methods for chemical analyses are included in Appendix C. The SOPs indicate procedures to follow when failures occur, identifying individuals responsible for corrective action and associated documentation. In the case a failure is not specified in the SOP, best professional judgment will be used and the laboratories will communicate to the County about the data quality. The SOPs indicate appropriate sample disposal procedures; if they are not identified in the SOP, they are available in the laboratory general QAPP, which is available upon request. Any modifications to standard methods are indicated in the SOPs.

B4. Quality Control

Acute Toxicity

Acute toxicity will be measured with *Hyalella azteca*, a test organism sensitive to pyrethroid pesticides and used in regulatory programs in the region and included on the alternate species list for EPA/821/R-02/012.

Quality control activities and calculations for acute toxicity analysis are taken from the SWAMP 2013 table and shown in Error! Reference source not found.Table 12. Corrective actions are shown in Table 13.

Table 12. Quality Control for Acute Toxicity (From SWAMP 2013 Table)

Negative Controls	Frequency of Analysis	Control Limits
Laboratory Control Water	Laboratory control water consistent with Section 7 of the appropriate EPA method/manual must be tested with each analytical batch.	Laboratory control water must meet all test acceptability criteria (please refer to Section 7 of the appropriate EPA method/manual) for the species of interest.
Conductivity/Salinity Control Water	A conductivity or salinity control must be tested when these parameters are above or below the species tolerance.	Follow EPA guidance on interpreting data and refer to tables below for tolerance ranges.
Additional Control Water	Additional method blanks are required whenever manipulations are performed on one or more of the ambient samples within each analytical batch (e.g., pH adjustments, continuous aeration).	There must be no statistical difference between the laboratory control water and each additional control water within an analytical batch.
Sediment Control	Sediment control consistent with Section 7 of the appropriate EPA method/manual must be tested with each analytical batch of sediment toxicity tests.	Sediment control must meet all data acceptability criteria (please refer to Section 7 of the appropriate EPA method/manual) for the species of interest.
Positive Controls	**Frequency of Analysis**	**Control Limits**
Reference Toxicant Tests	Reference toxicant tests must be conducted monthly for species that are raised within a laboratory, or per analytical batch for commercially-supplied or field-collected species.	Last plotted data point (LC50 or EC50) must be within 2 SD of the cumulative mean (n=20). Reference toxicant tests that fall outside of recommended control chart limits are evaluated to determine the validity of associated tests. An out of control reference toxicant test result does not necessarily invalidate associated test results. More frequent and/or concurrent reference toxicant testing may be advantageous if recent problems have been identified in testing.

Field Quality Control	Frequency of Analysis	Control Limits
Sample Duplicate	5% of total project sample count	Recommended acceptable RPD<20%
Field Blanks	Based on project requirements	No statistical difference between the laboratory control water (or sediment control) and the field blank within an analytical batch
Bottle Blanks	Based on project requirements	No statistical difference between the laboratory control water and the equipment blank within an analytical batch

[1]Unless method specifies more stringent requirements.

In special cases where the criteria listed in the above tables cannot be met, EPA minimum criteria may be followed. The affected data should be flagged accordingly.

Test data are reviewed to verify that the test acceptability criteria for a valid test have been met. Any test not meeting the minimum test acceptability criteria is considered invalid. All invalid tests should be repeated with the newly collected sample. If this is not possible, the test should be repeated with an archived sample and all tests must be properly flagged.

Deviations from the summary of recommended test conditions must be evaluated on a project-specific basis to determine the validity of test results. Depending on the degree of the departure and the objective of the test, deviations from recommended conditions may or may not invalidate a test result. Before rejecting or accepting a test result as valid, the reviewer should consider the degree of the deviation and the potential or observed impact of the deviation on the test result. For example, if dissolved oxygen is measured below 4.0 mg/L in one test chamber, the reviewer should consider whether any observed mortality in that test chamber corresponded with the drop in dissolved oxygen.

Table 13. Corrective Actions for Acute Toxicity (From SWAMP 2013 Table)

Negative Controls	Corrective Action
Laboratory Control Water	If tested with in-house cultures, affected samples and associated quality control must be retested within 24 hours of test failure. If commercial cultures are used, they must be ordered within 16 hours of test failure for the earliest possible receipt. Retests must be initiated within 30 hours of receipt, depending on the need for organism acclimation. The laboratory should try to determine the source of the control failure, document the investigation, and document the steps taken to prevent a recurrence.
Conductivity/Salinity Control Water	Affected samples and associated quality control must be flagged.
Additional Control Water	Based on the objectives of the study, a water sample that has similar qualities to the test sample may be used as an additional control. Results that show statistical differences from the laboratory control should be flagged. The laboratory should try to determine the source of variation, document the investigation, and document the steps taken to prevent a recurrence. This is not applicable for TIE method blanks.
Sediment Control	Based on the objectives of the study, a sediment sample that has similar qualities to the test sample may be used as an additional control. Results that show statistical differences from the laboratory control should be flagged. The laboratory should try to determine the source of variation, document the investigation, and document the steps taken to prevent a recurrence.
Positive Controls	**Corrective Action**
Reference Toxicant Tests	If the LC50 exceeds +/- two standard deviations of the running mean of the last 20 reference toxicant tests, the test should be flagged.
Field Quality Control	**Corrective Action**
Field Duplicate	For duplicates with a heterogeneous matrix, results that do not meet SWAMP criteria should be flagged. The project coordinator should be notified so that the sampling team can identify the source of variation and perform corrective action prior to the next sampling event.
Field Blanks	If contamination of the field blanks and associated samples is known or suspected, the laboratory should flag the affected data. The project coordinator should be notified so that the sampling team can identify the contamination source(s) and perform corrective action prior to the next sampling event.
Equipment Blanks	If contamination of the field blanks and associated samples is known or suspected, the laboratory should flag the affected data. The project coordinator should be notified so that the sampling team can identify the contamination source(s) and perform corrective action prior to the next sampling event.

Metals

Quality control activities and calculations for metals analysis are taken from the SWAMP 2013 table and shown in Table 14Error! Reference source not found.. Corrective actions are shown in Table 15.

Table 14. Quality Control for Metals (From SWAMP 2013 Table)

Laboratory Quality Control	Frequency of Analysis	Measurement Quality Objective
Calibration Standard	Per analytical method or manufacturer's specifications	Per analytical method or manufacturer's specifications
Calibration Verification	Per 10 analytical runs	80-120% recovery
Laboratory Blank	Per 20 samples or per analytical batch, whichever is more frequent	<RL for target analyte
Reference Material[2]	Per 20 samples or per analytical batch, whichever is more frequent	75-125% recovery (70-130% for MMHg)
Matrix Spike	Per 20 samples or per analytical batch, whichever is more frequent	75-125% recovery (70-130% for MMHg)
Matrix Spike Duplicate	Per 20 samples or per analytical batch, whichever is more frequent	75-125% recovery (70-130% for MMHg); RPD<25%
Laboratory Duplicate	Per 20 samples or per analytical batch, whichever is more frequent	RPD<25% (n/a if native concentration of either sample<RL)
Internal Standard	Accompanying every analytical run when method appropriate	60-125% recovery
Field Quality Control	**Frequency of Analysis**	**Measurement Quality Objective**
Field Duplicate	5% of total project sample count	RPD<25% (n/a if native concentration of either sample<RL), unless otherwise specified by method
Field Blank, Equipment Blank	Per method	Blanks<RL for target analyte

[1] Unless method specifies more stringent requirements

[2] Not applicable to selenium speciation

Table 15. Corrective Actions for Metals (From SWAMP 2013 Table)

Laboratory Quality Control	Recommended Corrective Action
Calibration Standard	Recalibrate the instrument. Affected samples and associated quality control must be reanalyzed following successful instrument recalibration.
Calibration Verification	Reanalyze the calibration verification to confirm the result. If the problem continues, halt analysis and investigate the source of the instrument drift. The analyst should determine if the instrument must be recalibrated before the analysis can continue. All of the samples not bracketed by acceptable calibration verification must be reanalyzed.
Laboratory Blank	Reanalyze the blank to confirm the result. Investigate the source of contamination. If the source of the contamination is isolated to the sample preparation, the entire batch of samples, along with the new laboratory blanks and associated QC samples, should be prepared and/or re-extracted and analyzed. If the source of contamination is isolated to the analysis procedures, reanalyze the entire batch of samples. If reanalysis is not possible, the associated sample results must be flagged to indicate the potential presence of the contamination.
Reference Material	Reanalyze the reference material to confirm the result. Compare this to the matrix spike/matrix spike duplicate recovery data. If adverse trends are noted, reprocess all of the samples associated with the batch.
Matrix Spike	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Reanalyze the matrix spike to confirm the result. Review the recovery obtained for the matrix spike duplicate. Review the results of the other QC samples (such as reference materials) to determine if other analytical problems are a potential source of the poor spike recovery.
Matrix Spike Duplicate	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Reanalyze the matrix spike duplicate to confirm the result. Review the recovery obtained for the matrix spike. Review the results of the other QC samples (such as reference materials) to determine if other analytical problems are a potential source of the poor spike recovery.
Laboratory Duplicate	Reanalyze the duplicate samples to confirm the results. Visually inspect the samples to determine if a high RPD between the results could be attributed to sample heterogeneity. For duplicate results due to matrix heterogeneity, or where ambient concentrations are below the reporting limit, qualify the results and document the heterogeneity.
Internal Standard	Check the response of the internal standards. If the instrument continues to generate poor results, terminate the analytical run and investigate the cause of the instrument drift.
Field Quality Control	**Recommended Corrective Action**
Field Duplicate	Visually inspect the samples to determine if a high RPD between results could be attributed to sample heterogeneity. For duplicate results due to matrix heterogeneity, or where ambient concentrations are below the reporting limit, qualify the results and document the heterogeneity. All failures should be communicated to the project coordinator, who in turn will follow the process detailed in the method.
Field Blank, Equipment Blank	Investigate the source of contamination. Potential sources of contamination include sampling equipment, protocols, and handling. The laboratory should report evidence of field contamination as soon as possible so corrective actions can be implemented. Samples collected in the presence of field contamination should be flagged.

TSS

Quality control activities and calculations for TSS analyses are taken from the SWAMP 2013 table and shown in Table 16. Corrective actions are shown in **Error! Reference source not found.**.

Table 16. Quality Control for TSS Testing (From SWAMP 2013 Table)

Laboratory Quality Control	Frequency of Analysis	Measurement Quality Objective
Laboratory Blank[2]	Per 20 samples or per analytical batch, whichever is more frequent	<RL for target analyte
Laboratory Duplicate[3]	Per 20 samples or per analytical batch, whichever is more frequent	RPD<25% (n/a if native concentration of either sample<RL)
Field Quality Control	**Frequency of Analysis**	**Measurement Quality Objective**
Field Duplicate	5% of total project sample count	RPD<25% (n/a if native concentration of either sample<RL)
Field Blank, Equipment Blank	Per method	<RL for target analyte

[1] Unless method specifies more stringent requirements

[2] Not applicable to volatile suspended solids

[3] Applicable only to total suspended solids, total dissolved solids, and ash-free dry mass

Table 17. Corrective Actions for TSS Testing (From SWAMP 2013 Table)

Laboratory Quality Control	Recommended Corrective Action
Laboratory Blank	Reanalyze the blank to confirm the result. Investigate the source of contamination. If the source of the contamination is isolated to the sample preparation, the entire batch of samples, along with the new laboratory blanks and associated QC samples, should be prepared and/or re-extracted and analyzed. If the source of contamination is isolated to the analysis procedures, reanalyze the entire batch of samples. If reanalysis is not possible, the associated sample results must be flagged to indicate the potential presence of the contamination.
Laboratory Duplicate	Reanalyze the duplicate samples to confirm the results. Visually inspect the samples to determine if a high RPD between the results could be attributed to sample heterogeneity. For duplicate results due to matrix heterogeneity, or where ambient concentrations are below the reporting limit, qualify the results and document the heterogeneity.
Field Quality Control	**Recommended Corrective Action**
Field Duplicate	Visually inspect the samples to determine if a high RPD between results could be attributed to sample heterogeneity. For duplicate results due to matrix heterogeneity, or where ambient concentrations are below the reporting limit, qualify the results and document the heterogeneity. All failures should be communicated to the project coordinator, who in turn will follow the process detailed in the method.
Field Blank, Equipment Blank	Investigate the source of contamination. Potential sources of contamination include sampling equipment, protocols, and handling. The laboratory should report evidence of field contamination as soon as possible so corrective actions can be implemented. Samples collected in the presence of field contamination should be flagged.

Hardness

Quality control activities and calculations for hardness analyses are taken from the SWAMP 2013 table and

shown in Table 18. Corrective actions are shown in **Error! Reference source not found.**.

Table 18. Quality Control for Hardness Testing (From SWAMP 2013 Table)

Laboratory Quality Control	Frequency of Analysis	Measurement Quality Objective
Calibration Standard	Per analytical method or manufacturer's specifications	Per analytical method or manufacturer's specifications
Calibration Verification	Per 10 analytical runs	80-120% recovery
Laboratory Blank	Per 20 samples or per analytical batch, whichever is more frequent	<RL for target analyte
Reference Material	Per 20 samples or per analytical batch, whichever is more frequent	80-120% recovery
Matrix Spike	Per 20 samples or per analytical batch, whichever is more frequent (n/a for chlorophyll a and pheophytin a)	80-120% recovery
Matrix Spike Duplicate	Per 20 samples or per analytical batch, whichever is more frequent (n/a for chlorophyll a and pheophytin a)	80-120% recovery; RPD<25% for duplicates
Laboratory Duplicate	Per 20 samples or per analytical batch, whichever is more frequent (chlorophyll a/pheophytin a: per method)	RPD<25% (n/a if native concentration of either sample<RL)
Internal Standard	Accompanying every analytical run as method appropriate	Per method
Field Quality Control	**Frequency of Analysis**	**Measurement Quality Objective**
Field Duplicate[2]	5% of total project sample count	RPD<25% (n/a if native concentration of either sample<RL)
Field Blank, Travel Blank, Equipment Blank	Per method	<RL for target analyte

[1] Unless method specifies more stringent requirements

[2] Field duplicate relative percent differences are not calculated for chlorophyll a analyses for bioassessment

Table 19. Corrective Actions for Hardness Testing (From SWAMP 2013 Table)

Laboratory Quality Control	Recommended Corrective Action
Calibration Standard	Recalibrate the instrument. Affected samples and associated quality control must be reanalyzed following successful instrument recalibration.
Calibration Verification	Reanalyze the calibration verification to confirm the result. If the problem continues, halt analysis and investigate the source of the instrument drift. The analyst should determine if the instrument must be recalibrated before the analysis can continue. All of the samples not bracketed by acceptable calibration verification must be reanalyzed.
Laboratory Blank	Reanalyze the blank to confirm the result. Investigate the source of contamination. If the source of the contamination is isolated to the sample preparation, the entire batch of samples, along with the new laboratory blanks and associated QC samples, should be prepared and/or re-extracted and analyzed. If the source of contamination is isolated to the analysis procedures, reanalyze the entire batch of samples. If reanalysis is not possible, the associated sample results must be flagged to indicate the potential presence of contamination.
Reference Material	Reanalyze the reference material to confirm the result. Compare this to the matrix spike/matrix spike duplicate recovery data. If adverse trends are noted, reprocess all of the samples associated with the batch.
Matrix Spike	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Reanalyze the matrix spike to confirm the result. Review the recovery obtained for the matrix spike duplicate. Review the results of the other QC samples (such as reference materials) to determine if other analytical problems are a potential source of the poor spike recovery.
Matrix Spike Duplicate	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Reanalyze the matrix spike duplicate to confirm the result. Review the recovery obtained for the matrix spike. Review the results of the other QC samples (such as reference materials) to determine if other analytical problems are a potential source of the poor spike recovery.
Laboratory Duplicate	Reanalyze the duplicate samples to confirm the results. Visually inspect the samples to determine if a high RPD between the results could be attributed to sample heterogeneity. For duplicate results due to matrix heterogeneity, or where ambient concentrations are below the reporting limit, qualify the results and document the heterogeneity.
Internal Standard	Check the response of the internal standards. If the instrument continues to generate poor results, terminate the analytical run and investigate the cause of the instrument drift.
Field Quality Control	**Recommended Corrective Action**
Field Duplicate	Visually inspect the samples to determine if a high RPD between results could be attributed to sample heterogeneity. For duplicate results due to matrix heterogeneity, or where ambient concentrations are below the reporting limit, qualify the results and document the heterogeneity. All failures should be communicated to the project coordinator, who in turn will follow the process detailed in the method.
Field Blank, Travel Blank, Equipment Blank	Investigate the source of contamination. Potential sources of contamination include sampling equipment, protocols, and handling. The laboratory should report evidence of field contamination as soon as possible so corrective actions can be implemented. Samples collected in the presence of field contamination should be flagged.

Nutrients

Quality control activities and calculations for nutrients analyses are taken from the SWAMP 2013 table and shown in Table 20Error! Reference source not found.. Corrective actions are shown in Table 21.

Table 20. Quality Control for Nutrients Testing (From SWAMP 2013 Table)

Laboratory Quality Control	Frequency of Analysis	Measurement Quality Objective
Calibration Standard	Per analytical method or manufacturer's specifications	Per analytical method or manufacturer's specifications
Calibration Verification	Per 10 analytical runs	90-110% recovery
Laboratory Blank	Per 20 samples or per analytical batch, whichever is more frequent	<RL for target analyte
Reference Material	Per 20 samples or per analytical batch, whichever is more frequent	90-110% recovery
Matrix Spike	Per 20 samples or per analytical batch, whichever is more frequent	80-120% recovery
Matrix Spike Duplicate	Per 20 samples or per analytical batch, whichever is more frequent	80-120% recovery RPD<25% for duplicates
Laboratory Duplicate	Per 20 samples or per analytical batch, whichever is more frequent	RPD<25% (n/a if native concentration of either sample<RL)
Field Quality Control	**Frequency of Analysis**	**Measurement Quality Objective**
Field Duplicate	5% of total project sample count	RPD<25% (n/a if native concentration of either sample<RL)
Field Blank, Travel Blank, Equipment Blank	Per method	<RL for target analyte

[1] Unless method specifies more stringent requirements

Table 21. Corrective Actions for Nutrients Testing (From SWAMP 2013 Table)

Laboratory Quality Control	Recommended Corrective Action
Calibration Standard	Recalibrate the instrument. Affected samples and associated quality control must be reanalyzed following successful instrument recalibration.
Calibration Verification	Reanalyze the calibration verification to confirm the result. If the problem continues, halt analysis and investigate the source of the instrument drift. The analyst should determine if the instrument must be recalibrated before the analysis can continue. All of the samples not bracketed by acceptable calibration verification must be reanalyzed.
Laboratory Blank	Reanalyze the blank to confirm the result. Investigate the source of contamination. If the source of the contamination is isolated to the sample preparation, the entire batch of samples, along with the new laboratory blanks and associated QC samples, should be prepared and/or re-extracted and analyzed. If the source of contamination is isolated to the analysis procedures, reanalyze the entire batch of samples. If reanalysis is not possible, the associated sample results must be flagged to indicate the potential presence of the contamination.
Reference Material	Reanalyze the reference material to confirm the result. Compare this to the matrix spike/matrix spike duplicate recovery data. If adverse trends are noted, reprocess all of the samples associated with the batch.
Matrix Spike	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Reanalyze the matrix spike to confirm the result. Review the recovery obtained for the matrix spike duplicate. Review the results of the other QC samples (such as reference materials) to determine if other analytical problems are a potential source of the poor spike recovery.
Matrix Spike Duplicate	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Reanalyze the matrix spike duplicate to confirm the result. Review the recovery obtained for the matrix spike. Review the results of the other QC samples (such as reference materials) to determine if other analytical problems are a potential source of the poor spike recovery.
Laboratory Duplicate	Reanalyze the duplicate samples to confirm the results. Visually inspect the samples to determine if a high RPD between the results could be attributed to sample heterogeneity. For duplicate results due to matrix heterogeneity, or where ambient concentrations are below the reporting limit, qualify the results and document the heterogeneity.
Field Quality Control	**Recommended Corrective Action**
Field Duplicate	Visually inspect the samples to determine if a high RPD between results could be attributed to sample heterogeneity. For duplicate results due to matrix heterogeneity, or where ambient concentrations are below the reporting limit, qualify the results and document the heterogeneity. All failures should be communicated to the project coordinator, who in turn will follow the process detailed in the method.
Field Blank, Travel Blank, Equipment Blank	Investigate the source of contamination. Potential sources of contamination include sampling equipment, protocols, and handling. The laboratory should report evidence of field contamination as soon as possible so corrective actions can be implemented. Samples collected in the presence of field contamination should be flagged.

Pesticides

Quality control activities and calculations for pesticides analyses are taken from the SWAMP 2013 table and shown in Table 22Error! Reference source not found.. Corrective actions are shown in **Error! Reference source not found.**Error! Reference source not found.. Analyses of pyrethroid pesticides are shown separately in Table 24 and **Error! Reference source not found.**.

Table 22. Quality Control for Pesticides Testing (From SWAMP 2013 Table)

Laboratory Quality Control	Frequency of Analysis	Measurement Quality Objective
Tuning[4]	Per analytical method	Per analytical method
Calibration	Initial method setup or when the calibration verification fails	• Correlation coefficient (r^2 >0.990) for linear and non-linear curves • If RSD<15%, average RF may be used to quantitate; otherwise use equation of the curve • First- or second-order curves only (not forced through the origin) • Refer to SW-846 methods for SPCC and CCC criteria[4] • Minimum of 5 points per curve (one of them at or below the RL)
Calibration Verification	Per 12 hours	• Expected response or expected concentration ±20% • RF for SPCCs=initial calibration[4]
Laboratory Blank	Per 20 samples or per analytical batch, whichever is more frequent	<RL for target analytes
Reference Material	Per 20 samples or per analytical batch (preferably blind)	70-130% recovery if certified; otherwise, 50-150% recovery
Matrix Spike	Per 20 samples or per analytical batch, whichever is more frequent	50-150% or based on historical laboratory control limits (average±3SD)
Matrix Spike Duplicate	Per 20 samples or per analytical batch, whichever is more frequent	50-150% or based on historical laboratory control limits (average±3SD); RPD<25%
Surrogate	Included in all samples and all QC samples	Based on historical laboratory control limits (50-150% or better)
Internal Standard	Included in all samples and all QC samples (as available)	Per laboratory procedure
Field Quality Control	**Frequency of Analysis**	**Measurement Quality Objective**
Field Duplicate	5% of total project sample count	Per method
Field Blank, Travel Blank, Equipment Blank	Per method	<RL for target analytes

[1] Unless method specifies more stringent requirements; ELISA results must be assessed against kit requirements.

[2] Pyrethroids quality control guidelines are presented in Table 2 immediately below.

[3] All detected analytes must be confirmed with a second column, second technique, or mass spectrometry.

[4] Mass spectrometry only

Table 23. Corrective Actions for Pesticides Testing (From SWAMP 2013 Table)

Laboratory Quality Control	Recommended Corrective Action
Calibration	Recalibrate the instrument. Affected samples and associated quality control must be reanalyzed following successful instrument recalibration.
Calibration Verification	Reanalyze the calibration verification to confirm the result. If the problem continues, halt analysis and investigate the source of the instrument drift. The analyst should determine if the instrument must be recalibrated before the analysis can continue. All of the samples not bracketed by acceptable calibration verification must be reanalyzed.
Laboratory Blank	Reanalyze the blank to confirm the result. Investigate the source of contamination. If the source of the contamination is isolated to the sample preparation, the entire batch of samples, along with the new laboratory blanks and associated QC samples, should be prepared and/or re-extracted and analyzed. If the source of contamination is isolated to the analysis procedures, reanalyze the entire batch of samples. If reanalysis is not possible, the associated sample results must be flagged to indicate the potential presence of the contamination.
Reference Material	Reanalyze the reference material to confirm the result. Compare this to the matrix spike/matrix spike duplicate recovery data. If adverse trends are noted, reprocess all of the samples associated with the batch.
Matrix Spike	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Reanalyze the matrix spike to confirm the result. Review the recovery obtained for the matrix spike duplicate. Review the results of the other QC samples (such as reference materials) to determine if other analytical problems are a potential source of the poor spike recovery.
Matrix Spike Duplicate	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Reanalyze the matrix spike duplicate to confirm the result. Review the recovery obtained for the matrix spike. Review the results of the other QC samples (such as reference materials) to determine if other analytical problems are a potential source of the poor spike recovery.
Internal Standard	Check the response of the internal standards. If the instrument continues to generate poor results, terminate the analytical run and investigate the cause of the instrument drift.
Surrogate	Analyze as appropriate for the utilized method. Troubleshoot as needed. If no instrument problem is found, samples should be re-extracted and reanalyzed if possible.
Field Quality Control	**Recommended Corrective Action**
Field Duplicate	Visually inspect the samples to determine if a high RPD between results could be attributed to sample heterogeneity. For duplicate results due to matrix heterogeneity, or where ambient concentrations are below the reporting limit, qualify the results and document the heterogeneity. All failures should be communicated to the project coordinator, who in turn will follow the process detailed in the method.
Field Blank, Travel Blank, Equipment Blank	Investigate the source of contamination. Potential sources of contamination include sampling equipment, protocols, and handling. The laboratory should report evidence of field contamination as soon as possible so corrective actions can be implemented. Samples collected in the presence of field contamination should be flagged.

[1] Pyrethroids corrective actions are presented in Table 5 immediately below

Table 24. Quality Control for Pyrethroids Testing (From SWAMP 2013 Table)

Laboratory Quality Control	Frequency of Analysis	Measurement Quality Objective
Tuning[2]	Per analytical method	Per analytical method
Calibration	Daily, or just prior to analysis; five or more standards spanning the sample result range[3], with the lowest standard at or below the RL	r ≥0.995 (or r^2 ≥0.995, all curve types not forced through origin)
Calibration Verification	Per 10 analytical samples[4]	80-120%[5]
Laboratory Blank	Per 20 samples or per analytical batch, whichever is more frequent	<RL for target analytes
Laboratory Control Sample[6]	Per 20 samples or per analytical batch, whichever is more frequent	50-150%
Matrix Spike	Per 20 samples or per analytical batch, whichever is more frequent	50-150%
Matrix Spike Duplicate	Per 20 samples or per analytical batch, whichever is more frequent	50-150%; RPD≤35%
Surrogate[7]	Included in all samples and all QC samples	Based on historical laboratory control limits (50-150% or better)
Internal Standard	Included in all samples and all QC samples (as available)	Per laboratory procedure
Field Quality Control[8]	**Frequency of Analysis**	**Measurement Quality Objective**
Field Duplicate	5% of total project sample count	RPD ≤ 35%

[1] Unless project specifies more stringent requirements

[2] Mass spectrometry only

[3] Sample results above the highest standard are to be diluted and re-analyzed.

[4] Analytical samples include samples only and do not include clean-out or injection blanks.

[5] Limit applies to a mid-level standard; low-level calibration checks near the reporting limit may have a wider range that is project - specific

[6] Laboratory control samples must be matrix-specific. A clean sediment, roasted sand, or roasted sodium sulfate may be used for sediments.

[7] Laboratory historical limits for surrogate recovery must be submitted to the SWAMP database in the lab result comment section.

[8] A technical group consisting of regional, laboratory, and research representatives determined that field blanks do not provide technical value to a pyrethroids data set.

Table 25. Corrective Actions for Pyrethroids Testing (From SWAMP 2013 Table)

Laboratory Quality Control	Recommended Corrective Action
Calibration	Affected samples and associated quality control must be reanalyzed following successful instrument recalibration.
Calibration Verification	Initial calibration is analyzed immediately after calibration and should be from a source different than the calibration curve. Bracketing continuing calibration standards are used every ten sample runs for quantitation per method protocol. The analysis must be halted, the problem investigated, and the instrument recalibrated. All samples after the last acceptable continuing calibration verification must be reanalyzed.
Laboratory Blank	The sample analysis must be halted, the source of the contamination investigated, the samples along with a new laboratory blank prepared and/or re-extracted, and the sample batch and fresh laboratory blank reanalyzed. If reanalysis is not possible due to sample volume, flag associated samples.
Laboratory Control Sample	The LCS is analyzed in the same manner as an environmental sample and the spike recovery demonstrates the accuracy of the method. Affected samples and associated quality control must be reanalyzed following LCS troubleshooting and resolution. After troubleshooting, compare to matrix spike/matrix spike duplicate recovery data. If adverse trends are noted, reprocess all samples associated with the batch.
Matrix Spike	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Appropriately spiked results should be compared to the matrix spike duplicate to investigate matrix interference. If matrix interference is suspected, the matrix spike result must be flagged. Appropriately spiked results should be compared to the matrix spike duplicate to investigate matrix interference. If matrix interference is suspected and LCS recoveries are acceptable, the matrix spike and matrix spike duplicate results must be flagged.
Matrix Spike Duplicate	The spiking level should be should be near the midrange of the calibration curve or at a level that does not require sample dilution. Appropriately spiked results should be compared to the matrix spike to investigate matrix interference. If matrix interference is suspected and LCS recoveries are acceptable, the matrix spike duplicate result must be flagged.
Surrogate	Analyze as appropriate per method. Trouble shoot as appropriate, if no instrument problem is found samples should be re-extracted and re-analyzed if possible.
Internal Standard	Analyze as appropriate per method. Troubleshoot as appropriate. If, after trouble-shooting, the responses of the internal standards remain unacceptable, the analysis must be terminated and the cause of drift investigated.
Field Quality Control	**Recommended Corrective Action**
Field Duplicate	For duplicates with a heterogeneous matrix or ambient levels below the reporting limit, failed results may be flagged. All failures should be communicated to the project coordinator, who in turn will follow the process detailed in the method.

B5. Instrument/Equipment Testing, Inspection, and Maintenance

Laboratory instruments and equipment are inspected and maintained by the State certified contract laboratories. Details about testing schedules, testing criteria, spare parts (location and availability), inspection, personnel responsible, and corrective actions can be obtained from the laboratory if needed. The laboratories will provide pre-sterilized collection bottles and ensure the bottle contain the appropriate preservative prior to

delivery to County staff. There is no field equipment used in this project.

B6. Instrument/Equipment Calibration and Frequency

Both project laboratories maintain calibration practices as part of the method SOPs, performed by laboratory technicians under the direction of the individual lab QA Officers. Details about calibration frequency, test criteria, standards or certified equipment, and corrections of deficiencies can be obtained from the laboratories if needed.

B7. Inspection/Acceptance of Supplies and Consumable

All supplies, containers, and other consumable equipment used in this study will be inspected upon purchase or delivery by the Field Technician. The contracted laboratories will determine that all supplies and consumables comply with acceptance criteria outlined in their Standard Operating Procedures prior to conducting analyses. The laboratories will perform inspections of all project related materials per the acceptance criteria within their respective SOPs.

B8. Non-direct Measurement

Rain gauge data from the County of Santa Barbara Water Resources Division (WRD) will be used to plot a hydrograph of each storm event to inform mixing of the composite samples after each sampling session. WRD has 75 rain gauges County-wide that are calibrated annually each September.

B9. Data Management

The County of Santa Barbara and the contracted laboratories will be responsible for the project's data handling and storage. The data produced during this project will be managed following SWAMP protocols and be held in a SWAMP-compatible database at the County. Laboratory data will be transferred to the County in .pdf format and compiled into the database. Data will be reviewed to ensure that they are consistent with the format of the database and other data records. The County database is backed up on a daily basis. Original raw data sheets are stored at the contracted laboratory. All data are compiled and analyzed by the Field Technician. The QA Officer is responsible for overall data quality review. There is no continuous monitoring raw data. There are no identified procedures to demonstrate the acceptability of hardware and software configurations.

Group C. Assessment and Oversight

C1. Assessments and Response Actions

Assessments will be conducted by the QA Officer at the end of each storm season. Assessments will include:

1. Review of field notebooks and datasheets for completeness.

2. Review of laboratory data against SWAMP QA Tables.
3. If necessary, request for corrective action to laboratory QA officers.
4. Confirm corrective actions have been taken.
5. Review of electronic data formatted by Field Technician.
6. Request for corrective action, including data flagging, to Field Technician.
7. Confirm corrective actions have been taken.

A log of assessment activities for this Project will be maintained by the QA Officer and summarized for the Project Manager to review before the annual Municipal General Permit reporting is submitted via SMARTs. The QA Officer has the authority to issue stop work orders.

The laboratories will also conduct assessment activities, and the laboratory QA Officers can be contacted if more information is required.

C2. Reports to Management

A summary of all sampling events will be drafted by the Field Technician and submitted to the QA officer at the end of each rainy season. The summary will include any recommended program changes. Reporting is described in section A9

Group D. Data Validation and Usability

D1. Data review, Verification, and Validation Requirements

Data generated for the field monitoring component of this project will be reviewed by the QA Officer, and compared against the MQOs and the QA/QC practices provided in section A7.

D2. Verification and Validation Methods

In addition to the MQOs presented in Tables 13 through 17, the standard data validation procedures documented in the contract laboratories' Quality Assurance Manuals will be used to accept, reject, or qualify the data generated by the laboratory. Laboratory personnel will verify that the measurement process met all specified MQOs or acceptable deviations explained, for each batch of samples before proceeding with the analysis of a subsequent batch. When QA requirements have not been met, the samples will be reanalyzed when possible and only the results of the reanalysis will be submitted, provided they are acceptable. The contract laboratory's QA Officer will be responsible for validating data generated by the laboratory. All data reported will be assessed for errors in transcription, calculation, and computer input. Field data will be entered electronically and verified against the field data log sheets. The project QA Officer is responsible for reviewing data against the SWAMP MQOs provided in section B5. The project QA Officer will contact the laboratory QA Officer should QC issues be identified and work with them to resolve any data and or procedures that are not consistent with the QC measures described in this document.

D3. Reconciliation with User Requirements

The project is designed to collect data that can be used to characterize pollutant concentrations and loads from representative MS4 discharge locations within the County. The laboratory information produced will be used to estimate a pollutant load for the sampled drainage areas. These results will be used to support model calibration and allow more accurate prediction of local conditions. The model results will then be used to prioritize catchments by their generated pollutant load. This will help identify potential locations for BMPs to improve overall program effectiveness. Data that meet the QA requirements in this document will be considered to meet the user's requirements.

The reports produced by this project will describe some of the limitations of the data. This includes constraints and ability to meet project Measurement Quality Objectives. For data that do not meet MQOs, management has two options: 1. Retain the data for analytical purposes, but flag these data for QA deviations in CEDEN. 2. Do not retain the data and exclude them from all calculations and interpretations. The choice of option is the decision of the Project QA Officer and State Waterboard staff. If qualified data are to be used, then it must be made clear in any associated reporting that these deviations do not alter the conclusions.

Appendix A: Collections of Water and Bed Sediment Samples with Associated Field Measurements and Physical Habitat in California. Version 1.1 updated March 2014

Appendix B: EPA Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms. Fifth Edition October 2002

Appendix C: Weck Laboratories Analytical Methods Standard Operating Procedures

Appendix D: Weck Laboratories Chain of Custody Form

Appendix E: Aquatic Bioassay & Consulting Laboratories Chain of Custody Form

Appendix F: Field Sampling Data Sheet

Collections of Water and Bed Sediment Samples with Associated Field Measurements and Physical Habitat in California.Version 1.1 updated March-2014

The SOPs below are for reference and information purposes only, the documents are recommended, not required by the Surface Water Ambient Monitoring Program (SWAMP). Please see the SWAMP Quality Assurance Program Plan at: http://www.waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa for more information regarding SWAMP QA/QC requirements.

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Acknowledgements:

This procedure has been modified from the Texas Natural Resources Conservation Commission's Procedure Manual for Surface Water Quality Monitoring, with major input from the United State's Geological Survey's (USGS's) National Water Quality Assessment (NAWQA) Protocol for Collection of Stream Water Samples, for which due credit is here with given.

The current version of these protocols was written by Sean Mundell (Moss Landing Marine Labs MPSL Field Sampling Team) with most of the credit to Max Puckett (CDFW) for originally writing this document for part of the original SWAMP QAMP, 2001. Significant contributions also came from Eric von der Geest and the (SWAMP) Quality Assurance (QA) Team, The SWAMP Data Management Team(DMT), Billy Jakl(MPSL), Mary Hamilton (RWQCB 3), and Bettina Sohst(former MPSL employee),

Field Measurements

Field Data Sheets

Field data sheets are used to record field observations, probe measurements, and water and sediment chemistry sampling. Field data sheets are provided on the SWAMP Data Management Resources Website at: **Water Quality Field Data Sheet** *(updated 12/18/12).*

There are guidelines provided below to standardize what is recorded on all data sheets and that should be helpful in completing each form. The entries discussed below and on the field data sheets are recorded at each sampling site.

Notes to Standardize SWAMP Field Data Sheets (For in the field use)

KEY REMINDERS to IDENTIFY SAMPLES:

1. **SAMPLE TIME** is the SAME for all samples (Water, Sediment, & Probe) taken at the sampling event. Use time of FIRST sample; important for COC (is used for identification of sample).
2. **LEFT BANK/RIGHT BANK**
   Left bank is defined as the bank to the left of the observer when facing downstream, and the *right bank* is to the right of the observer when facing downstream
3. **GROUP;** many different ways to do a group, one suggestion is to create groups which assign trips to assess frequency of field QA

COLLECTION DETAILS:

1. **PERSONELL**: S. Mundell, G Ichikawa (first person listed is crew leader)
2. **LOCATION:** Bank, Thalweg, Mid-Channel, Open Water**.** Use "open water" in bay/estuary/harbor only if no distinguishable channel exists
3. **GRAB vs. INTEGRATED**: GRAB samples are when bottles are filled from a single depth; INTEGRATED sample are taken from MULTIPLE depths/grabs and combined.
   A. GRAB: use 0.1 for subsurface samples; if too shallow to submerge bottle; depth = 0
   B. INTEGRATED: -88 in depth sampled, record depths combined in sample comments
4. **TARGET LAT/LONG**: Refers to the existing station location that the sampling crew is trying to achieve; can be filled out prior to sampling
5. **ACTUAL LAT/ LONG**: is the location of the current sample event.
6. **HYDROMODIFICATION:** Describe existing hydro modifications such as a grade control, drainage pipes, bridge, culvert
7. **HYDROMOD LOC**: if there is an IMMEDIATE (with in range potentially effecting sample) hydro modification; Is the hydro modification upstream/downstream/within area of sample; if there is no hydro modification, NA is appropriate
8. **STREAM WIDTH and DEPTH**: describe in meters at point of sample.

FIELD OBSERVATIONS: (each one of these observations has a comment field in the database so use comment space on data sheet to add information about an observation if necessary)

1. **PICTURES:** use space to record picture numbers given by camera; be sure to rename accordingly back in the office. (StationCode_yyyy_mm_dd_unique code)
2. **WADEABILITY**: in general, is water body being sampled wadeable to the average person AT the POINT of SAMPLE
3. **DOMINANT SUBSTRATE**: if possible; describe DOMINANT substrate type; use UNK if you cannot see the dominant substrate type
4. **BEAUFORT SCALE**: use scale 0-12; refer to scales listed on page 28
5. **WIND DIRECTION**: records the direction from which the wind is blowing
6. **OTHER PRESENCE**: VASCULAR refers to terrestrial plants or submerged aquatic vegetation

(SAV) and NONVASCULAR refers to plankton, periphyton etc. These definitions apply to vegetation IN the water at the immediate sampling area.

7. **OBSERVED FLOW**: Visual estimates of flow range in cubic feet/second. Flow should be recorded even if flow is visible but not measurable on that sampling visit. This is an observational measurement that is highly dependent on the knowledge of monitoring personnel.
8. **WATER COLOR**: This is the color of the water from standing creek side
9. **WATER CLARITY**: this describes the clarity of the water while standing creek side; clear represents water that is clear to the bottom, cloudy may not be clear to bottom but greater than 4 inches can be seen through the water column.
10. **PRECIPITATION LAST24hrs:** refers to field crew's best categorization of rainfall in the last 24 hrs; may or may not effect Overland Runoff Last 24 hrs
11. **OVERLAND RUNOFF LAST 24 hrs**: Significant precipitation is defined as any amount that visibly influences water quality. Light Precipitation = fog, drizzle, and/or light rain with no overland runoff; Mod to Heavy Precipitation = rain such that site probably or definitely received at least some overland runoff.
12. **SEDIMENT COMP**: generally described sediments used for chemistry sample Note: these reminders do not give all details needed to maintain equivalent SWAMP sampling protocols, they are strictly for "infield" use to help insure comparability of field observations.
13. **WATER APPEARANCE:** Note general appearance (e.g., color, unusual amount of suspended matter, debris or foam)
14. **SEDIMENT APPEARANCE** Color, Odor and sediment composition should be noted.
15. **WEATHER:** Note recent meteorological events that may have impacted water quality; (e.g., heavy rains, cold front, very dry, very wet)
16. **BIOLOGICAL ACTIVITY:** Note excessive macrophyte, phytoplankton or periphyton growth. The observation of water color and excessive algal growth is very important in explaining high chlorophyll a values. Other observations such as presence of fish, birds and spawning fish are noted.
17. **WATERSHED or INSTREAM ACTIVITIES:** Note in stream or drainage basin activities or events that is impacting water quality (e.g., bridge construction, shoreline mowing, livestock watering upstream).
18. **RECORD of PERTINENT OBSERVATIONS RELATED to WATER QUALITY and STREAM USES:** If the water quality conditions are exceptionally poor, note that standards are not met in the observations, (e.g., dissolved oxygen is below minimum criteria). Note uses (e.g., swimming, wading, boating, fishing, irrigation pumps, navigation). Eventually, for setting water quality standards, the level of use will be based on comments related to the level of fishing and swimming activities observed at a station.
19. **SPECIFIC SAMPLE INFORMATION:** Note specific comments about the sample itself that may be useful in interpreting the results of the analysis (e.g., number of sediment grabs, or type and number of fish in a tissue sample). If the sample was collected for a complaint or fish kill, make a note of this in the observation section.
20. **MISSING PARAMETERS:** If a scheduled parameter or group of parameters is not collected, make some note of this in the comments.
21. **RECORD of DATA SUBMISSION:** Initials and date are recorded on the field data sheet showing a record that the data has been transcribed onto data forms and submitted to the SWAMP data management staff.

Record of Samples Collected for Purposes of Chemical Analysis

The general types of chemical samples to be collected are listed for each site, since this may vary from site-to-site (e.g., metals-in-water, pesticides-in-sediments, conventional water quality). Analyses authorization forms are recommended since different authorized laboratories perform different chemical analyses. The method of preservation for each chemical sample is recorded, as appropriate on the Chain of Custody Form (COC).

Field Data Measurements

While collecting water samples (see Field Collection Procedures for Water Samples page 29), record appropriate field measurements. When field measurements are made with a multi-parameter instrument, it is preferable to place the sonde in the body of water to be sampled and allow the dissolved oxygen (D.O.) to equilibrate. D.O. usually takes the longest to equilibrate out of the probe measurements (pH, Temperature, Conductivity and Turbidity) Field measurements are made at the centroid of flow, if the stream visually appears to be completely mixed from shore to shore. *Centroid* is defined as the midpoint of that portion of the stream width which contains 50% of the total flow. Probe measurements and water sampling are best to collect in the stream location that best represents the entire stream. For routine field measurements, the date, time and depth are reported as a grab. Quality control requirements for field measurements are listed in Quality Control and Sample Handling Tables for Field Measurements in Fresh and Marine Water.

Recommended Depths for Conducting Field Data Measurements

Water Depth Less than 5 ft (<1.5 m)	If the water depth is less than 5 ft (1.5 m), grab samples for water are taken at approximately 0.1 m (4 in.), and multi-probe measurements are taken at approximately 0.2 m (8 in.). This is because all sensors have to be submerged, so 0.1 m would not be deep enough. But taking a grab sample at 0.2 m is not always feasible, as it is difficult to submerge bottles to that depth, and in many cases the bottle will hit the stream bottom.
Water Depth Greater than 5 ft (>1.5 m)	If the water depth at the sampling point exceeds 5 ft (1.5 m) in depth, a vertical profile of dissolved oxygen, temperature, pH and specific conductance are made using the multi-parameter probe equipment. The depth of the sonde at the time of measurement is most accurately determined from the depth sensor on the multi-parameter sonde rather than depth labels on the cable.
Vertical Depth Profiles and Depth-Integrated Sample Collection	If depth integration sampling is being conducted, or if vertical profile measurements are requested, multi-probe measurements are made starting at a depth of 0.2 m, and are then conducted at 1.0, 2.0, 3.0, 4.0, and 5.0 m depths after that until 5.0 m depth is reached. Beginning at 5.0 m, measurements are made every 5.0 m through depth profile.

Field data for multi-parameter vertical depth profiles are recorded in final form on the SWAMP Field Data Sheets and submitted to the SWAMP data management staff. Go to http://www.waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa for detailed information on data reporting.

Water Temperature (^{O}C)

Water temperature data are recorded for each site visit in final form on a Field Data Sheet and submitted to the SWAMP data management staff.

Temperature Sampling Procedures

Temperature is measured in-stream at the depth(s) specified above. Measuring temperature directly from the stream by immersing a multi-probe instrument or thermometer is preferred.

Hand Held Centigrade Thermometer

If an electronic meter is not available, the temperature is measured with a hand-held, centigrade thermometer (Rawson, 1982).

- In wadeable streams, stand so that a shadow is cast upon the site for temperature measurement.
- Hold the thermometer by its top and immerse it in the water. Position the thermometer so that the scale can be read.
- Allow the thermometer to stabilize for at least one minute, then without removing the thermometer from the water, read the temperature to the nearest 0.1^{o} C and record.
- Do not read temperature with the thermometer out of the water. Temperature readings made with modern digital instruments are accurate to within $\pm$ 0.1^{o} C.

Temperature Measurement from a Bucket

When temperature cannot be measured in-stream, it can be measured in a bucket-Nalgene or plastic container. Care must be taken to insure a measurement representative of in-stream conditions.

The following conditions must be met when measuring temperature from a bucket:

- The bucket must be large enough to allow full immersion of the probe or thermometer.
- The bucket must be brought to the same temperature as the water before it is filled.
- The probe must be placed in the bucket immediately, before the temperature changes.
- The bucket must be shaded from direct sunlight and strong breezes prior to and during temperature measurement.
- The probe is allowed to equilibrate for at least one minute before temperature is recorded.
- After these measurements are made, this water is discarded and another sample is drawn for water samples which are sent to the laboratory.

pH (standard units)

pH data is recorded for each SWAMP visit in final form on the Field Data Sheets and submitted to the SWAMP data management staff. Go to http://www.waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa for detailed information on data reporting.

pH Sampling Equipment

The pH meter should be calibrated according to the recommended procedures for calibration and maintenance of SWAMP field equipment. Calibration directions are listed in the manufactures field equipment operations manual. The pH function is pre and post calibrated every 24 h of use for multi-parameter instruments.

pH Sampling Procedures

In-stream Method

Preferably, pH is measured directly in-stream at the depth(s) specified earlier in this document. Allow the pH probe to equilibrate for at least one minute before pH is recorded to the nearest 0.1 pH unit.

pH Measurement from a Bucket

When pH cannot be measured in-stream, it can be measured in a bucket-Nalgene or plastic container. The following precautions are outlined above; “Temperature Measurement from a Bucket”.

Potential Problems

- < If the pH meter value does not stabilize in several minutes, out gassing of carbon dioxide or hydrogen sulfide, or the settling of charged clay particles may be occurring (Rawson, 1982).
- < If out gassing is suspected as the cause of meter drift, collect a fresh sample, immerse the pH probe and read pH at one minute.
- < If suspended clay particles are the suspected cause of meter drift, allow the sample to settle for 10 min, then read the pH in the upper layer of sample without agitating the sample.
- < With care, pH measurements can be accurately measured to the nearest 0.1 pH unit.

Dissolved Oxygen (mg/L)

Dissolved oxygen (D.O.) data is recorded for each SWAMP visit in final form on a Field Data Sheet and submitted to the SWAMP data management staff.
See http://www.waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa for detailed information on data reporting.

Dissolved Oxygen Sampling Equipment

The dissolved oxygen meter should be calibrated according to the recommended procedures for calibration and maintenance of SWAMP field equipment. Calibration directions are listed in the manufactures field equipment operations manual.

Multi-probe Instrument

Pre and post calibrate the D.O. sensor every 24 h and for elevations greater than 500 ft on the multi-probe instrument. Preferably, D.O. is measured directly in-stream at the depth(s) specified in the Field Measurements section above. The D.O. probe must equilibrate for at least 90 s before D.O. is recorded to the nearest 0.1 % saturation or mg/L. Care must be taken at profile stations to insure that the reading is stable for each depth. Since dissolved oxygen takes the longest to stabilize, record this parameter after temperature, conductivity and pH. If the D.O. probe has an operable, automatic stirrer attached, the D.O. probe does not have to be manually stirred. However, if the probe is not equipped with an automatic stirrer, manual stirring must be provided by raising and lowering the probe at a rate of 1 ft/s (0.3m/s) without agitating the water surface. If the stream velocity at the sampling point exceeds 1 ft/s, the probe membrane can be pointed upstream into the flow and manual stirring can be avoided (Rawson, 1982).

D.O. Measurement from a Bucket

When D.O. cannot be measured in-stream, it can be measured in a bucket-Nalgene or plastic container, following precautions outlined in the Temperature Measurement from a Bucket listed above. During equilibration and reading, water should be moved past the membrane surface at a velocity of 1 ft/s (0.3 m/sec), either by automatic stirrer or manual stirring. If stirred manually in a bucket, the water surface is not agitated (Rawson, 1982).

24-Hour Average D.O. Continuous Monitoring (if requested in special study)

Unattended 24-Hour D.O. Data Collection

Why Collect 24-Hour Data

Dissolved oxygen sampling for standards compliance is targeted to water bodies where low instantaneous D.O. levels indicate partial or nonsupport of designated aquatic life uses. Intensive monitoring is conducted with automated equipment that is preset to record and store field measurements hourly over one 24-h period. Four or more dissolved oxygen measurements may also be made manually at 4-6-h intervals over one 24-h period, as long as one is made near sunrise (0500-0900 h) to approximate the daily minimum. However, data collected with automated equipment is preferred.

When to Take Measurements

All 24-h D.O. monitoring events must be spaced over an index period representing warm-weather seasons of the year (approx March 15-October 15), with between one-half to two-thirds of the measurements occurring during the critical period (July 1-September 30). The ***critical period*** of the year is when minimum stream flows, maximum temperatures, and minimum dissolved oxygen concentrations typically occur in area streams. **A flow measurement must be taken at the time of deployment.** In a perennial stream, a 24-h data for standards compliance can not be used if the flow is less than the 7Q2. In perennial streams, the D.O. criterion to do not

apply for flows under the 7Q2. A period of about one month must separate each 24-h sampling event. Additional samples may be collected outside the index period to further characterize a water body, but that information is generally not used for assessing standards compliance.

Frequency of Measurements

The measurement interval should be no more than once per 15 min and no less than once per hour.

Where to Take Measurements

For purposes of determining standards compliance with the 24-h average criteria, samples collected near the surface will be considered representative of the mixed surface layer. In deep streams, reservoirs, and tidally influenced water bodies, automated equipment is positioned between 1 foot (from the surface) to one-half the depth of the mixed surface layer. At least 10 24-h monitoring events (using the 24-h criteria and/or absolute minimum criteria) at each site within a 5-year period are recommended to provide adequate data for assessment.

When to Collect Other Routine Samples, if doing 24-hour D.O. measurements

Other routine field measurements and water samples should be collect at either the time of deployment, at the reference check, or when the multi-probe recording 24-h data is retrieved. When ever possible, flow must be measured at the 24-h site.

Priority for Scheduling 24-Hour Sampling Events

- 303d listed waterbodies
- Waterbodies with Concerns for DO problems (too few samples available for full use assessment).
- Occurrence of low D.O. concentrations observed during the day
- Waterbodies with trends indicating declining D.O. concentrations
- Waterbodies which would contribute to an Eco-region data set

Data Reporting for 24-hour D.O. measurements

Dissolved oxygen values recorded over the 24-h period are summed and divided by the number of measurements to determine the average concentration, which is compared to the 24-h criterion. The lowest D.O. value from each 24-h set is compared to the minimum criterion. There will be occasions when a complete 24-h data set won’t be possible. For example, if there are 18 measurements instead of 24, a time weighted diurnal average needs to be calculated. This can be easily done using GW Basic.

Support of assigned aquatic life use is based on 24-h D.O. average and minimum criteria for each monitoring event. Report the 24-h average D.O. value, number of measurements over a 24-h period, and the minimum, and maximum values. Report data as a time composite sample with a beginning and ending date and time, covering the 24-h period measured.

Specific Conductance (µS/cm)

Specific conductance should be recorded for each SWAMP visit in final form on a Field Data Sheet and submitted to the SWAMP data management staff.
See http://www.waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa for detailed information on data reporting.

Specific Conductance Sampling Equipment

The conductivity meter should be calibrated according to the recommended procedures for calibration and maintenance of SWAMP field equipment. Calibration directions are listed in the manufactures field equipment operations manual.

Specific Conductance Sampling Procedure

Preferably, conductivity is measured directly in-stream at the depth(s) specified earlier in this document. Allow the conductivity probe to equilibrate for at least one minute before specific conductance is recorded to three significant figures (if the value exceeds 100). The primary physical problem in using a specific conductance meter is entrapment of air in the conductivity probe chambers. The presence of air in the probe is indicated by unstable specific conductance values fluctuating up to ±/-100 µS/cm. The entrainment of air can be minimized by slowly, carefully placing the probe into the water; and when the probe is completely submerged, quickly move it through the water to release any air bubbles.

If specific conductance cannot be measured in-stream, it should be measured in the container it can be measured in a bucket-Nalgene or plastic container. The following precautions are outlined above; “Temperature Measurement from a Bucket”.

Salinity (parts per thousand--ppt, or ‰)

The value for salinity is computed from chloride concentration or specific conductance. The calculation assumes a nearly constant ratio for major ions in an estuary when seawater is diluted by river water. This assumption does not hold for cases where salinity is less than about three parts per thousand. Salinity determinations at such low values are only approximate. In estuarine waters, salinity is a relevant and meaningful parameter. Often the salinity may be low, approaching that of freshwater. Nevertheless, this is useful information. Determine if a station is estuarine from historical records (i.e., experiences cases where salinity is >2.0 ppt) and always report salinity at this station, regardless of the salinity during periods of high flow.

Salinity is measured directly in-stream at the depth(s) specified earlier in this document. Salinity data should be recorded for each SWAMP visit in final form on a Field Data Sheet and submitted to the SWAMP data management staff. See http://www.waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa for detailed information on data reporting.

Values between 2.0 ppt and 1.0 ppt should be reported as <2.0 ppt rather than the actual value and values <1.0 ppt should be reported as <1.0 ppt. The field instruments compute salinity from specific conductance and temperature, and display the value in parts per thousand. Report salinity values above 2.0 ppt to the nearest 0.1 ppt.

Secchi Disc Transparency (meters)--if requested in special study

Secchi disk transparency should be recorded for each SWAMP visit in final form on a Field Data Sheet and submitted to the SWAMP data management staff. See http://www.waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa for detailed information on data reporting.

Secchi Disk Sampling Equipment

- Secchi disk, 20 cm in diameter
- Measuring tape

Secchi Disk Transparency Sampling Procedures

Preferably, Secchi disk transparency is measured directly in-stream wherever conditions allow. The Secchi disk should be clean, weighted and suspended with chain, wire, or Dacron line (the line used to suspend the Secchi disk should not be nylon or cotton; stretching may cause erroneous readings). Another option is to attach the Secchi disk to a metal rod calibrated in metric units.

Average Turbidity

The Secchi disk should be lowered vertically in a location shielded from direct sunlight. Glare from the water's surface will affect the accuracy of the measurement. Don't wear sunglasses.

Slowly lower the disk until it disappears from view. The person viewing the disk should maintain an eye level of less than two meters above the water's surface. Note the depth at which the disk disappears from view.

Slowly raise the disk until it becomes visible. Note the depth at which the disk reappears.

Compute the mathematical average of the two depths noted and record the average value to two significant figures on the field data sheet. The recorded average value is the Secchi disk transparency.

High Turbidity (Muddy Water)

In streams with very high turbidity, high velocity, and/or poor access, it may be necessary to measure Secchi disk transparency in a bucket. Fill the bucket from the centroid of flow being careful not to disturb the substrate.

Follow steps above for measuring the Secchi disk depth within 30 s after raising the filled bucket from the water's surface. Or, re-suspend the solids by stirring, then quickly make the measurement.

Record Secchi disk transparency to two significant figures.

Low Turbidity (Clear Water)

Some bodies of water will be so clear and shallow that it will not be possible to lower the Secchi disk until it disappears from view.

Measure and record the depth at the deepest point accessible. Report Secchi disk transparency as greater than the deepest depth measured.

Example (Low Turbidity): South Fork Rocky Creek is a small (<1 ft^3/s) clear stream. The stream in the vicinity of the sampling site was less than 1 m deep and the bottom was clearly visible everywhere. However, a pool was located in the stream next to a bridge. The maximum depth of the pool was 2.6 m at which depth the Secchi disk was still visible. Therefore, Secchi disk transparency for South Fork Rocky Creek was recorded as > 2.6 m.

Importance of Secchi Disk Data

Eutrophication, the natural aging process in reservoirs and lakes is accelerated by human activities which add nutrients to lakes, reservoirs, and the surrounding watersheds. Section 314 of the Clean Water Act (CWA) of 1987 requires all states to classify lakes and reservoirs according to trophic state. Although chlorophyll a is the most direct measure of algal biomass, other indices and programs utilize Secchi disk depth as the primary factor.

Turbidity Measurement with Turbidity Meter

Nephelometric Turbidity (turbidity standard unit is called Nephelometric Turbidity Units (NTU)) can be determined by measuring the amount of scatter when light is passed through a sample using a turbidity meter. The LaMotte 2020 Turbidity meter is a suitable instrument for example. There are also turbid-ometers attached to multi-probe instruments like YSI or Hydro-Lab.

Turbidity meters should be calibrated using a standard close to the expected sample value. Calibration standards should be used that are relative to the suspended sediment particles in the sampleable water column. Typical calibration standard values are 1, 10, 100, and 1000 NTU's.

For instructions on how to operate the instruments refer to the manufacturer's manual. Turbidity measurements can be executed together with water sampling. The turbidity sample has to be representative for the sampled water mass. Make sure that no gas bubbles are trapped in the vial for the reading and that the outside of the vial is wiped completely clean (i.e., meaning free of moisture, lint and fingerprints). Take several measurements to assure an accurate reading. Do not record values that vary greatly. If variations are small, record an average. If settling particles are present, record a reading before and one after settling. The meter might have to be recalibrated with a different standard, if the sample water readings are outside of the calibration standard limits.

Flow

Sampling crews should be notified on reconnaissance forms if it is known that there is an operational United States Geological Survey (USGS) gage located at or nearby a sampling site. If there is a USGS gage nearby, a gage height in feet is recorded and later converted to an instantaneous flow value and recorded on the field data sheet. The gage height is always to be reported to the USGS for conversion to flow. If a USGS gage is not available, a flow measurement should be taken, if requested. See Instantaneous Flow Measurement information starting on page 13 in this document. Centroid velocity measurements may also be taken as a minimum acceptable rough characterization of the stream flow as requested, although this measurement is not to be recorded as a flow, since it is only a velocity measurement
Flow information for over 200 USGS sites is available on the Internet. The address is **http://water.usgs.gov/index.html**. This is useful information in determining flow conditions prior to sampling. This information may be included in general observations.

Flow Measurement Method (Reporting)

The method used to measure flow is noted by reporting which instrument or gage is used. Examples are, Flow Gage Station (USGS/IBWC), Electric Marsh-McBirney flo mate 4000, Mechanical (ex. Pigmy meter), Weir/Flume, Other (orange peel, etc.) Flow data transformers are used to enter flow data into the SWAMP database. Please contact the SWAMP data management team to obtain the flow data transformer.

Flow (ft^3/s)

If requested, flow data should be recorded for each monitoring visit to non-tidal, flowing streams. Flow data should be recorded in final form on a Field Data Sheet and submitted to the SWAMP data management staff. See http://www.waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa for detailed information on data reporting. The following are two exceptions to the flow reporting requirement:

No Flow/ Pools — If there is no flow at a stream site and accessible, isolated pools remain in the stream bed, collect and report the required field data and laboratory samples from the pools and report instantaneous flow. Under these conditions, flow (ft^3/s) should be reported as zero. Pools may represent natural low-flow conditions in some streams and the chemistry of these pools will reveal natural background conditions.

Dry — If the stream bed holds no water, the sampling visit is finished. Report that the stream was "dry" in the observations. No value is reported for flow since there is no water.

Flow Measurement

If a flow measurement is required at a site, measure and record flow after recording visual observations. The intent of measuring flow first is to delay collection of chemical and biological water samples with limited holding times. Care must be taken not to collect water samples in the area disturbed during flow measurement. There are several acceptable flow measurement methods that can be used.

U.S. Geological Survey (USGS) Gaging Station

Some SWAMP Stations are sampled at sites where the USGS maintains flow gaging equipment. On any type of sampling visit to a site that has a USGS flow gage, observe and record the gage height to the nearest hundredth of a foot in the field logbook. Upon return to the office, contact the USGS office responsible for maintaining the gage. USGS personnel can provide the flow value in cubic feet per second (ft^3/s) that corresponds to the gage height. Although SWAMP personnel may have a rating curve available to them, shifts associated with changes in the stream bed may occur over time. Always call the USGS to determine the shift. At some sites the shift changes frequently. At others, the relation between stream flow and gage height is almost unchanging. If a gage is no longer maintained by USGS, cross out the recorded gage height and be prepared to measure flow by another method on the return visit to that site.

Several factors may influence the accuracy of the USGS rating curves that are used to convert gage height to flow. If there is any doubt about the accuracy of a USGS gage height reading or flow rating curve, sampling personnel should measure the flow if possible.

Gage height may be indicated at a USGS gage by one of three methods:

Staff Gage

Staff gages are enameled steel plates (with the appearance of large measuring tapes) bolted to some stable structure. For example, staff gages may be bolted to concrete bridge abutments, pillars, or docks. The staff gage face is white with black lettering and gradations. The gradations shown are feet, tenths of a foot, and 0.02 of a foot. The point at which the water level crosses the staff gage should be recorded to the nearest hundredth of a foot.

Wire Weight Gage

Wire weight gages are locked, metal boxes with approximate dimensions of 15 in. long x 12 in. tall x 12 in. deep. Wire weight gages are usually affixed to bridge rails near mid-stream. They must be unlocked with a USGS key. The wire weight gages house a weight attached by wire cable to a graduated reel (gradations are tenths and hundredths of feet) with a counter at one end.

When the reel is released the weight can be gradually lowered until the bottom of the weight contacts the water surface. At the point of contact, the weight causes the water surface to ripple slightly. Maintaining the weight in that position, record the counter value to the nearest whole number and the point indicated by the stylus on the graduated reel to the nearest hundredth of a foot. Determine if the gage is the movable type that can be moved to multiple

locations on the bridge. This type is common on braided streams. A correction value is stamped on the bridge near each point that the gage can be attached. Record the corrected value as the gage height in feet.

Bubble Gage

Bubble gages are locked in metal sheds that are approximately 4 ft wide x 4 ft deep x 6.5 ft tall. The gage houses are most frequently located on the shore near a bridge but sometimes are attached to bridge pillars near mid-stream or established on the stream bank far from any bridge. The gage house must be unlocked with a USGS key. Bubble gages in gage houses usually indicate the gage height in two or three locations. A counter attached to the manometer system indicates gage height in feet. Some gage houses have stilling wells that can be entered. Often there is a staff gage on the inside wall.

Most bubble gages are also equipped with digital recorders. Digital recorders consist of two white, coded discs, approximately 4 in. in diameter with a punch tape overlapping a portion of each disc. The discs are marked with 100 gradations. As the front of the digital recorder is viewed, the stylus at the disc on the left indicates height in feet. The stylus at the disc on the right indicates gage height in hundredths of feet. The gage height from both discs should be added and the number recorded in the field logbook as gage height to the nearest hundredth of a foot.

Many USGS metal sheds also contain a surface level recorder. This devise can be opened to determine how stable stream flow has been prior to the sampling event. Record observations concerning the flow hydrograph.

Instantaneous Flow Measurement

Water quality monitoring visits to sites where there are no nearby USGS flow gauges will require water quality monitoring personnel to measure flow, when requested by Regional Water Quality Control Boards (Regional Boards).

Flow Measurement Equipment

Flow meter

One of the following or an equivalent:

- Marsh-McBirney Electronic meter
- Montedoro-Whitney Electronic meter
- Price Pigmy meter (with timer and beeper)
- Price meter, Type AA (with Columbus weight)

Additional Equipment

- Top-setting wading rod (preferably measured in tenths of feet)(see Figure 1).
- Tape measure (with gradations every tenth of a foot or every centimeter).

Flow Measurement Procedure (USGS, 1969)

Select a stream reach with the following characteristics:

- Straight reach with laminar flow (threads of velocity parallel to each other) and bank to bank. These conditions are typically found immediately upstream of riffle areas or places where the stream channel is constricted.
- The site should have an even streambed free of large rocks, weeds, and protruding obstructions that create turbulence. The site should not have dead water areas near the banks, and a minimum amount of turbulence or back eddies.

Flat Streambed Profile (cross section)

Stretch the measuring tape across the stream at right angles to the direction of flow. When using an electronic flow meter, the tape does not have to be exactly perpendicular to the bank (direction of flow). When using a propeller or pigmy type meter, however, corrections for deviation from perpendicular must be made.

If necessary and possible, modify the measuring cross section to provide acceptable conditions by building dikes to cut off dead water and shallow flows, remove rocks, weeds, and debris in the reach of stream one or two meters upstream from the measurement cross section. After modifying a streambed, allow the flow to stabilize before starting the flow measurement.

Record the following information on the flow measurement form (see example Flow Measurement Forms at end of this document):

- Station Location and Station ID
- Date
- Time measurement is initiated and ended
- Name of person(s) measuring flow
- Note if measurements are in feet or meters
- Total stream width and width of each measurement section
- For each cross section, record the mid-point, section depth and flow velocity

Measuring the Stream Width

Measure and record the stream width between the points where the tape is stretched (waters edge to waters edge).

Determining the Number of Flow Cross Sections

Determine the spacing and location of flow measurement sections. Some judgment is required depending on the shape of the stream bed. Measurements must be representative of the velocity within the cross-section. If the stream banks are straight and the depth is nearly constant and the bottom is free of large obstructions, fewer measurements are needed, because the flow is homogeneous over a large section. Flow measurement sections do not have to be equal width. However, they should be unless an obstacle or other obstruction prevents an accurate velocity measurement at that point. ***No flow measurement section should have greater than 10% of the total flow.***

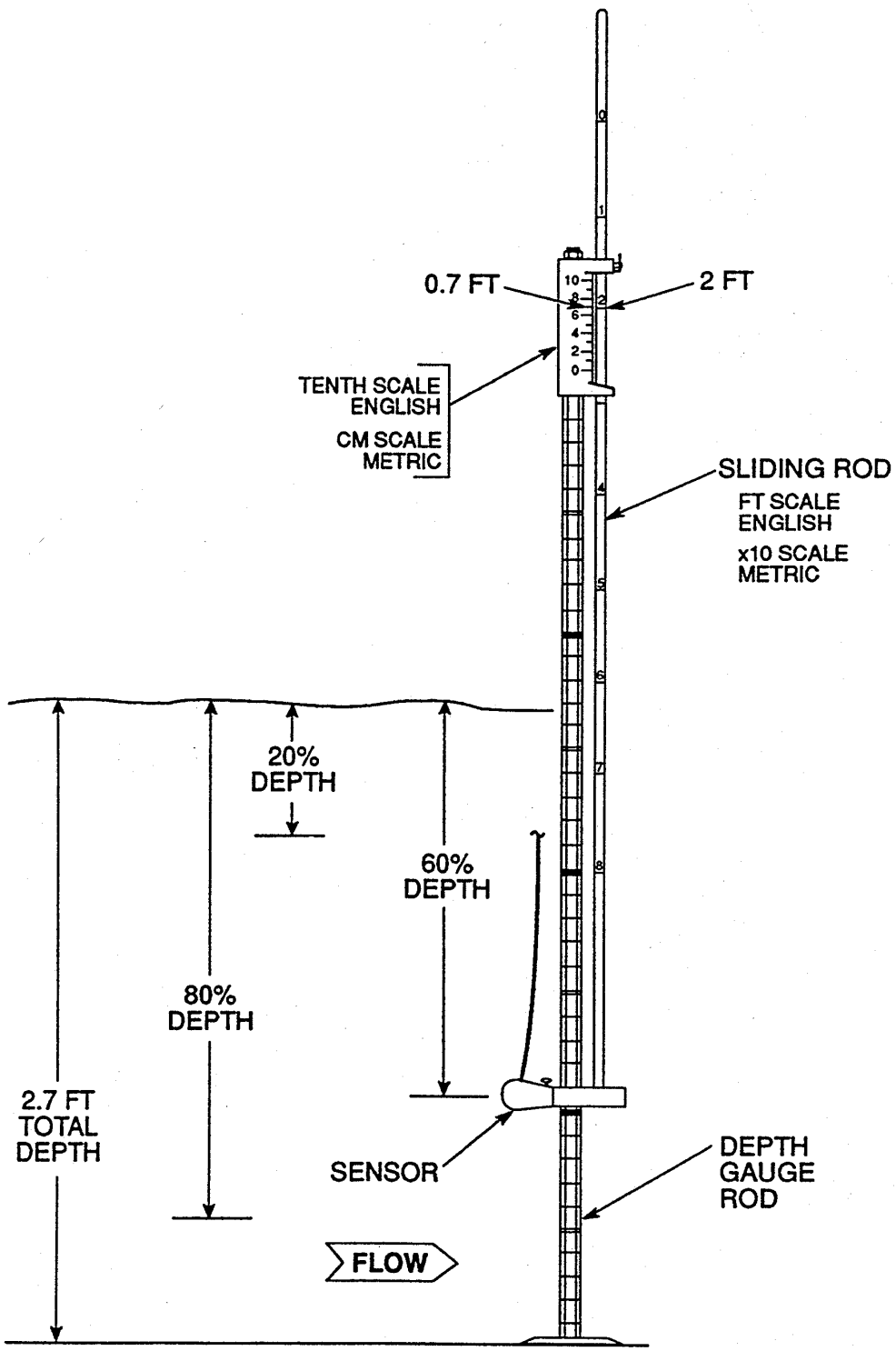
If the *stream width is less than 5 ft*, use flow sections with a width of 0.5 ft (See example 1 on page 23 of this document). If the *stream width is greater than 5 ft*, the minimum number of flow measurements is 10. The preferred number of flow measurement cross sections is 20-30 (See Example 2 on page 24 on this document). The total stream width is 26 ft with 20 measurements, section widths will be 1.3 ft (26/20 = 1.3).

Determining the Mid-Point of the Cross Section

To find the mid-point of a cross section, divide the cross section width in half. Using Example 2 (see forms at end of document);

- The total stream width is 26 ft with 20 cross sections and each cross section width is equal to 1.3 ft.
- Divide 1.3 ft in half and the mid-point of the first section is 0.65 ft. In this example the tape at waters edge is set at zero (0) ft.
- By adding 0.65 to zero the mid-point of the first section is 0.65 ft.
- Each subsequent mid-point is found by adding the section width (1.3 ft) to the previous mid-point. For example; MIDPOINT #1 is 0.65 + 0.0 = 0.65; MIDPOINT #2 is 0.65 + 1.3= 1.95 ft; MIDPOINT #3 is 1.95 + 1.3 = 3.25 ft and ....MIDPOINT # 20 is 24.05 +1.3.
- Place the top setting wading rod at 0.65 ft for the first measurement.
- Using a top setting wading rod, measure the depth at the mid-point of the first flow measurement section and record to the nearest 0.01 ft.

Figure 1. Top-Setting Wading Rod (Marsh-McBirney)



Adjusting the Sensor Depth at a Cross Section

Adjust the position of the sensor to the correct depth at each mid-point. The purpose of the top setting wading rod is to allow the user to easily set the sensor at 20%, 60%, and 80% of the total depth. The total depth can be measured with the *depth gage rod*. Each single mark represents 0.10 foot, each double mark represents 0.50 foot, and each triple mark represents 1.00 foot (see Figure 2).

For Depths < 2.5 Ft	If the depth is less than 2.5 ft, only one measurement is required at each measurement section. To set the sensor at 60% of the depth, line up the foot scale on the *sliding rod* with the *tenth scale*, located on top of the depth gage rod. If, for example, the total depth is 2.7 ft (as shown on Figure 2), then line up the 2 on the foot scale with the 7 on the tenth scale (Marsh-McBirney 1990).
For Depths > 2.5 Ft	If the depth is greater than 2.5 ft, measurements should be taken at 20% and 80% of the total depth.

Measuring Velocity (this has typically been measured at 6/10 of the total depth, for velocity-only measurements)

- Position the meter at the correct depth and place at the mid-point of the flow measurement section. Measure and record the velocity and depth. The wading rod is kept vertical and the flow sensor kept perpendicular to the tape rather than perpendicular to the flow while measuring velocity with an electronic flow meter. When using a propeller or pigmy-type meter, however, the instrument should be perpendicular to the flow.
- Permit the meter to adjust to the current for a few seconds. Measure the velocity for a minimum of 20 s with the Marsh-McBirney and Montedoro-Whitney meters. Measure velocity for a minimum of 40 s (preferably 2 min with the Price and pigmy meters).

- When measuring the flow by wading, stand in the position that least affects the velocity of the water passing the current meter. The person wading stands a minimum of 1.5 ft downstream and off to the side of the flow sensor.
- A flow sensor, equipped with cable and weight may be used to measure flows where the water is too deep to wade. Follow the procedure involving meters attached to wading rods.
- Report flow values less than 10 ft^2/s to two significant figures. Report flow values greater than 10 ft^3/s to the nearest whole number, but no more than three significant figures.
- In cases where the flow is low and falling over an obstruction, it may be possible to measure the flow by timing how long it takes to fill a bucket of known volume.

Avoid measuring flow in areas with back eddies. The first choice would be to select a site with no back eddy development. However, this can not be avoided in certain situations. Measure the

negative flows in the areas with back eddies. These negative values will be included in the final flow calculation.

Calculating Flow

To calculate flow, multiply the width x depth (ft^2) to derive the area of the flow measurement section. The area of the section is then multiplied by the velocity (ft/s) to calculate the flow in cubic feet per second (cfs or ft^3/sec) for that flow measurement section. When flow is calculated for all of the measurement sections, they are added together for the total stream flow (see Figure 2). Flow data transformers are also provided by the SWAMP data management team. The transformer provides the calculations needed to obtain a final flow value in cubic feet per second.

Q=Total Flow (or discharge), W=Width, D=Depth, V=Velocity.

$$Q = (W_1 * D_1 * V_1) + (W_2 * D_2 * V_2) + \ldots\ldots (W_n * D_n * V_n)$$

What to Do with Negative Values

<u>Do not</u> treat cross sections with negative flow values as zero. Negative values obtained from areas with back eddies should be subtracted during the summation of the flow for a site.

Flow Estimate (ft^3/s)

Flow estimate data may be recorded for a non-tidally influenced stream when it is not possible to measure flows by one of the methods described above. Flow estimates are subjective measures based on field personnel's experience and ability to estimate distances, depths, and velocities. If flow can not be measured at a routine non-tidal station, a new site should be selected where flow can be measured.

Flow Estimate Procedure

- Observe the stream and choose a reach of the stream where it is possible to estimate the stream cross section and velocity.
- Estimate stream width (ft) at that reach and record.
- Estimate average stream depth (ft) at that reach and record. Estimate stream velocity (ft/s) at that reach and record. A good way to do this is to time the travel of a piece of floating debris. If doing this method from a bridge, measure the width of the bridge. Have one person drop a floating object (something that can be distinguished from other floating material) at the upstream side of the bridge and say start. The person on the downstream side of the bridge will stop the clock when the floating object reaches the downstream side of the bridge. Divide the bridge width by the number of seconds to calculate the velocity. The velocity can be measured at multiple locations along the bridge. These velocities are averaged. If this is done alone, watch for road traffic.
- Multiply stream width (ft) time's average stream depth (ft) to determine the cross sectional area (in ft^2) which when multiplied by the stream velocity (in ft/s) and a correction constant, gives an estimated flow (ft^3/s).

Example: A stream sampler conducted a sampling visit to a stream while the flow meter was being repaired. The sampler looked at the creek downstream from the bridge and saw a good place to estimate flow. The stream width was around 15 ft. It appeared the average depth on this reach was about 0.75 ft. The sampler timed a piece of floating debris as it moved a distance of 10 ft in 25 s downstream over the reach. An estimated flow with a smooth bottom was calculated using the following formula.

Width x Depth x Velocity x A (correction factor)= estimated flow
15 ft (width) x 0.75 ft (depth) x 2.5 ft/s (velocity) x A =25 ft^3/s (cfs)

A is a correction constant: 0.8 for rough bottom and 0.9 for smooth bottom

Estimated flow should be reported to one or two significant figures.

Experienced field personnel are able to estimate flow to within 20% of actual flow for total flows less than 50 ft^3/s. The best way to develop this skill is to practice estimating flow before making measurements at all monitoring visits to non-tidally influenced flowing streams and then compare estimated flows with those obtained from USGS gages or from instantaneous flow measurements

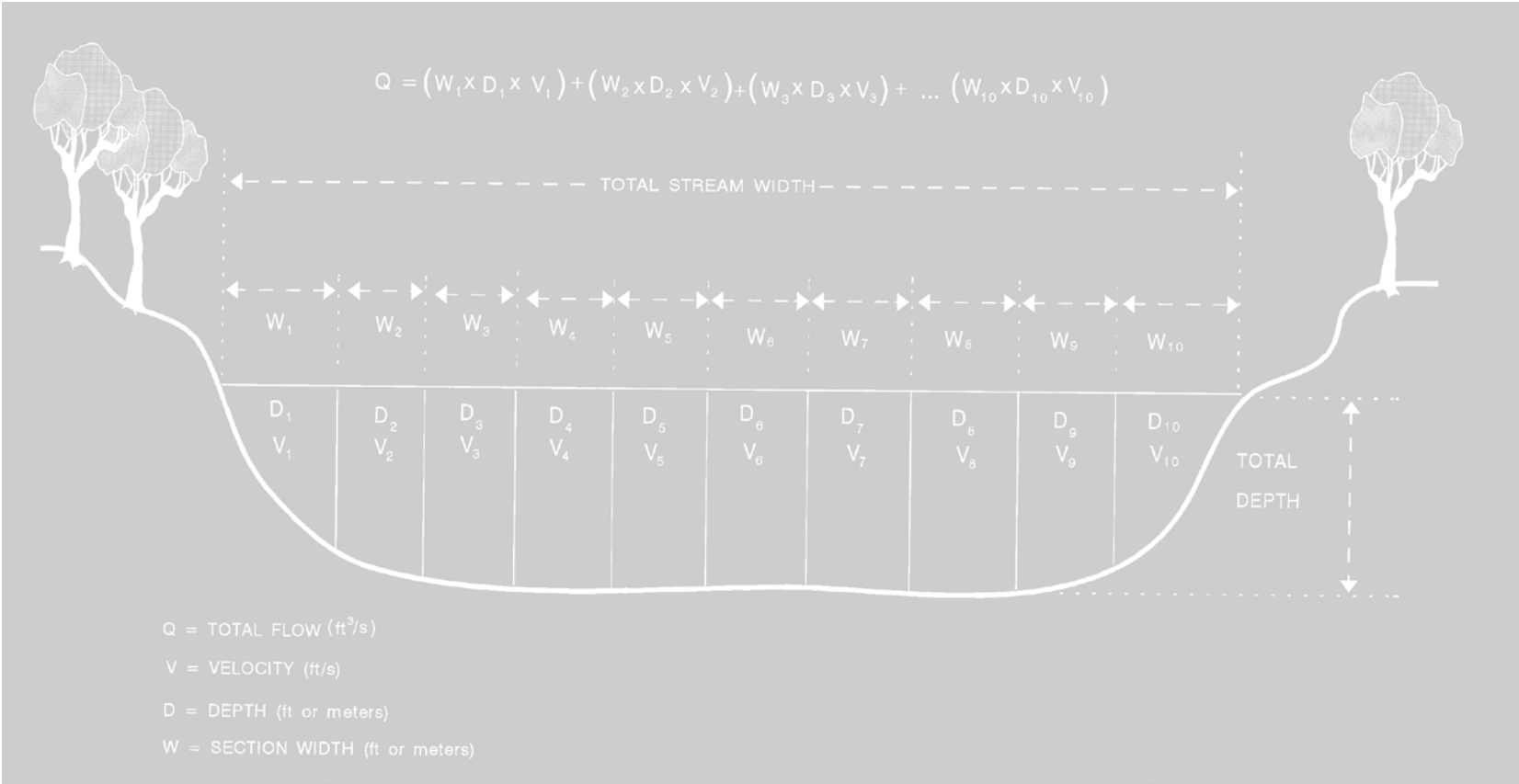


Figure 2. Stream Flow (Discharge) Measurement

Example 1.
Stream Flow (Discharge) Measurement
Small Stream < 5 Ft Wide and #2.5 Ft Deep

Stream:____**OAK CREEK**_____Date:__**5/29/91**___ _____
Station Description:_____**at US Hwy 90A**_____
Time Begin:__**1545**_____Time End:__**1630**_____Meter Type:__**Marsh-McBirney**_____
Observers:_____**BK/MK**_____Stream Width*:____**5 ft**_____ Section Width:____**0.5 ft**_____
Observations:_____
_____

Section Midpoint (ft)	Section Depth (ft)	Observational Depth** Ft	Velocity		Area W x D (ft^2)	Discharge (Q) V x A (ft^3/s)
			At Point (ft/s)	Average (ft/s)		
0.25	**0.55**			**0.05**		**0.01375**
0.75	**0.80**			**0.11**		**0.044**
1.25	**0.85**			**0.27**		**0.42635**
1.75	**0.90**			**0.49**		**0.2205**
2.25	**1.10**			**0.58**		**0.275**
2.75	**1.50**			**0.72**		**0.540**
3.25	**1.20**			**0.76**		**0.456**
3.75	**0.90**			**0.76**		**0.342**
4.25	**0.75**			**0.44**		**0.165**
4.75	**0.30**			**0.00**		**0.00**

m^3/s x 35.3 =ft^3/s

Total Discharge (3Q) (ft^3/s)	**2.4826**

Example 2: Stream Discharge Measurement **Example (Larger Stream > 5 Ft and #2.5 Ft Deep)**

Stream:____**RED RIVER**_____Date:__**5/28/91**___

Station Description:_____**Post Oak Creek 40 m Below Sherman WWTP Outfall**_____

Time Begin:__**1542**_____Time End:__**1601**_____Meter Type:_**Marsh-McBirney**_____

Observers:_____**CM, EW, DO**_____Stream Width*:____**26 ft**___ Section Width:___**1.3 ft**_____

Observations:_____

Section Midpoint (ft)	Section Depth (ft)	Observational Depth** ft	Velocity		Area W x D (ft^2)	Discharge (Q) V x A (ft^3/s)
			At Point (ft/s)	Average (ft/s)		
0.65	0.55			2.03	0.715	1.451
1.95	0.40			2.04	0.520	1.061
3.25	0.42			2.02	0.546	1.103
4.55	0.38			1.77	0.494	0.874
5.25	0.40			1.75	0.520	0.910
7.15	0.42			1.93	0.546	1.054
8.45	0.40			1.99	0.52	1.035
9.75	0.37			1.92	0.481	0.924
11.05	0.37			1.56	0.481	0.750
12.35	0.43			1.32	0.559	0.738
13.65	0.40			1.36	0.520	0.707
14.95	0.42			1.33	0.546	0.726
16.25	0.40			1.35	0.520	0.702
17.55	0.45			1.64	0.585	0.959
18.85	0.48			1.70	0.624	1.061
20.15	0.48			2.00	0.624	1.248
21.45	0.50			1.95	0.650	1.268
22.75	0.40			2.18	0.520	1.134
24.05	0.48			1.71	0.624	1.067
25.35	0.50			0.60	0.650	0.390
				Total Discharge (3Q) (ft^3/s)		**19.162**

m^3/s x 35.3 =ft^3/s

Example 3: Stream Flow (Discharge) Measurement (Larger Stream > 5 Ft and >2.5 Ft Deep)

Stream:____ARROYO COLORADO_____Date:__**6/16/98**__

Station Description:_____Downstream of Harlingen WWTP_____

Time Begin:__**1400**_____Time End:__**1445**_____Meter Type:___**Marsh-McBirney**_____

Observers:_____**JD, CK**_____Stream Width*:___**47.5 ft**___ Section Width:___**2.375 ft**_____

Observations: *Note that the starting point is at 4.7 ft on the measuring tape and not zero.

Section Midpoint (ft)	Section Depth (ft)	Observational Depth** ft	Velocity At Point (ft/sec)	Velocity Average (ft/sec)	Area W x D (ft^2)	Discharge (Q) V x A (ft^3/s)
4.70	0.73			0.65	1.73	1.127
7.08	1.10			1.08	2.61	2.822
9.45	1.85			0.90	4.39	3.954
11.83	2.20			1.05	5.23	5.486
14.20	2.20			1.44	5.23	7.531
16.58	2.45			1.09	5.82	6.342
18.95	2.55	0.20 0.80	1.75 1.76	1.76	6.06	10.659
21.33	2.60	0.20 0.80	1.79 1.32	1.56	6.18	9.633
23.70	2.70	0.20 0.80	1.63 1.26	1.45	6.41	9.298
26.10	3.05	0.20 0.80	1.68 1.15	1.42	7.24	10.286
28.48	3.10	0.20 0.80	1.23 0.69	0.96	7.36	7.068
30.85	2.90	0.20 0.80	1.22 0.89	1.06	6.89	7.301
33.23	2.84	0.20 0.80	0.60 0.37	0.49	6.75	3.305
35.60	2.65	0.20 0.80	0.80 0.21	0.51	6.29	3.210
37.98	2.65	0.20 0.80	0.85 0.96	0.91	6.29	5.727
40.35	2.20			0.28	5.23	1.464
42.73	2.30			0.16	5.46	0.874
45.10	2.05			0.51	4.87	2.483
47.48	1.10			0.49	2.61	1.280
49.86	0.65			0.62	1.54	0.957

m^3/s x 35.3 =ft^3/s

Total Discharge (3Q) (ft^3/s)

Stream Flow (Discharge) Measurement Form

Stream:_____Date:_____
Station Description:_____
Time Begin:_____ Time End:_____ Meter Type:_____
Observers:_____ Stream Width*:_____ Section Width:_____
Observations:_____

Section Midpoint (ft) (m)	Section Depth (ft) (m) (cm)	Observational Depth** ft-m-cm	Velocity		Area W x D (ft^2) (m^2)	Flow (Q) V x A (m^3/s) (ft^3/s)
			At Point (ft/s) (m/s)	Average (ft/s)(m/s)		

Summary of Significant Figures for Reporting Field Parameters

Parameter	Field Data Reporting Requirements
Water Temperature (^{o}C)	Report temperature to the nearest tenth of a degree. Round insignificant figures 0 through 4 down and 5 thru 9 up.
pH (s.u.)	Report pH to the nearest tenth of a pH standard unit.
D.O. mg/L **D.O.** (% saturation)	Report dissolved oxygen to the nearest tenth of a mg/L. Report % saturation to the nearest tenth of a percent
Specific Conductance (micro siemens/cm)	Report specific conductance to only three significant figures if the value exceeds 100. Do not report ORP which is displayed by some multi-probes.
Salinity (ppt)	Report salinity values above 2.0 ppt to the nearest tenth of a part per thousand. In estuarine waters report the actual values displayed by the multi-probe above 2.0 ppt and values less than 2.0 as <2.0 or <1.0 only. Determine if a station is estuarine (i.e., experiences cases where salinity is >2.0 ppt) and always report salinity at this station, regardless of the salinity during periods of high flow.
Secchi Disk (meters)	Report Secchi depth transparency in meters to two significant figures.
Flow (ft^3/s)	Report instantaneous flow values less than 10 ft^3/s to two significant figures. Report flow values greater than 10 ft^3/s to the nearest whole number, but no more than three significant figures. When there is no flow (pools), report as 0.0. When there is no water, don't report a value, but report as "dry" in the observations.

BEAUFORT SCALE: Specifications and equivalent speeds for use at sea

FORCE	EQUIVALEN SPEED 10 m above ground		DESCRIPTION	SPECIFICATIONS FOR USE AT SEA
	Miles/hour	knots		
0	0-1	0-1	Calm	Sea like a mirror
1	1-3	1-3	Light air	Ripples with the appearance of scales are formed, but without foam crests.
2	4-7	4-6	Light Breeze	Small wavelets, still short, but more pronounced. Crests have a glassy appearance and do not break.
3	8-12	7-10	Gentle Breeze	Large wavelets. Crests begin to break. Foam of glassy appearance. Perhaps scattered white horses.
4	13-18	11-16	Moderate Breeze	Small waves, becoming larger; fairly frequent white horses.
5	19-24	17-21	Fresh Breeze	Moderate waves, taking a more pronounced long form; many white horses are formed. Chance of some spray.
6	25-31	22-27	Strong Breeze	Large waves begin to form; the white foam crests are more extensive everywhere. Probably some spray.
7	32-38	28-33	Near Gale	Sea heaps up and white foam from breaking waves begins to be blown in streaks along the direction of the wind.
8	39-46	34-40	Gale	Moderately high waves of greater length; edges of crests begin to break into spindrift. The foam is blown in well-marked streaks along the direction of the wind.
9	47-54	41-47	Severe Gale	High waves. Dense streaks of foam along the direction of the wind. Crests of waves begin to topple, tumble, and roll over. Spray may affect visibility.
10	55-63	48-55	Storm	Very high waves with long over- hanging crests. he resulting foam, in great patches, is blown in dense white streaks along the direction of the wind. On he whole the surface of the sea takes on a white appearance. The 'tumbling' of the sea becomes heavy and shock-like. Visibility affected.

Last edited on 09 January, 1999 Dave Wheeler weatherman@zetnet.co.uk
Web Space kindly provided by Zetnet Services Ltd, Lerwick, Shetland.
http://www.zetnet.co.uk/sigs/weather/Met_Codes/beaufort.htm

Field Collection Procedures for Water Samples

Scope and Application

This protocol describes the techniques used to collect water samples in the field in a way that neither contaminates, loses, or changes the chemical form of the analytes of interest. The samples are collected in the field into previously cleaned and tested (if necessary) sample bottles of a material appropriate to the analysis to be conducted. Pre-cleaned sampling equipment is used for each site, whenever possible and/or when necessary. Appropriate sampling technique and measuring equipment may vary depending on the location, sample type, sampling objective, and weather. Trade names used in connection with equipment or supplies do not constitute an endorsement of the product. Safety equipment is always used while water sampling including gloves, waders and eye protection. Safety equipment helps to protect the sampler from potential contaminants and to prevent sample contamination.

Summary of Method

Appropriate sample containers and field measurement gear as well as sampling gear are transported to the site where samples are collected according to each sample's protocol. Water velocity, turbidity, temperature, pH, conductivity, dissolved oxygen as well as other field data are measured and recorded using the appropriate equipment. These field data measurement protocols are provided in this Field Measurement SOP. Samples are immediately put on ice and appropriately shipped to the authorized laboratories. This procedure has been modified from the Texas Natural Resources Conservation Commission's Procedure Manual for Surface Water Quality Monitoring, with major input from the United State's Geological Survey's (USGS's) National Water Quality Assessment (NAWQA) Protocol for Collection of Stream Water Samples.

WATER SAMPLE COLLECTION

Water chemistry and bacteriological samples, as requested, are collected at the same location. *Water samples are best collected before any other work is done at the site*. If other work (e.g., sediment sample collection, flow measurement or biological/habitat sample collection or assessment) is done after or downstream of the collection of water samples, it might be difficult to collect representative samples for water chemistry and bacteriology from the disturbed stream. Care must be taken, though, to not disturb sediment collection sites when taking water samples. Don't be trampling where you are sampling.

The following general information applies to all types of water samples, unless noted otherwise:

Sample Collection Depth

Sub-Surface Grab Sample Samples are collected at 0.1 m below the water surface. Containers should be opened and re-capped under water in most cases.

Depth-integrated Sample If a depth-integrated sample is taken, the sample is pumped from discrete intervals within the entire water column.

Surface Grab Sample Samples are collected at the surface when water depth is <0.1 m. Since there is a difference in water chemistry on the surface, compared to subsurface, surface water should be noted on the field data sheet as 0 m.

Where to Collect Samples

Water samples are collected from a location in the stream where the stream visually appears to be completely mixed. Ideally this would be at the centroid of the flow (*Centroid* is defined as the midpoint of that portion of the stream width, which contains 50% of the total flow), but depth and flow do not always allow centroid collection. For stream samples, the sampling spot must be accessible for sampling physicochemical parameters, either by bridge, boat or wading. Sampling from the shoreline of any water body (meaning standing on shore and sampling from there) is the least acceptable method, but in some cases is necessary.

In reservoirs, lakes, rivers, and coastal bays, samples are collected from boats at designated locations provided by Regional Water Quality Control Boards (Regional Boards). Samples from boats should be collected where the vessel does not interfere with the water being collected.

Sampling Order if Multiple Media are Requested to be Collected

The order of events at every site has to be carefully planned. For example, if sediment is to be collected, the substrate can not be disturbed by stepping over or on it; water samples can not be collected where disturbed sediment would lead to a higher content of suspended matter in the sample. *For the most part, water samples are best collected before any other work is done at the site*. This information pertains to walk-in sampling.

Sample Container Labels

Label each container with the station ID, sample code, matrix type, analysis type, project ID, and date and time of collection (in most cases, containers will be pre-labeled). After sampling, secure the label by taping around the bottle with clear packaging tape.

Procedural Notes

For inorganic and organic water samples, bottles do not have to be rinsed if they are I-Chem 200 series or higher or ESS PC grade or higher. This means that the sample bottles are analyzed for contamination, and a certification of analysis is included with the bottles. Other sample containers are usually rinsed at least three times if the bottles do not meet these requirements. See filling instruction for each type of analyses if there is uncertainty. If applicable to the sample and analysis type, the sample container should be opened and re-capped under water.

Sample Short-term Storage and Preservation

Properly store and preserve samples as soon as possible. Usually this is done immediately after returning from the collection by placing the containers on bagged, crushed or cube ice in an ice chest. Sufficient ice will be needed to lower the sample temperature to at least 6 ° □(time of collection. Sample temperature will be maintained at 6 °□C until delivered to the laboratory. Care is taken at all times during sample collection, handling and transport to prevent exposure of the sample to direct sunlight. Samples are preserved in the laboratory, if necessary, according to protocol for specific analysis (acidification in most cases).

Field Safety Issues

Proper gloves must be worn to prevent contamination of the sample and to protect the sampler from environmental hazards (disposable polyethylene, nitrile, or non-talc latex gloves are recommended, **<u>however, metals and mercury sample containers can only be sampled and handled using clean polyethylene gloves as the outer layer</u>**). Wear at least one layer of gloves, but two layers help protect against leaks. One layer of shoulder high gloves worn as a first (inside) layer is recommended to have the best protection for the sampler. Safety precautions are needed when collecting samples, especially samples that are suspected to contain hazardous substances, bacteria, or viruses.

Sample Handling and Shipping

Due to increased shipping restrictions, samples being sent via a freight carrier require additional packing. Although care is taken in sealing the ice chest, leaks can and do occur. Samples and ice should be bagged placed inside a large trash bag inside the ice chest for shipping. Ice should be double bagged to prevent melted ice water from leaking into the sample. The large trash bag can be sealed by simply twisting the bag closed (while removing excess air) and taping the tail down. Prior to shipping the drain plug of the ice chests have to be taped shut. Leaking ice chests can cause samples to be returned or arrive at the lab beyond the holding time.

Although glass containers are acceptable for sample collection, bubble wrap must be used when shipping glass.

Chain of Custody (COC) Forms

Every shipment must contain a complete Chain of Custody (COC) Form that lists all samples collected and the analyses to be performed on these samples.

Make sure a COC is included for every laboratory, every time you send a shipment of samples. Electronic COC's can also be emailed to the various laboratories but must be sent before the samples arrive at their destinations.
Include region and trip information as well as any special instructions to the laboratory on the COC.

The original COC sheet (not the copies) is included with the shipment (insert into ziplock bag) One copy goes to the sampling coordinator, and the sampling crew keeps one copy.

Samples collected should have the salinity (in parts per thousand) or specific conductivity (**µS/cm),** depth of collection, and date/time collected for each station on every COC.

Write a comment on this form, if you want to warn the laboratory personnel about possibly hazardous samples that contain high bacteria, chlorine or organic levels.

Field QC Samples for Water Analyses

Field duplicates are currently submitted at an annual rate of 5%. Field travel blanks are required for volatile organic compounds at a rate of one per cooler shipped. Field blanks are required for trace metals (including mercury and methyl mercury), DOC, and volatile organic compounds in water at a

project rate of 5%. See the SWAMP Quality Control and Sample Handling Guidelines for information regarding frequency and types of field QC samples.

SWAMP Field Data Sheets

Each visited field site requires a field observation completed SWAMP Field Data Sheet, even if no samples are collected (i.e. at a site which is found to be dry). If water and/or sediment samples are collected, all elements of the SWAMP Field Data Sheet must be completely filled out. Data sheets are provided from the SWAMP Data Management Resources website at: **Water Quality Field Data Sheet** *(updated 12/18/12)*

General Pre-Sampling Procedures

Instruments. All instruments must be in proper working condition. Make sure all calibrations are current. Multi-probe sondes should be pre-calibrated every morning prior to sampling and post-calibrated within 24 h of the original calibration. Conductivity should also be calibrated between stations if there is a significant change in salinity. Dissolved oxygen sensors should be re-calibrated if there is a 500 ft change in elevation.

Calibration Standards. Pack all needed calibration standards.

Sample Storage Preparations. A sufficient amount of cube ice, blue ice and dry ice as well as enough coolers of the appropriate type/size must be brought into the field, or sources for purchasing these supplies identified in advance.

Sample Container Preparation. After arriving at the sample station, pack all needed sample containers for carriage to the actual collection site, and label them with a pre-printed label containing Station ID, Sample Code, Matrix info, Analysis Type info, Project ID and blank fields for date and time (if not already pre-labeled).
Safety Gear. Pack all necessary safety gear like waders, protective gloves and safety vests.

Walk to the site. For longer hikes to reach a sample collection

site, large hiking backpacks are recommended for transport of gear, instruments and containers. Tote bins can be used, if the sampling site can be accessed reasonably close to the vehicle.

GPS. At the sampling site, compare/record reconnaissance GPS reading with current site reading and note differences. GPS coordinates should be in Decimal Degrees (e.g. 38.12345 -117.12345).

COLLECTION OF WATER SAMPLES FOR ANALYSIS OF CONVENTIONAL CONSTITUENTS

In most streams, sub-surface (0.1 m below surface) water is representative of the water mass. A water sample for analysis of conventional constituents is collected by the grab method in most cases, immersing the container beneath the water surface with the cap on to a depth of 0.1 m. Remove cap and fill container replacing the cap before removing the container from the water. Sites accessed by bridge can be sampled with a sample container-suspending device. Extreme care must be taken to avoid contaminating the sample with debris from the rope and bridge. Care must also be taken to rinse the device between stations. If the centroid of the stream cannot be sampled by wading, sampling devices can be attached to an extendable sampling pole. It should be noted on the field data sheet if using a bucket sampler that surface water is entering the sample bottle.

In some cases, depth-integrated sampling is required, as requested by Regional Boards. This is useful when lakes or rivers are stratified and a sample is wanted that represents the entire water column. Depth-integrated sample collection is explained later in this document.

Conventional Water Constituents, Routinely Requested in SWAMP	Chloride (Cl-), Sulfate ($SO4^{2-}$), Nitrite ($NO2^{-}$), Nitrate ($NO3^{-}$) (or Nitrate + Nitrite (NO_3 + NO_2)), Ortho-phosphate, Fluoride (F-), Total Phosphorus (TPO_4), Ammonia (NH3), Total Nitrogen (TN), Alkalinity, Chlorophyll a.
Conventional Water Constituents, Occasionally Requested in SWAMP	Total Suspended Solids (TSS) or Suspended Sediment Concentration (SSC), Total Dissolved Solids (TDS--especially if total metals requested), Total Kjeldahl Nitrogen (TKN), Total Organic Carbon (TOC), Dissolved Organic Carbon (DOC), hardness (if trace metals analysis is requested).
Conventional Water Constituents Sample Volume	Due to the potential for vastly different arrays of requested analyses for conventional constituents, please refer to table at the end of this document, as well as the Quality Control and Sample Handling Guidelines for Conventional Parameters, for

information on the proper volume to collect for the various types of analyses.

Conventional Water Constituents Sample Container Type

Due to the potential for vastly different arrays of requested analyses for conventional constituents, please refer to table at the end of this document, as well as the Quality Control and Sample Handling Guidelines for Conventional Parameters, for information on the proper type of sample containers.

Chlorophyll a Syringe Sample Method

Chlorophyll a syringe method: Chlorophyll a is sampled by forcing water with a 60-mL syringe through a filter holder containing a 25-mm glass microfiber filter. The 60-mL syringe and an in-line filter holder are rinsed three times with the ambient water before filtration. The syringe is then filled with 60 mL of ambient water. The filter holder is then removed and a 25-mm glass microfiber filter is placed inside. The filter holder is then screwed onto the syringe and the ambient water is then flushed through the filter. The filter holder is removed every time more water needs to be drawn into the syringe. The process is then repeated until the desired amount of Chlorophyll a is present (usually 60 to 360 mL depending on the water clarity). When filtering is complete the filter holder is opened and the filter is removed with tweezers without touching the Chlorophyll a. The filter is then folded in half, then again, in half with the Chlorophyll a inside the folds. The folded filter is then wrapped in aluminum foil and placed in an envelope labeled with the site information and the volume filtered. The envelope is then immediately placed on dry ice until transferred to the lab.

Collection of Water Samples for Analysis of Trace Metals (Including Mercury)

When deciding to measure total and dissolved metals in water the purpose of the sampling must be considered. Water quality standards for the protection of aquatic life are determined for the dissolved form of heavy metals in most cases, although this, too, can vary within different Basin Plans for different regions. The exception to routinely conducting dissolved metals analyses is usually mercury (and often selenium). Water quality standards usually apply to the total form of mercury (and often selenium), and not the dissolved form of these elements. Several regions are interested in conducting total metals analyses, in order to address specific issues. In order to budget inputs, transport, and accumulation of metals, it is necessary to know the concentration of total metals in the water column, sediments, effluent, etc. Sample collection for trace metals and mercury in water requires "Clean Hands/Dirty Hands" methodology.

Metals-in-water: General Information

Unless otherwise requested to collect for total metals analysis, dissolved metals are collected for all elements with the exception of mercury. Metals-in-water samples should **not** be collected during periods of abnormally high turbidity if at all possible. Samples with high turbidity are unstable in terms of soluble metals, and it is difficult to collect a representative grab sample. Special study sampling, however, may be an exception. For example, wet weather sampling is likely to include some samples with high turbidity.

Metals-in-water: Sample Collection Depth

Collect a metals sample from a depth of 0.1 m using a sub - surface grab method, or at discrete depths using a depth-integrated sampling method with a peristaltic pump (described further down). In most streams, sub-surface water is representative of the water mass. For the purpose of determining compliance with numerical toxic substance standards, a sample taken at the surface is adequate.

Metals-in-water: Sample Volume

Refer to table at end of this document for specific information on the proper volume to collect for trace metals analyses. Generally, for procedures most commonly used for analysis of metals in water (total or dissolved metals); one 60-mL polyethylene container is filled with the salinity recorded on the field data sheet and COC. Generally, for the procedures most commonly used for analysis of mercury in water (whether total or dissolved), one 250-mL glass or teflon container is filled, regardless of the salinity. All containers are pre-cleaned in the lab using HNO_3.

Metals-in-water:

Sampling Equipment

The method of choice for the collection of water samples for trace metals analysis in small, wadeable streams is the grab method, where the sampler submerges the sample bottle or syringe beneath the surface of the water until filled. The procedure for filtration of water samples for trace metals analysis must be performed within 15 minutes of collection to meet the required filtration holding time. For Mercury(Hg) samples, preservation may take place in the field or at the laboratory within 48 hours of collection. Extreme care must be taken to avoid contamination of the water sample. Considering these factors, it is best to use a **field** filtration system, such as a set-up with peristaltic pump with in-line filter, or a set-up with a syringe filter, if filtered water is required. Samples are pumped and/or filtered directly into the sample container. This minimizes contamination by using no intermediate sampling device. Samples can also be filtered in lab if need be Un-powdered (no-talc) polyethylene gloves are always worn during sampling for metals-in-water.

Depth-integrated sampling is useful when lakes or rivers are stratified and a representative sample is wanted which represents the entire water column. The method involves a peristaltic pump system with enough Teflon tubing to pump at the desired depth with an inline filter. Filter equipment blanks are analyzed for five percent of all cleaned equipment.

Equipment Preparation

It is best if the metals-in-water sampling materials are prepared by a laboratory that can guarantee contamination-free sampling supplies. If a laboratory assembles a Metals-in-Water Sample Collection Kit, it should contain the following items packaged together **for each sample**:

- Tubing with an in-line filter (disposable, 0.45 µm) attached for dissolved metals-in-water sampling. This same tubing is used for total metals-in-water samples without filter. If an in-line pumping system is not used, an acid cleaned syringe and filter are packed.
- Sample containers- polyethylene for total and dissolved samples and blanks; Glass or Teflon for total and dissolved mercury.
- Acid preservation is performed in the laboratory.
- Metals-free DI water (for blanks).
- Powder-free polyethylene gloves

If a laboratory is not assembling collection kits, individuals should take care to keep containers in the original packaging. When removed from the box, sample containers are placed in clean plastic bags (zipper closure bags). Although filters come individually wrapped, they should also be stored in new zipper closure bags to avoid possible contamination.

The filtering equipment is pre-cleaned according to laboratory protocol. Clean tubing is put into clean containers, such as large zipper closure bags. Metals-free filter cartridges with the capacity to filter several liters are commercially available. Equipment blanks are run at the laboratory on batches of metals-in-water sampling equipment prior to their distribution to field staff. One to two liter containers with metals-free deionized water are taken into the field for travel blanks. Metals-free deionized water is supplied by the laboratory performing metals analysis. The deionized water containers are kept clean and dust-free on the outside by wrapping in two plastic bags.

Dissolved and Total Metals-in-Water: Detailed Collection Techniques

- ***Sub-Surface Grab Method***
- ***Syringe Filtration Method (for sub- surface collection)***
- ***Peristaltic Pumping Method (Using Tubing/In-line Cartridge Filters)for sub- surface collection or for depth-integrated collection***

Metals-in-water Sample Collection:

Sub-Surface Grab Method

Clean Hands/Dirty Hands Technique

Unfiltered Samples (for total metals analysis, if requested, and for mercury almost always, unless otherwise requested): Some samples can be sampled directly from the ambient water either by wading into the stream and dipping bottles under the surface of the water until filled, or by sampling from a boat and dipping the bottle under the surface of the water until it is filled. The bottles are cleaned according to laboratory protocol. It is very critical that all the acid is rinsed out of the bottles before the samples are collected. Personnel involved in field sample collection/processing wear polyethylene gloves. The laboratory pre-cleaned glass or Teflon™ 250 mL (for mercury) or polyethylene 60 mL (for metals) sample bottles are taken from the double-wrapped

zipper closure plastic bags using "Clean Hands/Dirty Hands" techniques. The dirty hands collector opens the first outer bag, and the clean hands collector opens the inner bag around the bottle. The clean hands collector then removes the bottle from the inner bag. Clean hands collector then places the inner bag back inside the outer bag while sampling occurs. The clean hands collector dips the bottle into the ambient water, with the cap on, to approximately 0.1 m (avoiding disturbing surface scums), placing the cap back on the bottle before being removed from the water, rinses the bottle five times with ambient water, making sure the threads of the bottle get rinsed as well, and fills the bottle to the top. The lid is secured under the water surface and the bottle is put back into the inner clean bag and sealed by the clean hand collector. The sealed clean bag is then placed back inside the outer bag by the clean hands collector. The dirty hands collector then seals the outer bag.

Metals-in-water Sample Collection:

Syringe Filtration Method (for sub-surface collection)

Filtered Samples (for dissolved metals analyses): Sub-surface water samples are filtered for dissolved trace metals analysis (not for mercury, however, in almost all cases) using the following syringe filtration method.

The syringe (60 cc size, pre-cleaned in the laboratory) and in-line filter are pre-packed in two zipper closure bags. The syringe and filter are taken out of the bags using "Clean Hands/Dirty Hands" technique, as previously described. The sub-surface water sample is collected by 1) wading out into the centroid portion of the stream, or by leaning over the edge of the boat, and aspirating water into the syringe, filling and rinsing the syringe five times with ambient water; 2) attaching the filter onto the syringe and filling the syringe body; 3) rinsing the filter with a few milliliters of the sample; 4) rinsing the sample bottle five times with the filtered ambient water; and 5) extruding the sample through the syringe filter and completely filling each bottle. The bottles are taken out of and put back into their bags using "Clean Hands/Dirty Hands".

Metals-in-water Sample Collection--

Peristaltic Pump

The basic "Clean Hands/Dirty Hands" technique is also applied in the use of a peristaltic pump with an in-line filter cartridge for metals-in-water sample collection. Dirty Hands removes the plastic cover from the end of the pump tubing and inserts the tubing into the sampling container. Dirty Hands holds the tubing in place. The in-line cartridge filter is attached to the outlet end of the tubing.

Clean Hands takes the plastic cover off the other end of the tubing. Dirty Hands turns on the pump and flushes lL of ambient water through the tubing to purge it for dissolved metals.

Clean Hands removes the cap from the sample bottle and uses the pump to fill it with ambient water. Clean Hands puts the cap back on the bottle and places it in the plastic bag.

Metals-in-water Sample Collection:

Depth-Integrated Sampling, using In-line Cartridge Filter and Peristaltic Pump

Preparation for Depth-integrated sample collection:
Depth-integrated sampling is useful when lakes or rivers are stratified, and a representative sample is wanted that represents the entire water column to the extent possible. The method utilized to date for SWAMP involves a peristaltic pump system with enough Teflon tubing to pump from the desired depth. Regional Boards must request depth-integrated sampling.

The tubing set consists of a small length of CFLEX tubing that fits in the peristaltic pump, with an appropriate length of Teflon tubing on the suction side of the pump and a 3-ft section of Teflon tubing on the discharge side of the pump.

The tubing set is pre-cleaned in 10% reagent grade HCL at the laboratory, and to date in SWAMP, a new pre-cleaned tubing set is used for each site. However, the same peristaltic tubing set can be used at multiple sites, as long as it has been cleaned in the field between stations, according to protocol as outlined below. If this is to be done, however, and Dissolved or Total Organic Carbon samples are collected, equipment blanks should be collected at each site until it is determined that the blanks are acceptably low.

The field cleaning procedure for tubing that is to be re-used is:

- Pump phosphate free detergent through tubing.
- Pump 10% HCL through tubing.
- Pump methanol through tubing.
- Pump 1 l of blank water (Milli-Q) through.

All reagents must be collected in appropriate hazardous waste containers (separated by chemical), and transport, as well as

disposal, must follow appropriate local, state, and federal regulations.

If a field blank is needed, collect it after the 1 L of blank water is pumped through. Pump the amount of ambient water equivalent to 3 times the volume of the tubing before sampling the next site.

Filtered and Unfiltered Samples, Depth-integrated:
It is recommended to attach the tubing to a line with depth measurement markers (preferably in meters). At the end of this line should be a trace metal-safe weight, which hangs about one meter below the tubing end, avoiding any sediment intake from the bottom of the water column with the pump tubing.

At the site, Dirty Hands sets up the pump, while Clean Hands takes a bottle from the plastic bag and places it in a container holder or on a clean surface. A container holder can be anything trace metal clean that supports the bottle, freeing up the collector's hands. Clean Hands takes the outlet-end of the tubing (with the in-line filter cartridge attached) out of the bag, and places it in the peristaltic pump head. The outlet end is long enough to allow easy bottle filling; the other end is long enough to easily reach beneath the water surface and to the desired depth. Dirty Hands closes the pump head, locking the tubing in place.

Make sure that all bottles are filled with a depth-integrated water sample. This can be accomplished by dividing the total vertical length of the water column into 2 to 10 equal intervals, and sampling each interval equally, filling the bottles at each depth proportional to the number of intervals sampled. For example, if 10 intervals are sampled, every bottle is filled $1/10^{th}$ full at each depth sampled. A very common method of dividing the water column is by first determining the depth of the thermo-cline. Samples are taken at the midpoint between the surface and the thermo-cline, at the midpoint between the top of the thermo-cline and the bottom of thermo-cline, and at the midpoint between the bottom of the thermo-cline and just above the bottom of the water column. For these methods, all containers have to be filled at the same time. Note the number of intervals sampled on the data sheet.

When filling bottles, Clean Hands immerses the intake tube directly into the water at the appropriate depth, and Dirty Hands operates the pump to flush the tubing with a minimum of 1L of ambient water through the tubing and filter.

Clean Hands removes the cap from the sample bottle, holds the tubing outlet with the in-line filter cartridge over the container opening (without touching the container), and allows the container to fill. The container is filled and rinsed five times with ambient water, and is then filled to the top for the actual sample. Clean Hands puts the cap back on the bottle, and places the bottle back it in the zipper closure plastic bag. Whenever Clean Hands touches the boat or equipment, which may be contaminated, gloves should be changed immediately.

(Note for Unfiltered samples: *If an unfiltered sample is required for total metals, total mercury, conventional constituents, toxicity, or synthetic organics, the same procedure is used as described above, except the filter is detached from the end of the tubing before filling the bottles.)*

When sampling is finished, the tubing is brought to the surface, clean water (Milli-Q or deionized) is pumped through system, and the tubing is stored in a polyethylene bag.

The tubing set can be used at multiple sites, as long as it has been cleaned in the field between stations (see field cleaning procedure above). However, if Dissolved or Total Organic Carbon samples (in water) are collected, equipment blanks should be collected at enough sites until it is determined the blanks are appropriate.

Metals-in-water Sample Collection:

Composite Bottle

Collecting the Sample:

The sample collection methodologies are identical to those described above except the sample is collected first into a composite bottle(s). The sample is collected in an amber glass 4-L bottle for mercury and methyl mercury, and a 4-L polyethylene bottle for other trace metals. The compositing bottle is cleaned according to SWAMP SOP.SC.G.1. It is very critical that all the acid is rinsed out of the bottle and that the bottle is rinsed with sample water (five times) before the

sample is taken. The sample is collected by the grab or pumping method after being rinsed five times with ambient water and is brought inside the water quality vehicle or sampling box for processing. Personnel involved in sample processing don polyethylene gloves. During sampling the dirty hands person opens the bag holding the composite bottle and opens the outer plastic bag. The clean hands person opens the inner plastic bag, removes the bottle and holds the bottle while the Dirty Hands sampler controls the flow of water through the pump into the bottle.

Preparing sample aliquots from a composite bottle into smaller sample bottles using an inline pump and filter:

The dirty hands person opens the first bag, and the clean hands person opens the inner bag around the composite bottle. The clean hands person then removes the bottle from the inner bag and places the bags and the bottle in a designated clean place.

This process is repeated until all sample bottles are lined up on the clean bench with their tops still on.

The top of the bottles are loosened so that they fit very loosely on top of the bottles so the clean hands person can remove the caps and pour or pump water into the bottles easier.

The clean hands person shakes the 4-L sample in a steady and slow up and down motion for two full minutes.

Samples that are not to be filtered (including TSS/SSC) are sub-sampled out of the bottle by pouring out of the large compositing bottle into the sample bottles. The compositing bottle is shaken for 15 s between these subsamples.

Each sample bottle is rinsed five times with ambient water before filling.

For the clean pumping system setup procedure, see above.

(The equipment or field blank is processed exactly like a sample following the same steps.)

The clean end of the tubing used for suction is placed into 1 L bottle. Approximately 750 mL of Milli-Q are then pumped through the system to purge any residual contamination.

The 250-mL sample bottles are then filled to the neck and capped as soon as possible.

Note: if volatile organics are to be collected they should be pumped directly into the sample containers before the compositing procedure.

Metals-in-water: Short-term Sample Preservation

After collecting the sample, the double-bagged container is placed in another plastic bag for shipping, and placed on ice in the ice chest, cooled to 6 °C. This is to prevent possible contamination from other samples in the ice chest. Metals-in-water samples are acid-preserved in the lab.

Metals-in-water: Sample Container Label

Label each outer sample-bag with the station ID, sample code, matrix type, analysis type, project ID, and date and time of collection.

Metals-in-water: Field Equipment Blank

Pumping Method. If required, field blanks are collected at the last site of a sampling trip, with the same tube and filter used to collect the last dissolved metals-in-water sample of the day (before the ambient sample is collected); and with the tube used for the last total metals-in-water sample of the day. If each sample is taken using a new set of tubing, a separate tubing-set should be used for the blank.

The same Clean Hands/Dirty Hands collection techniques are followed for the field blank as the samples, pumping trace metal-free water from a clean container supplied by the laboratory.

Syringe Method. If required, field blanks are collected in much the same way as in the pumping method. "Clean Hands/ Dirty Hands" techniques are used. The syringe is taken out of the double bags, deionized water is aspirated into the syringe, syringe is rinsed five times with ambient water, the filter is attached, and the blank water is extruded into a sample bottle. A minimum of one blank per trip is taken, if required.

Grab Method. Bottles full of deionized water or Milli-Q are opened at the site for the same length of time the sample bottles are open.

COMPANION SAMPLES FOR METALS-IN-WATER

A hardness analysis should be requested by the Regional Water Control Board whenever metals-in-water are to be analyzed from an inland (freshwater) site. Estuarine/marine sites do not require hardness analysis.
If a total metals sample is collected, it is recommended to submit a sample for total suspended solids/suspended sediment concentration (TSS/SSC) in a companion sample for "conventionals in water".

Hexavalent Chromium

Very rarely, a request may be made for conducting hexavalent chromium analysis in water samples. Acidification alters the hexavalent form of chromium. A separate (un-acidified) sample must be submitted if hexavalent chromium is to be analyzed. Filter and submit a minimum of 500 mL water. The sample is collected in a DI-water-rinsed polyethylene or glass container, placed on ice, and shipped to the lab in time for analysis to begin within 24 h of collection. The lab must be notified when a hexavalent chromium sample will arrive. Hexavalent chromium is not usually analyzed on unfiltered samples.

FIELD QC SAMPLE COLLECTION REQUIREMENTS FOR METALS-IN-WATER

In order to assess contamination, "blanks" are submitted for analysis. Special projects may have other requirements for blanks. The same group of metals requested for the ambient samples are requested for the blank(s). Run a blank for each type of metal sample collected. Blanks results are evaluated (as soon as available) along with the ambient sample results to determine if there was contamination or not. See the Quality Control and Sample Handling Guidelines for Inorganic Analytes for information regarding frequency and types of field QC samples.

Field Equipment Blank (Ambient Blank)

Submit an equal volume (equal to the ambient sample) of metals-free deionized water that has been treated exactly as the sample at the same location and during the same time period. Use the same methods as described above (Grab sample, pumping method, syringe method). At least one ambient blank per field trip is required each for trace metal and Mercury samples in water. *If contamination is detected in field equipment blanks, blanks are required for every metals-in-water sample until the problem is resolved.*

Laboratory Equipment Blank	Laboratory Equipment Blanks for pumping and sampling equipment (Metals-in-Water Sample Collection Kits and Syringe Filtration Kits) are run by the laboratory that cleans and distributes the collection materials. It documents that the materials provided by the laboratory are free of contamination. When each batch of tubes, filters, bottles, acid and deionized water are prepared for a sampling trip, about five percent of the Mercury sampling materials are chosen for QC checks. Trace metal equipment needs to be subjected to an initial blank testing series. If these blanks are acceptable only occasional re-testing is required for TM equipment. The QC checks are accomplished by analyzing metals-free water which has been pumped through the filter and tube; collected in a sample container; and preserved.
Field Duplicates	Five percent Field Duplicates are submitted every year. (If fewer than 20 samples are collected during an event, submit one set of duplicates per event.)

Collection of Water Samples for Analysis of Synthetic Organic Compounds

Collect organic samples at a depth of 0.1 m by submerging the sample container by hand. If depth-integrated sampling is required, use the in-line peristaltic pump methodology described previously. Since organic compounds tend to concentrate on the surface of the sampling device or container, the sampling device and sample container are ***not*** to be rinsed with ambient water before being filled.

Sample Containers and Collection

Also refer the Quality Control and Sample Handling Guidelines for Synthetic Organic Compounds in Fresh and Marine Water for a list of recommended container types.

Pesticides/ Herbicides	The sample container for pesticides and herbicides is a new, clean, unused amber glass jar with a Teflon-liner inside the cap. Collect one liter of water for each of the three sample types (Organophosphorus Pesticides, Organochlorine Pesticides and Chlorinated Herbicides). **EACH ANALYSIS TYPE REQUIRES A SEPARATE JAR**. Minimize the air space in the top of the jar. Preserve immediately after collection by placing on ice out of the sunlight.
Semi-volatile Organics	The sample container for semi-volatile organics must also be new, clean, unused amber glass bottles with a Teflon-liner inside the cap, and pre-rinsed with pesticide-grade hexane, acetone, or methylene chloride. Fill jars to the top and place on ice in the dark. In addition to other sample information, label the jar Semi-volatiles.
Volatile Organics: **Volatile Organic Carbon (VOC), Methyl-Tert Butyl Ether (MTBE) and (BTEX)**	The sample containers for volatiles are VOA vials. Fill the 40-mL VOA vials to the top and cap without trapping any air bubbles. If possible, collect directly from the water, keeping the vial under water during the entire collection process. To keep the vial full while reducing the chance for air bubbles, cap the vials under the water surface. Fill one vial at a time and preserve on ice. The vials are submitted as a set. If the vial has been pre-acidified for preservation, fill the vial quickly, without shaking using a separate clean glass jar. Fill the vial till the surface tension builds a meniscus, which extends over the top end of the vial, then cap tightly and check for bubbles by turning the vial on its head. Ensure that the pH is less than 2. If the water may be alkaline or have a significant buffering capacity, or if there is concern that pre-acidified samples may have the acid wash out, take a few practice vials to test with pH paper. It may take more than two

	drops, and it will then be known how to preserve the other samples that are being submitted to the lab. If an alternative method has proven successful, continue with that method. **Note**: If vigorous foaming is observed following acidification, discard that sample and collect another set. Do not acidify the second set. Mark the sample clearly "not acidified" and the lab will run them immediately. Holding time is 14 days with acid, 7 days without acid. Collect three VOA vials, if VOC, MTBE and BTEX are required, two vials, if only VOC is required and two vials, if only MTBE and BTEX are require. The vials may be taped together to keep them together.
Perchlorate	Surface water samples for perchlorate should be collected in a new unused polyethylene or glass container. Perchlorate samples should be placed immediately on ice to maintain temperature at 6 ^{o}C. The sample holding time is 28 days, under refrigeration.
Sample Treatment in Presence of Chlorine	If in stream chlorine residual is suspected, measure the chlorine residual using a separate water subsample. Free chlorine will oxidize organic compounds in the water sample even after it is collected. If chlorine residual is above a detectable level, (i.e., the pink color is observed upon adding the reagents) immediately add 100 mg of sodium thiosulfate to the pesticides, herbicides, semi-volatiles and VOA samples; invert until sodium thiosulfate is dissolved. Record the chlorine residual concentration in field logbook. If chlorine residual is below detectable levels, no further sample treatment necessary.
VOA Trip Blank	Submit one Trip Blank for VOA samples (2- 40 mL VOA vials) for each sampling event. Trip Blanks are prepared in advance just before the sampling trip and transported to the field. Ask the laboratory for DI water and specify that it is for a VOA trip blank. VOA blanks require special purged water. Trip blanks demonstrate that the containers and sample handling did not introduce contamination. The trip blank vials are never opened during the trip.
Field QC Samples	If required, field Duplicates and field blanks are submitted at a rate subject to the discretion of the project manager. Refer to the SWAMP Quality Control and Sample Handling Guidelines for details on required blanks and duplicates.

BACTERIA AND PATHOGENS IN WATER SAMPLES

Summary of Collection Procedure (Based on EPA water quality monitoring procedures)

Make sure the containers are sterilized; either factory-sealed or labeled.

Whirl-pak® bags

- Label the bottle as previously described for SWAMP.
- Tear off the top of the bag along the perforation above the wire tab just prior to sampling. Avoid touching the inside of the bag. If you accidentally touch the inside of the bag, use another one.
- If wading into the stream, try to disturb as little bottom sediment as possible. Be careful not to collect water that has sediment from bottom disturbance. Stand facing upstream. Collect the water sample on your upstream side, in front of you.
- If taking sample from a boat, carefully reach over the side and collect the water sample on the upstream side of the boat.
- Hold the two white pull-tabs in each hand and lower the bag into the water on your upstream side with the opening facing upstream. Open the bag midway between the surface and the bottom by pulling the white pull-tabs. The bag should begin to fill with water. You may need to "scoop" water into the bag by drawing it through the water upstream and away from you. Fill the bag no more than 3/4 full.
- Lift the bag out of the water. Pour out excess water. Pull on the wire tabs to close the bag. Continue holding the wire tabs and flip the bag over at least 4-5 times quickly to seal the bag. Don't try to squeeze the air out of the top of the bag. Fold the ends of the wire tabs together at the top of the bag, being careful not to puncture the bag. Twist them together, forming a loop.
- If the samples are to be analyzed in the lab, place them in a cooler with ice or cold packs for transport to the lab.

Screw cap containers

- Label the bottle as previously described for SWAMP.
- Remove the plastic seal from the bottle’s cap just before sampling. Avoid touching the inside of the bottle or cap. If you accidentally touch the inside, use another bottle.

- If wading into the stream, try to disturb as little bottom sediment as possible. Be careful not to collect water that has sediment from bottom disturbance. Stand facing upstream. Collect the water sample on your upstream side, in front of you.
- If taking sample from a boat, carefully reach over the side and collect the water sample on the upstream side of the boat.
- Hold the bottle near its base with polyethylene gloves and submerge the bottle in the water with the cap on. Open the bottle collecting the water sample 0.1m beneath the surface. When the bottle is filled to the desired level recap the bottle and remove from water. You can only use this method if the sample bottles do not contain sodium thiosulfate.
- Turn the bottle underwater into the current and away from you. In slow moving stream reaches, push the bottle underneath the surface and away from you in an upstream direction.
- Alternative sampling method: In case the sample bottle contains preservatives/chlorine removers (i.e. Sodium-Thiosulfate), it cannot be plunged opening down. In this case hold the bottle upright under the surface while it is still capped. Open the lid carefully just a little to let water run in. Fill the bottle to the fill mark and screw the lid tight while the bottle is still underneath the surface.
- Leave a 1-in. air space so that the sample can be shaken just before analysis. Recap the bottle carefully, remembering not to touch the inside.
- If the samples are to be analyzed in the lab, place them in a cooler with ice or cold packs for transport to the lab. Samples should be placed immediately on ice to maintain temperature at 6 ^{o}C

Pouring from another clean bottle

- Due to different sampling conditions (high turbidity, rough water etc.) it is sometimes easy to pour water from another clean bottle into the bacteria bottle. This helps to make sure that the sample water is only being filled to the desired line and no overfilling occurs.

TOXICITY IN WATER

Sample Collection

Using the standard grab sample collection method described previously for water samples, fill (for typical suite of water toxicity tests conducted) the required amount of 2.25-L amber glass bottles with sub surface water. Since the size of the 2.25-L amber bottle is bigger than your average sample bottle, find a spot in the centroid of the stream to completely submerge the toxicity bottle if possible. A clean water organics(1-L glass amber) bottle can be used if there is no sampling point deep enough to submerge a large toxicity bottle. If the stream is not deep enough to submerge any bottle, then comments should be made on the field data sheets that surface water was collected. Depth should also equal 0 for the sampling depth. All toxicity samples should be. put on ice, and cooled to 4 °C. Label the containers as described above and notify the laboratory of the impending sample delivery, since there is a 48-hr maximum sample hold time. Sample collection must be coordinated with the laboratory to guarantee appropriate scheduling.

Summary of Sample Container, Volume, Initial Preservation, and Holding Time Recommendations for Water Samples

Parameters for Analysis in WATER Samples	**Recommended Containers (all containers pre-cleaned)**	**Typical Sample Volume (mL)**	**Initial Field Preservation**	**Maximum Holding Time (analysis must start by end of max)**
Conventional Constituents in Water				
Alkalinity	Polyethylene bottles (see **NOTE**[(1)] below)	950 mL	Cool to ≤ 6 °C, dark	14 days at ≤ 6 °C, dark
Chloride (Cl), Sulfate (SO_4) and Fluoride (F)	Polyethylene bottles (see **NOTE**[(1)] below)	950 mL	Cool to ≤ 6 °C, dark	28 days at ≤ 6 °C, dark
Ortho-phosphate (OPO_4)	Field filtered during collection into a 125 mL polyethylene bottle	60 mL	Filter within 15 minutes; Cool to ≤ 6 °C, dark	48 h at ≤ 6 °C, dark
Nitrate + Nitrite (00630) (NO_3 + NO_2)	Clear polyethylene 500 mL with 0.4mL concentrate H_2SO_4 Preservative.	500 mL	Cool to ≤ 6 °C, dark	48 h at ≤ 6 °C, dark
Total Keldjahl Nitrogen (TKN)	Clear polyethylene 500 mL with 0.4mL concentrate H_2SO_4 Preservative.	500 mL	Cool to ≤ 6 °C, dark; H_2SO_4 to pH<2	Unacidified: 7 days Acidified: 28 days Either one at ≤ 6 °C, dark
Total Dissolved Solids (TDS)	Polyethylene bottles (see **NOTE**[(1)] below)	950 mL	Cool to ≤ 6 °C, dark Cool to 4°C, dark	7 days at ≤ 6 °C, dark
Ammonia (NH_3)	Clear polyethylene 500 mL with 0.4mL concentrate H_2SO_4 Preservative.	500 mL	Cool to ≤6 ˚C; samples may be preserved with 2 mL of H_2SO_4 per L	Unacidified: 48 h Acidified: 28 days Either one at ≤ 6 °C, dark
Total Phosphorus (TPO_4) and Total Nitrogen (TN)	Clear polyethylene 500 mL with 0.4mL concentrate H_2SO_4 Preservative.	500 mL	Cool to ≤ 6 °C, dark	Unacidified: 48 h Acidified: 28 days Either one at ≤ 6 °C, dark
(1)NOTE: The volume of water necessary to collect in order to analyze for the above constituents is typically combined in 1 950mL polyethylene bottle. More water volume might be needed for possible re-analysis and for conducting lab spike duplicates. This is possible since the same laboratory is conducting all of the above analyses; otherwise, individual volumes apply.				
Total Organic Carbon (TOC),	125 mL amber glass PC with 1ml 1:1 H_2SO_4 preservative.	125 mL for TOC	Cool to ≤6 ◦C; acidify to pH<2 with HCl, H_3PO_4, or H_2SO_4 within 2 hrs	28 days
Dissolved Organic Carbon (DOC)	Field filtered 125 mL amber glass PC with 1ml 1:1 H_2SO_4 preservative.	125 mL for DOC	Filter and preserve to pH<2 within 48 hours of collection; cool to ≤6 ˚C	28 days
Total Suspended Solids (TSS)	Clear HDPE 2000 mL narrow mouth bottle	2000 mL	Cool to ≤6 ˚C, dark	7 days at ≤6 ˚C, dark
Suspended Sediment Concentration (SSC)	Amber 950 mL HDPE wide mouth bottle.	Up to 950 ml depending on turbidity of water	Cool to ≤6 ˚C, dark	7 days at ≤6 ˚C, dark

Parameters for Analysis in WATER Samples	Recommended Containers (all containers pre-cleaned)	Typical Sample Volume (mL)	Initial Field Preservation	Maximum Holding Time (analysis must start by end of max)
Chlorophyll *a* **Pheophytin *a*** **Chlorophyll a** **Pheophytin *a***	1-L amber polyethylene bottle Aluminum Foil, GFC Filters	1000 mL (one bottle) 20-420 mL	Centrifuge or filter as soon as possible after collection; if processing must be delayed, keep samples on ice or at ≤6 °C; store in the dark	Samples must be frozen or analyzed within 4 hours of collection; filters can be stored frozen for 28 days
Non-Routine Compounds in Water Samples				
OIL AND GREASE	1-L glass jar with Teflon lid-liner, rinsed with hexane or methylene chloride	1000 mL (one jar)	Cool to ≤6 °C; HNO_3 or H_2SO_4 to pH<2	28 days at ≤6 °C, dark
PHENOLS	1-L glass jar with Teflon lid-liner	1000 mL (one jar)	Cool to ≤6 °C; H_2SO_4 to pH<2	28 days at ≤6 °C, dark
CYANIDE	1-L cubitainer	1000 mL (one cubitainer)	Cool to ≤6 °C; NaOH to pH>10; add 0.6 g $C_6H_8O_6$ if residual chlorine is present	14 days at ≤6 °C, dark
BIOCHEMICAL OXYGEN DEMAND (BOD)	4-L cubitainer	4000 mL (one cubitainer)	Cool to ≤6 °C; add 1 g FAS crystals per liter if residual chlorine is present	48 h at ≤6 °C, dark
CHEMICAL OXYGEN DEMAND (COD)	1-L cubitainer	110 mL (one cubitainer)	Cool to ≤6 °C; H_2SO_4 to pH<2	28 days at ≤6 °C, dark; biologically active samples should be tested as soon as possible
Trace Metals in Water Samples				
DISSOLVED METALS (except Dissolved Mercury)	60 mL polyethylene bottle, pre-cleaned in lab using HNO_3	60 mL (one bottle)	Filter at sample site using 0.45 micron in-line filter, or syringe filter (within 15 minutes of collection). Cool to 6°C, dark. Acidify in lab, within 48 hrs, using pre-acidified container (ultra-pure HNO_3) for pH<2.	Once sample is filtered and acidified, can store up to 6 months at room temperature

Parameters for Analysis in WATER Samples	**Recommended Containers (all containers pre-cleaned)**	**Typical Sample Volume (mL)**	**Initial Field Preservation**	**Maximum Holding Time (analysis must start by end of max)**
DISSOLVED MERCURY	250 mL glass or Teflon bottle, pre-cleaned in lab using HNO_3	250 mL (one bottle)	Filter within 15 minutes of collection. Cool to 6°C, dark. Acidify in lab within 48 hrs, with pre-tested HCL to 0.5%.	Once sample is filtered and acidified, can store up to 90 days at room temperature
TOTAL METALS (except Total Mercury)	60 mL polyethylene bottle, pre-cleaned in lab using HNO_3	60 mL (one bottle)	Cool to ≤6 °C, dark. Acidify in lab within 48 hrs, with pre-acidified container (ultra-pure HNO_3), for pH<2.	Once sample is acidified, can store up to 6 months at room temperature
TOTAL MERCURY	250 mL glass or Teflon bottle, pre-cleaned in lab using HNO_3	250 mL (one bottle)	Cool to ≤6 °C, dark. Acidify in lab within 48 hrs, with pre-tested HCL to 0.5%.	Once sample is acidified, can store up to 90 days at room temperature.
HEXAVALENT CHROMIUM (filtered)	600 mL plastic or glass bottle	600 mL (one bottle)	Cool to ≤6 °C, dark No acid	Keep at ≤6 °C, dark for up to 24 h; must notify lab in advance.
HARDNESS	200 mL polyethylene bottle	200 mL (one bottle)	Cool to 6°C, dark OR Cool to ≤6 °C; HNO_3 or H_2SO_4 to pH<2	48 h at 6°C, dark 6 months at ≤6 °C, dark
Synthetic Organic Compounds in Water Samples				
VOLATILE ORGANIC ANALYTES (VOA's) including VOC, MTBE and BTEX	40 mL VOA vials	120 mL (three VOA vials)	All vials are pre-acidified (50% HCl or H_2SO_4) at lab before sampling. Cool to 6°C, dark	unacidified: 7 days acidified: 14 days Both at 6°C, dark
PESTICIDES & HERBICIDES* ☐Organophosphate Pesticides ☐Organochlorine Pesticides ☐Chlorinated Herbicides **SEMI-VOLATILE ORGANICS*** **POLYCHLORINATED* BIPHEYNYL AND AROCHLOR COMPOUNDS** **TPH, PAH, PCP/TCP***	1-L I-Chem 200-series amber glass bottle, with Teflon lid-liner (per each sample type)	1000 mL (one container) ***Each sample type requires 1000 mL in a separate container**	Cool to 6°C, dark If chlorine is present, add 0.1g sodium thiosulfate	Keep at 6°C, dark, up to 7 days. Extraction must be performed within the 7 days; analysis must be conducted within 40 days.

Parameters for Analysis in WATER Samples	**Recommended Containers (all containers pre-cleaned)**	**Typical Sample Volume (mL)**	**Initial Field Preservation**	**Maximum Holding Time (analysis must start by end of max)**
Toxicity Testing Water Samples				
TOXICITY IN WATER	Four 2.25 L amber glass bottles	9000 mL	Cool to 4°C, dark	48 hrs at 4°C, dark
Bacteria and Pathogens in Water Samples				
E. Coli	Factory-sealed, pre-sterilized, disposable Whirl-pak® bags or 125 mL sterile plastic (high density polyethylene or polypropylene) container	100 mL volume sufficient for both E. coli and Enterococcus analyses	Sodium thiosulfate is pre-added to the containers in the laboratory (chlorine elimination). Cool to ≤ 10°C; dark.	STAT: 8 hrs at ≤ 10°C, dark if data for regulatory purposes; otherwise, 24 hrs at ≤ 10°C, dark if non-regulatory purpose.
Enterococcus	Factory-sealed, pre-sterilized, disposable Whirl-pak® bags or 125 mL sterile plastic (high density polyethylene or polypropylene) container	100 mL volume sufficient for both E. coli and Enterococcus analyses	Sodium thiosulfate is pre-added to the containers in the laboratory (chlorine elimination). Cool to ≤ 10°C ; dark.	STAT: 8 hrs at ≤ 10°C, dark if data for regulatory purposes; otherwise, 24 hrs at ≤ 10°C, dark if non-regulatory purpose.
FECAL COLIFORM	Factory-sealed, pre-sterilized, disposable Whirl-pak® bags or 125 mL sterile plastic (high density polyethylene or polypropylene) container	100 mL volume sufficient for both fecal and total coliform analyses	Sodium thiosulfate is pre-added to the containers in the laboratory (chlorine elimination). Cool to ≤ 10°C; dark.	STAT: 8 hrs at ≤ 10°C, dark if data for regulatory purposes; otherwise, 24 hrs at ≤ 10°C, dark if non-regulatory purpose.
TOTAL COLIFORM	Factory-sealed, pre-sterilized, disposable Whirl-pak® bags or 125 mL sterile plastic (high density polyethylene or polypropylene) container	100 mL volume sufficient for both fecal and total coliform analyses	Sodium thiosulfate is pre-added to the containers in the laboratory (chlorine elimination). Cool to ≤ 10°C; dark.	STAT: 8 hrs at ≤ 10°C, dark if data for regulatory purposes; otherwise, 24 hrs at ≤ 10°C, dark if non-regulatory purpose.

Field Collection Procedures for Bed Sediment Samples

Bed sediment (hereafter termed "sediment") samples are collected after any water samples are collected where water and sediment are taken in the same reach. Care must be taken not to sample sediments that have been walked on or disturbed in any manner by field personnel collecting water samples. Sediment samples are collected into a composite jar, where they are thoroughly homogenized in the field, and then aliquoted into separate jars for chemical or toxicological analysis. Sediment samples for metals and organics are submitted to the respective analytical laboratories in separate glass jars, which have been pre-cleaned according to laboratory protocol.

Sediment chemistry samples give information regarding both trends in contaminant loading and the potential for adverse effects on sediment and aquatic biota. In order to compare samples over time and from site to site, they must be collected in a consistent manner. Recently deposited fine grain sediments (see attached table) are the target for sediment collection. If a suitable site for collecting sediments cannot be found at a station (it only contains larger grain material), sampling personnel should not collect the sediment sample, and should instead attempt to reschedule the sample collection or move to a different area that has more recently deposited fine sediment. If this is not possible, make a note so that the missing sample is accounted for in the reconciliation of monitoring events during preparation of sample collection "cruise reports". Sites that are routinely difficult to collect should be considered for elimination or relocation from the sample schedule, if appropriate.

Characteristics of Ideal Sediment Material to be Collected

Many of the chemical constituents of concern are adsorbed onto fine particles. One of the major objectives in selecting a sample site, and in actually collecting the sample while on site, is to obtain recently deposited fine sediment, to the extent possible. Avoid hard clay, bank deposits, gravel, disturbed and/or filled areas. Any sediment that resists being scooped by a dredge is probably not recently deposited fine sediment material. In following this guidance, the collection of sediment is purposefully being biased for fine materials, which must be discussed thoroughly in any subsequent interpretive reporting of the data, in regards to representation of the collected sample to the environment from which it was collected.

Characteristics of an Ideal Site

Quiescent areas are conducive to the settling of finer materials (EPA/USACOE, 1981).
Choose a sampling site with lower hydrologic energy, such as the inner (depositional) side of bends or eddies where the water movement may be slower. Reservoirs and estuaries are generally

depositional environments, also.

Selecting the Appropriate Sediment Type for Analysis

Sediment will vary from site to site and can vary between sample events at a particular site.

Streams and Rivers: Sediment collection in flowing streams is often a challenge. In areas of frequent scouring there may not be sufficient sediment for collection during or following periods of high flow. Sediment collection during these times may prove unsuccessful and may have to be rescheduled or cancelled.

When the suspended load in rivers and streams precipitates due to reduction of velocity, most of the resulting sediment will be fine-grained. More often than not, a dredge or mechanical grab device does not function well for collection of sediment in smaller streams. In many cases, sediment will have to be collected using a pre-cleaned polyethylene scoop. Collect the top 2 cm for analysis. Five or more (depending on the volume of sediment needed for conducting analyses) fine-sediment sub-sites within a 100-m reach are sampled into the composite jar.

Reservoirs and Estuaries: Collect the top 2 cm for analysis. Grabs are composited for the sediment sample, depending on the volume of sediment needed for conducting analyses.

GENERAL PROCEDURE FOR COLLECTION OF BED SEDIMENT

After choosing an appropriate site, and identifying appropriate fine-grained sediment areas within the general reach, collect the sample using one or more of the following procedures, depending on the setting:

A. <u>Sediment Scoop Method—Primary Method for Wadeable, Shallow Streams</u>

- The goal is to collect the top 2 cm of recently-deposited fine sediment only.
- Wear gloves and protective gear, in areas of potential exposure hazards, per appropriate protocol (make sure gloves are long enough to prevent water from overflowing gloves while submerging scoop).
- Survey the sampling area for appropriate fine-sediment depositional areas before stepping into the stream, to avoid disturbing possible sediment collection sub-sites.
- Carefully enter the stream and start sampling at the closest appropriate reach, then continue sampling UPSTREAM. Never advance downstream, as this could lead to sampling

disturbed sediment.

- Stir, do not shake, collected sediment with a polyethylene scoop for at least 5 min making sure all sediment is completely homogenized.
- Quickly scoop sediment out of the homogenizing jar into desired sampling jars making sure to stir the sediment in the homogenizing jar in between each aliquot.
- Inspect each individual sediment jar making sure of consistent grain size throughout the entire sample collection.
- Single bag all sediment containers to prevent cross contamination.
- Make sure all containers are capped tightly and stored in a cooler on cube ice at 6 °C.

B. Hand Core Method-Alternate method for wadeable shallow streams with fine sediment

- A hand core is used in wadeable streams where there is very fine sediment.
- The hand core sampler consists of a 3-in. diameter polycarbonate core that is 8 inches long. Samplers push the core into the sediment to the desired depth, pull the core out of the sediment, and cap the bottom with a polyethylene core cap or by placing their hand underneath the cap to hold the sediment in place.
- Hand cores are usually measured and marked at 2 cm length so the sampler knows how far to deploy the core into the sediment.
- Sediment is then emptied into a homogenizing jug and aliquoted accordingly.

C. Sediment Grab Method—Primarily for Lake, River, Bridge, and Estuarine Settings (or deeper streams)

Description of sediment grab equipment:

- A mechanical sediment grab is used for the SWAMP bed sediment collection field effort for lake, river, bridge, and estuarine/coastal settings (or deeper, non-wadeable streams).
- The mechanical grab is a stainless steel “Young-modified Van Veen Grab", and is 0.5 m^2 in size.
- The mechanical grab is deployed primarily from a boat, and is used in deeper, non-wadeable waters, such as lakes, rivers, estuaries, and coastal areas.
- It is also deployed by field personnel from land in settings which allow its use: primarily from bridges; from smaller vessels in streams or drainage channels too deep or steep to wade into, but too shallow for a larger boat.

Deploying and retrieving the grab:

- Slowly lower the grab to the bottom with a minimum of substrate disturbance.
- Retrieve the closed dredge at a moderate speed (e.g., less than two feet per second).
- Upon retrieval, open the lids of the sediment grab, examine the sample to ensure that the

sediment surface is undisturbed and that the grab sample should not be rejected.

Rejection Criteria—reject the sample if the following are not met:

- Mud surface must not be pressing out of the top of the sampler. If it is, lower the grab more slowly.
- Overlying water must not be leaking out along the sides of the sediment in the grab. This ensures the surficial sediment is not washed out.
- Sediment surface is flat and level in the sampler. If it is not level, the grab has tilted over before closing.

Processing the sediment sample from the grab equipment:

- The water overlying the sediment in the grab is very gently decanted by slightly tipping the grab with the lid closed until the water runs out the top.
- The decanting process should remove all of the overlying water but not remove the surficial sediments. The laboratory reports percent water for the sample, so overlying water is not included in the sample container.
- The sediment is examined for depth of penetration, color and thickness of top aerobic zone, and texture. These observations are recorded on the field data sheet.
- Collect the top 2 cm from at least five sub samples, and otherwise, exclude the bottom-most layer and composite.
- In streams or other settings with excessive bottom debris (e.g., rocks, sticks, leaves) where the use of a grab is determined to be ineffective (e.g., dredge does not close, causing loss of sediment), samples may be collected by hand using a clean plastic scoop, or by a variety of coring methods, if appropriate for the situation.
- Sediment is handled as described below in the metals and organic sections.

Cleaning the Grab Equipment and Protection from Potential Contaminating Sources:

- The sediment sampler will be cleaned prior to sampling EACH site by: rinsing all surfaces with ambient water, scrubbing all sediment sample contact surfaces with Micro™ or equivalent detergent, rinsing all surfaces with ambient water, rinsing sediment sample contact surfaces with 5% HCl, and rinsing all sediment sample contact surfaces with methanol.
- The sediment grab will be scrubbed with ambient water between successive deployments at ONE site, in order to remove adhering sediments from contact surfaces possibly originating below the sampled layer, thus preventing contamination from areas beyond target sampling area.
- Sampling procedures will attempt to avoid exhaust from any engine aboard any vessel involved in sample collection. An engine will be turned off when possible during portions of the sampling process where contamination from engine exhaust may occur. It is critical that sample contamination be avoided during sample collection. All sampling equipment (e.g., siphon hoses, scoops, containers) will be made of non-contaminating material and will be appropriately cleaned before use. Samples will not be touched with un-gloved fingers. In addition, potential airborne contamination (e.g., from engine exhaust, cigarette smoke) will be avoided.

D. Core Method--alternative for fast-moving, wadeable streams

The core method is used in soft sediments when it is difficult to use the other methodologies. The cores can be used in depths of water from 0 to 10 ft by using a pole deployment device or in deeper water using SCUBA divers. The pole deployment device consists of a pole that attaches to the top of the core. The top of the core is fitted with a one-way valve, which allows the core to be filled with sediment, but when pulled from the sediment catches the sediment within the core. The core is then brought to the surface and the sediments within the core are extruded out the top of the core so that 2 cm of sediment is above the top of the plastic core. The 2 cm of sediment is then sliced off and placed in the homogenizing jar. A new core, homogenizing jar, and device used to slice off the top two cm. are used at each station unless the equipment is cleaned using laboratory protocols.

E. Sediment Grab Method – Primarily used from bridges or for streams with restricted bank access.

Description and sampling procedure for the Eckman sediment grab

- The Eckman grab is 0.2 m^2 in size with a lead "messenger" that triggers the spring loaded doors.
- The primary use is for sampling from bridges or from small vessels in streams or drainage channels too deep or steep to wade into, but too shallow for a larger boat.
- The grab must be cleaned with a Micro™ and tap water rinse before sampling and in-between sample stations.
- To deploy the grab, pull the spring loaded doors open and hook the cables on the actuator plate.
- With a rope, lower the grab to the desired sample reach making sure that the grab has penetrated the sediment. Clip the "messenger" on the rope and release it while maintaining tension on the rope. Pull up the grab once the "messenger" has activated the doors.
- While wearing clean poly gloves, open the top hatch and remove the top 2 cm of sediment with a clean polyethylene scoop. Place the sediment into the homogenizing jug and repeat the sampling process until there is enough desired sediment. See general procedures for processing of bed sediment samples, once they are collected for sediment homogenization and aliquoting into sample jars.

GENERAL PROCEDURE FOR PROCESSING OF BED SEDIMENT SAMPLES, ONCE THEY ARE COLLECTED

Sediment Homogenization, Aliquoting and Transport

For the collection of bed sediment samples, the top 2 cm is removed from the scoop, or the grab, or the core, and placed in the 4-L glass compositing/homogenizing container. The composited

sediment in the container is homogenized and aliquoted on-site in the field. The sample is stirred with a polyethylene scoop until sediment/mud appears homogeneous. All sample identification information (station numbers, etc.) will be recorded prior to homogenizing and aliquoting. Sediment samples will immediately then be cooled to 6 °□C and separated for preservation according to the: Summary of Sample Container, Volume, Preservation, and Storage Requirements for SWAMP Bed Sediment, Biota, and Tissue Samples (for contaminant analysis).Each container will be sealed in one large plastic bag to prevent contact with other samples or ice or water.

Metals and Semi-volatile Organics in Sediment	For trace metals and semi-volatile organics, a minimum of three grabs is distributed to the composite bottle and/or sample containers. Mixing is generally done with a polyethylene scoop. Make sure the sample volume is adequate, but the containers do not need to be filled to the top. Seal the jars with the Teflon liner in the lids.
Sediment Conventionals	Sediment conventionals are sometimes requested when sediment organics, sediment metals, and/or sediment toxicity tests are requested for analysis of samples. The collection method is the same as that for metals, semi-volatile organics, and pesticides. Sediment conventionals include: grain size analysis and total organic carbon. These are used in the interpretation of metals and organics in sediment data.
Sample Containers	See “Sediment Sample Handling Requirements” table at end of this document.
Sediment Sample Size	Must collect sufficient volume of sediment to allow for proper analysis, including possible repeats, as well as any requested archiving of samples for possible later analysis. See “Sediment Sample Handling Requirements” Table at end of this document.
Labeling	Label the jars with the station ID, sample code, matrix type, project ID, time, and date of collection, as well as the type of analysis requested (e.g., metals, conventionals, organics, or archives).
Short-term Field Preservation	Immediately place the labeled jar on ice, cool to 6 °□C, and keep in the dark at 4 °□C until delivery to the laboratory.
Field Notes	Fill out the SWAMP Sediment Data Sheet. Make sure to record any field notes that are not listed on the provided data sheets. This information can be reported as comments with the sediment analytical results.

Summary of Sample Container, Volume, Preservation, and Storage Requirements for SWAMP Bed Sediment, Biota, and Tissue Samples (for contaminant analysis)

Parameters for Analysis	**Recommended Containers**	**Typical Sample Volume (mL)**	**Initial Field Preservation**	**Maximum Holding Time**
Bed Sediment Samples				
Trace Metals, including Hg and As (except for Se--see below)	60-mL I-Chem 300- series clear glass jar with Teflon lid-liner; Pre-cleaned	60 mL (one jar)	Cool to ≤6 °C within 24 hours, then freeze to ≤-20 °C	12 months(1) (-20 °C)
Methylmercury	60-mL I-Chem 300- series clear glass jar with Teflon lid-liner; Pre-cleaned	60 mL (one jar)	Freeze to ≤-20 °C immediately	12 months(1) (-20 °C)
Selenium (separate container required)	60-mL I-Chem 300- series clear glass jar with Teflon lid-liner; Pre-cleaned	60 mL (one jar)	Cool to ≤6 °C within 24 hours, then freeze to ≤-20 °C	12 months(1) (-20 °C)
Synthetic Organic Compounds	250-mL I-Chem 300-series amber glass jar with Teflon lid-liner; Pre-cleaned	500 mL (two jars)	Cool to ≤6 °C within 24 hours, then freeze to ≤-20 °C	12 months(1) (-20 °C)
Sediment TOC	250-mL(3) clear glass jar; Pre-cleaned	125 mL (one jar)	Cool to ≤6 ˚C or freeze to ≤-20 ˚C	28 days at ≤6 ˚C; 1 year at ≤-20 ˚C (2)
Sediment Grain Size	250-mL(3) clear glass jar; Pre-cleaned	125 mL (one jar)	Wet ice to ≤6 ˚C in the field, then refrigerate at ≤6 ˚C	1 year (≤6 ˚C) ***Do not freeze***
Sediment Toxicity Testing	1-L I-Chem wide-mouth polyethylene jar with Teflon lid-liner; Pre-cleaned	2 (two jars filled completely)	Cool to 4 °C, dark, up to 14 days	14 days (4 °C) ***Do not freeze***

(1) Sediment samples for parameters noted with one asterisk (*) may be refrigerated at 6 °C for up to 14 days maximum, but analysis must start within the 14-day period of collection or thawing, or the sediment sample must be stored frozen at minus (-) 20 °C for up to 12 months.

(2) Sediment samples for sediment TOC analysis can be held at 4°C for up to 28 days, and should be analyzed within this 28-day period, but can be frozen at any time during the initial 28 days, for up to 12 months at minus (-) 20 °C.

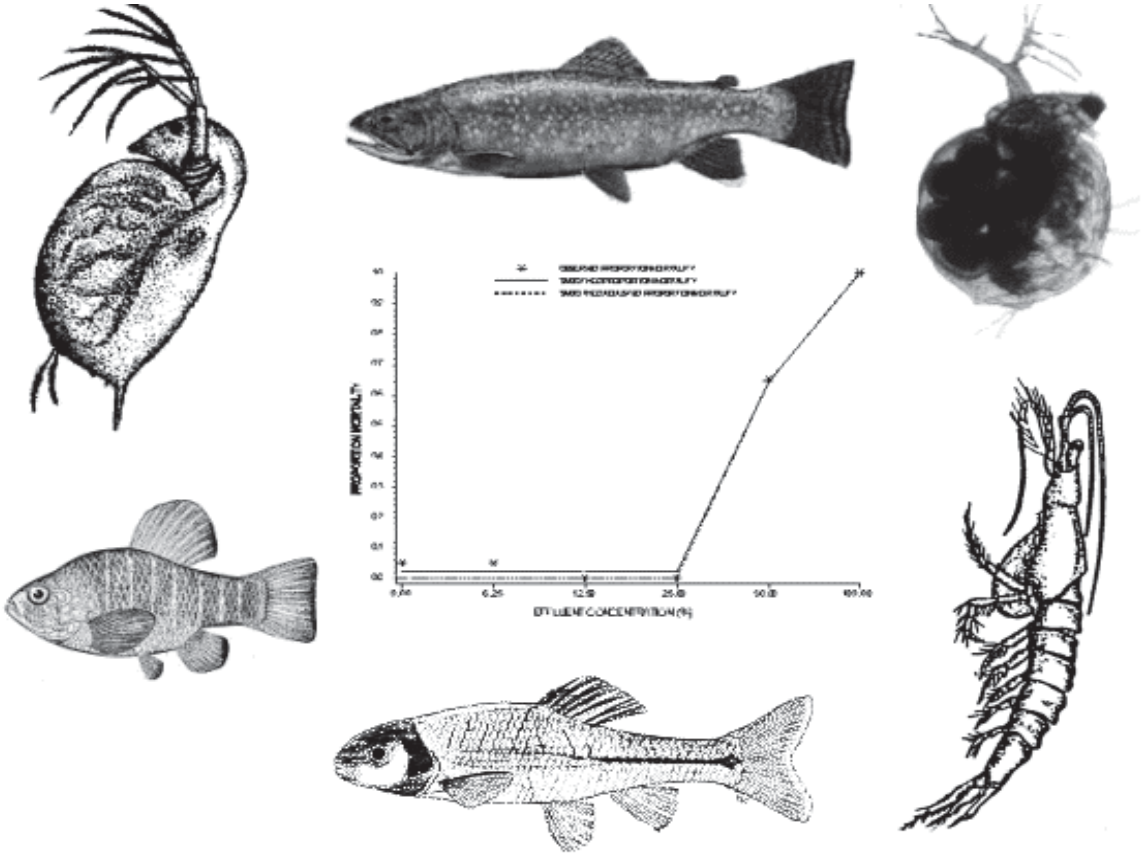
(3) Sediment samples for TOC AND grain size analysis can be combined in one 250 mL clear glass jar, and sub-sampled at the laboratory in order to utilize holding time differences for the two analyses. If this is done, the 250 mL combined sediment sample must be refrigerated only (not frozen) at 4 °C for up to 28 days, during which time the sub-samples must be aliquoted in order to comply with separate storage requirements (as shown above).

United States
Environmental Protection
Agency

Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms

Fifth Edition

October 2002



Weck Laboratories Analytical Methods Standard Operating Procedures

Analyte	Analytical Method	Analytical Method Lab SOP	Analytical Method Modified
Hardness	varies	MET025	None
Nitrate, Nitrite, Nitrate+Nitrite	EPA 353.2	WET084	None
Phosphorus, Total & Dissolved	EPA 365.1	WET087	None
Ammonia	EPA 350.1	WET086	None
Orthophosphate, Total & Dissolved	EPA 365.3	WET080	None
Total Kjeldahl Nitrogen	EPA 351.2	WET089	None
Total Suspended Solids	SM 2540D	WET042	None
Trace Metals, total & dissolved	EPA 200.8	MET018	None
Carbamates	EPA 531.1	ORG028	None
Diuron +degredates (DCPMU DCPU DCA)	EPA 8321	ORG140	None
Neonicotinoid Pesticides	EPA 8321	ORG140	None
Organo-Phosphorus Pesticides	EPA 525.2	ORG115	Yes - SIM or QQQ
Pyrethroid Pesticides by GC/MS SIM	GC/MS NCI-SIM	ORG117	None

Weck Laboratories, Inc.
Analytical Laboratory Services - Since 1964

CHAIN OF CUSTODY RECORD

14859 East Clark Avenue : Industry : CA 91745
Tel 626-336-2139 ♦ Fax 626-336-2634 ♦ www.wecklabs.com

STANDARD

CLIENT NAME:

PROJECT:

ADDRESS:

PHONE:
FAX:
EMAIL:

PROJECT MANAGER

SAMPLER

ANALYSES REQUESTED

SPECIAL HANDLING

- ☐ Same Day Rush 150%
- ☐ 24 Hour Rush 100%
- ☐ 48-72 Hour Rush 75%
- ☐ 4 - 5 Day Rush 30%
- ☐ Rush Extractions 50%
- ☐ 10 - 15 Business Days
- ☐ QA/QC Data Package

Charges will apply for weekends/holidays

Method of Shipment:

ID# (For lab Use Only)	DATE SAMPLED	TIME SAMPLED	SMPL TYPE	SAMPLE IDENTIFICATION/SITE LOCATION	# OF CONT.											COMMENTS

RELINOUISHED BY	DATE / TIME	RECEIVED BY
RELINQUISHED BY	DATE / TIME	RECEIVED BY
RELINQUISHED BY	DATE / TIME	RECEIVED BY

SAMPLE CONDITION:

Actual Temperature:

Received On Ice	Y / N
Preserved	Y / N
Evidence Seals Present	Y / N
Container Attacked	Y / N
Preserved at Lab	Y / N

SAMPLE TYPE CODE:

AQ=Aqueous
NA= Non Aqueous
SL = Sludge
DW = Drinking Water
WW = Waste Water
RW = Rain Water
GW = Ground Water
SO = Soil
SW = Solid Waste
OL = Oil
OT = Other Matrix

PRESCHEDULED RUSH ANALYSES WILL TAKE PRIORITY
OVER UNSCHEDULED RUSH REQUESTS
Client agrees to Terms & Conditions at: www.wecklabs.com

SPECIAL REQUIREMENTS / BILLING INFORMATION

CHAIN OF CUSTODY RECORD

Client:	Project Name/Number:
Address	Project Mgr.
	P.O. #
Phone Number:	Sampled By *(signature)*

Date	Time	Comp.	Grab	Matrix	Sample ID	Volume/ Number	Analysis									Comments

Relinquised By:*(signature)* Date: Time:

Received By:*(signature)* Date: Time:

Relinquised By:*(signature)* Date: Time:

Received By:*(signature)* Date: Time:

Upon sample reciept record the following results:

Temp (°C) _____ NH_3 (mg/L) _____ Cl (mg/L): _____

Aquatic Bioassay and Consulting Laboratories
29 N. Olive Street Ventura, CA 93001 Phone: (805) 643-5621 Fax: (805) 643-2930

Surface Water Ambient Monitoring Program (SWAMP) Station Recon Form

1	Surveyed By	
2	Date and Time	
3	Station Name	
4	StationCode	
5	Local Waterbody	
6	Cell phone coverage?	
7	Cell phone provider	
8	Latitude (dd)	
9	Longitude (-ddd)	
10	Datum	
11	Accuracy (ft)	
12	GPS Unit, serial #	
13	7.5" TOPO Map	
14	Nearest Stream Gage #	
15	Stream Gage Agency/Contact	
16	Elevation (ft)	
17	County	
18	Major Highways/Streets	
19	Nearest Mile Post	
20	Landmarks	
21	Access Permission	
22	Number of Gates	
23	Keys/Combo	
24	4x4 required?	
25	Traffic flow/parking	
26	Driving Directions	
27	Station Description/Directions	
28	Known access precautions?	
29	WaterbodyType	
30	Perennial or Intermittent	
31	Approximate stream width	
32	Approximate depth	
33	Approximate velocity (ft/s)	
34	Salinity Range (EC)	
35	Seasonal considerations	
36	Tidal influence?	
37	Known hazards	
38	Stream impacts, health hazards, land use activities	
39	Sewage treatment plants	
40	CHP	
41	Fire/Rescue	
42	Hospital	

Surface Water Ambient Monitoring Program (SWAMP) Station Recon Form

3	Station Name	
4	StationCode	

No.	Description
3	**StationName**: Regional Board defined name for station; e.g., Los Penasquitos Creek
4	**StationCode**: Combination of 3-digit Hydrologic Unit Code (HUC) and 6-digit alpha numeric station ID; e.g., 111EELHST, 206WIL070
5	**Local Waterbody**: Name of waterbody (creek, river, etc) as defined by the Regional Board; e.g., Los Penasquitos Creek or Smith River
7	**Cell Phone Service Provider**: What company provides your cell phone coverage? e.g., Verizon, AT&T
8	**Latitude (dd)**: Provide the target latitude in decimal degrees
9	**Longitude (-ddd)**: Provide the target longitude in decimal degrees
10	**Datum**: What datum is the GPS using? e.g., NAD83, NAD27, WGS84; SWAMP prefers NAD83
12	**GPS Unit and serial #**: GPS Unit (e.g., Garmin, Magellan, Lowrance) and Serial number
13	**7.5" TOPO Map**: What is the name of the 7.5" TOPO Map used for this area?
15	**Stream Gage Agency/Contact**: Name of the nearest stream gage agency (e.g., USGS) and contact info.
18	**Major Highways/Streets**: Indicate major highways or streets used to access the site
21	**Access Permission**: Include name, phone number, and special time considerations (e.g., only between 8 am and 5 pm)
22	**Number of gates**: Indicate the number of gates, if any, required to access the site
25	**Traffic flow/parking**: Indicate if and where there are traffic or parking concerns
26	**Driving Directions**: Provide a DETAILED description of how to reach site. Please provide as much information as possible. For boat sites, include directions to the boat launch and ramp type (concrete, dirt, etc).
27	**Station Description/Directions**: Provide a physical description of the site including any bridges, grade controls, etc.; attach a layout and site location if applicable
29	**Waterbody Type**: Waterbody type from GEOWBS list: B (Bays and Harbors), C (Coastal Shorelines), E (Estuaries), L (Lakes/Reserviors), R (Rivers/Streams), S (Saline Lakes), T (Wetlands, Tidal), W (Wetlands, Freshwater)
35	**Seasonal Considerations**: List any seasonal considerations as flooding, agricultural runoff, etc.
38	**Stream Impacts, Health Hazards, Land Use Activities**: List known stream impacts (e.g., agriculture, urban runoff, construction, industry, grazing), health hazards, and land use activities
40	**CHP, Fire, Hospital**: Please list the address and contact info of the nearest emergency services

Use this space to attach extra directions, pictures, maps, etc.

SWAMP Field Data Sheet (Water Chemistry & Discrete Probe) - EventType=WQ

Entered in d-base (initial/date)			Pg of Pgs
*StationID: ___ ___ ___ ___ ___ ___ ___ ___ ___	*Date (mm/dd/yyyy): / /	*Group: Summer 2015	*Agency: City of SB
*Funding: ___ ___ ___ ___ ___ ___ ___ ___	ArrivalTime: / DepartureTime:	*SampleTime (1st sample):	*Protocol:
*ProjectCode: 303d	*Personnel:	*Purpose (circle applicable): WaterChem WaterTox Habitat FieldMeas	*PurposeFailure:

*Location: Bank Thalweg Midchannel OpenWater	*GPS/DGPS	Lat (dd.ddddd)	Long (ddd.ddddd)	OCCUPATION METHOD: Walk-in Bridge R/V _____ Other
GPS Device:	Target:		-	STARTING BANK (facing downstream): LB / RB / NA
Datum: NAD83 Accuracy (ft / m):	*Actual:		-	Point of Sample (if Integrated, then -88 in dbase)

Habitat Observations (CollectionMethod = Habitat_generic)

SITE ODOR:	None,Sulfides,Sewage,Petroleum,Smoke,Other_____	WADEABILITY: Y / N / Unk	BEAUFORT SCALE (see attachment):
SKY CODE:	Clear, Partly Cloudy, Overcast, Fog, Smoky, Hazy	WIND DIRECTION (from):	N W E S
OTHER PRESENCE:	Vascular,Nonvascular,OilySheen,Foam,Trash,Other___		
DOMINANT SUBSTRATE:	Bedrock, Concrete, Cobble, Boulder, Gravel, Sand, Mud, Unk, Other_____		
WATERCLARITY:	Clear (see bottom), Cloudy (>4" vis), Murky (<4" vis)	PRECIPITATION:	None, Fog, Drizzle, Rain, Snow
WATERODOR:	None, Sulfides, Sewage, Petroleum, Mixed, Other_____	PRECIPITATION (last 24 hrs):	Unknown, <1", >1", None
WATERCOLOR:	Colorless, Green, Yellow, Brown	EVIDENCE OF FIRES:	No, <1 year, <5 years

DISTANCE FROM BANK (m):

STREAM WIDTH (m):

WATER DEPTH (m):

HYDROMODIFICATION: None, Bridge, Pipes, ConcreteChannel, GradeControl, Culvert, AerialZipline, Other LOCATION (to sample): US / DS / WI /

PHOTOS (RB & LB assigned when facing downstream; RENAME to StationCode_yyyy_mm_dd_uniquecode):

1: (RB / LB / BB / US / DS / ##)

2: (RB / LB / BB / US / DS / ##)

3: (RB / LB / BB / US / DS / ##)

OVERLAND RUNOFF (Last 24 hrs): none, light, moderate / heavy, unknown

OBSERVED FLOW: NA, Dry Waterbody Bed, No Obs Flow, Isolated Pool, Trickle (<0.1cfs), 0.1-1cfs, 1-5cfs, 5-20cfs, 20-50cfs, 50-200cfs, >200cfs

Field Measurements (SampleType = FieldMeasure; Method = Field)

	DepthCollec (m)	Velocity (fps)	Air Temp (°C)	Water Temp (°C)	pH	O_2 (mg/L)	O_2 (%)	Specific Conductivity	Salinity (ppt)	Turbidity (ntu)			
SUBSURF/MID/ BOTTOM/REP													
SUBSURF/MID/ BOTTOM/REP													
SUBSURF/MID/ BOTTOM/REP													
Instrument:													
Calib. Date:													

Samples Taken (# of containers filled) - Method=Water_Grab

Field Dup YES / NO: (SampleType = Grab / Integrated; LABEL_ID = FieldQA; create collection record upon data entry

SAMPLE TYPE: Grab / Integrated

COLLECTION DEVICE: Indiv bottle (by hand, by pole, by bucket); Teflon tubing; Kemmer; Pole & Beaker; Other _____

	DepthCollec (m)	Inorganics	Bacteria	Chl a	TSS / SSC	TOC / DOC	Total Hg	Dissolved Mercury	Total Metals	Dissolved Metals	Organics	Toxicity	VOAs
Sub/Surface													
Sub/Surface													

COMMENTS:

Modified 02/10/11

CITY OF SOLVANG
STORMWATER PROGRAM MANAGEMENT
CERTIFICATION STATEMENT

In accordance to the National Pollutant Discharge Elimination System (NPDES) General Permit for Waste Discharge Requirements (WDRs) for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4) Order No. 2013-0001-DWQ; NPDES No. CAS000004, Section E.6. Program Management Element:

I, Brad Vidro, City Manager and acting Principal Executive Officer, hereby certify, the City of Solvang has and will maintain full legal authority to implement and enforce each of the requirements contained within this Order. The City of Solvang implements elements of the Stormwater Program Management specified within Section E.6.b. Certification as follows:

(a) Identification of all departments within the Permittee's jurisdiction that conduct stormwater-related activities and their roles and responsibilities under this Order.

DEPARTMENT	ROLES AND RESPONSIBILITIES
City Manager	• Enforce all laws and ordinances of the City; • Control, order and give direction to all department head and to subordinate officers and employees of the City under his jurisdiction; • Recommend to the City Council for adoption such measures and ordinances as he or she deems necessary; • Exercise general supervision over all public buildings, public parks, and all other public properties which are under the control and jurisdiction of the city.
City Clerk	• Official custodian of all City records; • Records and files all ordinances, resolutions and motions which may be enacted by the City Council; • Maintains complete and accurate record of City Council meetings; • Prepares and distributes the City Council agendas, prepares minutes, maintains an index of all legislative actions including agreements, resolutions, and ordinances, and publishes ordinances as required by law; • Ensure all records of City Council meeting are readily accessible and open to the public; • Codifies Ordinances within Solvang Municipal Code as needed; • Distributes updates to the municipal code; • Custodian of the City seal.
Planning / Building / Code Enforcement	• Verifies resolution of a Solvang Municipal Code violation; • Tracks all phases of enforcement process.

DEPARTMENT	ROLES AND RESPONSIBILITIES
City Attorney Office	• Investigates and resolves Solvang Municipal Code violations on private property; • Advises city officials on all legal matters; • Frames an ordinance or resolution required by the legislative body; • Upon approval by the City Council, the City Attorney may commence any available administrative, civil or criminal proceedings to any nuisance, violation of any municipal code violation in the city.
Public Works	• Administer, implement and enforce Solvang Municipal Code Title 14 Stormwater Management and the Spill Response Plan; • Inspects existing commercial and industrial facilities. • Inspects all new development and construction sites and facilities any enforcement actions that may result; • Supports implementation of the Stormwater Management Program and enforcement of the Solvang Municipal Code as it relates to stormwater quality, illicit discharges and connections, construction stormwater controls, and post-construction stormwater controls and maintenance; • Implementing or Coordinating each minimum control measure and Stormwater Management Program.
Recreation and Parks	• Maintains Mutt Mitt Stations at designated locations.

(b) Citation of stormwater runoff related ordinances, identification of the topics each ordinance addresses;

Solvang Municipal Code Title 14 Stormwater Management is the citation for Solvang "Stormwater Management Ordinance" for management of storm water runoff. Solvang Municipal Code Title 14 Stormwater Management was created to protect and enhance the water quality of waters of the state and water bodies in a manner pursuant to and consistent with the Porter-Cologne Water Quality Control Act (California Water Code Section 13000 et seq.) and State Water Resources Control Board Water Quality Order No. 2013-0001-DWQ by reducing pollutants in stormwater discharges to the maximum extent practicable and by prohibiting non-stormwater discharges to the storm drain system. Topics covered within Solvang Municipal Code Title 14 Stormwater Management are as follows:

<u>Solvang Municipal Code Title 14 STORMWATER MANAGEMENT</u>:
Chapter 1 – Title, Purpose and General Provisions
- 14-1-1: Title.
- 14-1-2: Purpose and Intent.
- 14-1-3: Definitions.
- 14-1-4: Applicability and Effective Dates.
- 14-1-5: Responsibility for Administration.
- 14-1-6: Stormwater Management Fee.

14-1-7: Severability.
14-1-8: Regulatory Consistency.
14-1-9: Ultimate Responsibility of Discharger.

Chapter 2 – Discharge Prohibitions

14-2-1: Prohibition of Illegal Discharges.
14-2-2: Prohibition of Illicit Connections.
14-2-3: Discharges in Violation of Industrial or Construction Activity NPDES Stormwater Discharge Permit.

Chapter 3 – Regulations and Requirements

14-3-1: Requirement to Prevent, Control, and Reduce Stormwater Pollutants.
14-3-2: Requirement to Eliminate Illegal Discharges.
14-3-3: Requirement to Eliminate or Secure Approval for Illicit Connections.
14-3-4: Watercourse Protection.
14-3-5: Requirements to Remediate.
14-3-6: Requirements to Monitor and Analyze.
14-3-7: Notification of Spills.

Chapter 4 – Inspection and Monitoring

14-4-1: Compliance Certificate for Stormwater Management Facilities.
14-4-2: Authority to Inspect.
14-4-3: Authority to Sample, Establish Sampling Devices, and Test.
14-4-4: Access to Facilities.

Chapter 5 – Enforcement

14-5-1: Enforcement and Administration.
14-5-2: Urgency Abatement.
14-5-3: Violations Deemed a Public Nuisance.
14-5-4: Acts Potentially Resulting in a Violation of the Federal Clean Water Act and/or California Porter-Cologne Act.
14-5-5: Right to Appeal.
14-4-6: Civil Penalties to be Deposited in the Stormwater Fund.

(c) *Identification of the local administrative and legal procedures and ordinances available to mandate compliance with stormwater related ordinances and therefore with the conditions of this Order.*

Solvang Municipal Code Title 1 Administration, Chapter 3 (General Penalty), and Chapter 6 (Appeal Procedures); and Title 6 Police Regulations, Chapter 5 (Administrative Remedies Process) provides administrative and legal procedures to mandate compliance with Solvang Municipal Code Title 14 Stormwater Management.

<u>Solvang Municipal Code Title 1 ADMINISTRATION</u>:

Chapter 3 – General Penalty

1-3-1: Violation or Noncompliance; General Penalty.
1-3-2: Infractions.
1-3-3: Misdemeanors.
1-3-4: Continuing Violations.
1-3-5: Nuisances Declared; Abatement.

1-3-6: Citation Procedures.
1-3-7: Notice Procedures.
1-3-8: Reference to Acts or Omissions; Jurisdiction.
Chapter 6 – Appeal Procedures
1-6-1: Applicability.
1-6-2: Notice of Appeal.
1-6-3: Service on Respondents, Report.
1-6-4: Denial of Appeal.
1-6-5: Rehearings.
1-6-6: Hearing Procedures.
1-6-7: Final Decisions.
1-6-8: Findings.
1-6-9: Petitions for Judicial Review.

Solvang Municipal Code Title 6 POLICE REGULATIONS:
Chapter 5 – Administrative Remedies Process
Article A. Administrative Citations
6-5A-1: Applicability.
6-5A-2: Definitions.
6-5A-3: Issuance of Administrative Citation.
6-5A-4: Amount of Fines.
6-5A-5: Payment of the Fine.
6-5A-6: Hearing Request.
6-5A-7: Advance Deposit Hardship Waiver.
6-5A-8: Hearing Officer.
6-5A-9: Hearing Procedure.
6-5A-10: Hearing Officer's Decision.
6-5A-11: Late Payment Charges.
6-5A-12: Recovery of Administrative Citation Fines and Collection Costs.
6-5A-13: Right to Judicial Review.
6-5A-14: Notices.

(d) A description of how stormwater related ordinances are reviewed and implemented.

The City Clerk places the notice on the Consent Agenda for the "First Reading" of the ordinance. If no changes to the ordinance, the City Council approves Consent Agenda for the "Second Reading" of the ordinance. If changes in the ordinance are required, the process repeats until ordinance is approved.

The City Clerk places the notice on the Consent Agenda for the "Second Reading" and adoption of the ordinance. If the City Council approves the "Second Reading" of the ordinance, the City Clerk documents approval on the Consent Calendar and posts the "Notice of Adoption" at 3 designated locations within the City of Solvang.

The City Clerk will record the ordinance and codify the ordinance into the Solvang Municipal Code; and distribute hard copies to City staff for implementation. The Public Works Director / City Engineer will administer, implement and enforce the

provisions of the codified chapter of the ordinance. If any amendments to the codified chapter are required following implementation, the Public Works Director / City Engineer will coordinate changes to the municipal code as needed.

(e) A statement that the municipality will implement enforcement actions consistent with its Enforcement Response Plan developed pursuant to Section E.6.c.

The City of Solvang will develop and implement an Enforcement Response Plan that will contain enforcement actions as defined within E.6.c. Enforcement Measures and Tracking during Year 3 (2015-2016) of the effective date of the permit. The plan will contain enforcement procedures and actions and identify the City of Solvang responses to violations and it will outline steps to address repeat and continuing violations by implementing progressively stricter responses as need to achieve compliance. During the development of the plan, the City of Solvang will review Solvang Municipal Code Title 1 Administration, Chapter 3 (General Penalty), Chapter 6 (Appeal Procedures) and Title 6 Police Regulations, Chapter 5 (Administrative Remedies Process) to determine if the municipal code requires updating for consistency with the plan.

CERTIFICATION:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature

CITY OF SOLVANG

Brad Vidro
City Manager

Attachment 1: Solvang Municipal Code Title 14 Stormwater Management

Attachment 2: Solvang Municipal Code Title 1 Administration, Chapter 3 (General Penalty) and Chapter 6 (Appeal Procedures)

Attachment 3: Solvang Municipal Code Title 6 Police Regulations, Chapter 5 (Administrative Remedies Process)

Urban Storm Water Monitoring Plan 2015-2018

For the NPDES Phase II Small MS4 General Permit
Sections E.13.c *303(d) Monitoring* and E.14.a *Program Effectiveness Assessment and Improvement Plan*

***For the following Regulated MS4s*:**

City of Goleta
City of Carpinteria
City of Buellton
City of Solvang
Unincorporated Santa Barbara County

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Introduction

The NPDES Municipal General Permit E.13.c. 303(d) Monitoring section outlines requirements as follows:

> All Permittees that discharge to waterbodies listed as impaired on the 303(d) list where urban runoff is listed as the source, shall consult with the Regional Water Board within one year of the effective date of the permit to assess whether monitoring is necessary and if so, determine the monitoring study design and a monitoring implementation schedule. Permittees shall implement monitoring of 303(d) impaired water bodies as specified by the Regional Water Board Executive Officer.

During initial consultations with the Santa Barbara County MS4s (August 19, 2014), Regional Water Board staff indicated that permittees should monitor for pollutants typically associated with wet weather discharges, rather than limit monitoring to listed impairments for the County's receiving waters. Regional Water Board staff also indicated that, for MS4s, instream monitoring was less important than discharge monitoring (specifically, pollutant *loading*). In an email dated July 25, 2014, Regional Water Board staff also provided supplemental guidance to Permittees as follows:

- Prepare and submit a draft plan for 303(d) monitoring program by January 1, 2015. Incorporate: catchment-based discharge monitoring; source tracking/source ID; synthesis and reporting of data. Receiving water monitoring not required.
- Prepare and submit a Quality Assurance Project Plan (QAPP), for 303(d) monitoring program by May 1, 2015.
- Prepare to initiate monitoring program by Year 3: July 1, 2015.
- Prepare to submit monitoring results with Year 3 and subsequent Annual Reports (E.14.a.iii)

In conjunction with this guidance, the Regional Water Board staff also identified that BMP Effectiveness Assessment should include a pollutant loading model, as follows:

> Identify Steps to Quantify Pollutant Loads and Pollutant Load Reductions Achieved by the Program as a Whole (E.14.a):

- Evaluate and select flow and pollutant loading models
- Prioritize load quantification by catchment: e.g., determine annual average volume of discharge to receiving waters from outfalls draining priority areas and quantify pollutant loads for catchments with largest volumes first; or, use available constituent concentration data from existing data to screen for problem outfalls
- Provide schedule for completing pollutant load quantification to inform submittal of Stormwater Program Modifications by Year 5 (E.14.b)

The Cities of Carpinteria, Goleta, Buellton and Solvang, and the County of Santa Barbara determined that monitoring and modeling requirements are related insofar as the future monitoring results should inform future modeling efforts. Therefore, this monitoring plan is designed so that the results will be useable for future refinement of the County-wide pollutant load model.

Goals and Objectives of Monitoring

The goal of this monitoring effort is to characterize pollutant concentrations and loads from representative MS4 discharge locations within the County, excluding the City of Santa Barbara. The objective of this effort is to collect sufficient data to inform, update, or calibrate the land use-based pollutant load model. The monitoring program is defined for a period of three years, at which time continuing monitoring, or revisions to this plan, will be considered.

This monitoring program focuses on pollutants typically associated with wet weather MS4 discharges in key watersheds. Samples will be taken at the outfalls discharging into impaired waterbodies. The results of monitoring will then be used to inform a pollutant load model.

The monitoring program will analyze flow-weighted composite samples, which will be used to define the Event Mean Concentration, then combined with total volume to produce a pollutant load for the given drainage area. The pollutant load results will be used to support model calibration and allow a more accurate prediction of local conditions. The model results will then be used to prioritize catchments, i.e. rank or categorize catchments by their generated pollutant load. This will help identify potential locations for and prioritize BMPs to improve overall program effectiveness and success.

Over time as the monitoring data is used to inform the model, the model results will be used as part of implementing the Permittee's Program Effectiveness Assessment and Improvement Plans, by allowing the Permittees to assess subwatersheds with existing BMPs, compare pollutant loading between subwatersheds, and better tailor future BMPs by focusing on areas of potentially higher pollutant load.

Pollutant Parameters

Pollutants of concern were selected based upon the following criteria:

1. Pollutants are representative of typical MS4 wet weather discharges and impairments to urban receiving waters;
2. Pollutants are cost-effective to analyze and don't require special sample collection or handling procedures;
3. Pollutants can be addressed through BMPs in the Permittee's stormwater program (and BMP performance data exist in order to model these pollutants), and
4. Pollutants are of interest to Regional Water Board staff based on initial discussions.

Some pollutants identified on the 303(d) list for County receiving waters were not selected because they did not meet the above criteria. For example, bacteria is not included because it would require special sampling (flow weighted composites might need to be replaced with grab samples) and short hold time requirements, and because of feedback received from Regional Water Board staff indicating that it was a low priority for MS4 dischargers in the region. Also, given its ubiquitousness in the natural and urban environments, the uncertainty regarding its sources to/in urban MS4s, and the uncertainty regarding effective source control strategies (and their performance), bacteria has been excluded from this monitoring plan. A preferable approach for addressing bacteria (or "pathogens") is through dry weather monitoring when illicit discharges can be observed. These discharges would then be investigated through source-tracking and special studies to identify source-specific BMPs. Further, bacteria modeling for annual pollutant load based on land use Event Mean Concentrations will be developed.

Similarly, salts (such as chloride, sodium, and boron), legacy chlorinated pesticides (primarily associated with agricultural activities), pH, and selenium (primarily associated with rising groundwater) will not be included as these are primarily dry weather issues and/or not associated with MS4 wet weather discharges. Pollutant effects such as temperature, DO, and algae/eutrophication were excluded since they are less associated with wet weather conditions or wet weather MS4 discharges.

Discharges into Orcutt Creek are not included in this plan because that waterbody is subject to TMDLs and therefore subject to a separate monitoring program.

The following parameters will be analyzed:

- Acute Toxicity (Hyallella sp)
- Metals (dissolved Al, Cu, Zn, Cd, Pb, and Fe)
- TSS
- Hardness
- Nutrients

Samples will be archived for pesticide testing if there is evidence of toxicity based on pass or fail of No-Observed-Adverse-Effect Concentration, i.e. if survival in the sample is significantly different than survival in the control. Pesticides will include organophosphate pesticides, carbamates, pyrethroids, neonicotinoids (acetamidprid, clothianidin, dinotefuran, imidiaclorprid, thiacloprid, and thiamethoxam), and diuron (including DCPMU, DCPU, and 3,4-DCA).

Site Conditions and Characteristics

Six MS4 outfall sampling locations, each representing drainage areas with varying land use, will be monitored. There were twenty sites tentatively identified; six were selected that best represent the land use character to best inform the model. These are located in Solvang, Buellton, Goleta, and Carpinteria.

The six locations were selected based on the following considerations:

- Safety and accessibility – sampling locations should be safely accessible during wet weather conditions
- Performance – accurate flow monitoring and sample collection can be reproduced at that location
- Drainage area characteristics – drainage areas should represent homogenous urban land use to the extent possible, with a large enough area to be representative of typical variability that is expected within that land use type in this study area.

The targeted urban land use categories are:

- Single-family, or low density residential
- Multi-family or high density residential
- Commercial
- Industrial (multiple industrial sites may be necessary to characterize the diversity of "industrial" areas in this study area)

Other potential urban land use categories that are not included, but can be modeled are:

- Transportation (outside of Caltrans, finding an outfall with this homogeneous land use within the MS4 may prove challenging.
- Open Space (these areas generally don't have storm sewers and may prove similarly challenging)
- Agriculture

Proposed Locations

Monitoring locations are shown in Table 1 and Figure 1 and summarized below.

Watershed: Santa Monica Creek, Franklin Creek, Carpinteria Salt Marsh
City of Carpinteria (medium density residential)
City of Carpinteria (indoor urban agriculture)

Watersheds: San Jose Creek, Las Vegas Creek
City of Goleta (industrial)
City of Goleta (commercial)

Watershed: Santa Ynez River and tributaries
City of Solvang (low density residential)
City of Buellton (industrial)

Table 1. Monitoring Locations

Location	Land Use	Receiving Water
City of Solvang	Low density residential	Santa Ynez River
City of Carpinteria	Medium density residential	Franklin Creek
City of Goleta	Commercial	Las Vegas
City of Buellton	Industrial	Santa Ynez River
City of Goleta	Industrial	San Jose Creek
City of Carpinteria	Indoor Urban Agriculture	Franklin Creek

Figure 1. Monitoring Locations

The County of Santa Barbara will be responsible for the monitoring logistics and managing the lab contracts. This includes tracking and selecting a storm to monitor, providing one or two staff to conduct the sampling, determining the number of time-proportioned aliquots (10 to 12 based on storm depth collected over a period of two hours), and arranging for courier pick-up of sample bottles. The Cities have agreed through an MOU to fund their proportionate cost of the monitoring effort. The Cities may provide an additional staff person so that there are two people working together for safety during the stormwater monitoring activities.

Monitoring Frequency and Event Targeting

Time-paced aliquots will be taken at twenty minute intervals for two to three hours in duration as the characteristics of the individual storms allow. A minimum number of aliquots will be taken depending on the forecast rain event depth, ranging from 8 to 10 for storms 0.2" to 0.5" and 10 to 12 for storms 0.5" and greater. Details are shown in the QAPP. Subsequently to the sampling event data obtained from the County of Santa Barbara Water Resources Division rain gauge network, will be used to describe the rainfall pattern and the timing of the sampling. The monitoring program will not include automated samples or flow measurement. Representative composite samples will be generated by combining aliquots. The composite sample will be generated by the analyzing laboratories based on instructions provided by the County of Santa Barbara storm staff.

Two sites will be monitored per storm, grouped as follows:

Storm 1 – Carpinteria area (two outfalls)

Storm 2 – Goleta area (two outfalls)

Storm 3 – Santa Ynez (one outfall each from Buellton and Solvang)

During a given year, as many storms will be monitored as possible, but no more than 8 sampling events per year.

Targeted storm events will be those forecast for 50-75% probability of 0.2" or greater over a period of 24 hours. The County's Water Resources Division hydrologists will provide updated forecast information for the specific sampling locations. The County develops forecasts based on a contracted private weather forecaster, National Weather Service information, and professional judgment based on local experience.

Sample Collection Procedures

Water samples will be manually collected from outfalls during the storm event.

Based upon the prediction of the anticipated storm duration, field staff will collect samples at twenty minute intervals over a period of two hours with a target of achieving 8-12 individual aliquots per storm.

Clean bottles will be supplied by the analyzing laboratories. Samples will be kept on ice and held for a courier service. All hold times for the sample parameters will be followed. Chain of custody forms will be provided to the lab courier.

Quality Assurance Project Plan (QAPP)

All monitoring samples shall be collected and analyzed according to the details presented in the Program QAPP. The QAPP will be prepared consistent with the California Surface Water Ambient Monitoring Program Quality Assurance Program Plan (Sep 1, 2008, or most current).

Data Management and Reporting

Results of the prior season's monitoring will be reported annually under the Municipal General Permit report, via SMARTs, Oct 15th each year.

As described in the Goals and Objectives section above, a land use-based pollutant load model will be used to calculate wet weather loads produced in the monitoring area, prioritize catchments for BMP placement, and evaluate the performance of existing and future BMPs. The monitoring data collected through the activities described in this Plan will be used to inform the model, by providing site-specific land use pollutant concentration data. As described above, monitoring outfalls will be selected based on their drainage areas consisting of a more or less homogenous land use category. Since land use-based pollutant concentration data are limited, and to our knowledge, there is currently no dataset representing this monitoring area, the proposed monitoring program will allow for more representative and reliable modeling results. Once 8 to 10 storms have been analyzed, the EMCs used in the model will be revised to include our local runoff concentrations, and new modeling results will be reported.