

Watershed Monitoring and Assessment Program



Urban Creeks Monitoring Report *Water Quality Monitoring* *Water Year 2016 (October 2015 – September 2016)*

Submitted in compliance with Provision C.8.h.iii of NPDES Permit # CAS612008
(Order No. R2-2015-0049)

March 31, 2017

PREFACE

In early 2010, several members of the Bay Area Stormwater Agencies Association (BASMAA) joined together to form the Regional Monitoring Coalition (RMC), to coordinate and oversee water quality monitoring required by the Municipal Regional National Pollutant Discharge Elimination System (NPDES) Stormwater Permit (in this document the permit is referred to as the MRP).¹ The RMC includes the following participants:

- Alameda Countywide Clean Water Program (ACCWP)
- Contra Costa Clean Water Program (CCCWP)
- San Mateo County Wide Water Pollution Prevention Program (SMCWPPP)
- Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP)
- Fairfield-Suisun Urban Runoff Management Program (FSURMP)
- City of Vallejo and Vallejo Sanitation and Flood Control District (Vallejo)

This Urban Creeks Monitoring Report complies with MRP provision C.8.h.iii for reporting of all data in Water Year 2016 (October 1, 2015 through September 30, 2016). Data were collected pursuant to provision C.8 of the MRP. Data presented in this report were produced under the direction of the RMC and the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) using probabilistic and targeted monitoring designs as described herein.

Consistent with the BASMAA RMC Multi-Year Work Plan (Work Plan; BASMAA 2011) and the Creek Status and Long-Term Trends Monitoring Plan (BASMAA 2012), monitoring data were collected in accordance with the BASMAA RMC Quality Assurance Program Plan (QAPP; BASMAA, 2016a) and the BASMAA RMC Standard Operating Procedures (SOPs; BASMAA, 2016b). Where applicable, monitoring data were derived using methods comparable with methods specified by the California Surface Water Ambient Monitoring Program (SWAMP) QAPP.² Data presented in this report were also submitted in electronic SWAMP-comparable formats by SCVURPPP to the Regional Water Board on behalf of SCVURPPP Co-permittees and pursuant to provision C.8.h.ii of the MRP.

¹ The San Francisco Bay Regional Water Quality Control Board (SFRWQCB or Regional Water Board) issued the MRP to 76 cities, counties and flood control districts (i.e., Permittees) in the Bay Area on October 14, 2009 (SFRWQCB 2009). On November 19, 2015, the Regional Water Board updated and reissued the MRP (SFRWQCB 2015). The BASMAA programs supporting MRP Regional Projects include all MRP Permittees as well as the cities of Antioch, Brentwood, and Oakley, which are not named as Permittees under the MRP but have voluntarily elected to participate in MRP-related regional activities.

² The current SWAMP QAPP is available at:
http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/qapp/swamp_qapp_master090108a.pdf

LIST OF ACRONYMS

ACCWP	Alameda Countywide Clean Water Program
BASMAA	Bay Area Stormwater Management Agency Association
BASMAA BOD	BASMAA Board of Directors
BMP	Best Management Practice
CADDIS	Causal Analysis/Diagnosis Decision Information System
CCCWP	Contra Costa Clean Water Program
CEC	Chemicals of Emerging Concern
CEDEN	California Environmental Data Exchange Network
CFWG	Contaminant Fate Workgroup
COLD	Cold Freshwater Habitat
CSCI	California Stream Condition Index
ECWG	Emerging Contaminant Workgroup
EEWG	Exposure and Effects Workgroup
FSURMP	Fairfield Suisun Urban Runoff Management Program
FY	Fiscal Year
GIS	Geographic Information Systems
IBI	Index of Biological Integrity
IPM	Integrated Pest Management
IWRMP	Integrated Water Resources Master Plan
LID	Low Impact Development
MPC	Monitoring and Pollutants of Concern Committee
MRP	Municipal Regional Permit
MWAT	Maximum Weekly Average Temperature
MYP	Multi-Year Monitoring Plan
NMFS	National Marine Fisheries Service
NPDES	National Pollution Discharge Elimination System
PAHs	Polycyclic Aromatic Hydrocarbons
PBDEs	Polybrominated Diphenyl Ethers
PCBs	Polychlorinated Biphenyls
PEC	Probable Effect Concentration
PFAS	Perfluoroalkyl and Polyfluoroalkyl Substances
PFOS	Perfluorooctane Sulfonate
POC	Pollutant of Concern
POTW	Publicly Owned Treatment Works
QAPP	Quality Assurance Project Plan
RMC	Regional Monitoring Coalition
RMP	Regional Monitoring Program
RWSM	Regional Watershed Spreadsheet Model
SAP	Sampling and Analysis Plan
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SCVWD	Santa Clara Valley Water District
SFEI	San Francisco Estuary Institute
SMCWPPP	San Mateo County Water Pollution Prevention Program
SOP	Standard Operating Procedures
SPLWG	Sources, Pathways, and Loadings Workgroup
SPoT	Statewide Stream Pollutant Trend Monitoring
SSC	Suspended Sediment Concentration
SSID	Stressor/Source Identification
S&T	Status and Trends Monitoring Program
STLS	Small Tributary Loading Strategy

SCVURPPP WY 2016 Urban Creeks Monitoring Report

SWAMP	Surface Water Ambient Monitoring Program
TEC	Threshold Effect Concentration
TMDL	Total Maximum Daily Load
TRC	Technical Review Committee
TU	Toxic Unit
UCMR	Urban Creeks Monitoring Report
USEPA	US Environmental Protection Agency
USGS	US Geological Survey
WMA	Watershed Management Area
WQ	Water Quality
WQO	Water Quality Objective
WY	Water Year

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Appendix B.	Regional Stressor/Source Identification (SSID) Report
Appendix C.	Upper Penitencia Creek SSID Report
Appendix D.	SCVURPPP POC Data Report, Water Year 2016
Appendix E.	RMP’s POC Reconnaissance Monitoring Final Progress Report, Water Years 2015 and 2016

TABLE E.1. WATER YEAR 2016 CREEK STATUS MONITORING STATIONS

In compliance with provision C.8.h.iii.(1), this table of all Creek Status Monitoring stations sampled by SCVURPPP in Water Year 2016 is provided immediately following the Table of Contents. See Section 3.0 for additional information on Creek Status Monitoring.

Map ID	Probabilistic Station Number	Targeted Station Number	Watershed	Creek Name	Land Use	Latitude	Longitude	Probabilistic Monitoring		Targeted Monitoring		
								Bioassessment, Nutrients, Chlorine, General WQ	Toxicity, Sediment Chemistry	Temp	Cont WQ	Pathogen Indicators
213	205R00213		Coyote Creek	Cow Creek	NU	37.264449	-121.650393	x				
305	205R00305		Coyote Creek	San Felipe Creek	NU	37.256256	-121.66266	x				
578	205R00578		Coyote Creek	Arroyo Aguague	NU	37.349247	-121.71812	x				
1114	205R01114		Guadalupe River	Guadalupe River	U	37.2845	-122.88231	x				
1731	205R01731	205COY117	Coyote Creek	Upper Penitencia Creek	U	37.392645	-121.834768	x		x	x	x
2330	205R02330		Guadalupe River	Ross Creek	U	37.2552	-121.90656	x				
2422	205R02422	205GUA329	Guadalupe River	Arroyo Calero	U	37.21059	-121.82717	x				x
2458	205R02458	205GUA262	Guadalupe River	Alamitos Creek	U	37.218965	-121.843211	x				x
2474	205R02474	205SAR075	San Tomas Aquino	Saratoga Creek	U	37.25819	-122.03437	x				x
2538	205R02538		San Tomas Aquino	Calabazas Creek	U	37.275375	-122.042246	x				
2547	205R02547		Stevens Creek	Stevens Creek	U	37.31243	-122.16309	x				
2563	205R02563		Guadalupe River	Los Gatos Creek	U	37.329237	-121.899601	x				
2602	205R02602		San Tomas Aquino	Tributary to San Tomas	U	37.23547	-122.00528	x				
2618	205R02618		Guadalupe River	Aldercroft Creek	U	37.17623	-121.98942	x				
2650	205R02650		Guadalupe River	Alamitos Creek	U	37.2215	-121.847003	x				
2659	205R02659		Stevens Creek	Stevens Creek	U	37.344735	-122.064166	x				
2730	205R02730		San Tomas Aquino	Saratoga Creek	U	37.28141	-122.00642	x				
2762	205R02762		Guadalupe River	Ross Creek	U	37.23593	-121.95184	x				
2771	205R02771		Coyote Creek	Lower Silver Creek	U	37.352282	-121.835429	x				
2835	205R02835	205COY135	Coyote Creek	Upper Penitencia Creek	U	37.396581	-121.803899	x		x		x
021		205STE021	Stevens Creek	Stevens Creek	U	37.41096	-122.06893		x			
010		205STQ010	San Tomas Aquino	San Thomas Aquino	U	37.38895	-121.96858		x			
025		205AAG025	Coyote Creek	Arroyo Aguague	NU	37.39711	-121.78570			x		
114		205COY114	Coyote Creek	Upper Penitencia Creek	U	37.39007	-121.84361			x	x	
121		205COY121	Coyote Creek	Upper Penitencia Creek	U	37.39530	-121.82668			x	x	
130		205COY130	Coyote Creek	Upper Penitencia Creek	U	37.39362	-121.81783			x	x	
140		205COY140	Coyote Creek	Upper Penitencia Creek	U	37.40113	-121.79541			x		
142		205COY142	Coyote Creek	Upper Penitencia Creek	U	37.40418	-121.79317			x		
145		205COY145	Coyote Creek	Upper Penitencia Creek	NU	37.40469	-121.79165			x		

U = Urban, NU = Non-urban

1.0 INTRODUCTION

This Urban Creeks Monitoring Report (UCMR) was prepared by the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP or Program), on behalf of its 15 member agencies (13 cities/towns, the County of Santa Clara, and the Santa Clara Valley Water District) subject to the National Pollutant Discharge Elimination System (NPDES) stormwater permit for Bay Area municipalities referred to as the Municipal Regional Permit (MRP). The MRP was first adopted by the San Francisco Regional Water Quality Control Board (SFRWQCB or Regional Water Board) on October 14, 2009 as Order R2-2009-0074 (SFRWQCB 2009). On November 19, 2015, the SFRWQCB updated and reissued the MRP as Order R2-2015-0049 (SFRWQCB 2015). This report fulfills the requirements of Provision C.8.h.iii of the MRP for comprehensively interpreting and reporting all monitoring data collected during the foregoing October 1 – September 30 (i.e., Water Year 2016). Data were collected pursuant to water quality monitoring requirements in provision C.8 of the MRP. Monitoring data presented in this report were submitted electronically to the Regional Water Board by SCVURPPP and may be obtained via the San Francisco Bay Area Regional Data Center of the California Environmental Data Exchange Network (CEDEN) (<http://water100.waterboards.ca.gov/ceden/sfei.shtml>).

Chapters in this report are organized according to the following topics and MRP sub-provisions. Several of the topics are summarized briefly in this report but described fully in appendices.

- 1.0 Introduction
- 2.0 San Francisco Estuary Receiving Water Monitoring (MRP provision C.8.c)
- 3.0 Creek Status Monitoring (MRP provision C.8.d) and Pesticides and Toxicity Monitoring (MRP provision C.8.g) (**Appendix A**)
- 4.0 Stressor/Source Identification (SSID) Projects (MRP provision C.8.e) (**Appendices B and C**)
- 5.0 Pollutants of Concern (POC) Monitoring (MRP provision C.8.f) (**Appendices D and E**)
- 6.0 Recommendations and Next Steps

Figure 1.1 illustrates locations of monitoring stations associated with provision C.8 compliance in Water Year 2016 (WY 2016), including Creek Status Monitoring, the SSID project, Pesticides and Toxicity Monitoring, and POC Monitoring conducted by SCVURPPP and the Small Tributaries Loading Strategy (STLS). This figure illustrates the geographic extent of monitoring conducted in Santa Clara County in WY 2016.

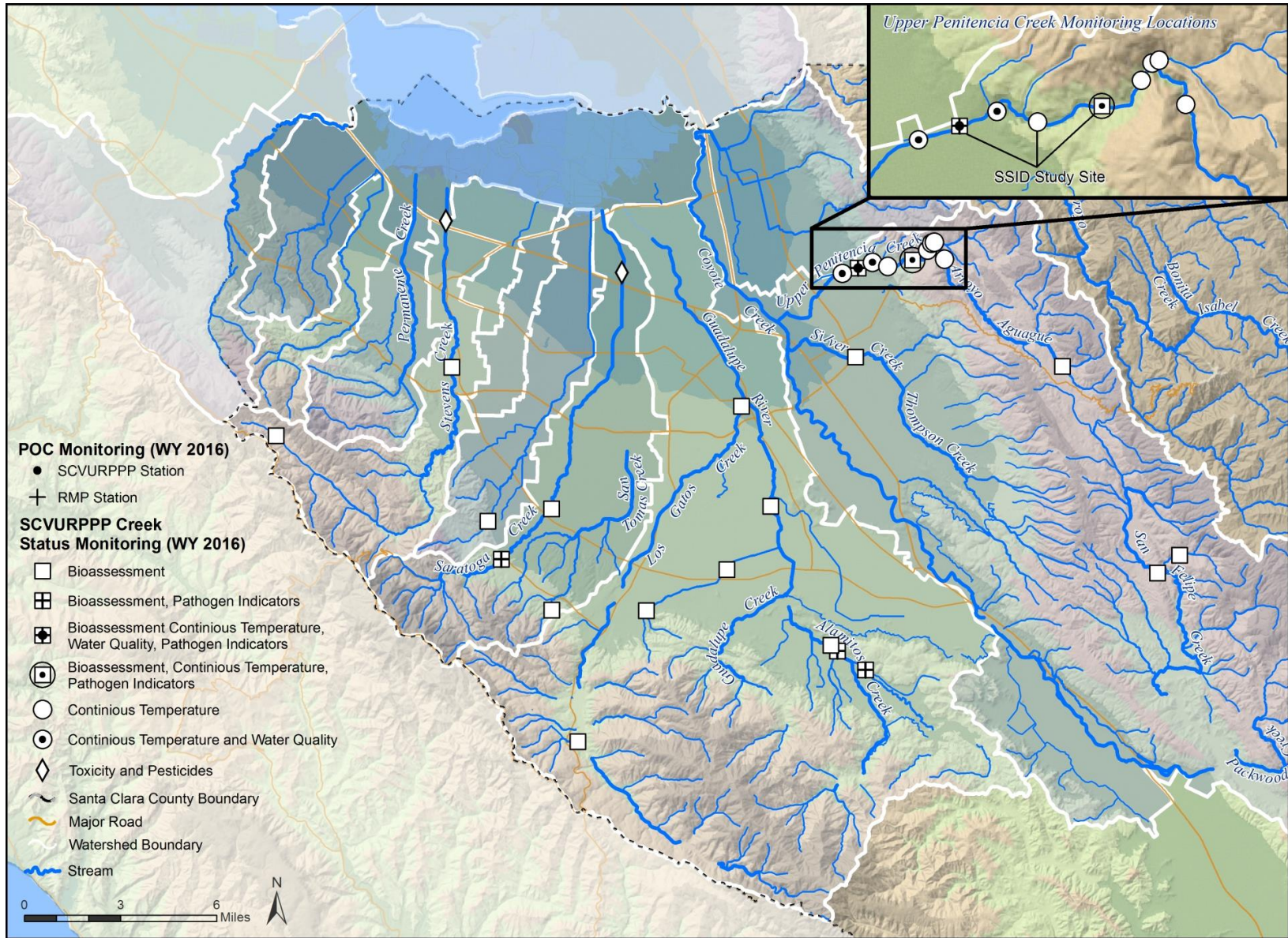


Figure 1.1. SCVURPPP Creek Status, Pollutant of Concern (POC), Pesticides and Toxicity, and Stressor/Source Identification (SSID) monitoring stations in WY 2016.

1.1 RMC Overview

Provision C.8.a (Compliance Options) of the MRP allows Permittees to address monitoring requirements through a “regional collaborative effort,” their Stormwater Program, and/or individually. In June 2010, Permittees notified the Water Board in writing of their agreement to participate in a regional monitoring collaborative to address requirements in provision C.8. The regional monitoring collaborative is referred to as the Bay Area Stormwater Management Agencies Association (BASMAA) Regional Monitoring Coalition (RMC). In a November 2, 2010 letter to the Permittees, the Water Board’s Assistant Executive Officer (Dr. Thomas Mumley) acknowledged that all Permittees have opted to conduct monitoring required by the MRP through a regional monitoring collaborative, the BASMAA RMC. Participants in the RMC are listed in Table 1.1.

In February 2011, the RMC developed a Multi-Year Work Plan (RMC Work Plan; BASMAA 2011) to provide a framework for implementing regional monitoring and assessment activities required under provision C.8 of the 2009 MRP. The RMC Work Plan summarizes RMC projects planned for implementation between Fiscal Years 2009-10 and 2014-15. Projects were collectively developed by RMC representatives to the BASMAA Monitoring and Pollutants of Concern Committee (MPC), and were conceptually agreed to by the BASMAA Board of Directors (BASMAA BOD). Although there are no plans to update the Multi-Year Work Plan, several regional projects have already been identified and will be conducted in compliance with the 2015 MRP.

Regionally implemented activities are conducted under the auspices of BASMAA, a 501(c)(3) non-profit organization comprised of the municipal stormwater programs in the San Francisco Bay Area. Scopes, budgets, and contracting or in-kind project implementation mechanisms for BASMAA regional projects follow BASMAA’s Operational Policies and Procedures, approved by the BASMAA BOD. MRP Permittees, through their stormwater program representatives on the BASMAA BOD and its subcommittees, collaboratively authorize and participate in BASMAA regional projects or tasks. Regional project costs are shared by either all BASMAA members or among those Phase I municipal stormwater programs that are subject to the MRP.

Table 1.1 Regional Monitoring Coalition (RMC) participants.

Stormwater Programs	RMC Participants
Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP)	Cities of Campbell, Cupertino, Los Altos, Milpitas, Monte Sereno, Mountain View, Palo Alto, San Jose, Santa Clara, Saratoga, Sunnyvale, Los Altos Hills, and Los Gatos; Santa Clara Valley Water District; and, Santa Clara County
Alameda Countywide Clean Water Program (ACCWP)	Cities of Alameda, Albany, Berkeley, Dublin, Emeryville, Fremont, Hayward, Livermore, Newark, Oakland, Piedmont, Pleasanton, San Leandro, and Union City; Alameda County; Alameda County Flood Control and Water Conservation District; and, Zone 7
Contra Costa Clean Water Program (CCCWP)	Cities of Antioch, Brentwood, Clayton, Concord, El Cerrito, Hercules, Lafayette, Martinez, Oakley, Orinda, Pinole, Pittsburg, Pleasant Hill, Richmond, San Pablo, San Ramon, Walnut Creek, Danville, and Moraga; Contra Costa County; and, Contra Costa County Flood Control and Water Conservation District
San Mateo County Wide Water Pollution Prevention Program (SMCWPPP)	Cities of Belmont, Brisbane, Burlingame, Daly City, East Palo Alto, Foster City, Half Moon Bay, Menlo Park, Millbrae, Pacifica, Redwood City, San Bruno, San Carlos, San Mateo, South San Francisco, Atherton, Colma, Hillsborough, Portola Valley, and Woodside; San Mateo County Flood Control District; and, San Mateo County
Fairfield-Suisun Urban Runoff Management Program (FSURMP)	Cities of Fairfield and Suisun City
Vallejo Permittees	City of Vallejo and Vallejo Sanitation and Flood Control District

1.2 Coordination with Third-party Monitoring Programs

SCVURPPP strives to work collaboratively with our water quality monitoring partners to find mutually beneficial monitoring approaches. Provision C.8.a.iii of the MRP allows Permittees to use data collected by third-party organizations to fulfill monitoring requirements, provided the data are demonstrated to meet the required data quality objectives.

In WY 2016, SCVURPPP continued to coordinate with water quality monitoring programs conducted by third parties. These programs include the Regional Monitoring Program for Water Quality in San Francisco Bay's (RMP) Small Tributaries Loading Strategy (STLS) and the Stream Pollutant Trends (SPoT) monitoring conducted by the State of California's Surface Water Ambient Monitoring Program (SWAMP). Water quality data from the STLS are reported in this document and were utilized to supplement SCVURPPP compliance with provision C.8 of the MRP, consistent with sub-provision C.8.a.iii.^{3,4} Data are specifically referenced in section 5.0 (POC Monitoring) of this report.

³ Data reported by the RMP STLS are summarized in this report but were not included in the SCVURPPP electronic data submittal.

⁴ In most years, the SPoT Program monitors two stations in Santa Clara County for constituents required by provision C.8.f of the MRP. In WY 2016, the stations were not sampled for those constituents.

2.0 SAN FRANCISCO ESTUARY RECEIVING WATER MONITORING (C.8.C)

As described in provision C.8.c of the MRP, Permittees are required to provide financial contributions towards implementing an Estuary receiving water monitoring program on an annual basis that at a minimum is equivalent to the Regional Monitoring Program for Water Quality in the San Francisco Estuary (RMP). Since the adoption of the 2009 MRP, SCVURPPP has complied with this provision by making financial contributions to the RMP. Additionally, SCVURPPP staff actively participates in RMP committees, workgroups, and strategy teams as described in the following sections, which also provide a brief description of the RMP and associated monitoring activities conducted during WY 2016.

Now in its 24th year, the RMP is a long-term monitoring program that is discharger-funded and shares direction and participation by regulatory agencies and the regulated community with the goal of assessing water quality in the San Francisco Bay. The regulated community includes municipal stormwater (MS4s), publicly owned treatment works (POTWs), dredger, and industrial dischargers. The San Francisco Estuary Institute (SFEI) is the implementing entity for the RMP and the fiduciary agent for RMP stakeholder funds. SFEI does not provide direct oversight of the RMP but does help identify stakeholder information needs, develop workplans that address these needs, and implement the workplans.

The RMP is intended to answer the following core management questions:

1. *Are chemical concentrations in the Estuary potentially at levels of concern and are associated impacts likely?*
2. *What are the concentrations and masses of contaminants in the Estuary and its segments?*
3. *What are the sources, pathways, loadings, and processes leading to contaminant related impacts in the Estuary?*
4. *Have the concentrations, masses, and associated impacts of contaminants in the Estuary increased or decreased?*
5. *What are the projected concentrations, masses, and associated impacts of contaminants in the Estuary?*

The RMP budget is generally broken into two major program elements: Status and Trends and Pilot/Special Studies. The following sections provide a brief overview of these programs. The *RMP 2016 Detailed Workplan and Budget*⁵ provides more details and establishes deliverables for each component of the RMP budget. The RMP publishes annual summary reports. In odd years, the *Pulse of the Estuary Report* focuses on Bay water quality and summarizes information from all sources. In even years, the *RMP Update Report* has a narrower and specific focus. The *2016 RMP Update*⁶ provides a concise overview of recent RMP activities and findings, and a look ahead to significant products anticipated in the next two years.

2.1 RMP Status and Trends Monitoring Program

The Status and Trends Monitoring Program (S&T Program) is the long-term contaminant-monitoring component of the RMP. The S&T Program was initiated as a pilot study in 1989, implemented thereafter, and was redesigned in 2007 based on a more rigorous statistical design that enables the detection of trends. The Technical Review Committee (TRC), in which SCVURPPP participates, continues to assess the efficacy and value of the various elements of the S&T Program and to recommend modifications to

⁵ http://www.sfei.org/sites/default/files/biblio_files/2016%20RMP%20Detailed%20Workplan%20and%20Budget%20FINAL.pdf

⁶ http://www.sfei.org/sites/default/files/biblio_files/Update%202016_FINAL%20for%20web%20with%20covers.pdf

S&T Program activities based on ongoing findings. The current S&T sampling schedule is listed in Table 2.1.

Table 2.1. RMP Status and Trends Monitoring Schedule.

Program Element	Schedule	2016 Sampling
Water	Every two years	No
Bird Eggs	Every three years	Yes
Sediment	Every four years	No
Sport Fish	Every five years	No
Bivalves	Every two years	Yes
Support to the USGS for suspended sediment and nutrient monitoring	Every year	Yes

Additional information on the S&T Program and associated monitoring data are available for download via the RMP website at <http://www.sfei.org/content/status-trends-monitoring>.

2.2 RMP Pilot and Special Studies

The RMP also conducts Pilot and Special Studies on an annual basis. Studies are typically designed to investigate and develop new monitoring measures related to anthropogenic contamination or contaminant effects on biota in the Estuary. Special Studies address specific scientific issues that RMP committees, workgroups, and strategy teams identify as priority for further study. These studies are developed through an open selection process at the workgroup level and selected for funding through the TRC and the Steering Committee.

In 2016, Pilot and Special Studies focused on the following topics:

- Nutrients Management Strategy
 - Continuous monitoring of nutrients, phytoplankton biomass, and dissolved oxygen at moored sensors
 - Continuous monitoring of dissolved oxygen in shallow margin habitats
 - Nutrients monitoring program development
- Small Tributary Loadings Strategy (see below and Section 5.0 for more details)
- Chemicals of emerging concern (CEC) monitoring (perfluorochemicals, fipronil, and microplastics)
- Development of conceptual PCB models for prioritized Bay margin units
- Selenium in fish tissue monitoring
- Evaluation of toxicity testing protocols for marine sediments

Results and summaries of the most pertinent Pilot and Special Studies can be found on the RMP website (http://www.sfei.org/rmp/rmp_pilot_specstudies).

In WY 2016, a considerable amount of RMP and Stormwater Program staff time was spent overseeing and implementing Special Studies associated with the RMP's Small Tributary Loading Strategy (STLS). Pilot and Special Studies associated with the STLS are intended to fill data gaps associated with loadings of Pollutants of Concern (POC) from relatively small tributaries to the San Francisco Bay. Additional information on STLS-related studies is included in Section 5.0 (POC Loads Monitoring) of this report.

2.3 Participation in Committees, Workgroups and Strategy Teams

In WY 2016, SCVURPPP actively participated in the following RMP committees, workgroups, and strategy teams:

- Steering Committee (SC)
- Technical Review Committee (TRC)
- Sources, Pathways and Loadings Workgroup (SPLWG)
- Emerging Contaminant Workgroup (ECWG)
- Nutrient Technical Workgroup
- Strategy Teams (e.g., Small Tributaries, PCBs, and Selenium)

Committee, workgroup, and strategy team representation was provided by Permittee, Stormwater Program staff, and/or individuals designated by RMC participants and the BASMAA BOD. Representation included participating in meetings, reviewing technical reports and work products, co-authoring or reviewing articles included in the *2016 RMP Update*, and providing general program direction to RMP staff. Representatives of the RMC also provided timely summaries and updates to, and received input from Stormwater Program representatives (on behalf of Permittees) during BASMAA Monitoring and Pollutants of Concern Committee (MPC) and/or BASMAA BOD meetings to ensure that Permittees' interests were represented.

3.0 CREEK STATUS (C.8.D) AND PESTICIDES/TOXICITY MONITORING (C.8.G)

Creek status monitoring parameters, methods, occurrences, durations and minimum number of sampling sites for each stormwater program are described in provision C.8.d of the MRP. The RMC's regional monitoring strategy for complying with creek status monitoring requirements is described in the RMC Creek Status and Long-Term Trends Monitoring Plan (BASMAA 2012). The strategy includes a regional ambient/probabilistic monitoring component and a component based on local "targeted" monitoring. The combination of these monitoring designs allows each individual RMC participating program to assess the status of beneficial uses in local creeks within its Program (jurisdictional) area, while also contributing data to answer management questions at the regional scale (e.g., differences between aquatic life condition in urban and non-urban creeks). Implementation began in WY 2012.

The probabilistic monitoring design was developed to remove bias from site selection such that ecosystem conditions can be objectively assessed on local (i.e., SCVURPPP) and regional (i.e., RMC) scales. Probabilistic parameters consist of bioassessments, nutrients, and conventional analytes conducted according to methods described in the SWAMP SOP (Ode et al. 2016). Free chlorine and total chlorine residual were also measured at probabilistic sites. Twenty probabilistic sites were sampled by SCVURPPP in WY 2016.

The targeted monitoring design focuses on sites selected based on the presence of significant fish and wildlife resources as well as historical and/or recent indications of water quality concerns. Targeted monitoring parameters consist of water temperature, general water quality, and pathogen indicators using methods, sampling frequencies, and number of stations required in provision C.8.d of the MRP. Hourly water temperature measurements were recorded during the dry season at eight sites using HOBO® temperature data loggers in the Upper Penitencia Creek watershed. General water quality monitoring (temperature, dissolved oxygen, pH and specific conductivity) was conducted using YSI continuous water quality equipment (sondes) for two 2-week periods (spring and late summer) at three sites in the Upper Penitencia Creek watershed. Water samples for analysis of pathogen indicators (*E. coli* and enterococcus) were collected at five probabilistic sites that were located in parks.

Provision C.8.g of the MRP requires Permittees to conduct wet weather and dry weather pesticides and toxicity monitoring. Test methods, sampling frequencies, and number of stations required are described in the MRP. In WY 2016, SCVURPPP conducted dry weather pesticides and toxicity monitoring at two bottom-of-the-watershed stations. Consistent with provision C.8.g.iii, wet weather pesticides and toxicity monitoring will be conducted on a regional basis and will begin in WY 2018.

Creek Status and Pesticides and Toxicity monitoring stations are listed in Table E-1 and illustrated in Figure 1.1. Creek status monitoring data from WY 2016 were submitted to the Regional Water Board by SCVURPPP. The analyses of results from creek status monitoring conducted by SCVURPPP in WY 2016 are summarized below and presented in detail in **Appendix A**. The WY 2016 report includes stressor analysis of the five-year (i.e., WY 2012 – WY 2016) SCVURPPP dataset. Analysis of the five-year *regional* RMC dataset is anticipated to occur in Fiscal Year 2017/18.

3.1 Management Questions

Provision C.8.d of the MRP requires Permittees to conduct creek status monitoring that is intended to answer the following management questions:

1. *Are water quality objectives, both numeric and narrative, being met in local receiving waters, including creeks, rivers and tributaries?*
2. *Are conditions in local receiving waters supportive of or likely supportive of beneficial uses?*

The first MRP creek status management question is addressed primarily through the evaluation of probabilistic and targeted monitoring data with respect to the triggers defined in the MRP. The MRP also

defines triggers for pesticides and toxicity monitoring data. A summary of trigger exceedances observed for each site is presented below in Table 3.2. Sites where triggers are exceeded may indicate potential impacts to aquatic life or other beneficial uses and are considered for future stressor/source identification (SSID) projects (see Section 4.0 for a discussion of ongoing and completed SSID projects).

The second MRP creek status management question is addressed primarily by assessing indicators of aquatic biological health using benthic macroinvertebrate and algae data collected at probabilistic sites. Biological condition scores for the five-year (i.e., WY 2012 – WY 2016) SCVURPPP dataset were compared to physical habitat and water quality data collected synoptically with bioassessments to evaluate whether correlations exist that may explain the variation in biological condition scores.

3.2 Monitoring Results and Conclusions

3.2.1 Bioassessment Monitoring

Twenty sites were sampled for benthic macro-invertebrates (BMIs), benthic algae, physical habitat (PHab) observations, and nutrients. Stations were randomly selected using a probabilistic monitoring design. The following preliminary conclusions and recommendations are made based on these data.

Probabilistic Survey Design

- Site evaluations were conducted at a total of 76 potential probabilistic sites in Santa Clara County during WY 2016. Of these sites, a total of twenty were sampled in WY 2016 (rejection rate of 74%). Three of the twenty sites (15%) were classified as non-urban land use.
- Between WY 2012 and WY 2016, a total of 112 probabilistic sites were sampled by SCVURPPP (n=100) and SWAMP (n=12)⁷ in Santa Clara County, including 87 urban and 25 non-urban sites.
- There is a sufficient number of samples from probabilistic sites to develop estimates of biological condition and stressor assessment for urban streams in Santa Clara County (in development). More samples are needed to estimate biological condition at more local scales (e.g., watershed and jurisdictional areas).

Biological Condition Assessment (WY 2016)

- The California Stream Condition Index (CSCI) tool was used to assess the biological condition. The CSCI translates benthic macroinvertebrate data into an overall measure of stream health. Of the 20 sites monitored in WY 2016, five sites (25%) rated as likely intact or possibly intact (CSCI scores ≥ 0.795); five sites rated as likely altered condition (CSCI score 0.635 – 0.795), and ten sites rated as very likely altered condition (≤ 0.635).
- The 15 sites with CSCI scores less than the trigger threshold of 0.795 will be added to the list of candidate SSID projects.
- Diatoms were relatively well represented across all sites ranging from 15 to 61 taxa. Soft algae taxa were less common across sites, ranging from 1 to 10 taxa. Seven of the sites (30%) had three or less soft algae taxa.
- Three algae IBI metrics were used to evaluate stream condition using benthic algae data collected synoptically with BMIs. These include D18 (diatoms), S2 (soft algae), and H20 (combination of diatoms and algae). Eight sites were ranked in good condition based on D18 scores (D18 ≥ 62). Two sites were ranked in good condition based on S2 scores (S2 ≥ 47) and one site was ranked in good condition based on H20 scores (H20 ≥ 63).

⁷ The data from three SWAMP samples collected in WY 2015 were not available for analyses in this report. Data results from nine probabilistic sites sampled by SWAMP are included in this report.

Biological Condition Assessment (WY 2012-WY 2016)

- CSCI scores were calculated for the five-year Santa Clara County probabilistic data set (n=112). Good biological condition scores (CSCI score > 0.795) occurred at 11% of the urban sites and 52% of non-urban sites.
- There was no significant difference in median CSCI scores between perennial (n=85) and non-perennial (n=27) sites. Median algal IBI scores were slightly higher at non-perennial sites.
- The CSCI and three algae IBI tools showed were relatively consistent in their response across an urban gradient, with generally lower median scores associated with higher percent imperviousness.
- CSCI scores were better correlated with site elevation ($r^2 = 0.34$) compared to D18 scores ($r^2 = 0.18$), suggesting that physical habitat variables associated with changing elevation (e.g., stream gradient, substrate size) have greater influence on the BMI community compared to diatom assemblages.
- It is unknown whether drought conditions that were present from WY 2012 through WY 2015 affected overall CSCI scores in Santa Clara County.

Stressor Assessment

- Potential stressors (nutrients, algal biomass indicators, conventional analytes) were measured in samples collected concurrently with bioassessments which are conducted in the spring season. Physical habitat parameters were also observed during bioassessments. Other potential stressors (e.g., percent urbanization/imperviousness in contributing catchments) were calculated in GIS.
- The association of potential stressors with biological condition scores collected over five years was assessed using the Spearman rank method and random forests. Land use variables (percent impervious and urban), chloride, temperature and specific conductivity showed significant negative correlations with CSCI scores. Two PHAB parameters (epifaunal substrate score and channel alteration score) were significantly positively correlated with CSCI scores.
- Water quality objectives were generally not exceeded in WY 2016.

Trend Assessment

- Trend analysis for the RMC probabilistic survey will require more than five years of data collection. Preliminary long-term trend analysis of biological condition may be possible for some stream reaches using a combination of historical targeted data with the probabilistic data.
- Targeted re-sampling at probabilistic sites can provide additional data to evaluate longer term trends at selected locations.

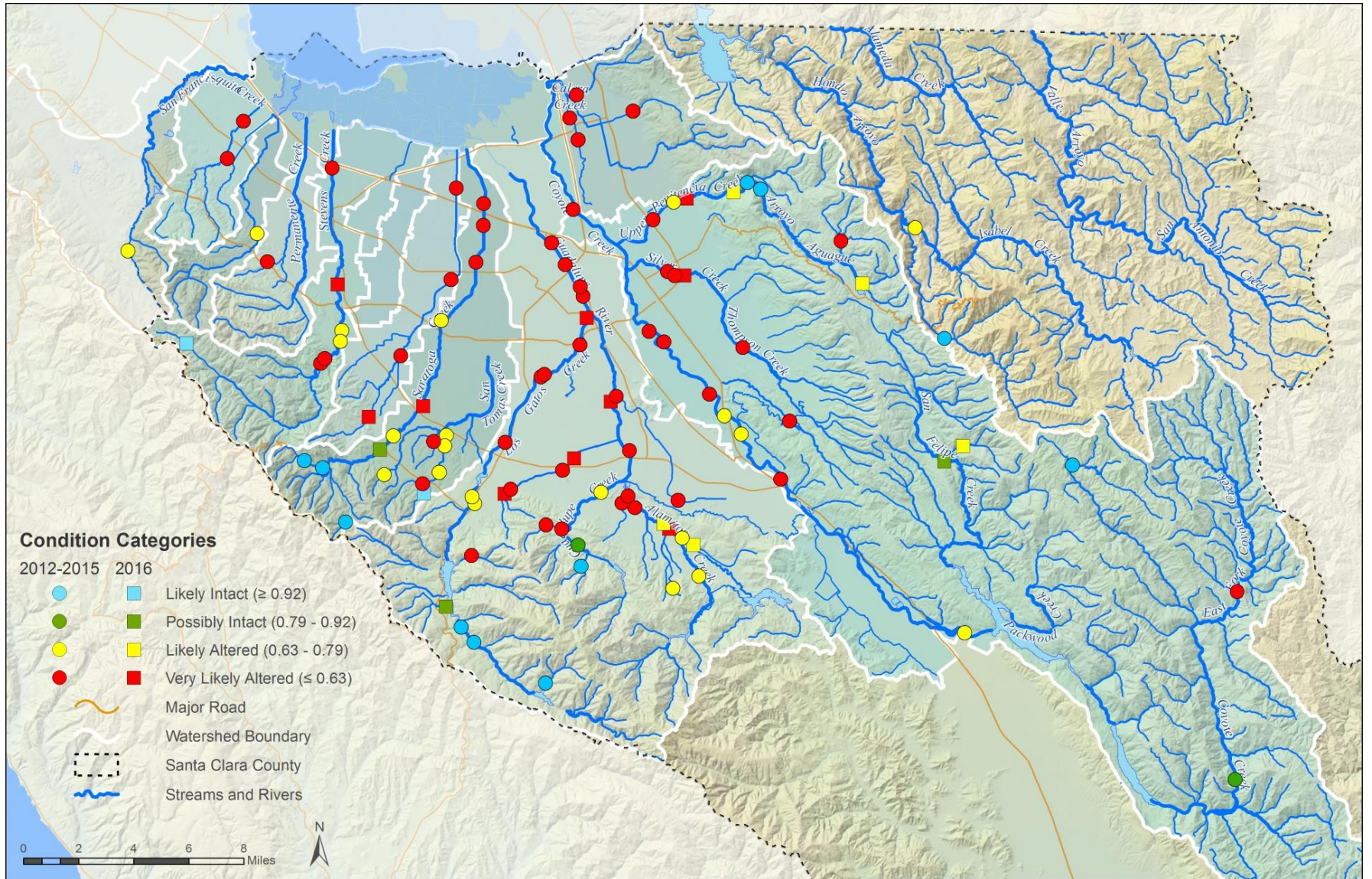


Figure 3.1. CSCI condition category for probabilistic sites sampled in Santa Clara County (n=112), WY 2012 – WY 2016.

3.2.2 Targeted Monitoring Results/Conclusions

Targeted monitoring in WY 2016 was conducted in compliance with Provisions C.8.d.iii – v of the MRP. Hourly temperature measurements were recorded at eight sites in the Upper Penitencia Creek watershed from April through September. Continuous (15-minute) general water quality measurements (pH, DO, specific conductance, temperature) were recorded at two sites in the Upper Penitencia Creek watershed during two 2-week periods in May (Event 1) and September (Event 2). Pathogen indicator grab samples were collected during a sampling event in June at five probabilistic sites throughout Santa Clara County that coincide with public parks. Stations were deliberately selected using the Directed Monitoring Design Principle.

Conclusions and recommendations from targeted monitoring in WY 2016 are listed below. The sections below are organized on the basis of three management questions:

1. *What is the spatial and temporal variability in water quality conditions during the spring and summer season?*
2. *Do general water quality measurements indicate potential impacts to aquatic life?*
3. *What are the pathogen indicator concentrations at creek sites where there is potential for water contact recreation to occur?*

Spatial and Temporal Variability in Water Quality

- Median water temperatures continuously measured in the Upper Penitencia Creek watershed were generally coolest at the four upper elevation sites in Alum Rock Park. Temperatures became elevated at the four lower elevation sites between May and September 2016. Water temperatures were highest at site 114 when it was influenced by discharge from upstream percolation ponds.

Potential Impacts to Aquatic Life

- Potential impacts to aquatic life were assessed through analysis of continuous temperature data collected at eight targeted stations and continuous general water quality data (pH, dissolved oxygen, specific conductance, temperature) collected at three targeted stations.
- Five of the eight temperature stations in Upper Penitencia Creek exceeded the MRP trigger threshold of having two or more weeks where the maximum weekly average temperature (MWAT) exceeded 17°C. None of the stations exceeded the maximum instantaneous trigger threshold of 24°C.
- All stations with MWAT trigger exceedances will be added to the list of candidate SSID projects; however, review of the monitoring data in the context of the ongoing drought and locally-derived temperature thresholds developed by NMFS suggests that temperature is not a limiting factor for salmonid habitat (i.e., summer rearing juveniles) in the study reaches.
- The WQO for DO in waters designated as having cold freshwater habitat (COLD) beneficial uses (i.e., 7.0 mg/L) was met in all measurements recorded at the three water quality stations in Upper Penitencia Creek, with the exception of site 117, which had drops in DO that appeared to be related to significant drop in flow level during the dry season.
- Values for pH measured at the three sites in Upper Penitencia Creek during WY 2016 frequently exceeded the upper pH WQO of 8.5. As a result, all sites will be added to the list of potential SSID projects.
- Specific conductivity recorded at the three Upper Penitencia Creek sites in WY 2016 was consistently below the MRP trigger threshold of 2000 us/cm.

Potential Impacts to Water Contact Recreation

- Pathogen indicator densities were measured at five targeted sites during WY 2016. Although none of the stations could be considered “bathing beaches,” monitoring locations were selected at city parks or trails that were considered to have a relatively high potential for public access. MRP trigger thresholds for *E. coli* (410 cfu/100 ml) were not exceeded. MRP trigger thresholds for enterococcus (130 cfu/100 ml) were exceeded at two sites: one site on the Alamitos Creek at Leland High School and one on Upper Penitencia Creek at Alum Rock Park. These sites will be added to the list of candidate SSID projects.
- It is important to recognize that pathogen indicator thresholds are based on human recreation at beaches receiving bacteriological contamination from human wastewater, and may not be applicable to conditions found in urban creeks. Pathogen indicators observed at the WY 2016 stations may not be associated with human sources and therefore may not pose a threat to human health. As a result, the comparison of pathogen indicator results to water quality objectives and criteria for full body contact recreation, may not be appropriate and should be interpreted cautiously.

3.2.3 Chlorine Monitoring Results/Conclusions

Monitoring of total and free chlorine residual at probabilistic stations was conducted in compliance with provision C.8.d.ii of the MRP. While chlorine residual is generally not a concern in Santa Clara Valley urban creeks, WY 2016 and prior monitoring results suggest there are occasional free chlorine and total chlorine exceedances in the County. The Program will continue to monitor chlorine in compliance with the MRP and will follow-up with illicit discharge staff as needed.

3.2.4 Pesticides and Toxicity Monitoring Results/Conclusions

In WY 2016, SCVURPPP conducted dry weather pesticides and toxicity monitoring at two stations in compliance with provision C.8.g of the MRP. Statistically significant toxicity to *Chironomus dilutus* was observed either water or sediment samples collected from both sites during dry weather; however, the magnitude of the toxic effects in the samples compared to laboratory controls were not great and did not exceed MRP trigger criteria. Although the midge, *Chironomus dilutus*, has been observed to be sensitive to fipronil, fipronil concentrations measured in sediment samples collected concurrently with the water and sediment toxicity samples were below the method detection limit.

Threshold effect concentration (TEC) and probable effect concentration (PEC) quotients were calculated for all metals and PAHs measured in sediment samples. Both sites had at least one TEC or PEC quotient exceeding 1.0. In compliance with the MRP, both stations will therefore be placed on the list of candidate SSID projects. Decisions about which SSID projects to pursue should be informed by the fact that most of the TEC and PEC quotient exceedances are related to naturally occurring chromium and nickel.

SCVURPPP will continue to sample the same two stations for dry weather pesticides and toxicity throughout the permit term. In WY 2018, SCVURPPP anticipates working with the BASMAA RMC partners on a regional approach to wet weather pesticides and toxicity monitoring.

3.3 Trigger Assessment

The MRP requires analysis of the monitoring data to identify candidate sites for SSID projects. Trigger thresholds against which to compare the data are provided for most monitoring parameters in the MRP and are described in the foregoing sections of this report. Stream condition was determined based on CSCI scores that were calculated using BMI data. Water and sediment chemistry and toxicity data were evaluated using numeric trigger thresholds specified in the MRP. Nutrient data were evaluated using applicable water quality standards from the Basin Plan. In compliance with provision C.8.e.i of the MRP, all monitoring results exceeding trigger thresholds are added to a list of candidate SSID projects that will

be maintained throughout the permit term. Followup SSID projects will be selected from this list. Table 6.1 lists candidate SSID projects based on WY 2016 Creek Status and Pesticides/Toxicity monitoring data.

Additional analysis of the data is provided in the foregoing sections of this report and should be considered prior to selecting and defining SSID projects. The analyses include review of physical habitat (including channel type and location with respect to reservoirs) and water chemistry data to identify potential stressors that may be contributing to degraded or diminished biological conditions. Analyses in this report also include historical and spatial perspectives that help provide context and deeper understanding of the trigger exceedances.

Table 3.1. Summary of SCVURPPP trigger threshold exceedance analysis in WY 2016. “No” indicates samples were collected but did not exceed the MRP trigger; “Yes” indicates an exceedance of the MRP trigger.

Probabilistic Station Number	Targeted Station Number	Creek	Bioassessment ¹	Nutrients ²	Chlorine	Water Toxicity	Sediment Toxicity	Sediment Chemistry	Continuous Temperature	Continuous WQ	Pathogen Indicators
205R00213		Cow Creek	Yes	No	No	--	--	--	--	--	--
205R00305		San Felipe Creek	No	No	No	--	--	--	--	--	--
205R00578		Arroyo Aguague	Yes	No	No	--	--	--	--	--	--
205R01114		Guadalupe River	Yes	No	No	--	--	--	--	--	--
205R01731	205COY117	Upper Penitencia Creek	Yes	No	No	--	--	--	--	Yes	No
205R02330		Ross Creek	Yes	No	No	--	--	--	--	--	--
205R02422	205GUA329	Arroyo Calero	Yes	No	No	--	--	--	--	--	No
205R02458	205GUA262	Alamitos Creek	Yes	No	No	--	--	--	--	--	Yes
205R02474	205SAR075	Saratoga Creek	No	No	No	--	--	--	--	--	No
205R02538		Calabazas Creek	Yes	No	No	--	--	--	--	--	--
205R02547		Stevens Creek	No	No	No	--	--	--	--	--	--
205R02563		Los Gatos Creek	Yes	No	No	--	--	--	--	--	--
205R02602		Tributary to San Tomas	No	No	No	--	--	--	--	--	--
205R02618		Aldercroft Creek	No	No	No	--	--	--	--	--	--
205R02650		Alamitos Creek	Yes	No	No	--	--	--	--	--	--
205R02659		Stevens Creek	Yes	No	No	--	--	--	--	--	--
205R02730		Saratoga Creek	Yes	No	No	--	--	--	--	--	--
205R02762		Ross Creek	Yes	No	No	--	--	--	--	--	--
205R02771		Lower Silver Creek	Yes	No	Yes	--	--	--	--	--	--
205R02835	205COY135	Upper Penitencia Creek	Yes	No	No	--	--	--	Yes	--	Yes
	205STE021	Stevens Creek	--	--	--	No	No	Yes	--	--	--
	205STQ010	San Thomas Aquino	--	--	--	No	No	Yes	--	--	--
	205AAG025	Arroyo Aguague	--	--	--	--	--	--	Yes	--	--
	205COY114	Upper Penitencia Creek	--	--	--	--	--	--	Yes	No	--
	205COY121	Upper Penitencia Creek	--	--	--	--	--	--	Yes	Yes	--
	205COY130	Upper Penitencia Creek	--	--	--	--	--	--	Yes	--	--
	205COY140	Upper Penitencia Creek	--	--	--	--	--	--	No	--	--
	205COY142	Upper Penitencia Creek	--	--	--	--	--	--	No	--	--
	205COY145	Upper Penitencia Creek	--	--	--	--	--	--	No	--	--

Notes:

1. CSCI score ≥ 0.795 .

2. Unionized ammonia (as N) ≥ 0.025 mg/L, nitrate (as N) ≥ 10 mg/L, chloride > 250 mg/L.

3.4 Management Implications

The Program's Creek Status and Pesticides and Toxicity Monitoring programs (consistent with MRP provisions C.8.c and C.8.g, respectively) focus on assessing the water quality condition of urban creeks in the Santa Clara Valley and identifying stressors and sources of impacts observed. Although the sample size from WY 2016 (overall n=20; urban n=17) is not sufficient to develop statistically representative conclusions regarding the overall condition of all creeks, it builds on data collected in WY 2012 through WY 2015 and is analyzed with the full five-year dataset (n=112). Most urban streams have likely or very likely altered populations of aquatic life indicators (e.g., aquatic macroinvertebrates). These conditions are likely the result of long-term changes in stream hydrology, channel geomorphology, in-stream habitat complexity, and other modifications to the watershed and riparian areas associated with the urban development that has occurred over the past 50 plus years. Additionally, episodic or site specific increases temperature (particularly in lower creek reaches) may not be optimal for aquatic life in local creeks.

The Program and its Co-permittees are actively implementing many stormwater management programs to address these and other stressors and associated sources of water quality conditions observed in local creeks, with the goal of protecting these natural resources. For example:

- In compliance with MRP provision C.3, new and redevelopment projects in the Bay Area are now designed to more effectively reduce water quality and hydromodification impacts associated with urban development. Low impact development (LID) methods, such as rainwater harvesting and use, infiltration and biotreatment are required as part of development and redevelopment projects. In addition, Green Infrastructure planning is now part of all municipal projects. These LID measures are expected to reduce the impacts of urban runoff and associated impervious surfaces on stream health.
- In compliance with MRP provision C.9, the Program and Co-permittees are implementing pesticide toxicity control programs that focus on source control and pollution prevention measures. The control measures include the implementation of integrated pest management (IPM) policies/ordinances, public education and outreach programs, pesticide disposal programs, the adoption of formal State pesticide registration procedures, and sustainable landscaping requirements for new and redevelopment projects. Through these efforts, it is estimated that the amount of pyrethroids observed in urban stormwater runoff will decrease by 80-90% over time, and in turn significantly reduce the magnitude and extent of toxicity in local creeks.
- Trash loadings to local creeks have been reduced through implementation of new control measures in compliance with MRP provision C.10 and other efforts by Co-permittees to reduce the impacts of illegal dumping directly into waterways. These actions include the installation and maintenance of trash capture systems, the adoption of ordinances to reduce the impacts of litter prone items, enhanced institutional controls such as street sweeping, and the on-going removal and control of direct dumping. The MRP establishes a mandatory trash load reduction schedule, minimum areas to be treated by full trash capture systems, and requires development of receiving water monitoring programs for trash.
- In compliance with MRP provisions C.2 (Municipal Operations), C.4 (Industrial and Commercial Site Controls), C.5 (Illicit Discharge Detection and Elimination), and C.6 (Construction Site Controls) Co-permittees continue to implement programs that are designed to prevent non-stormwater discharges during dry weather and reduce the exposure of contaminants to stormwater and sediment in runoff during rainfall events.
- In compliance with MRP provision C.13, copper in stormwater runoff is reduced through implementation of controls such as architectural and site design requirements, prohibition of discharges from water features treated with copper, and industrial facility inspections.

- Mercury and polychlorinated biphenyls (PCBs) in stormwater runoff are being reduced through implementation of the respective TMDL water quality restoration plans. In compliance with MRP provisions C.11 (mercury) and C.12 (PCBs), the Program will continue to identify sources of these pollutants and will implement control actions designed to achieve new minimum load reduction goals. Monitoring activities conducted in WY 2016 that specifically target mercury and PCBs are described in the Pollutants of Concern Monitoring Data Report that is included as **Appendix D** to the WY 2016 UCMR.

In addition to the Program and Co-permittee controls implemented in compliance with the MRP, numerous other efforts and programs designed to improve the biological, physical and chemical condition of local creeks are underway. For example, the Santa Clara Valley Water District's Integrated Water Resources Master Plan (IWRMP) or "One Water Plan" is an ongoing, multi-year process to develop a framework for long-term management of Santa Clara county water resources. The One Water Plan will identify, prioritize and implement activities at a watershed scale to meet flood protection, water supply, water quality and environmental stewardship goals and objectives. The Santa Clara Valley Water District was also recently awarded a Proposition 1 grant to develop a Storm Water Resource Plan for the Santa Clara Basin that will support the development and implementation of MRP-required Green Infrastructure Plans and produce a list of prioritized runoff capture and use projects eligible for future State implementation grant funds. Through the continued implementation of MRP-associated and other watershed stewardship programs, SCVURPPP anticipates that stream conditions and water quality in local creeks will continue to improve overtime. In the near term, toxicity observed in creeks should decrease as pesticide regulations better incorporate water quality concerns during the pesticide registration process. In the longer term, control measures implemented to "green" the "grey" infrastructure and disconnect impervious areas constructed over the course of the past 50-plus years will take time to implement. Consequently, it may take several decades to observe the outcomes of these important, large-scale improvements to our watersheds in our local creeks. Long-term creek status monitoring programs designed to detect these changes over time are therefore beneficial to our collective understanding of the condition and health of our local waterways.

In recognition of SCVURPPP's accomplishments, the Water Environment Federation (WEF) awarded SCVURPPP the Overall Highest Score for a Phase 1 Municipal Stormwater Program and Gold Level for Innovation and Program Management. The awards are part of the National Municipal Stormwater and Green Infrastructure Awards program, led by WEF through a cooperative agreement with the U.S. Environmental Protection Agency (USEPA). The awards program was established in 2015 to recognize high-performing regulated MS4s throughout the United States. The objective of the program is to inspire MS4 program leaders to seek new and innovative ways to meet and exceed regulatory requirements in a manner that is both technically effective as well as financially efficient.

4.0 STRESSOR/SOURCE IDENTIFICATION (C.8.E)

Provision C.8.e of the MRP requires that Permittees evaluate creek status (provision C.8.d) and pesticides and toxicity (provision C.8.g) monitoring data with respect to triggers defined in the MRP, and maintain a list of all results exceeding trigger thresholds. Table 3.1 lists the results of the trigger evaluation for WY 2016 data. Sites where triggers are exceeded may indicate potential impacts to aquatic life or other beneficial uses and are therefore considered as candidates for future Stressor/Source Identification (SSID) projects. SSID projects are selected from the list of trigger exceedances based on criteria such as magnitude of threshold exceedance, parameter, and likelihood that stormwater management action(s) could address the exceedance. The MRP requires that Permittees initiate a minimum number of SSID projects during the permit term. SCVURPPP and its RMC partners must collectively initiate a region-wide minimum of eight new SSID Projects during the term of the current permit. All SSID project reports must be summarized in a unified, regional-level report. The regional SSID report is attached to this UCMR as **Appendix B**.

SSID projects must identify and isolate potential sources and/or stressors associated with observed water quality impacts. They are intended to be oriented to taking action(s) to alleviate stressors and reduce sources of pollutants. The MRP describes the stepwise process for conducting SSID projects:

- Step 1: Develop a work plan for each SSID project that defines the problem to the extent known, describes the SSID project objectives, considers the problem within a watershed context, lists candidate causes of the problem, and establishes a schedule for investigating the cause(s) of the trigger. The MRP recommends study approaches for specific triggers. For example, toxicity studies should follow guidance for Toxicity Reduction Evaluations (TRE) or Toxicity Identification Evaluations (TIE), physical habitat and conventional parameter (e.g., dissolved oxygen, temperature) studies should generally follow Step 5 (Identify Probable Causes) of the Causal Analysis/Diagnosis Decision Information System (CADDIS), and pathogen indicator studies should generally follow the California Microbial Source Identification Manual (SCCWRP 2013).
- Step 2: Conduct SSID investigation according to the schedule in the SSID work plan and report on the status of SSID investigations annually in the UCMR.
- Step 3: Conduct follow-up actions based on SSID investigation findings. These may include development of an implementation schedule for new or improved best management practices (BMPs). If a Permittee determines that MS4 discharges are not contributing to an exceedance of a water quality standard, the Permittee may end the SSID project upon written concurrence of the Executive Officer. If the SSID investigation is inconclusive, the Permittee may request that the Executive Officer consider the SSID project complete.

SCVURPPP has not yet initiated an SSID project during the current MRP, but due to delays associated with the 2012-16 drought is still implementing one SSID project that was initiated during the previous MRP term. The Upper Penitencia Creek SSID Project is described in the section below.

4.1 Upper Penitencia Creek SSID Project

In WY 2013, SCVURPPP initiated the Upper Penitencia Creek SSID Project by developing a work plan to investigate low creek condition scores (e.g., CSCI, SoCal B-IBI) and temperature trigger exceedances. Over the next two years, field work could not be conducted due to severe drought conditions resulting in a lack of flow in the study reach during the bioassessment index period. In WY 2016, biological assessments and water and sediment quality monitoring were conducted at two locations in Upper Penitencia Creek. The monitoring design followed the CADDIS framework developed by the USEPA (2010). Monitoring parameters were selected to evaluate range of potential stressors to biological condition at two locations. One site (the “test site”) is potentially affected by percolation ponds discharges and the second site (the “comparator site”) is located about one mile upstream test site above the discharge outfall. Results from the Upper Penitencia Creek SSID Study are presented in **Appendix C**.

Based on results of the WY 2016 monitoring, the reduced biological integrity observed in Upper Penitencia creek is believed to be associated with the lack of stream flow in the segment where the reduced condition was observed. This segment has historically dried up during the spring/summer season due to percolation of surface flow into the underlying groundwater basin. The biological conditions of this loss of flow are reflected in the aquatic biota that has adapted to abrupt, seasonal changes in flow and water quality conditions. The natural seasonal changes in habitat have further been magnified by anthropogenic activities associated with periodic water operations. However, the sources of stressors identified as causing poor biological condition in the study area cannot be mitigated through stormwater management.

Based on the conclusions drawn to-date, steps #1 and #2 of the SSID process outlined in the MRP are now complete. Although no enhanced or improved municipal stormwater management actions are warranted, in an effort to evaluate and inform future actions that may improve biological conditions in Upper Penitencia, SCVURPPP is moving forward with follow-up actions consistent with Step #3 (i.e., conduct follow-up actions based on SSID investigation findings) in the SSID process. The follow-up actions will include an evaluation of current management practices associated with water quality and water flows in Upper Penitencia creek and the development of recommendations that should be considered by partner regulatory agencies to protect the biological condition of the stream in the future. A control measure evaluation and recommendations report will be completed in FY 2017-18 and submitted with the SCVURPPP Water Year 2017 UCMR. Once this report is submitted, the Upper Penitencia SSID project will be complete.

5.0 POLLUTANTS OF CONCERN MONITORING

Pollutants of Concern (POC) monitoring is required by provision C.8.f of the MRP. POC monitoring is intended to assess inputs of POCs to the Bay from local tributaries and urban runoff, provide information to support implementation of total maximum daily load action plans (TMDLs) and other pollutant control strategies, assess progress toward achieving wasteload allocations (WLA) for TMDLs, and help resolve uncertainties associated with loading estimates for these pollutants. The MRP identifies five priority POC management information needs that need to be addressed through POC monitoring:

1. **Source Identification** – identifying which sources or watershed source areas provide the greatest opportunities for reductions of POCs in urban stormwater runoff;
2. **Contributions to Bay Impairment** – identifying which watershed source areas contribute most to the impairment of San Francisco Bay beneficial uses (due to source intensity and sensitivity of discharge location);
3. **Management Action Effectiveness** – providing support for planning future management actions or evaluating the effectiveness or impacts of existing management actions;
4. **Loads and Status** – providing information on POC loads, concentrations, and presence in local tributaries or urban stormwater discharges; and
5. **Trends** – evaluating trends in POC loading to the Bay and POC concentrations in urban stormwater discharges or local tributaries over time.

Provision C.8.f of the MRP requires POC monitoring of polychlorinated biphenyls (PCBs), mercury, copper, emerging contaminants, and nutrients.⁸ The MRP defines yearly and total (i.e., permit term) minimum number of samples for each POC and specifies the minimum number of samples for each POC that must address each information need. Progress toward POC monitoring requirements accomplished in WY 2016 and the planned allocation of effort for WY 2017 is described in the SCVURPPP POC Monitoring Report (SCVURPPP 2016) that was submitted to the Regional Water Board on October 15, 2016 in compliance with provision C.8.h.iv of the MRP.

In WY 2016, SCVURPPP complied with Provision C.8.f of the MRP through the following activities:

- Implementation of a catchment-scale storm sampling program for PCBs, mercury, and copper analysis;
- Collection of dry weather samples for nutrients analysis; and
- Continued participation in the RMP Small Tributaries Loading Strategy Team (STLS).⁹

POC monitoring in WY 2016 focused primarily on identification of source areas of PCBs and mercury to the MS4 and San Francisco Bay. WY 2016 data continued to assist SCVURPPP implement a process to identify and prioritize watershed management areas (WMAs) in the Santa Clara Valley. This process is generally consistent with the efforts underway by other RMC partners. WMAs are priority watersheds or catchments in the urban landscape where control measures for PCBs and mercury are currently being implemented or will be implemented during the MRP permit term, to the extent that feasible and cost-effective controls can be identified.

⁸ Emerging contaminant monitoring requirements will be met through participation in RMP special studies. The special study will account for relevant constituents of emerging concern (CECs) in stormwater and will address at least PFOS, PFAS, and alternative flame retardants being used to replace PBDEs.

⁹ SCVURPPP strives to work collaboratively with our water quality monitoring partners to find mutually beneficial monitoring approaches. Provision C.8.a.iii of the MRP allows Permittees to use data collected by third-party organizations to fulfill monitoring requirements, provided the data are demonstrated to meet the required data quality objectives. Samples collected in Santa Clara County through the RMP are used to supplement the Program's efforts towards achieving provision C.8.f monitoring requirements.

A report describing the results of all POC monitoring conducted by SCVURPPP is included as **Appendix D** to this report and a report describing the results of POC monitoring conducted by the STLS is included as **Appendix E**.

5.1 SCVURPPP POC Monitoring

In compliance with provision C.8.f of the MRP, the Program conducted POC monitoring in WY 2016 for PCBs, mercury, copper, and nutrients. The MRP-required yearly minimum number of samples was met or exceeded for all POCs. Results are summarized in the sections below.

5.1.1 PCBs and Mercury

PCBs, mercury, and copper monitoring by the Program in WY 2016 was conducted in accordance with the Water Year 2016 Pollutant of Concern Monitoring - Sampling and Analysis Plan (SCVURPPP 2015). The primary goal of the monitoring, as described in the Sampling and Analysis Plan (SAP), is to provide information to identify WMAs where control measures could be implemented to comply with MRP requirements for load reductions of PCBs and mercury. WY 2016 PCBs and mercury monitoring was focused on collection of storm composite samples from high interest WMAs that may contain PCB and/or mercury source properties. High interest WMAs were identified and prioritized for sampling by evaluating several types of data, including: PCBs and mercury concentrations from prior sediment and water sampling efforts, land use data showing old industrial parcels, municipal storm drain data showing pipelines and access points (e.g., manholes, outfalls, pump stations), catchment areas delineated from municipal storm drain data, and logistical/safety considerations (SCVURPPP 2015).

During WY 2016, the Program collected nine¹⁰ samples for PCBs and mercury analysis. Composite samples consisting of six to eight aliquots collected during the rising limb and peak of the storm hydrograph (as determined through field observations) were analyzed for the “RMP 40” PCB congeners (method EPA 1668C), total mercury (method EPA 1631E), and suspended sediment concentration (SSC; method ASTM D3977-97).

In summary, WY 2016 results included:

- Total PCB concentrations, calculated as the sum of the “RMP 40” congeners, ranged from 0.584 ng/L to 9.04 ng/L; and PCB particle ratios, calculated by dividing total PCB concentrations by SSC, ranged from 30.1 ng/g to 367 ng/g.
- Mercury concentrations ranged from 4.0 ng/L to 35.7 ng/L and mercury particle ratios ranged from 128 ng/g to 962 ng/g.

Results were relatively low compared to other samples collected throughout the region, including samples collected by the RMP STLS in WY 2015 and WY 2016. Because no samples were above preliminary thresholds set to identify catchments that likely have PCB sources, no WMAs were identified as “Known High Interest Source Areas” based on WY 2016 data. SCVURPPP plans to continue working with other Bay Area countywide stormwater programs (through the BASMAA MPC Committee) and the RMP STLS to evaluate the results of the ongoing efforts in the Bay Area to identify PCBs and mercury source areas and plan next steps in Santa Clara County. Figure 5.1 illustrated those WMAs (i.e., catchments) that have been identified as high interest source areas (9) or are confirmed to contain source properties (2).

¹⁰ The Program had planned to collect up to 25 samples in WY 2016; however, a lack of rainfall in the study area relative to the rest of the Bay Area limited monitoring opportunities. The industrial areas of Santa Clara County are located in the rain shadow of the Santa Cruz Mountains.

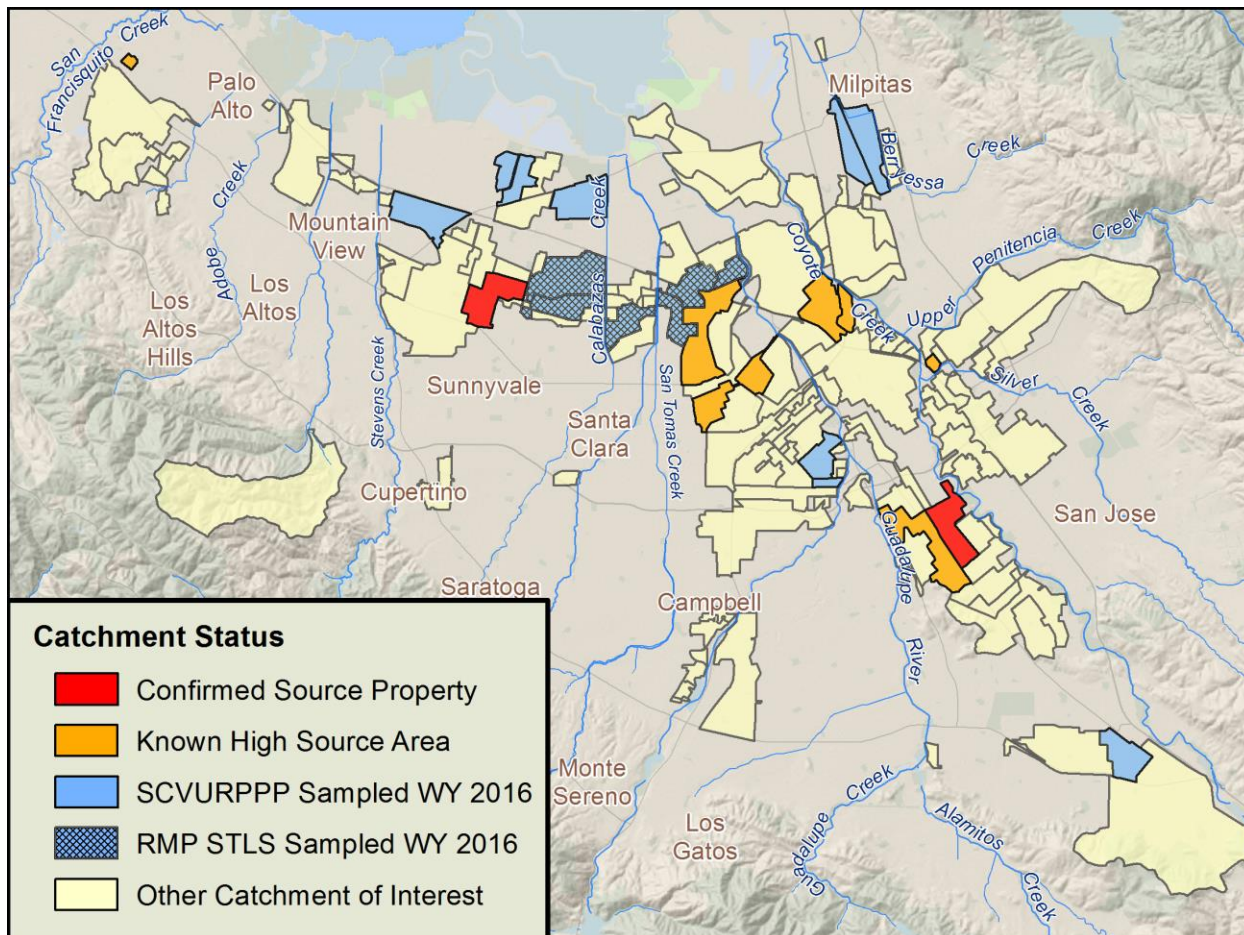


Figure 5.1. WMA map of Santa Clara County, showing catchments sampled in WY 2016.

5.1.2 Copper

A subset (four of nine) of the wet weather samples collected by SCVURPPP in WY 2016 were analyzed for total and dissolved copper and hardness to characterize copper concentrations in stormwater runoff from highly urban catchments. Two samples were collected in the MS4 and two in local small creeks. Dissolved copper concentrations in creek samples were compared to hardness-dependent acute water quality objectives (WQOs). Neither sample exceeded the copper WQO.

5.1.3 Nutrients

Two samples, collected synoptically with bioassessment monitoring in Upper Penitencia Creek as part of the SSID study were analyzed for the suite of nutrients required in the MRP (i.e., ammonium¹¹, nitrate, nitrite, total Kjeldahl nitrogen, orthophosphate, and total phosphorus). No applicable WQOs were exceeded.

¹¹ Ammonium was calculated as the difference between ammonia and un-ionized ammonia. Un-ionized ammonia was calculated using the formula provided by the American Fisheries Society Online Resources.

5.1.4 Recommendations for WY 2017 POC Monitoring

As described in **Appendix D**, the Program identified the following recommendations for POC monitoring in WY 2017 and beyond:

- SCVURPPP and the RMP's STLS will continue to conduct PCB and mercury monitoring with the goal of identifying WMAs and specific source properties where new PCB and mercury control measures can be implemented during the permit term.
- At least eight samples that address Management Question #3 (Management Action Effectiveness) must be collected by the end of year four of the permit. SCVURPPP is currently working with BASMAA to develop a regional project to design a Monitoring Plan for POC Management Action Effectiveness. The goal is to finalize the Monitoring Plan/study design in WY 2017 and implement the plan in WY 2018. A major consideration for the regional Management Action Effectiveness Monitoring Plan and other future monitoring efforts will be collection of data in support of conducting the Reasonable Assurance Analysis (RAA) that is required by Provision C.12.c.iii.(3) of the MRP and which must be submitted with the 2020 Annual Report (September 30, 2020).
- At least eight samples that address Management Question #5 (Trends) must be collected by the end of year four of the permit. SCVURPPP will continue to participate in the STLS Trends Strategy Team to meet this requirement. The STLS Trends Strategy Team, initiated in WY 2015, is currently developing a regional monitoring strategy to assess trends in POC loading to San Francisco Bay from small tributaries. The STLS Trends Strategy will initially focus on PCBs and mercury, but will not be limited to those POCs. The preliminary design concept includes additional monitoring at one or two of the region-wide loadings stations to gain a better understanding of the variability in PCBs concentrations/loadings in the existing dataset. The variability of PCB concentrations in stormwater runoff will predict the number and frequency of samples needed to depict given load reductions over given periods of time. STLS Trends Strategy monitoring could begin as early as WY 2017 and will likely continue through the Permit term, however, the monitoring design is still being developed.
- SCVURPPP will continue to work with the SPoT Program to address Management Question #5 (Trends). The *SPoT Monitoring Program* conducts annual dry season monitoring (subject to funding constraints) of sediments collected from a statewide network of large rivers. The goal of the SPoT Program is to investigate long-term trends in water quality (Management Question #5 – Trends). Sites are targeted in bottom-of-the-watershed locations with slow water flow and appropriate micromorphology to allow deposition and accumulation of sediments, including two stations in Santa Clara County (Coyote Creek and Guadalupe River). In most years, sediments are analyzed for PCBs, mercury, toxicity, pesticides, and organic pollutants (Phillips et al. 2014). In WY 2016, SPoT monitoring in Santa Clara County did not include PCBs or mercury; however, those constituents are anticipated for WY 2017.
- A subset of the wet weather PCB and mercury samples collected in WMAs with suspected sources will continue to be analyzed for total and dissolved copper in WY 2017.
- Nutrient samples will be collected from mixed land use watersheds. Nutrient monitoring efforts should be increased above the minimum number of yearly samples in order to make more progress towards the total number of samples required by the end of year five of the MRP.
- SCVURPPP will continue to participate in the RMP and the RMP's CEC Strategy.

5.2 Small Tributaries Loading Strategy

The RMP Small Tributaries Loading Strategy was developed in 2009 by the STLS Team, which included representatives from BASMAA, Regional Water Board staff, RMP staff, and technical advisors and is overseen by the Sources, Pathways, and Loadings Workgroup (SPLWG). The objective of the STLS is to develop a comprehensive planning framework to coordinate POC monitoring/modeling between the RMP and RMC participants. In 2011, with concurrence of participating Regional Water Board staff, a framework (i.e., the STLS Multi-Year Plan) was developed presenting an alternative approach to the POC loads monitoring requirements described in provision C.8.e.i of the 2009 MRP, as allowed by provision C.8.e. The most recent published version (Version 2013a) of the STLS Multi-Year Plan (MYP) was submitted with the Regional Urban Creeks Monitoring Report in March 2013 (BASMAA 2013). The STLS MYP is integrated with other RMP-funded activities (see Section 2.0) and is a major component of the RMP MYP. Version 2013a of the STLS MYP includes two main elements that collectively address the four priority management questions for POC monitoring described in the 2009 MRP:

- Development and improvement of the Regional Watershed Spreadsheet Model (RWSM) as a tool for estimating regional loads of POCs to the Bay, and
- Watershed monitoring at six fixed stations.

Based on the lessons learned through the implementation of the STLS MYP in WY 2012, WY 2013, and WY 2014, and the reprioritization of management information needs in the 2015 MRP, SCVURPPP and its RMC partners implemented a revised approach to POC Loads monitoring in WY 2015¹². The revised monitoring approach was discussed at numerous STLS workgroup meetings during WY2014¹³ and was agreed upon by STLS members, including Water Board staff, as the best approach to addressing near-term high priority information needs regarding PCB and mercury sources and loadings. The revised alternative approach initiated in WY 2015 discontinues most POC loads monitoring stations sampled in previous Water Years, adds wet weather characterization monitoring, and maintains support of the RWSM. The sections below describe the tasks implemented by the RMP STLS in WY 2016.

5.2.1 Wet Weather Characterization

With a goal of identifying watershed sources of PCBs and mercury, STLS field monitoring in WY 2016 continued to focus on collection of storm composite samples in the downstream reaches of catchments located throughout the region. In WY 2016, 17 catchments ranging in size from 0.23 km² to 17.47 km² and representing engineered MS4 drainage areas were sampled during storm events. The storm composite water samples were analyzed for concentrations of PCBs, total mercury, other metals (arsenic, cadmium, lead, copper, zinc), total organic carbon, dissolved organic carbon, suspended sediment concentration, and grain size distribution. In addition, a pilot study was continued at a subset of locations to collect fine sediments using specialized settling chambers. A full description of the methods and results from WY 2015 and WY 2016 monitoring is included in **Appendix E** (Pollutants of concern reconnaissance monitoring final progress report, water years 2015 and 2016).

In WY 2016 six catchments were targeted in Santa Clara County based on recommendations by Program staff evaluating land uses in the County that have the highest likelihood of generating PCBs in stormwater runoff. All of the six Santa Clara County sampling stations were located at manholes accessing the MS4 or MS4 outlets to receiving waters. One of the stations was sampled twice in WY 2016.

Wet weather characterization monitoring by the RMP STLS is planned to continue in WY 2017.

¹² The BASMAA Phase I stormwater managers discussed the approach with the Assistant Executive Officer of the SF Bay Regional Water Quality Control Board at the August 28, 2014 monthly meeting and amended the RMC to reflect the modification.

¹³ Discussions about revised POC loads monitoring approaches for FY 13-14 (Water Year 2015) were discussed and ultimately agreed upon by Water Board staff and other STLS and RMC partners at the following STLS meetings: October 13, 2013; March 19, 2014; April 1, 2014; April 16, 2014; May 15, 2014; and June 9, 2014.

Preliminary Findings

The RMP STLS now has a growing database of 62 stations that have been sampled during wet weather for PCBs, mercury, and SSC since 2003. (Some stations have also been sampled for a larger suite of constituents.) Prior to WY 2015, most of the stations were located in natural creeks; whereas, WY 2015 and WY 2016 stations were primarily located in small catchments draining primarily old industrial land uses. Acknowledging that dynamic climatic conditions and individual storm characteristics may affect data interpretation, a number of conclusions have been identified:

- While PCB particle ratios appear to positively correlate with impervious cover and old industrial land use, they inversely correlate with watershed area and other trace metals analyzed (As, Cu, Cd, Pb, and Zn).
- Mercury concentrations have a positive but weaker relationship with impervious cover and old industrial land use. This is consistent with the understanding that atmospheric deposition plays a role in mercury source areas.
- Many areas of interest in terms of identifying PCBs and mercury source areas are located within close proximity to the Bay, in tidal zones that are often very difficult to sample due to lack of public right-of-way.
- The PCB and mercury load allocations from the TMDLs of 2 and 80 kg respectively translate to mean annual concentrations of 1.33 ng/L (PCBs) and 53 ng/L (mercury) and mean annual particle ratios of 1.4 ng/g (PCBs) and 0.058 ug/g (mercury) (assuming certain annual average flow and suspended sediment loads). None of the concentrations or particle ratios measured at the 62 stations sampled to date (including those in natural creeks) approach these estimated goals.

Comparison to Applicable Water Quality Standards

MRP provision C.8.g.iii requires RMC participants to assess all data collected pursuant to provision C.8 for compliance with applicable water quality standards. In compliance with this requirement, comparisons of data collected at the wet weather characterization monitoring stations in WY 2016 to applicable numeric WQO is provided below.

When conducting a comparison to applicable WQOs/criteria, certain considerations should be taken into account to avoid the mischaracterization of water quality data:

Discharge vs. Receiving Water – WQOs apply to receiving waters, not discharges. WQOs are designed to represent the maximum amount of pollutants that can remain in the water column without causing any adverse effect on organisms using the aquatic system as habitat, on people consuming those organisms or water, and on other current or potential beneficial uses. POC monitoring data were not collected in receiving waters; instead, they were collected within the engineered storm drain network. Dilution is likely to occur when the MS4 discharges urban stormwater (and non-stormwater) runoff into the local receiving water. Therefore, it is unknown whether or not discharges that exceed WQOs result in exceedances in the receiving water itself, the location where there is the potential for exposure by aquatic life.

Freshwater vs. Saltwater - POC monitoring data were collected in freshwater, above tidal influence and therefore comparisons were made to freshwater WQOs/criteria.

Aquatic Life vs. Human Health - Comparisons were primarily made to objectives/criteria for the protection of aquatic life, not objectives/criteria for the protection of human health to support the consumption of water or organisms. This decision was based on the assumption that water and organisms are not likely being consumed from the stations monitored.

Acute vs. Chronic Objectives/Criteria - Monitoring was conducted during episodic storm events and results do not likely represent long-term (chronic) concentrations of monitored constituents. POC

monitoring data were therefore compared to “acute” WQOs/criteria for aquatic life that represent the highest concentrations of an analyte to which an aquatic community can be exposed briefly (e.g., 1-hour) without resulting in an unacceptable effect.

Of the analytes monitored at POC stations in WY 2016, WQOs or criteria have only been promulgated for total mercury and total cadmium. WQOs for other metals analyzed are expressed in terms of the dissolved fraction of the metal in the water column for which data are not available. Furthermore, the WQO for cadmium is based on hardness, which was not measured in the WY 2016 samples. Therefore, the comparison of data collected in WY 2016 to applicable numeric WQOs or criteria adopted by the Regional Water Board is limited to total mercury.

All samples collected in Santa Clara County in WY 2016 were well below the freshwater acute objective for mercury of 2.4 µg/L. Total mercury concentrations ranged from 0.06 µg/L to 0.016 µg/L. See **Appendix E** for a list of RMP STLS sampling results.

5.2.2 Regional Watershed Spreadsheet Model

The STLS Team and SPLWG continued to provide oversight in WY 2016 to the development and refinement of the Regional Watershed Spreadsheet Model (RWSM), which is a land use based planning tool for estimation of overall POC loads from small tributaries to San Francisco Bay at a regional scale. The RWSM is being developed by SFEI on behalf of the RMP, with funding from both the RMP and BASMAA regional projects.

The RWSM is based on the idea that to accurately assess total contaminant loads entering San Francisco Bay, it is necessary to estimate loads from local watersheds. “Spreadsheet models” of stormwater quality provide a useful and relatively cheap tool for estimating regional scale watershed loads. Spreadsheet models have advantages over mechanistic models because the data for many of the input parameters required by mechanistic models may not currently exist, and also require large calibration datasets which take money and time to collect.

Development of a spreadsheet model to estimate POC loads from small tributaries to the Bay has been underway since 2010 when a water-based copper model was completed. Because PCBs and mercury are more closely related to sediments, a draft model for suspended sediments was developed. However, resulting loads estimates for PCBs and mercury appeared to be too high leading to the conclusion that accuracy and precision at small (e.g., watershed) scales is challenged by the regional nature of the calibration process and the simplicity of the model. In WY 2016, the water-based model for PCBs and mercury was improved with new approaches to calibration which reflect the growing wet weather characterization dataset and the greater understanding of regional hydrology. The improved RWSM can be used for estimating regional scale annual average loads and could be useful for comparing relative loading between sub-regions and more polluted versus less polluted watersheds.

During WY 2016, SCVURPPP reviewed and provided input on documents describing the RWSM and/or its loadings estimates (e.g., the annotated PowerPoint presentation). SCVURPPP also participated in the SPLWG which is the main venue for soliciting input from interested parties and technical advisors.

In WY 2017, the RWSM calibration will continue to be improved with data from the WY 2016 wet weather characterization monitoring and BASMAA studies. Improvements to the land use GIS layer will also help refine the model. As the modeling team at SFEI becomes more proficient with alternative water-based platforms (i.e., SWMM, HEC-RAS) through development of the Green Plan-IT tool, a more sophisticated basis may be adopted in future years. Decisions on model improvements will be made in consultation with the STLS and the SPLWG.

5.2.3 STLS Trends Strategy

In WY 2016, the STLS Trends Strategy team continued to meet. The STLS Trends Strategy was developed based on recommendations from the SPLWG to define where and how trends may be most

effectively measured in relation to management effort so that data collection methods deployed over the next several years will support this management information need. Initially comprised of SFEI staff, RMC participants, and Regional Water Board staff, the STLS Trends Strategy team expanded in WY 2016 to include additional interested parties (e.g., EPA) and technical advisors (e.g., USGS).

In WY 2016, the STLS Trends Strategy team drafted the Trends Strategy document and Technical Appendix. The main document summarizes the background, management questions, and guiding principles of the Trends Strategy. It also describes coordination between the RMP and BASMAA within the context of the MRP, proposed tasks to answer the management questions, anticipated deliverables, and the overall timeline. The current priority POCs are PCBs and mercury and trend indicators under consideration (i.e., PCB concentrations and particle-ratios) were identified within the context of existing datasets (e.g., POC loading stations) and TMDL timelines. However, the Strategy recognizes that priorities can change in the future. The Technical Appendix presents an evaluation of variability and statistical power for detecting trends based on POC loading station PCBs data. It recommends sample size and revisit frequency needed to detect declining trends in PCBs in 25 years with > 80% statistical power. Results of the statistical analyses were presented to USGS technical advisors with expertise in trends analysis of water data.

In WY 2017, the Trends Strategy team will continue to explore POC loading station data in an effort to model PCB concentrations and loads. Results of the analysis will inform the design of the long-term monitoring program for trends. It is likely that additional data will be collected from two POC loading stations (e.g., Guadalupe River in Santa Clara County and Zone 4 Line 7 in Alameda County) to fill data gaps the baseline dataset and increase understanding of variability.

5.2.4 Guadalupe River Loading Station Contingency Monitoring

POC loads monitoring activities have been conducted for nearly a decade on the Guadalupe River near the Highway 101 overpass. These efforts have occurred via a combination of RMP, SCVURPPP and Santa Clara Valley Water District (SCVWD) funding and were generally aimed at developing robust estimates of annual mercury and other POC loading to the Bay from the watershed. One key information gap that remains is the concentrations and loading associated with high intensity storm events that necessitate the release of water from reservoirs located in the upper watershed. These events rarely occur and did not occur in WY 2016, but the Program was prepared to institute contingency monitoring in WY 2016 to sample water at the Highway 101 station in the event of a qualifying storm. This same approach will be followed in WY 2017.

6.0 NEXT STEPS

Water quality monitoring required by provision C.8 of the MRP is intended to assess the condition of water quality in the Bay area receiving waters (creeks and the Bay); identify and prioritize stormwater associated impacts, stressors, sources, and loads; identify appropriate management actions; and detect trends in water quality over time and the effects of stormwater control measure implementation. On behalf of Co-permittees, SCVURPPP conducts creek water quality monitoring and monitoring projects in the Santa Clara Valley (Lower South Bay) in collaboration with the Regional Monitoring Coalition (RMC), and actively participates in the San Francisco Bay Regional Monitoring Program (RMP), which focuses on assessing Bay water quality and associated impacts.

In WY 2017, SCVURPPP will continue to comply with water quality monitoring requirements of the MRP. The following list of next steps will be implemented in WY 2017:

- SCVURPPP will continue to collaborate with the RMC (MRP provision C.8.a).
- Where applicable, monitoring data collected and reported by SCVURPPP will continue to be SWAMP comparable (MRP provision C.8.b).
- SCVURPPP will continue to provide financial contributions towards the RMP and to actively participate in the RMP committees and work groups described in Sections 2.0 and 5.0 (MRP provision C.8.c).
- SCVURPPP will continue to conduct probabilistic and targeted Creek Status Monitoring consistent with the specific requirements in the MRP (MRP provision C.8.d).
- SCVURPPP will continue to implement dry weather Pesticides and Toxicity Monitoring and will work with RMC partners to develop and begin implementation of a wet weather Pesticides and Toxicity Monitoring program consistent with MRP provision C.8.g.
- SCVURPPP will continue to review monitoring results and maintain a list of all results exceeding trigger thresholds (MRP provision C.8.e.i). SCVURPPP will coordinate with the RMC to initiate a region wide goal of four new SSID projects by the third year of the permit (MRP provision C.8.e.iii). This will include initiation (i.e., development of a work plan) of at least one new SSID project by SCVURPPP in calendar year 2017.
- SCVURPPP will continue to participate in the STLS and SPLWG which address MRP provision C.8.f POC management information needs and monitoring requirements through wet weather characterization monitoring, refinement of the RWSM, advancement of the STLS Trends Strategy, and contingency monitoring at the Guadalupe River loading stations
- SCVURPPP will implement a POC monitoring framework to comply with provision C.8.f of the MRP. The monitoring framework will address the annual and total minimum number of samples required for each POC (i.e., PCBs, mercury, copper, emerging contaminants, nutrients) and each management information need (i.e., Source Identification, Contributions to Bay Impairment, Management Action Effectiveness, Loads and Status, Trends). WY 2017 monitoring will include collection of wet weather composite water samples from catchments and collection of dry weather sediment samples from the public right-of-way to identify areas where PCB and mercury control measures may be implemented. WY 2017 monitoring will also include sampling for nutrients and copper.
- WY 2017 POC monitoring accomplishments and allocation of sampling efforts for POC monitoring in WY 2018 will be submitted in the Pollutants of Concern Monitoring Report that is due to the Water Board by October 15, 2017 (MRP provision C.8.h.iv).
- Results of WY 2017 monitoring will be described in the Programs WY 2017 Urban Creeks Monitoring Report that is due to the Water Board by March 31, 2018 (MRP provision C.8.h.iii).

7.0 REFERENCES

- BASMAA. 2011. Regional Monitoring Coalition Multi-Year Work Plan: FY 2009-10 through FY 2014-15. 26 pp + appendices and attachments.
- BASMAA. 2012. Regional Monitoring Coalition Final Creek Status and Long-Term Trends Monitoring Plan. Prepared By EOA, Inc. Oakland, CA. 23 pp.
- BASMAA. 2013. Regional Monitoring Coalition Urban Creeks Monitoring Report Water Year 2012. Submitted pursuant to Provision C.8.g.iii of Order R2-2009-0074 on behalf of all Permittees. March 15, 2013. 28 pp + appendices.
- BASMAA. 2016a. Creek Status Monitoring Program Quality Assurance Project Plan, Final Version 2.0. Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program. 81 pp plus appendices.
- BASMAA. 2016b. Creek Status Monitoring Program Standard Operating Procedures, Final Version 2.0. Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program. 203 pp.
- MacDonald, D.D., C.G. Ingersoll, T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39, 20-31.
- Ode, P.R., Fetscher, A.E., and Busse, L.B. 2016. Standard Operating Procedures (SOP) for the Collection of Field Data for Bioassessments of California Wadeable Streams: Benthic Macroinvertebrates, Algae, and Physical Habitat. SWAMP-SOP-SB-2016-0001.
- Phillips, B.M., Anderson, B.S., Siegler, K., Voorhees, J., Tadesse, D., Webber, L., Breuer, R. (2014). Trends in Chemical Contamination, Toxicity and Land Use in California Watersheds: Stream Pollution Trends (SPoT) Monitoring Program. Third Report – Five-Year Trends 2008-2012. California State Water Resources Control Board, Sacramento, CA.
- SCVURPPP. 2014a. Watershed Monitoring and Assessment Program. Integrated Monitoring Report, Part A. Water Quality Monitoring Water Years 2012 and 2013 (October 2011 – September 2013). March 15, 2014.
- SCVURPPP. 2014b. Sampling and Analysis Plan for PCBs/Mercury Opportunity Area Analysis & Implementation Planning. December 2014.
- SCVURPPP. 2015. Water Year 2016 Pollutant of Concern Monitoring. Sampling and Analysis Plan. November 16, 2015.
- SCVURPPP. 2016. Pollutants of Concern Monitoring Report. Water Year 2016 Accomplishments and Water Year 2017 Planned Allocation of Effort. October 2016.
- Southern California Coastal Water Research Project (SCCWRP). 2013. California Microbial Source Identification Manual: A Tiered Approach to Identifying Fecal Pollution Sources to Beaches. Technical Report 804.
- San Francisco Bay Regional Water Quality Control Board (SFBRWQCB). 2009. San Francisco Regional Water Quality Control Board Municipal Regional Stormwater NPDES Permit. Order R2-2009-0074, NPDES Permit No. CAS612008. 125 pp plus appendices.
- San Francisco Bay Regional Water Board. 2013. San Francisco Bay Basin (Region 2) Water Quality Control Plan (Basin Plan). San Francisco Bay Regional Water Quality Control Board. Dec 31.
- San Francisco Bay Regional Water Quality Control Board (SFBRWQCB). 2015. San Francisco Region Water Quality Municipal Regional Stormwater NPDES Permit. Order R2-2015-0049, NPDES Permit No. CAS612008. 152 pp plus appendices.
- USEPA. 2010. Causal Analysis/Diagnosis Decision Information System (CADDIS). Office of Research and Development, Washington, DC. Available online at <http://www.epa.gov/caddis>. Last updated September 23, 2010.