Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Watershed Monitoring and Assessment Program

Urban Creeks Monitoring Report
Water Quality Monitoring
Water Year 2015 (October 2014 – September 2015)

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

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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 2009 Municipal Regional National Pollutant Discharge Elimination System (NPDES) Stormwater Permit (in this document the 2009 permit is referred to as "MRP 1.0")[1]. The RMC includes the following participants:

- Clean Water Program of Alameda County (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)

In 2015, the San Francisco Bay Regional Water Quality Control Board (Regional Water Board) revised and reissued the MRP (the 2015 permit is referred to as "MRP 2.0"). This Urban Creeks Monitoring Report complies with MRP 2.0 provision C.8.h.iii for reporting of all data in Water Year 2015 (October 1, 2014 through September 30, 2015). Data were collected pursuant to provision C.8 of MRP 1.0. 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, 2014a) and the BASMAA RMC Standard Operating Procedures (SOPs; BASMAA, 2014b). 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 MRP 2.0.

[1] The San Francisco Bay Regional Water Quality Control Board (Regional Water Board) issued MRP 1.0 to 76 cities, counties and flood control districts (i.e., Permittees) in the Bay Area on October 14, 2009 (Regional Water Board 2009). 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 County Clean Water Program
AFDM	Ash Free Dry Mass
BASMAA	Bay Area Stormwater Management Agency Association
BASMAA BOD	BASMAA Board of Directors
BMP	Best Management Practice
BOD	Biological Oxygen Demand
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
CRAM	California Rapid Assessment Method
CSCI	California Stream Condition Index
CW4CB	Clean Watersheds for Clean Bay
ECWG	Emerging Contaminant Workgroup
EEWG	Exposure and Effects Workgroup
FSURMP	Fairfield Suisun Urban Runoff Management Program
FY	Fiscal Year
GI	Green Infrastructure
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
POC	Pollutants 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
SPCWC	Stevens Permanente Creek Watershed Council
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
SWAMP	Surface Water Ambient Monitoring Program
TEC	Threshold Effect Concentration
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
TRC	Technical Review Committee
TU	Toxic Unit
UCMR	Urban Creeks Monitoring Report
USEPA	US Environmental Protection Agency
USGS	US Geological Survey
WQ	Water Quality
WQO	Water Quality Objective
WY	Water Year

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TABLE E.1. WATER YEAR 2015 CREEK STATUS MONITORING STATIONS

In compliance with provision C.8.h.iii.(1), this table of all Creek Status Monitoring stations sampled in Water Year 2015 is provided immediately following the Table of Contents. See Section 3.0 for additional information on Creek Status Monitoring.

Site ID	Watershed	Creek Name	Land Use	Latitude	Longitude	Probabilistic Monitoring		Targeted Monitoring			
						Bioassessment, Nutrients, General WQ	Toxicity, Sediment Chemistry	CRAM	Temp	Cont WQ	Pathogen Indicators
204R00253	Alameda Creek	Isabella Creek	NU	37.37893	-121.68361	x		x			
205R01315	Coyote Creek	Coyote Creek	U	37.32263	-121.85837	x		x			
205R01411	San Thomas Aquino	San Thomas Aquino	U	37.38842	-121.96863	x	x	x			
205R01562	Guadalupe River	Shannon Creek	U	37.21995	-121.92418	x		x			
205R01610	Guadalupe River	Los Gatos Creek	U	37.15754	-121.97052	x		x			
205R01669	Coyote Creek	Coyote Creek	U	37.16628	-121.64787	x		x			
205R01706	San Thomas Aquino	Saratoga Creek	U	37.26485	-121.02638	x	x	x			
205R01715	Permanente Creek	Hale Creek	U	37.35606	-121.11071	x		x			
205R01738	Guadalupe River	Ross Creek	U	37.23844	-121.94789	x		x			
205R01747	Coyote Creek	Lower Silver Creek	U	37.35223	-121.84211	x		x			
205R01882	Guadalupe River	Alamitos Creek	U	37.23577	-121.87047	x	x	x			
205R01923	Lower Penitencia Creek	Lower Penitencia Creek	U	37.42266	-121.90707	x		x			
205R01930	Guadalupe River	Los Gatos Creek	U	37.26308	-121.95209	x		x			
205R01962	San Thomas Aquino	Sobey Creek	U	37.26295	-121.99919	x		x			
205R02051	Guadalupe River	Guadalupe River	U	37.34548	-121.90422	x		x			
205R02074	Guadalupe River	Golf Creek	U	37.23195	-121.87455	x		x			
205R02119	San Francisquito Creek	Los Trancos Creek	U	37.36044	-122.20276	x		x			
205R02154	San Thomas Aquino	Wildcat Creek	U	37.24502	-122.03136	x		x			
205R02211	Stevens Creek	Stevens Creek	U	37.30555	-122.07191	x		x			
205R02307	Guadalupe River	Los Gatos Creek	U	37.29904	-121.92683	x		x			
205SAR005	San Thomas Aquino	Saratoga Creek	U	37.35759	-121.97309						x
205STE064	Stevens Creek	Stevens Creek	U	37.31873	-122.06143				x		x
205STE065	Stevens Creek	Stevens Creek	U	37.31321	-122.06412				x	x	x
205STE070	Stevens Creek	Stevens Creek	U	37.30592	-122.07321				x		
205STE071	Stevens Creek	Stevens Creek	U	37.30253	-122.07487					x	x
205STE095	Stevens Creek	Stevens Creek	U	37.28269	-122.07527				x		
205STE105	Stevens Creek	Stevens Creek	U	37.26958	-122.09925				x	x	
204GUA225	Guadalupe River	Arroyo Calero	U	37.21388	-121.83368						x
205GUA205	Guadalupe River	Guadalupe Creek	U	37.22685	-121.90283				x		
205GUA210	Guadalupe River	Guadalupe Creek	U	37.21748	-121.91031				x		
205GUA213	Guadalupe River	Guadalupe Creek	U	37.21018	-121.90386				x		
205GUA218	Guadalupe River	Guadalupe Creek	U	37.20280	-121.88845				x		

U = Urban upstream land uses
NU = Non-urban upstream land uses

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 issued by the San Francisco Regional Water Quality Control Board (Regional Water Board) on October 14, 2009 as Order R2-2009-0074 (referred to as MRP 1.0). On November 19, 2015, the Regional Water Board updated and reissued the MRP as Order R2-2015-0049 (referred to as MRP 2.0). This report fulfills the requirements of Provision C.8.h.iii of MRP 2.0 for comprehensively interpreting and reporting all monitoring data collected during the foregoing October 1 – September 30 (i.e., Water Year 2015). Data were collected pursuant to water quality monitoring requirements in provision C.8 of MRP 1.0.[3] 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 1.0 provisions. Several of the topics are summarized briefly in this report but described fully in appendices.

1.0 San Francisco Estuary Receiving Water Monitoring (MRP 1.0 provision C.8.b)

2.0 Creek Status Monitoring (MRP 1.0 provision C.8.c), including local targeted monitoring and SCVURPPP's contribution to the regional probabilistic monitoring program (Appendix A)

3.0 Monitoring Projects (MRP 1.0 provision C.8.d), including Stressor/Source Identification Projects (Appendix B) and the BMP Effectiveness Investigation

4.0 Pollutants of Concern (POC) Monitoring (MRP 1.0 provision C.8.e.i) (Appendices C and D)

5.0 Long-Term Trends Monitoring (MRP 1.0 provision C.8.e.ii)

6.0 Citizen Monitoring and Participation (MRP 1.0 provision C.8.f)

7.0 Recommendations and Next Steps

Figure 1.1 illustrates locations of monitoring stations associated with provision C.8 compliance in Water Year 2015 (WY2015), including Creek Status Monitoring, the BMP Effectiveness Investigation, SCVURPPP and Small Tributaries Loading Strategy (STLS) POC Monitoring, and Long-Term Trends Monitoring conducted at Stream Pollution Trend (SPoT) stations. This figure illustrates the geographic extent of monitoring conducted in Santa Clara County in WY2015.

[3] Water quality monitoring requirements in MRP 2.0 are generally similar to requirements in MRP 1.0. Differences in water quality monitoring requirements between MRP 1.0 and MRP 2.0 are briefly outlined in this report where applicable.

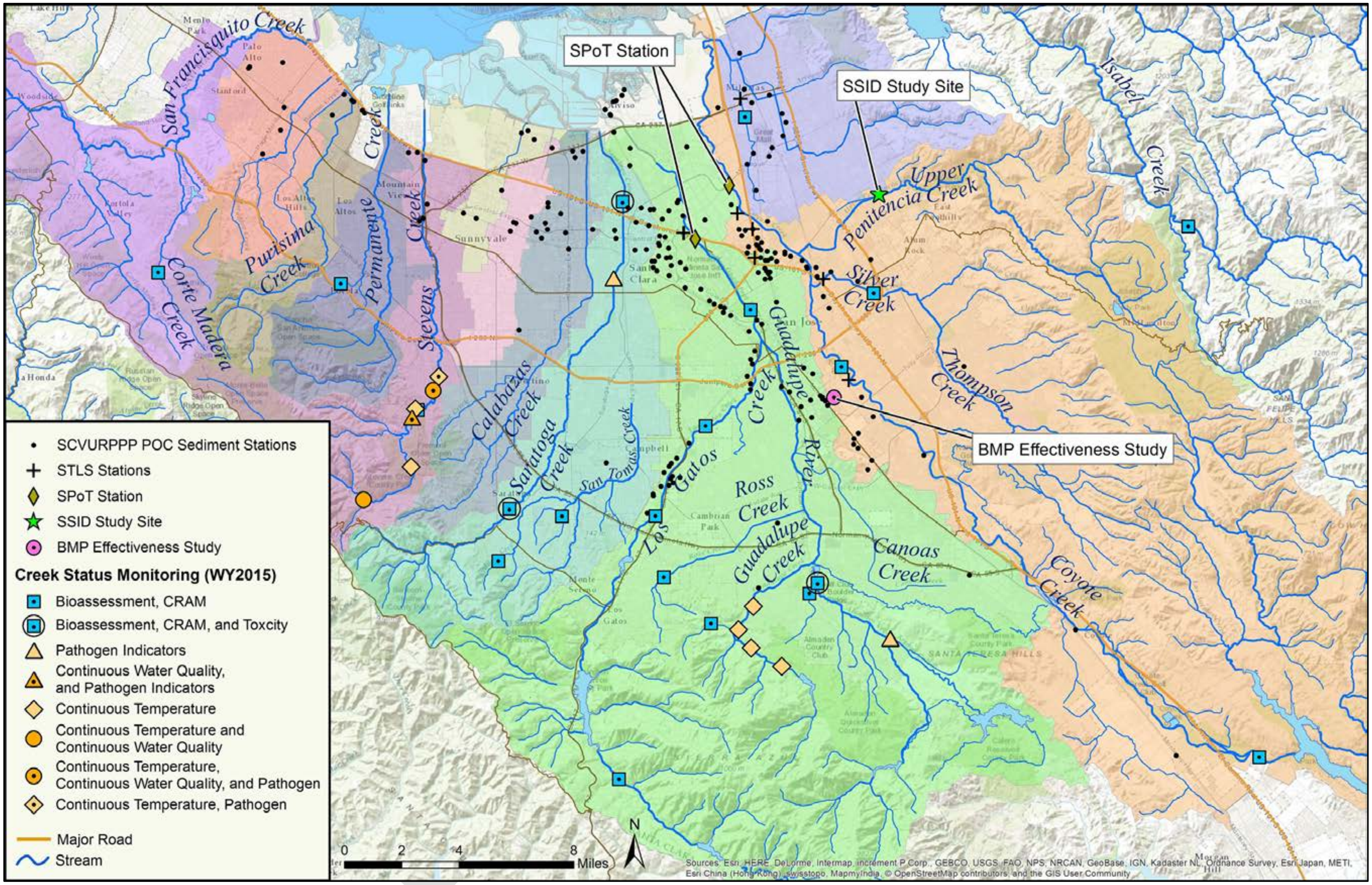

Figure 1.1. Creek Status, Long-Term Trends (SPoT), Pollutant of Concern (POC) Sediment Monitoring, Best Management Practice (BMP) Effectiveness, and Stressor/Source Identification (SSID) monitoring stations in WY2015.

1.1 RMC Overview

Provision C.8.a (Compliance Options) of the MRP allows Permitees 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). With notification of participation in the RMC, Permittees were required to commence water quality data collection by October 2011. 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. SCVURPPP will continue its participation in the RMC during the permit term of MRP 2.0.

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 MRP 1.0. 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). A total of 27 regional projects are identified in the RMC Work Plan, based on the requirements described in provision C.8 of MRP 1.0[4].

Regionally implemented activities in and related to the RMC Work Plan 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[5]. 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
Clean Water Program of Alameda County (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

[4] Several regional projects have already been identified and will be conducted in compliance with MRP 2.0; however, the RMC will likely not compile the project descriptions in an updated Multi-Year Work Plan.
[5] Regional projects conducted in compliance with MRP 2.0 will continue to follow BASMAA Operational Policies and Procedures.

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

In WY2015, SCVURPPP continued to coordinate with water quality monitoring programs conducted by third parties, but supplement Bay Area stormwater monitoring conducted via MRP 1.0. These programs include the San Francisco Bay Regional Monitoring Program (RMP) for Water Quality's 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 each of these programs are reported in this document and were utilized to comply with provision C.8 of MRP 1.0, consistent with subprovision C.8.a.[6] Data are specifically reference in sections 5.0 (POC Monitoring) and 6.0 (Trends Monitoring) of this report.

[6] Data reported by these programs are summarized in this report, however was not reported in the SCVURPPP electronic data submittal.

2.0 SAN FRANCISCO ESTUARY RECEIVING WATER MONITORING

As described in provision C.8.b of MRP 1.0 and C.8.c of MRP 2.0, 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 MRP 1.0, 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 WY2015. These contributions and participation are anticipated to continue through MRP 2.0.

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 2015 Detailed Workplan provides more details and establishes deliverables for each component of the RMP budget (http://www.sfei.org/sites/default/files/biblio_files/2015%20RMP%20Detailed%20Workplan.pdf). More information, including monitoring results, is available in the 2015 *State of the Estuary Report*[7] (http://www.sfestuary.org/about-the-estuary/soter/) and its companion, the 2015 *Pulse of the Bay* (http://www.sfei.org/programs/pulse-bay).

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 S&T Program activities based on ongoing findings. In 2015, the S&T Program was comprised of the

[7] In 2015, the *State of the Estuary Report* was published as an online *Flipbook* with interactive charts and data stories, as well as in portable document format (pdf).

following program elements that collect data to address the RMP management questions described above:

- Long-term water, sediment, and bivalve monitoring
- Episodic toxicity monitoring
- Sport fish monitoring on a five-year cycle
- USGS hydrographic and sediment transport studies
  - Factors controlling suspended sediment in San Francisco Bay
  - Hydrography and phytoplankton
- Triennial bird egg monitoring (cormorant and tern)
- Sediment sampling in Bay Margins

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 2015, Pilot and Special Studies focused on the following topics:

- Continuous monitoring of nutrients and dissolved oxygen at moored sensors
- Nutrients loads modeling
- Small tributary load monitoring (see Section 5.0 for more details)
- Chemicals of emerging concern (CEC) monitoring (perfluorochemicals, fipronil, and microplastics)
- Selection of priority margin areas for evaluation and development of conceptual PCB models
- Selenium in fish tissue monitoring

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 WY2015, 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) and the STLS Multi-Year Monitoring Plan (MYP). 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 WY2015, 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)
- Contaminant Fate Workgroup (CFWG)
- Exposure and Effects Workgroup (EEWG)
- Emerging Contaminant Workgroup (ECWG)
- Sport Fish Monitoring Workgroup
- Nutrient Technical Workgroup
- Strategy Teams (e.g., Small Tributaries, PCBs, Mercury, Dioxins, 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 RMP's *Pulse of the Estuary*, 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 Permittees' interests were represented.

3.0 CREEK STATUS MONITORING

Provision C.8.c of MRP 1.0 and provision C.8.d of MRP 2.0 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?

Creek status monitoring parameters, methods, occurrences, durations and minimum number of sampling sites for each stormwater program are described in Table 8.1 of MRP 1.0. Based on the implementation schedule described in MRP provision C.8.a.ii, creek status monitoring coordinated through the RMC began in October 2011.

The RMC's regional monitoring strategy for complying with MRP provision C.8.c - Creek Status Monitoring - 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).

Creek status monitoring data from WY2015 were submitted to the Regional Water Board by SCVURPPP. The analyses of results from creek status monitoring conducted by SCVURPPP in WY2015 are summarized below and presented in detail in Appendix A (SCVURPPP WY2015 Creek Status Monitoring Report).

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 bioassessment, nutrients and conventional analytes. Riparian assessments, chlorine measurements, and collection of water and sediment toxicity and sediment chemistry samples are also conducted at probabilistic sites. Twenty probabilistic sites were sampled by SCVURPPP in WY2015. An additional three non-urban sites were sampled by the Regional Water Board as part of the Surface Water Ambient Monitoring Program (SWAMP), in collaboration with SCVURPPP; however, the SWAMP data were not yet available at the time this report was completed.

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. In WY2015, SCVURPPP targeted the same sites as WY2014. Targeted monitoring parameters consist of water temperature, general water quality, and pathogen indicators using methods, sampling frequencies, and number of stations required in Table 8.1 of MRP 1.0. Hourly water temperature measurements were recorded during the dry season at nine sites using HOBO® temperature data loggers in the Guadalupe River (n=4) and Stevens Creek (n=5) watersheds. 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 Stevens Creek. Water samples were collected at five sites for analysis of pathogen indicators (*E. coli* and fecal coliform).

Probabilistic and targeted Creek Status monitoring stations are listed in Table E-1 and illustrated in Figure 1.1.

3.1 Management Questions

The first MRP creek status management question (***Are water quality objectives, both numeric and narrative, being met in local receiving waters, including creeks, rivers and tributaries?***) is addressed primarily through the evaluation of probabilistic and targeted monitoring data with respect to the triggers defined in MRP 2.0. 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 evaluation of 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 (***Are conditions in local receiving waters supportive of or likely supportive of beneficial uses?***) is addressed primarily by assessing indicators of aquatic biological health using benthic macroinvertebrate and algae data collected at probabilistic sites. Biological condition scores 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 Creek Status Results/Conclusions

Probabilistic Survey Design

- Between WY2012 and WY2015, a total of 92 probabilistic sites were sampled by SCVURPPP (n=80) and SWAMP (n=12)[8] in Santa Clara County, including 70 urban and 22 non-urban sites. There are now a sufficient number of samples from probabilistic sites to develop estimates of biological condition and stressor assessment for urban streams in Santa Clara County. A larger dataset is needed to estimate biological condition at more local scales (e.g., watershed and jurisdictional areas) and more than four years of data are required to assess trends.

Biological Condition

- The California Stream Condition Index (CSCI) tool was used to assess the biological condition for benthic macroinvertebrate (BMI) data collected at probabilistic sites. Of the 20 sites monitored in WY2015, three sites were rated in good condition (CSCI scores ≥ 0.795); four sites rated as likely altered condition (CSCI score 0.635 – 0.795) and thirteen sites rated as very likely altered condition (≤ 0.635) (Figure 3.2).
- Three algae indices of biological integrity (IBI) metrics were used to evaluate benthic algae data collected synoptically with BMIs at probabilistic sites. These include D18 (diatoms), S2 (soft algae, and H20 (combination of diatoms and algae). Five of the twenty sites ranked in good condition based on D18 scores (D18 ≥ 62). Two of these sites ranked in good condition for each of the three algae IBIs (D18, S2 and H20). The algae IBI results should be considered preliminary until additional research shows that these tools perform well for data collected in Santa Clara County. The five urban sites that ranked in good condition based on either CSCI or D18 scores had similar characteristics: limited urban influence (1-5% impervious area); foothill region of Santa Cruz Mountains (sites ranged between 400 and 750 feet in elevation); and not located below a major dam. Three of the five sites had non-perennial flow status.
- There was very little difference in CSCI or algae IBI scores between perennial (n=14) and non-perennial (n=6) sites. Both CSCI scores and algae IBI scores were responsive to the level of urbanization (calculated as percent impervious area).

[8] The data from three SWAMP samples collected in WY2015 were not available for analyses in this report. Data results from nine probabilistic sites sampled by SWAMP are included in this report.

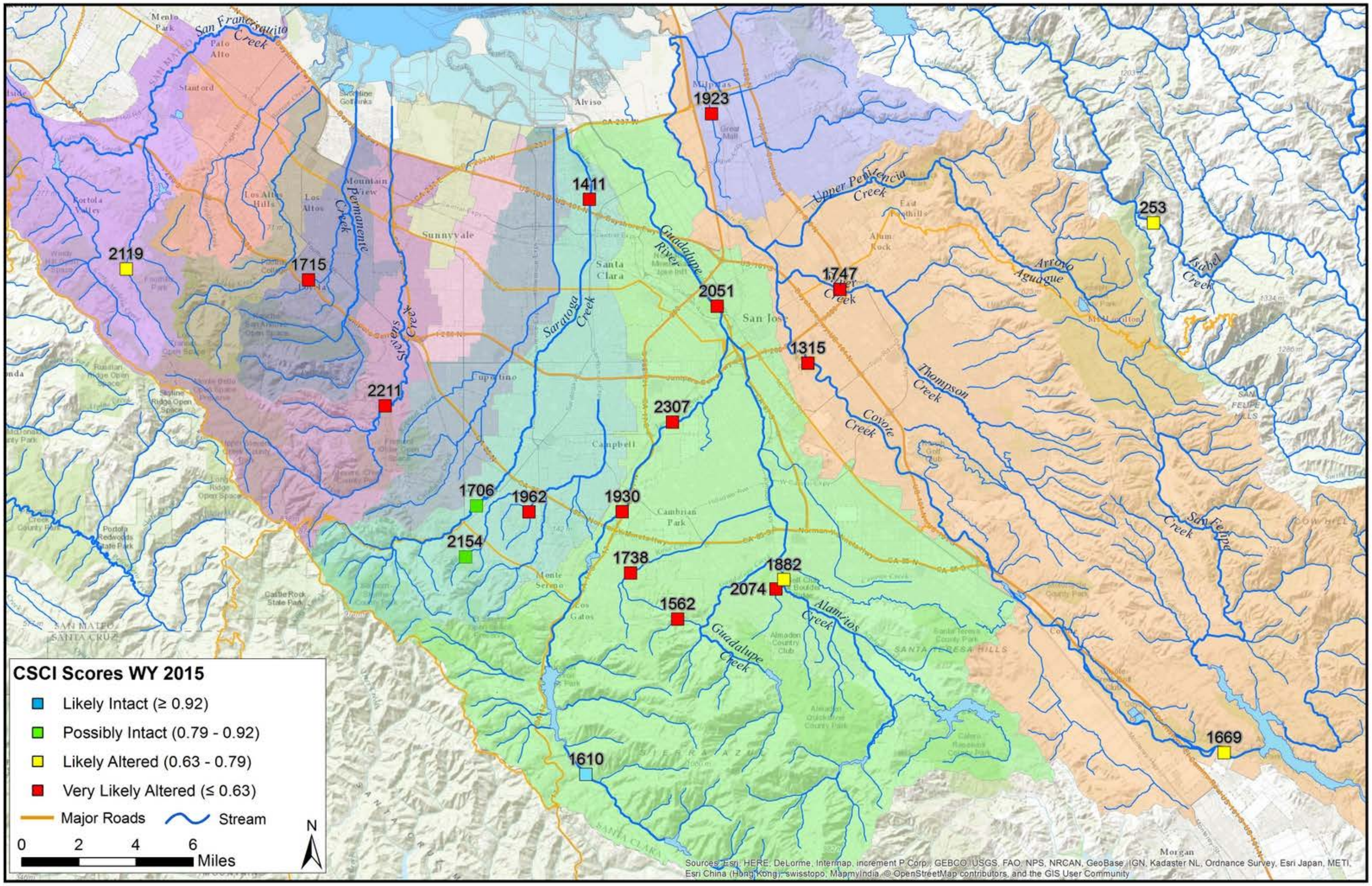

Figure 3.2. CSCI condition category for sites sampled in WY2015, Santa Clara County.

- CSCI scores were better correlated with site elevation (r^2 =0.76) compared to D18 scores (r^2= 0.13), suggesting at these sites, physical habitat variables associated with changing elevation (e.g., stream gradient, substrate size) have greater influence on the BMI community compared to diatom assemblages.

Stressor Assessment

- Nutrients, algal biomass indicators, and other conventional analytes were measured in samples collected concurrently with bioassessments which are conducted in the spring season. Trigger thresholds (water quality objectives) for chloride, unionized ammonia, and nitrate were generally not exceeded.
- Land use variables (percent impervious and urban), specific conductivity, unionized ammonia and suspended sediment concentration (SSC) showed negative correlations with CSCI scores. Two physical habitat (PHAB) parameters (epifaunal substrate score and channel alteration score) were positively correlated with CSCI scores.

Potential Impacts to Aquatic Life

- Potential impacts to aquatic life were assessed through analysis of continuous temperature data collected at nine targeted stations and continuous general water quality data (pH, dissolved oxygen, specific conductance, temperature) collected at three targeted stations. Stations were deliberatively selected using the Directed Monitoring Design Principle.
- **Temperature:** Four of the five temperature stations in Stevens Creek and three of the four temperature stations in Guadalupe Creek exceeded the MRP 2.0 trigger threshold of having two or more weeks where the maximum weekly average temperature (MWAT) exceeded 17°C. Furthermore, two of the three general water quality stations in Stevens Creek exceeded the MWAT trigger. 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 the National Marine Fisheries Service (NMFS) suggests that temperature is not a limiting factor for salmonid habitat (i.e., summer rearing juveniles) in the study reaches.
- **Dissolved Oxygen:** The water quality objective (WQO) for dissolved oxygen 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 Stevens Creek.
- **pH:** Values for pH measured at the three Stevens Creek sites in WY2015 were within WQOs (6.5 to 8.5).
- **Conductivity:** Specific conductivity concentrations recorded at the three Stevens Creek sites in WY2015 were below the trigger threshold of 2000 us/cm.
- **Chlorine:** Field testing for free chlorine and total chlorine residual was conducted at all 20 probabilistic sites concurrent with spring bioassessment sampling (April-May), and at a subset (three) of the sites concurrent with dry season toxicity sampling (July). The MRP 1.0 trigger threshold of 0.08 mg/L was exceeded at one site on Lower Penitencia Creek. This site will be added to the list of candidate SSID projects.

Potential Impacts to Water Contact Recreation

- Pathogen indicator densities were measured at five targeted sites during WY2015. Although none of the stations could be considered "bathing beaches," monitoring locations at each creek were selected at city parks or trails that were considered to exhibit a potential for public access.

Threshold triggers for fecal coliform and *E. coli* were exceeded at one site in Saratoga Creek (205SAR005). This site 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 WY2015 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.

Water/Sediment Toxicity and Sediment Chemistry

- Water toxicity samples were collected from three sites during two sampling events (winter storm event and summer). Although all three wet weather samples exhibited toxicity relative to the Lab Control treatment, no water toxicity samples exceeded MRP 1.0 trigger thresholds.
- Sediment toxicity and chemistry samples were collected concurrently with the summer water toxicity samples. There was complete mortality to *Hyalella azteca* in the sample from Alamitos Creek.
- All three sediment samples exceeded the trigger threshold from MRP 2.0 with at least one Threshold Effect Concentration (TEC) quotient or Probable Effect Concentration (PEC) quotient greater than or equal to 1.0. Therefore, all sites will be added to the list of candidate SSID projects. However, these findings were not unexpected in Santa Clara County where naturally occurring chromium and nickel from serpentinite geology often results in high concentrations of these metals in receiving water sediments.
- The Alamitos Creek sediment sample had a relatively high concentration of mercury, likely due to its location downstream of the former New Almaden Mercury Mining District. Mercury contamination in the Guadalupe River watershed (which contains Alamitos Creek) and throughout the region is being investigated and controlled through implementation of the San Francisco Bay and Guadalupe River Watershed Mercury TMDL water quality restoration program

3.3 Trigger Assessment

The MRP requires analysis of the monitoring data to identify candidate sites for SSID projects. Creek Status Monitoring data were collected pursuant to MRP 1.0 but were evaluated and reported pursuant to MRP 2.0 which became effective January 1, 2016. Trigger thresholds against which to compare the data are provided for most monitoring parameters in MRP 2.0 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. In compliance with provision C.8.e.i of MRP 2.0, all monitoring results exceeding trigger thresholds are added to a list of candidate SSID projects that will be maintained throughout the permit term. Follow up SSID projects will be selected from this list. Table 6.1 lists of candidate SSID projects based on WY2015 Creek Status 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 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 WY2015. "No" indicates samples were collected but did not exceed the MRP trigger; "Yes" indicates an exceedance of the MRP trigger

Station Number	Creek	Bioassessment [1]	Nutrients [2]	Chlorine	Water Toxicity	Sediment Toxicity	Sediment Chemistry	Continuous Temperature	Continuous WQ	Pathogen Indicators
204R00253	Isabella Creek	Yes	No	No	--	--	--	--	--	--
205R01315	Coyote Creek	Yes	No	No	--	--	--	--	--	--
205R01411	San Thomas Aquino	Yes	No	No	No	No	Yes	--	--	--
205R01562	Shannon Creek	Yes	No	No	--	--	--	--	--	--
205R01610	Los Gatos Creek	No	No	No	--	--	--	--	--	--
205R01669	Coyote Creek	Yes	No	No	--	--	--	--	--	--
205R01706	Saratoga Creek	No	No	No	No	No	Yes	--	--	--
205R01715	Hale Creek	Yes	No	No	--	--	--	--	--	--
205R01738	Ross Creek	Yes	No	No	--	--	--	--	--	--
205R01747	Lower Silver Creek	Yes	No	No	--	--	--	--	--	--
205R01882	Alamitos Creek	Yes	No	No	No	Yes	Yes	--	--	--
205R01923	Lower Penitencia Creek	Yes	No	Yes	--	--	--	--	--	--
205R01930	Los Gatos Creek	Yes	No	No	--	--	--	--	--	--
205R01962	Sobey Creek	Yes	No	No	--	--	--	--	--	--
205R02051	Guadalupe River	Yes	No	No	--	--	--	--	--	--
205R02074	Golf Creek	Yes	Yes	No	--	--	--	--	--	--
205R02119	Los Trancos Creek	Yes	No	No	--	--	--	--	--	--
205R02154	Wildcat Creek	No	No	No	--	--	--	--	--	--
205R02211	Stevens Creek	Yes	No	No	--	--	--	--	--	--
205R02307	Los Gatos Creek	Yes	No	No	--	--	--	--	--	--
205SAR005	Saratoga Creek	--	--	--	--	--	--	--	--	Yes
205STE064	Stevens Creek	--	--	--	--	--	--	Yes	--	No
205STE065	Stevens Creek	--	--	--	--	--	--	Yes	Yes	No
205STE070	Stevens Creek	--	--	--	--	--	--	Yes	--	--
205STE071	Stevens Creek	--	--	--	--	--	--	--	Yes	No
205STE095	Stevens Creek	--	--	--	--	--	--	Yes	--	--
205STE105	Stevens Creek	--	--	--	--	--	--	No	No	--
204GUA225	Arroyo Calero	--	--	--	--	--	--	--	--	No
205GUA205	Guadalupe Creek	--	--	--	--	--	--	Yes	--	--
205GUA210	Guadalupe Creek	--	--	--	--	--	--	Yes	--	--
205GUA213	Guadalupe Creek	--	--	--	--	--	--	Yes	--	--
205GUA218	Guadalupe 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. Station 205R02074 > unionized ammonia threshold.

3.4 Management Implications

The Program's Creek Status Monitoring program (consistent with MRP 1.0 provision C.8.c) focuses 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 for probabilistic sites in WY2015 (overall n=20; urban n=19) is not sufficient to develop statistically representative conclusions regarding the overall condition of all creeks, it builds on data collected in WY2012 through WY2014 and is used in a preliminary regional analysis of biological indicator and stressor data collected in Santa Clara County (Attachment 2). Even considering WY2015 data alone, it is clear that 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, creek sediments in the vicinity of historic mining operations contain mercury at concentrations known to adversely affect sensitive aquatic organisms (i.e., PEC). Furthermore, 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 1.0 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 develop (LID) methods, such as rainwater harvesting and use, infiltration and biotreatment are required as part of development and redevelopment projects. These LID measures are expected to reduce the impacts of urban runoff and associated impervious surfaces on stream health. MRP 2.0 expands these requirements to include Green Infrastructure (GI) planning for all municipal projects
- In compliance with MRP 1.0 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. This work will continue under MRP 2.0.
- Trash loadings to local creeks have been reduced through implementation of new control measures in compliance with MRP 1.0 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. MRP 2.0 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 1.0 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. These programs will continue under MRP 2.0.

- In compliance with MRP 1.0 provision C.13, copper in stormwater runoff is reduced through implementation of controls such as architectural and site design requirements, street sweeping, and participation in statewide efforts to significantly reduce the level of copper vehicle brake pads. These measures will be continued during the MRP 2.0 permit term.
- Mercury and polychlorinated biphenyls (PCBs) in stormwater runoff are being reduced through implementation of the respective TMDL water quality restoration plans. Under MPR 2.0, the Program will continue to identify sources of these pollutants and will implement control actions designed to achieve new minimum load reduction goals.

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 (e.g., Santa Clara Valley Water District Integrated Water Resources Master Plan (IWRMP) or “One Water Plan”). 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.

4.0 MONITORING PROJECTS

Three types of monitoring projects are required by provision C.8.d of MRP 1.0:

1. Stressor/Source Identification Projects (C.8.d.i);
2. BMP Effectiveness Investigations (C.8.d.ii); and,
3. Geomorphic Projects (C.8.d.iii).

The overall scopes of these projects are generally described in MRP 1.0 and the RMC Work Plan (BASMAA 2011). The results of projects conducted by SCVURPPP in WY2015 are described below.

4.1 Stressor/Source Identification Projects

4.1.1 MRP 1.0 SSID Projects

As a participant in the RMC, SCVURPPP agreed to initiate three Stressor/Source Identification (SSID) Projects toward the region wide minimum of ten SSID Projects required by MRP 1.0. The SSID Projects must identify and isolate potential sources and/or stressors associated with observed water quality impacts. Creeks considered for SSID Projects are those with creek status monitoring results that exceed the triggers identified in Table 8.1 of MRP 1.0.

SCVURPPP completed two SSID Projects in WY2013 and initiated a third SSID Project in WY2013. These projects are also summarized in the Regional SSID Project Report which includes all SSID projects that have been conducted by the RMC (Appendix B).

- The Coyote Creek SSID Project investigated reduced dissolved oxygen concentrations during the late summer/fall season in an urban reach near Watson Park. Results of the Coyote Creek SSID Project, completed in WY2013, were included in the Integrated Monitoring Report (SCVURPPP 2014a).
- The Guadalupe River SSID Project investigated recurrent fish kills associated with low dissolved oxygen in the watershed. Results of the Guadalupe River SSID Project, completed in WY2013, were included in the Integrated Monitoring Report (SCVURPPP 2014a).
- The Upper Penitencia Creek SSID Project will investigate low creek condition scores (e.g., CSCI, SoCal B-IBI) and temperature trigger exceedances following the Causal Analysis/Diagnosis Decision Information System (CADDIS) framework developed by the USEPA (2010). This SSID Project was initiated in WY2013 but has been suspended due to severe drought conditions resulting in a lack of flow in the study reach during the bioassessment index period. The study will continue when normal or wet weather conditions resume, as is anticipated for WY2016. A Project Work Plan for the Upper Penitencia Creek SSID Project was included with the WY2014 Urban Creeks Monitoring Report (SCVURPPP 2015). See Figure 1.1 for the general watershed location of the Upper Penitencia Creek SSID Project.

SSID projects conducted by RMC partners are summarized in the Regional SSID Project Summary Table (Appendix B).

4.1.2 MRP 2.0 SSID Projects

Provision C.8.e of MRP 2.0 requires that Permittees initiate a minimum number of SSID projects during the permit term. SCVURPPP intends to continue its participation in the RMC for which there is a region-wide minimum of eight new SSID Projects during the permit term. SCVURPP has not yet initiated any SSID projects during MRP 2.0. Provision C.8.e requires that creek status, toxicity, and pesticide monitoring results (C.8.d and C.8.g) are reviewed annually and that a list is developed of all results exceeding the C.8.d trigger thresholds. Pollutant of Concern Monitoring (C.8.f) results may be included on the list as appropriate. See Table 3.2 for the list of WY2015 trigger exceedances. These sites will be considered as candidates for future SSID projects.

4.2 BMP Effectiveness Investigation

Provision C.8.d.ii of MRP 1.0 requires Permittees to investigate the effectiveness of one stormwater treatment or hydrograph modification control measure.[9] The control measures used to fulfill requirements in provisions C.3, C.11, or C.12 may be used to fulfill this requirement provided the investigation includes a range of pollutants generally found in urban runoff.

Through the Clean Watersheds for Clean Bay project (CW4CB) and modeling conducted in compliance with provision C.3.iii (Green Streets Pilot Projects) of MRP 1.0, SCVURPPP is conducting a number of stormwater treatment effectiveness investigations in collaboration with the RMC. Specific to SCVURPPP Co-permittees, the Program is currently conducting effectiveness investigations at a stormwater treatment device in the Leo Avenue watershed (City of San Jose) as part of the CW4CB project. The CW4CB monitoring design at Leo Avenue includes paired influent and effluent sampling and volume/flow measurements to calculate Polychlorinated Biphenyl (PCB) and mercury load reductions. CW4CB analytical constituents include suspended sediments, total organic carbon, lead, mercury, and PCBs. Additional constituents generally found in stormwater runoff (e.g., nutrients, cadmium, chromium, copper, nickel, zinc) were added by the Program to supplement the CW4CB investigation and to comply with provision C.8.d.ii of MRP 1.0. Samples were collected and flow volumes were measured during two storm events in WY2014 and two events in WY2015. Detailed descriptions of the treatment device, monitoring methods, analytical results, and hydrologic calculations will be included in the final report for the project, which is anticipated to be completed by September 2016. An assessment of the effectiveness of the Leo Avenue stormwater treatment device for PCB and mercury removal will be conducted through the CW4CB program. The CW4CB Final Report is anticipated in April 2017.

4.3 Geomorphic Project

Provision C.8.d.iii of MRP 1.0 requires Permittees to conduct a geomorphic monitoring project intended to answer the management question:[10]

- How and where can our creeks be restored or protected to cost-effectively reduce the impacts of pollutants, increased flow rates, and increased flow durations of urban runoff?

The provision requires that Permittees select a waterbody/reach, preferably one that contains significant fish and wildlife resources, and conduct one of three types of projects. SCVURPPP elected to conduct a geomorphic study to help in the development of regional curves which help estimate equilibrium channel conditions for different sized drainages. As part of this Geomorphic Study, SCVURPPP surveyed bankfull geometries at two consecutive riffles in Coyote Creek above Coyote Reservoir near USGS gaging station #11169800 (Coyote Creek near Gilroy, CA). The results of the Geomorphic Study were described in the Integrated Monitoring Report (SCVURPPP 2014a).

[9] MRP 2.0 does not require a BMP Effectiveness Investigation under Provision C.8 but does require monitoring to provide information on the effectiveness of future or existing management actions under Provision C.8.f (Pollutants of Concern Monitoring). SCVURPPP is still in the process of developing a monitoring approach to comply with this requirement.

[10] MRP 2.0 does not require that Permittees conduct a Geomorphic Project under Provision C.8.

5.0 POC LOADS MONITORING

Pollutants of Concern (POC) loads monitoring is required by provision C.8.e.i of MRP 1.0[11]. Loads monitoring is intended to assess inputs of POCs to the Bay from local tributaries and urban runoff, assess progress toward achieving wasteload allocations (WLAs) for TMDLs, and help resolve uncertainties associated with loading estimates for these pollutants. In particular, there are four priority management questions that need to be addressed though POC loads monitoring:

1. Which Bay tributaries (including stormwater conveyances) contribute most to Bay impairment from POCs?
2. What are the annual loads or concentrations of POCs from tributaries to the Bay?
3. What are the decadal-scale loading or concentration trends of POCs from small tributaries to the Bay?
4. What are the projected impacts of management actions (including control measures) on tributaries and where should these management actions be implemented to have the greatest beneficial impact?

In WY2015, SCVURPPP complied with Provision C.8.e.i of MRP 1.0 through:

- Continued participation in the RMP Small Tributaries Loading Strategy (STLS) Team, and
- Implementation of a targeted reconnaissance sediment sampling program (i.e., the PCBs and Mercury Opportunity Area Analysis).

POC monitoring in WY2015 focused primarily on identification of source areas of PCBs and mercury to the MS4 and San Francisco Bay. This approach differed from prior years and addressed the reprioritization of near-term information needs that occurred during development of MRP 2.0. Both components of WY2015 POC monitoring are described below.

5.1 Small Tributaries Loading Strategy

The RMP STLS 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 loads 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 MRP 1.0, 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:

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

[11] Provision C.8.f of MRP 2.0 requires POC Monitoring of PCBs, mercury, copper, emerging contaminants, and nutrients. MRP 2.0 defines yearly and total minimum number of samples for each POC. Five priority POC management information needs are identified including Source Identification, Contributions to Bay Impairment, Management Action Effectiveness, Loads and Status, and Trends. MRP 2.0 specifies minimum number of samples for each POC that must address each information need. SCVURPPP is in the process of developing a POC monitoring framework to comply with Provision C.8.f of MRP 2.0 over the next five years.

- Watershed monitoring at six fixed stations.

Based on the lessons learned through the implementation of the STLS MYP in WY2012, WY2013, and WY2014, and the reprioritization of near-term information needs, SCVURPPP and its RMC partners implemented a revised approach to POC Loads monitoring in WY2015[12]. The revised monitoring approach was discussed at numerous STLS workgroup meetings during WY2014[13] 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 WY2015 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 WY2015.

5.1.1 Wet Weather Characterization

With a goal of identifying watershed sources of PCBs and mercury, STLS field monitoring in WY2015 focused on collection of storm composite samples in the downstream reaches of approximately 20 catchments located throughout the region. The catchments range in size from 42 to 2,842 acres and represent both natural creek watersheds and engineered MS4 drainage areas. 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 conducted at a subset of 12 locations to collect fine sediments using specialized settling chambers. A full description of the methods and results is included in Appendix D (POC Reconnaissance Monitoring Progress Report, Water Year 2015).

Eight catchments were targeted in Santa Clara County based on recommendations by Program staff evaluating land uses in the County. (See Appendix C - PCBs and Mercury Source Area Identification, Water Year 2015 POC Monitoring Report for a detailed description of the land use analysis approach.) All but one of the eight Santa Clara County sampling stations were located at manholes accessing the MS4 or MS4 outlets to receiving waters. One station was located within a receiving water (Lower Penitencia Creek) which had been sampled for PCBs in 2011. The prior Lower Penitencia Creek sample in 2011 had lower PCB concentrations (19 ng/g average particle ratio) than would be expected by the amount of impervious cover in the watershed. Similar analytical results in WY2015 (14 ng/g particle ratio) add credibility to the 2011 results and suggest that Lower Penitencia Creek is not a major source of PCBs to the Bay.

Wet weather characterization monitoring will continue in WY2016 with support and sample station identification by SCVURPPP.

Compliance with 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 WY2015 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

[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.

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. With one exception (Lower Penitencia Creek station), 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 WY2015, 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 are based on hardness which was not measured in the WY2015 samples. Therefore, the comparison of data collected in WY2015 to applicable numeric WQOs or criteria adopted by the Regional Water Board is limited to total mercury.

All of the samples collected in Santa Clara County in WY2015 were well below the freshwater acute objective for mercury of 2.4 µg/L. Total mercury concentrations ranged from 0.024 µg/L to 0.085 µg/L. See Appendix C for tables listing the sampling results.

5.1.2 Regional Watershed Spreadsheet Model

The STLS Team and SPLWG continued to provide oversight in WY2015 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 WY2015, a water-based model was adopted for PCBs and mercury along with new approaches to calibration which reflect the log-normal distribution of the dataset. The improved RWSM can be used for estimating regional scale annual average loads and could be useful for determining relative loading between sub-regions and more polluted versus less polluted watersheds.

During WY2015, SCVURPPP reviewed and provided input on draft reports referencing the RWSM or its loadings estimates (e.g., DRAFT Sources, Pathways and Loadings: Multi-Year Synthesis with a focus on PCBs and Hg). SCVURPPP also participated in the SPLWG which is the main venue for soliciting input from interested parties and technical advisors. SCVURPPP also worked with SFEI to identify potential GIS land use data layer improvements.

In WY2016, additional calibration data from the WY2015 wet weather characterization monitoring and BASMAA studies will be incorporated into the model. 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 will be made in consultation with the STLS and the SPLWG.

5.1.3 STLS Trends Strategy

In WY2015, a new STLS Trends Strategy team 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 support this future need. Initially comprised of SFEI staff, RMC participants, and Regional Water Board staff, the STLS Trends Strategy team met monthly between July and September 2015. Additional interested parties and advisors such as EPA and USGS will be invited to participate in subsequent meetings. In WY2015, the STLS Trends Strategy team developed a mission statement, a list of questions to be addressed by trends monitoring, and a draft document outline. Decisions were also made regarding which indicators (e.g., water concentration, water column particle ratio, load, bed sediment concentration) should be considered under various application scenarios (e.g., Bay Area, single watersheds, individual management measures). The Draft Trends Strategy document in anticipated for review in early 2016. It will summarize the background, management questions, and guiding principles, and will describe coordination between the RMP and BASMAA within the context of the MRP, proposed tasks to answer the management questions, deliverables, and the overall timeline. SCVURPPP will continue to participate in the STLS Trends Strategy team in WY2016.

5.1.4 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 WY2015, but the Program was prepared to institute contingency monitoring in WY2015 to sample water at the Highway 101 station in the event of a qualifying storm. This same approach will be followed in WY2016.

5.2 PCBs and Mercury Opportunity Area Analysis

As part of the development of PCB and mercury loading estimates presented in Part C of the Program's Integrated Monitoring Report (SCVURPPP 2014a), SCVURPPP (in collaboration with SFEI) developed preliminary GIS data layers illustrating potential PCB and mercury source areas. These data layers along with existing data on PCBs/mercury concentrations in sediment and stormwater represent the current state-of-knowledge of source areas for these pollutants in the Santa Clara Valley. These preliminary data layers, however, are based on limited and potentially outdated information on land uses and current activities at properties that may contribute or limit the level of pollutants transported to the Bay via stormwater. In an effort to collect additional information on current land uses, facility practices and contributions of PCBs and mercury from these properties, SCVURPPP conducted a *PCB and Mercury Opportunity Area Analysis* as part of the Program's revised POC monitoring approach in WY2015. The outcome of this activity will assist Permittees in identifying high opportunity areas in the Santa Clara Valley (i.e., within the SCVURPPP program area), which if managed may provide further load reductions.

Appendix C contains the PCBs and Mercury Source Area Identification, Water Year 2015 POC Monitoring Report, which describes results of the *PCB and Mercury Opportunity Area Analysis.* In WY2015 SCVURPPP conducted a targeted reconnaissance sediment sampling program on behalf of its Permittees in compliance with provision C.8.e.i of MRP 1.0. Over 200 bedded sediment samples were collected for PCBs and mercury analysis (these pollutants are often found bound to sediments in the environment) to screen for areas in the urban environment with elevated POC concentrations. The general goal was to continue identifying potential source areas for further study. These areas are potential opportunity areas for implementing controls to reduce stormwater discharges of PCBs and mercury.

Samples were distributed among the municipalities that collectively encompass over 99% of the old industrial land use in Santa Clara County. Sample stations, mapped in Figure 1.1, were sited in locations considered most likely to contain PCBs based on nearby current and historical land use (e.g., PCB-related activities, presence of heavy or electrical equipment, recycling operations) and housekeeping (e.g., pavement in poor condition, evidence of sediment track out) conditions. The Leo Avenue Watershed in San Jose, a known hot spot for PCBs, was specifically excluded from the program. Bedded sediment samples from the urban storm drainage system (e.g., beneath manholes, storm drain inlets) and public right-of-way surfaces (e.g., street gutters) were collected using methods detailed in the Sampling and Analysis Plan (SAP) for PCBs and Mercury Opportunity Area Analysis and Implementation Planning (SCVURPPP 2014b).

Total PCBs (i.e., sum of 40 PCB congeners) concentrations ranged from zero mg/kg to 4.83 mg/kg with an average of 0.13 mg/kg and a median of 0.02 mg/kg. A total of ten samples exceeded the 0.5 mg/kg threshold that was selected by the BASMAA Monitoring and Pollutants of Concern (MPC) Committee as an approximate benchmark for identifying areas that should be considered for future investigation (e.g., additional sampling, records review). Total mercury concentrations ranged from 0.03 mg/kg to 18.90 mg/kg with an average of 0.41 mg/kg and a median of 0.10 mg/kg. There is currently no comparable BASMAA benchmark for mercury; however, twelve samples exceeded 1.0 mg/kg, with ten of those samples being from San Jose. The primary objective of this project was not to identify specific source properties, but to identify areas where further investigation is warranted. However, based on results, there is enough evidence to categorize at least three properties as High Source Areas. Furthermore, at least five of the ten elevated samples (greater than 0.5 mg/kg) will require further investigation to identify the source of PCBs.

The sampling design specifically targeted sample stations within the old industrial landscape that are influenced by parcels that were classified and prioritized as having relatively higher potential to be sources of PCBs. However, a strong correlation between the land use analysis and sampling results was lacking, and only ten percent of the samples had total PCBs concentrations exceeding the 0.5 mg/kg threshold. This suggests that continuing to identify additional source areas and properties in Santa Clara County may be challenging. The remainder of the PCB load attributed to stormwater runoff appears to be coming from sources that are less elevated and more diffuse and will likely be more challenging to control. Thus data collected to-date suggests that the diffuse nature of PCB contamination within the urban landscape may require a rethinking of the approach and timeline needed to meet TMDL load reduction goals.

Identifying pollutant source areas is a challenging and often a multi-year process. The sediment samples collected during this project in combination with historical sediment and stormwater runoff samples are part of an ongoing effort to identify areas in Santa Clara County of high interest for further study and the potential opportunity to implement pollutant controls. SCVURPPP staff has identified priority outfall catchments and associated potential wet weather sampling locations that contain High interest source areas where elevated levels of PCBs have not already been found. SCVURPPP began the process of sampling wet weather composite samples for POC analysis at priority outfall catchments in WY2015 through the RMP (described in Section 5.1.1). In WY2016, the RMP will collect additional wet weather samples at high priority catchments, and SCVURPPP will conduct similar sampling at up to 25 locations. These wet weather samples will help identify catchments that contain source areas where further investigation will be required.

SCVURPPP plans to continue working with other Bay Area countywide stormwater programs (through the BASMAA MPC Committee) 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. Follow-up monitoring will be conducted in coordination with compliance with provision C.8.f (Pollutants of Concern Monitoring) of MRP 2.0. Monitoring under provision C.8.f is intended to address a number of management questions related to priority pollutants such as mercury and PCBs, including helping to identify pollutant source areas. The overall objectives of follow-up efforts to address PCBs and mercury under provisions C.11, C.12 and C.8.f of the reissued MRP will include continuing to identify which pollutant source areas in Santa Clara County provide the greatest opportunities for implementing controls to reduce discharges of these pollutants.

6.0 LONG-TERM TRENDS MONITORING

In addition to POC loads monitoring, provision C.8.e of MRP 1.0 requires Permittees to conduct long-term trends monitoring to evaluate if stormwater discharges are causing or contributing to toxic impacts on aquatic life. Required long-term monitoring parameters, methods, intervals and occurrences are included as Category 3 parameters in Table 8.4 of MRP 1.0, and prescribed long-term monitoring locations are included in Table 8.3. Similar to creek status and POC loads monitoring, MRP provision C.8.a (Compliance Options) allowed RMC participants to commence long-term trends monitoring in October 2011.

As described in the RMC Creek Status and Long-Term Trends Monitoring Plan (BASMAA 2012), the State of California's Surface Water Ambient Monitoring Program (SWAMP) through its Statewide Stream Pollutant Trend Monitoring (SPoT) program currently monitors the seven long-term monitoring sites required by provision C.8.e.ii. Sampling via the SPoT program is currently conducted at the sampling interval described in provision C.8.e.iii in the MRP. The SPoT program is generally conducted to answer the management question:

- What are the long-term trends in water quality in creeks?

Based on discussions with Region 2 Water Board (SWAMP) staff, RMC participants have complied with long-term trends monitoring requirements described in MRP 1.0 provision C.8.e via monitoring conducted by the SPoT program[14]. This manner of compliance is consistent with the MRP language in provisions C.8.e.ii and C.8.a.iv. RMC representatives coordinate with the SPoT program on long-term monitoring to ensure MRP monitoring and reporting requirements are addressed. The three specific goals of the SPoT program are:

1. Determine long-term trends in stream contaminant concentrations and effects statewide.
2. Relate water quality indicators to land-use characteristics and management effort.
3. Establish a network of sites throughout the state to serve as a backbone for collaboration with local, regional, and federal monitoring.

Additional information on the SPoT program can be found at http://www.waterboards.ca.gov/water_issues/programs/swamp/spot/. The most recent technical report prepared by SPoT program staff was published in 2014 and describes five-year trends from the initiation of the program in 2008 through 2012 (Phillips et al. 2014). An update to the report is anticipated in spring 2016.

The statewide network of SPoT sites represents approximately one half of California's watersheds and includes two stations in Santa Clara County at the base of large watersheds (Figure 1.1). Sites are targeted in locations with slow water flow and appropriate micro-morphology to allow deposition and accumulation of sediments. One of the Santa Clara County SPoT stations is located on Coyote Creek; the other is located on Guadalupe River at the POC Loading station (see Section 5.1.4). Stream sediments are collected annually (funding permitting) during summer base flow conditions. Sediments are analyzed for a suite of water quality indicators that may include (depending on funding) organic contaminants (organophosphate, organochlorine, pyrethroid pesticides, and PCBs), trace metals, total organic carbon (TOC), and polycyclic aromatic hydrocarbons (PAHs), and polybrominated diphenyl ethers

[14] Trends monitoring is one of the five priority management information needs identified in Provision C.8.f of MRP 2.0 and is required for PCBs, mercury, and copper. SCVURPPP is in the process of developing a POC monitoring framework to comply with all aspects of Provision C.8.f of MRP 2.0 over the next five years. It is unlikely that data collected through the SPoT program will address requirements of MRP 2.0 Provision C.8.f. Although the SPoT program will continue for the foreseeable future, SCVURPPP may no longer summarize results in future UCMRs prepared in compliance with MRP 2.0.

(PBDEs). Samples are also assessed for toxicity using the amphipod *Hyalella azteca* at standard protocol temperature (23°C) and at cooler temperatures (15°C) that more closely reflect the ambient temperature in California watersheds[15]. Although the data are not yet available, the SPoT analyte list was expanded in 2013 to include algal toxins (microcystin-LR) and the insecticide fipronil. An additional test organism (*Chironomus dilutus*) that is more sensitive to fipronil and imidacloprid was added in 2015. Imidacloprid may be added in the future.

The SPoT report (Phillips et al. 2014) summarizes the 2008 – 2012 data on statewide and regional scales. In addition, pollutant concentrations are correlated to SWAMP bioassessment data and land use characteristics (i.e., urban, agriculture, open space) on the 1 km, 5 km, and watershed scales. The SPoT report made the following ***statewide*** conclusions:

- There is a significant relationship between land use and stream pollution.
- Sediment toxicity remained relatively stable statewide between 2008 and 2011.
- Significantly more samples were toxic when tested at average ambient temperatures (15°C) compared to the standard protocol temperature (23°C). This is likely the result of the presence of pyrethroids which are slower to breakdown (metabolically) at lower temperatures (i.e., less pyrethroid is necessary to create the same toxic response).
- Percent *H. azteca* survival was significantly positively correlated with Index of Biological Integrity (IBI) scores[16]; whereas, pyrethroid pesticides and chlorinated compounds were significantly negatively correlated with IBI scores.
- IBI scores at toxic sites ranged from 0.1 to 13.6 and IBI scores at non-toxic sites ranged from 0 to 73.3, suggesting that factors other than contaminants (e.g., physical habitat) are influencing macroinvertebrate communities.
- There has been a steady decline statewide in organophosphate pesticide concentrations.

Regional conclusions include:

- Sediments from Coyote Creek and Guadalupe Creek showed marked, but statistically insignificant increases in pyrethroids.
- Sediments from Coyote Creek showed a statistically insignificant reduction in DDT.

SPoT program staff provided SCVURPPP with monitoring data from the two Santa Clara County sites (205COY060 – Coyote Creek, and 205GUA020 – Guadalupe Creek). Data provided for 2013 and 2014 are preliminary and have not been through the full data validation process. SCVURPPP evaluated the data using the same methods used to evaluate MRP 1.0 provision C.8.c sediment data. Threshold Effect Concentration (TEC) (Tables 6.1 and 6.2) and Probable Effect Concentration (PEC) quotients (Tables 6.3 and 6.4) as defined in MacDonald et al. (2000) were calculated for all non-pyrethroid constituents. In addition, pyrethroid Toxic Unit (TU) equivalents (Tables 6.5 and 6.6) were calculated using TOC-normalized data and LC50 values from Maund et al. (2002) and Amweg et al. (2005).

TEC and PEC quotients for sediment concentrations of metals, PAHs, and organic contaminants at the Santa Clara County SPoT stations are generally higher than those calculated for Creek Status monitoring (Provision C.8.c. of MRP 1.0) which was conducted in the same watersheds. These results may illustrate the ongoing movement of fine sediment and variability in sources. They may also reflect the location of the SPoT stations which are typically lower in the watershed than Creek Status stations.

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[15] *Hyalella azteca* toxicity increases with decreasing temperature due to slower metabolic breakdown of pyrethroids at lower temperatures and increased nerve sensitivity.

[16] IBI scores were calculated using methods that were appropriate to each region. The California Stream Condition Index (CSCI) will likely be used in the next reporting cycle.

Table 6.2. Threshold Effect Concentration (TEC) quotients for sediment chemistry constituents measured by SPoT at Coyote Creek. Bolded values exceed 1.0.

Site ID – Creek / Sample Date	TEC	205COY060 – Coyote Creek						
		6/17/08	6/16/09	6/30/10	7/21/11	7/5/12	7/2/13	7/25/14
Metals (mg/kg DW)								
Arsenic	*9.79*	0.71	0.58	0.75	0.82	0.68	0.74	ns
Cadmium	*0.99*	0.54	0.39	0.57	0.68	0.57	0.81	ns
Chromium	*43.4*	2.10	2.35	2.24	2.23	2.00	3.62	ns
Copper	*31.6*	1.33	0.91	1.51	1.50	1.56	2.02	ns
Lead	*35.8*	0.87	0.59	0.83	0.64	0.74	1.22	ns
Mercury	*0.18*	0.79	0.54	1.59	0.79	1.01	10.3	ns
Nickel	*22.7*	3.44	3.30	3.61	3.79	3.59	5.55	ns
Zinc	*121*	1.29	0.98	1.50	1.42	1.74	1.99	ns
PAHs (µg/kg DW)								
Anthracene	*57.2*	0.16	2.36	0.05	0.16	0.06	0.10	0.10
Fluorene	*77.4*	0.06	1.71	0.03	0.00	0.02	0.04	0.05
Naphthalene	*176*	0.08	0.38	0.04	0.06	0.02	0.04	0.05
Phenanthrene	*204*	0.23	5.15	0.11	0.21	0.08	0.15	0.20
Benz(a)anthracene	*108*	0.29	3.78	0.09	0.26	0.11	0.19	0.37
Benzo(a)pyrene	*150*	0.31	2.59	0.08	0.18	0.11	0.20	0.30
Chrysene	*166*	0.32	4.77	0.16	0.37	0.15	0.21	0.32
Dibenz[a,h]anthracene	*33.0*	0.49	3.67	0.15	0.48	0.13	0.29	0.37
Fluoranthene	*423*	0.20	0.00	0.08	0.18	0.08	0.13	0.20
Pyrene	*195*	0.52	0.00	0.22	0.45	0.21	0.30	0.50
Total PAHs	*1,610*	0.52	3.44	0.17	0.44	0.20	0.34	0.45
Pesticides (µg/kg DW)								
Chlordane	*3.24*	5.62	2.81	1.30	2.35	2.53	**3.63**	ns
Dieldrin	*1.90*	1.15	0.57	0.00	0.00	0.00	0.57	ns
Endrin	*2.22*	0.00	0.00	0.00	0.00	0.00	0.00	ns
Heptachlor Epoxide	*2.47*	0.00	0.00	0.00	0.00	0.00	0.00	ns
Lindane (gamma-BHC)	*2.37*	0.00	0.00	0.00	0.00	0.00	0.00	ns
Sum DDD	*4.88*	3.29	1.86	0.74	0.00	0.00	**1.52**	ns
Sum DDE	*3.16*	6.10	3.92	1.61	2.97	2.97	**3.92**	ns
Sum DDT	*4.16*	1.48	0.67	0.00	0.00	0.00	0.69	ns
Total DDTs	*5.28*	7.85	4.59	1.65	1.78	1.78	**4.30**	ns
Total PCBs	*59.8*	0.88	0.36	0.09	0.00	0.13	0.50	ns
Number of constituents with TEC >= 1.0		10	14	8	7	8	10	--

ns = not sampled in WY2015 due to budget limitations

Table 6.3. Threshold Effect Concentration (TEC) quotients for sediment chemistry constituents measured by SPoT at Guadalupe Creek. Bolded values exceed 1.0.

Site ID – Creek		205GUA020 – Guadalupe Creek					
Sample Date	TEC	6/17/08	6/30/10	7/21/11	7/5/12	7/2/13	7/25/14
Metals (mg/kg DW)							
Arsenic	*9.79*	0.69	0.65	0.60	0.55	0.74	ns
Cadmium	*0.99*	0.91	1.20	0.75	1.19	0.81	ns
Chromium	*43.4*	4.10	3.55	2.76	2.65	3.62	ns
Copper	*31.6*	1.71	2.20	1.61	1.63	2.02	ns
Lead	*35.8*	1.33	1.37	1.09	1.13	1.22	ns
Mercury	*0.18*	6.06	11.0	6.83	4.33	10.3	ns
Nickel	*22.7*	4.10	5.29	4.22	4.33	5.55	ns
Zinc	*121*	1.96	2.13	1.58	1.88	1.99	ns
PAHs (µg/kg DW)							
Anthracene	*57.2*	0.57	0.37	0.33	0.65	0.20	0.17
Fluorene	*77.4*	0.15	0.08	0.09	0.18	0.06	0.06
Naphthalene	*176*	0.15	0.09	0.07	0.07	0.06	0.05
Phenanthrene	*204*	0.84	0.84	0.46	0.73	0.33	0.34
Benz(a)anthracene	*108*	1.11	1.40	0.60	1.44	0.41	0.50
Benzo(a)pyrene	*150*	1.27	0.90	0.41	0.93	0.38	0.43
Chrysene	*166*	0.93	1.72	0.66	1.55	0.36	0.40
Dibenz[a,h]anthracene	*33.0*	1.02	2.09	0.95	1.40	0.41	0.41
Fluoranthene	*423*	1.84	1.16	0.53	0.88	0.25	0.30
Pyrene	*195*	0.00	2.26	1.18	1.85	0.61	0.64
Total PAHs	*1,610*	1.63	1.80	0.94	1.52	0.56	0.60
Pesticides (µg/kg DW)							
Chlordane	*3.24*	4.73	3.67	5.22	29.1	4.60	ns
Dieldrin	*1.90*	1.35	0.00	0.00	0.00	0.57	ns
Endrin	*2.22*	0.00	0.00	0.00	0.00	0.00	ns
Heptachlor Epoxide	*2.47*	0.00	0.00	0.00	0.00	0.00	ns
Lindane (gamma-BHC)	*2.37*	0.00	0.00	0.00	0.00	0.00	ns
Sum DDD	*4.88*	3.77	1.31	3.30	5.59	1.42	ns
Sum DDE	*3.16*	5.71	2.63	3.32	3.99	2.80	ns
Sum DDT	*4.16*	1.55	0.00	0.00	0.00	1.25	ns
Total DDTs	*5.28*	8.12	2.78	5.04	7.56	3.98	ns
Total PCBs	*59.8*	1.26	0.61	1.19	2.47	0.74	ns
Number of constituents with TEC >= 1.0		18	17	12	17	11	--

ns = not sampled in WY2015 due to budget limitations

Table 6.4. Probable Effect Concentration (PEC) quotients for sediment chemistry constituents measured by SPoT at Coyote Creek. Bolded values exceed 1.0.

Site ID – Creek		205COY060 – Coyote Creek						
Sample Date	PEC	6/17/08	6/16/09	6/30/10	7/21/11	7/5/12	7/2/13	7/25/14
Metals (mg/kg DW)								
Arsenic	*33.0*	0.21	0.17	0.22	0.24	0.20	0.21	ns
Cadmium	*4.98*	0.11	0.08	0.11	0.13	0.11	0.11	ns
Chromium	*111*	0.82	0.92	0.88	0.87	0.78	0.85	ns
Copper	*149*	0.28	0.19	0.32	0.32	0.33	0.33	ns
Lead	*128*	0.24	0.16	0.23	0.18	0.21	0.22	ns
Mercury	*1.06*	0.13	0.09	0.27	0.13	0.17	0.12	ns
Nickel	*48.6*	**1.61**	**1.54**	**1.69**	**1.77**	**1.67**	**1.81**	ns
Zinc	*459*	0.34	0.26	0.39	0.37	0.46	0.43	ns
PAHs (µg/kg DW)								
Anthracene	*845*	0.01	0.16	0.00	0.01	0.00	0.01	0.01
Fluorene	*536*	0.01	0.25	0.00	0.00	0.00	0.01	0.01
Naphthalene	*561*	0.02	0.12	0.01	0.02	0.01	0.01	0.01
Phenanthrene	*1170*	0.04	0.90	0.02	0.04	0.01	0.03	0.03
Benz(a)anthracene	*1050*	0.03	0.39	0.01	0.03	0.01	0.02	0.04
Benzo(a)pyrene	*1450*	0.03	0.27	0.01	0.02	0.01	0.02	0.03
Chrysene	*1290*	0.04	0.61	0.02	0.05	0.02	0.03	0.04
Fluoranthene	*2230*	0.04	0.00	0.02	0.04	0.02	0.02	0.04
Pyrene	*1520*	0.07	0.00	0.03	0.06	0.03	0.04	0.06
Total PAHs	*22,800*	0.04	0.24	0.01	0.03	0.01	0.02	0.03
Pesticides (µg/kg DW)								
Chlordane	*17.6*	**1.03**	0.52	0.24	0.43	0.47	0.67	ns
Dieldrin	*61.8*	0.04	0.02	0.00	0.00	0.00	0.02	ns
Endrin	*207.0*	0.00	0.00	0.00	0.00	0.00	0.00	ns
Heptachlor Epoxide	*16*	0.00	0.00	0.00	0.00	0.00	0.00	ns
Lindane (gamma-BHC)	*4.99*	0.00	0.00	0.00	0.00	0.00	0.00	ns
Sum DDD	*28*	0.57	0.32	0.13	0.00	0.00	0.27	ns
Sum DDE	*31.3*	0.62	0.40	0.16	0.30	0.30	0.40	ns
Sum DDT	*62.9*	0.10	0.04	0.00	0.00	0.00	0.05	ns
Total DDTs	*572*	0.07	0.04	0.02	0.02	0.02	0.04	ns
Total PCBs	*676*	0.08	0.03	0.01	0.00	0.01	0.04	ns
Mean PEC Quotient		0.24	0.28	0.17	0.18	0.17	0.21	--

ns = not sampled in WY2015 due to budget limitations

Table 6.5. Probable Effect Concentration (PEC) quotients for sediment chemistry constituents measured by SPoT at Guadalupe Creek. Bolded values exceed 1.0.

Site ID – Creek		205GUA00 – Guadalupe Creek					
Sample Date	PEC	6/17/08	6/30/10	7/21/11	7/5/12	7/2/13	7/25/14
Metals (mg/kg DW)							
Arsenic	*33.0*	0.20	0.19	0.18	0.16	0.22	ns
Cadmium	*4.98*	0.18	0.24	0.15	0.24	0.16	ns
Chromium	*111*	**1.60**	**1.39**	**1.08**	**1.04**	**1.41**	ns
Copper	*149*	0.36	0.47	0.34	0.35	0.43	ns
Lead	*128*	0.37	0.38	0.31	0.31	0.34	ns
Mercury	*1.06*	**1.03**	**1.87**	**1.16**	0.74	**1.75**	ns
Nickel	*48.6*	**1.92**	**2.47**	**1.97**	**2.02**	**2.59**	ns
Zinc	*459*	0.52	0.56	0.42	0.50	0.53	ns
PAHs (µg/kg DW)							
Anthracene	*845*	0.04	0.03	0.02	0.04	0.01	0.01
Fluorene	*536*	0.02	0.01	0.01	0.03	0.01	0.01
Naphthalene	*561*	0.05	0.03	0.02	0.02	0.02	0.01
Phenanthrene	*1170*	0.15	0.15	0.08	0.13	0.06	0.06
Benz(a)anthracene	*1050*	0.11	0.14	0.06	0.15	0.04	0.05
Benzo(a)pyrene	*1450*	0.13	0.09	0.04	0.10	0.04	0.04
Chrysene	*1290*	0.12	0.22	0.08	0.20	0.05	0.05
Fluoranthene	*2230*	0.35	0.22	0.10	0.17	0.05	0.06
Pyrene	*1520*	0.00	0.29	0.15	0.24	0.08	0.08
Total PAHs	*22,800*	0.12	0.13	0.07	0.11	0.04	0.04
Pesticides (µg/kg DW)							
Chlordane	*17.6*	0.87	0.68	0.96	**5.36**	0.85	ns
Dieldrin	*61.8*	0.04	0.00	0.00	0.00	0.02	ns
Endrin	*207.0*	0.00	0.00	0.00	0.00	0.00	ns
Heptachlor Epoxide	*16*	0.00	0.00	0.00	0.00	0.00	ns
Lindane (gamma-BHC)	*4.99*	0.00	0.00	0.00	0.00	0.00	ns
Sum DDD	*28*	0.66	0.23	0.58	0.98	0.25	ns
Sum DDE	*31.3*	0.58	0.27	0.34	0.40	0.28	ns
Sum DDT	*62.9*	0.10	0.00	0.00	0.00	0.08	ns
Total DDTs	*572*	0.07	0.03	0.05	0.07	0.04	ns
Total PCBs	*676*	0.11	0.05	0.11	0.22	0.07	ns
Mean PEC Quotient		0.35	0.36	0.30	0.49	0.93	--

ns = not sampled in WY2015 due to budget limitations

Table 6.6. Pyrethroid Toxic Unit (TU) equivalents for sediment chemistry constituents measured by SPoT at Coyote Creek. Bolded values exceeded 1.0 TU or significant toxicity.

Site ID – Creek Sample Date	LC50 (µg/g dw)	205COY060 – Coyote Creek						
		6/17/08	6/16/09	6/30/10	7/21/11	7/5/12	7/2/13	7/25/14
Pyrethroid								
Bifenthrin	0.52	0.63	nd	0.68	0.71	1.65	0.22	0.70
Cyfluthrin	1.08	nd	nd	0.09	0.31	12.1	0.09	0.11
Cypermethrin	0.38	0.12	nd	0.09	0.08	1.28	0.15	0.38
Deltamethrin	0.79	nd	nd	0.35	0.58	0.00	0.06	0.12
Esfenvalerate	1.54	nd	nd	0.05	0.46	1.33	0.01	0.01
Lambda-Cyhalothrin	0.45	nd	nd	0.01	0.02	0.05	0.03	0.13
Permethrin	10.83	0.04	nd	0.02	0.03	0.07	0.01	0.04
Sum of Toxic Unit Equivalents per Site	--	0.79	--	1.3	2.2	16	0.56	1.5
Survival as % of Control *Hyalella azteca*	--	82	76	96	92	90	99	101

nd = below detection limit

Table 6.7. Pyrethroid Toxic Unit (TU) equivalents for sediment chemistry constituents measured by SPoT at Guadalupe Creek. Bolded values exceeded 1.0 TU or significant toxicity.

Site ID – Creek Sample Date	LC50 (µg/g dw)	205GUA020 – Guadalupe Creek					
		6/17/08	6/30/10	7/21/11	7/5/12	7/2/13	7/25/14
Pyrethroid							
Bifenthrin	0.52	0.52	0.50	0.79	0.62	0.24	0.78
Cyfluthrin	1.08	nd	0.13	0.14	0.42	0.04	0.07
Cypermethrin	0.38	0.22	0.13	0.08	0.11	0.03	0.11
Deltamethrin	0.79	nd	nd	0.55	1.62	0.13	0.28
Esfenvalerate	1.54	nd	nd	0.07	0.20	0.08	0.09
Lambda-Cyhalothrin	0.45	nd	nd	0.01	0.16	0.01	0.01
Permethrin	10.83	0.01	0.01	0.06	0.14	0.01	0.03
Sum of Toxic Unit Equivalents per Site	--	0.75	0.76	1.7	3.3	0.54	1.4
Survival as % of Control *Hyalella azteca*	--	89	97	95	89	95	78

nd = below detection limit

7.0 CITIZEN MONITORING AND PARTICIPATION

Provision C.8.f of MRP 1.0[17] requires Permittees to encourage citizen monitoring, make reasonable efforts to seek out citizen and stakeholder information when reporting monitoring data, and demonstrate annually that they have encouraged citizen and stakeholder observations and reporting of waterbody conditions.

In WY2015, SCVURPPP continued to assist the Stevens Permanente Creek Watershed Council (SPCWC) in implementing a volunteer monitoring program. The SPCWC, which is now coordinated through Acterra (a non-profit organization that assists in managing community-based environmental activities), is generally focused on coordinating volunteer water quality monitoring, benthic macroinvertebrate bioassessments, habitat restoration projects, and general outreach and education. In support of the volunteer monitoring program, SCVURPPP provided technical support for the implementation of both field and laboratory methods, purchased monitoring equipment used by volunteers, and participated in SPCWC/Acterra meetings and events.

SCVURPPP and Permittees have continued to encourage other volunteer monitoring efforts in Santa Clara County. For example, the City of Palo Alto is collaborating with Acterra to engage volunteers in monitoring surface water quality at key locations in Palo Alto creeks to provide some indication of the water's ability to support aquatic life. SCVURPPP and Permittee staff continue to coordinate with Acterra on volunteer monitoring and provide technical advice and support. In addition, the City of San Jose maintains its own volunteer water quality monitoring program, which is open to all members of the public, and utilizes the World Water Monitoring Challenge kits and website database.

[17] Provision C.8 of MRP 2.0 no longer includes citizen monitoring; however provision C.7 of MRP 2.0 requires public outreach and citizen involvement events.

8.0 NEXT STEPS

Water quality monitoring required by provision C.8 of MRP 1.0 and 2.0 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 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 WY2016, SCVURPPP will continue to comply with water quality monitoring requirements of the MRP. As described throughout this UCMR, requirements in MRP 2.0 are generally similar but differ somewhat to requirements in MRP 1.0. The following list of next steps will be implemented in WY2016:

- SCVURPPP will continue to collaborate with the RMC (MRP 2.0 provision C.8.a).
- Where applicable, monitoring data collected and reported by SCVURPPP will continue to be SWAMP comparable (MRP 2.0 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 2.0 provision C.8.c).
- SCVURPPP will continue to conduct probabilistic and targeted Creek Status Monitoring consistent with the specific requirements in MRP 2.0 (MRP 2.0 provision C.8.d).
- SCVURPPP will develop and begin implementation of a dry and wet weather Pesticides and Toxicity Monitoring program consistent with MRP 2.0 provision C.8.g.
- Weather permitting, SCVURPPP will implement the Upper Penitencia Stressor Identification Project Work Plan (continuation of MRP 1.0 provision C.8.d.i).
- SCVURPPP will continue to review monitoring results and maintain a list of all results exceeding trigger thresholds (MRP 2.0 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 2.0 provision C.8.e.iii).
- SCVURPPP will continue to participate in the STLS and SPLWG which address MRP 2.0 provision C.8.f POC management information needs and monitoring requirements through wet weather characterization monitoring, refinement of the RWSM, development of the STLS Trends Strategy, and contingency monitoring at the Guadalupe River loading stations
- SCVURPPP will develop and begin implementation of a POC monitoring framework to comply with provision C.8.f of MRP 2.0. 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). WY2016 monitoring will include collection of wet weather composite water samples from catchments to identify watersheds where PCB and mercury control measures will be implemented as well as nutrient sampling.
- WY2016 POC monitoring accomplishments and allocation of sampling efforts for POC monitoring in WY2017 will be submitted in the Pollutants of Concern Monitoring Report that is due to the Water Board by October 15, 2016 (MRP 2.0 provision C.8.h.iv).
- Results of WY2016 monitoring will be described in the Programs WY2016 Urban Creeks Monitoring Report that is due to the Water Board by March 31, 2017 (MRP 2.0 provision C.8.h.iii).

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