Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Watershed Monitoring and Assessment Program




Urban Creeks Monitoring Report

Water Quality Monitoring
Water Year 2018 (October 2017 – September 2018)

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

March 31, 2019

EOA inc.

PREFACE

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

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

This Urban Creeks Monitoring Report complies with MRP provision C.8.h.iii for reporting of all data in Water Year 2018 (October 1, 2017 through September 30, 2018). Data were collected pursuant to provision C.8 of the MRP. Data presented in this report were produced under the direction of the RMC and the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) using probabilistic and targeted monitoring designs as described herein.

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

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

[2] The current SWAMP QAPrP, dated May 2017, is available at: https://www.waterboards.ca.gov/water_issues/programs/swamp/qapp/swamp_QAPrP_2017_Final.pdf

LIST OF ACRONYMS

ACCWP	Alameda Countywide Clean Water Program
AFDM	Ash Free Dry Mass
AFR	Alternative Flame Retardant
ASCI	Algae Stream Condition Index
BAHM	Bay Area Hydrological Model
BASMAA	Bay Area Stormwater Management Agency Association
BASMAA BOD	BASMAA Board of Directors
BMI	Benthic Macroinvertebrate
BMP	Best Management Practice
BSM	Bioretention Soil Media
CADDIS	Causal Analysis/Diagnosis Decision Information System
CCCWP	Contra Costa Clean Water Program
CEC	Chemicals of Emerging Concern
CEDEN	California Environmental Data Exchange Network
COLD	Cold Freshwater Habitat
CSCI	California Stream Condition Index
DPR	California Department of Pesticide Regulation
ECWG	Emerging Contaminant Workgroup
FSURMP	Fairfield Suisun Urban Runoff Management Program
GIS	Geographic Information Systems
HDS	Hydrodynamic Separator
IBI	Index of Biological Integrity
IMR	Integrated Monitoring Report
IPI	Index of Physical Habitat 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
NMFS	National Marine Fisheries Service
NMS	Nutrient Management Strategy
NPDES	National Pollution Discharge Elimination System
PAHs	Polycyclic Aromatic Hydrocarbons
PBDEs	Polybrominated Diphenyl Ethers
PCBs	Polychlorinated Biphenyls
PEC	Probable Effect Concentration
PFAS	Perfluoroalkyl and Polyfluoroalkyl Substances
PFOS	Perfluorooctane Sulfonate
PHAB	Physical Habitat Assessment
POC	Pollutant of Concern
POTW	Publicly Owned Treatment Works
QAPP	Quality Assurance Project Plan
QAPrP	Quality Assurance Program Plan
RAA	Reasonable Assurance Analysis
RMC	Regional Monitoring Coalition
RMP	Regional Monitoring Program for Water Quality in San Francisco Bay
RWSM	Regional Watershed Spreadsheet Model
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SCVWD	Santa Clara Valley Water District
SFEI	San Francisco Estuary Institute

SMCWPPP	San Mateo County Water Pollution Prevention Program
SOP	Standard Operating Procedures
SPLWG	Sources, Pathways, and Loadings Workgroup
SPoT	Statewide Stream Pollutant Trend Monitoring
SSC	Suspended Sediment Concentration
SSID	Stressor/Source Identification
S&T	Status and Trends Monitoring Program
STLS	Small Tributary Loading Strategy
SWAMP	Surface Water Ambient Monitoring Program
TEC	Threshold Effect Concentration
TIE	Toxicity Identification Evaluations
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TRC	Technical Review Committee
TRE	Toxicity Reduction Evaluations
TU	Toxic Unit
UCMR	Urban Creeks Monitoring Report
USEPA	US Environmental Protection Agency
USGS	US Geological Survey
WARM	Warm Freshwater Habitat
WMA	Watershed Management Area
WQ	Water Quality
WQO	Water Quality Objective
WY	Water Year

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TABLE E.1. WATER YEAR 2018 CREEK STATUS MONITORING STATIONS

In compliance with provision C.8.h.iii.(1), this table of all Creek Status Monitoring stations sampled by SCVURPPP in Water Year 2018 is provided immediately following the Table of Contents. See Section 3.0 for additional information on Creek Status Monitoring.

Table E.1. Water Year 2018 Creek Status Monitoring Stations.

Map ID [1]	Station ID	Watershed	Creek Name	Land Use	Latitude	Longitude	Probabilistic	Targeted				
							Bioassessment, Nutrients, General WQ	Chlorine	Pesticides & Toxicity	Temp [2]	Cont WQ [3]	Pathogen Indicators
749	204R00749	Alameda Creek	Smith Creek	NU	37.31672	-121.65057	X	X				
746	205R00746	San Tomas Aquino	Saratoga Creek	NU	37.25201	-122.06016	X	X				
769	205R00769	Coyote Creek	MF Coyote Creek	NU	37.21998	-121.54206	X	X				
3498	205R03498	San Tomas Aquino	Saratoga Creek	U	37.25747	-122.03631	X	X				
3562	205R03562	San Tomas Aquino	Saratoga Creek	U	37.25258	-122.04500	X	X				
3591	205R03591	San Francisquito Cr	Los Trancos Creek	U	37.35238	-122.19713	X	X				
3619	205R03619	San Tomas Aquino	Saratoga Creek	U	37.30297	-121.99653	X	X				
3683	205R03683	Permanente Creek	Permanente Creek	U	37.33985	-122.09228	X	X				
3699	205R03699	Permanente Creek	Hale Creek	U	37.36703	-121.69869	X	X				
3738	205R03738	Coyote Creek	Upper Silver Creek	U	37.28625	-121.77795	X	X				
3754	205R03754	San Tomas Aquino	San Tomas Aquino	U	37.25954	-121.99221	X	X				
3795	205R03795	Coyote Creek	Lower Silver Creek	U	37.35770	-121.85820	X	X				
3825	205R03825	Coyote Creek	Thompson Creek	U	37.28066	-121.75541	X	X				
3843	205R03843	San Tomas Aquino	San Tomas Aquino	U	37.38186	-121.96843	X	X				
3847	205R03847	San Francisquito Cr	Los Trancos Creek	U	37.38068	-122.19441	X	X				
3875	205R03875	Calabazas Creek	Calabazas Creek	U	37.31483	-122.01634	X	X				
3907	205R03907	Lower Penitencia	Lower Penitencia	U	37.43624	-121.91424	X	X				
4190	205R04190	Guadalupe River	Guadalupe Creek	U	37.23516	-121.89116	X	X				
4217	205R04217	Coyote Creek	Upper Penitencia	U	37.40062	-121.74910	X	X				
4266	205R04266	Calabazas Creek	Calabazas Creek	U	37.29627	-122.02921	X	X				
400	205LGA400	Guadalupe River	Los Gatos Creek	U	37.31830	-122.06197						X
30	205MAT030	Matadero Creek	Matadero Creek	U	37.41001	-122.13823						X
64	205STE064	Stevens Creek	Stevens Creek	U	37.25764	-122.03561						X
225	205GUA225	Guadalupe River	Arroyo Calero	U	37.23878	-121.97094						X
75	205SAR075	San Tomas Aquino	Saratoga Creek	U	37.21416	-121.83447						X
190	205GUA190	Guadalupe River	Guadalupe Creek	U	37.24373	-121.87561				X		
202	205GUA202	Guadalupe River	Guadalupe Creek	U	37.23291	-121.89795				X		
210	205GUA210	Guadalupe River	Guadalupe Creek	U	37.21746	-121.91039				X		
218	205GUA218	Guadalupe River	Guadalupe Creek	U	37.2028	-121.88845				X		
250	205GUA250	Guadalupe River	Alamitos Creek	U	37.23363	-121.87058				X		

Map ID [1]	Station ID	Watershed	Creek Name	Land Use	Latitude	Longitude	Probabilistic	Targeted				
							Bioassessment, Nutrients, General WQ	Chlorine	Pesticides & Toxicity	Temp [2]	Cont WQ [3]	Pathogen Indicators
255	205GUA255	Guadalupe River	Alamitos Creek	U	37.22607	-121.85842				X		
262	205GUA262	Guadalupe River	Alamitos Creek	U	37.22041	-121.84516				X		
270	205GUA270	Guadalupe River	Alamitos Creek	U	37.20129	-121.82891				X		
279	205GUA279	Guadalupe River	Alamitos Creek	U	37.17409	-121.82409				X		
235	205COY235	Coyote Creek	Coyote Creek	U	37.3536	-121.87417					X	
236	205COY236	Coyote Creek	Coyote Creek	U	37.35098	-121.87378					X	
239	205COY239	Coyote Creek	Coyote Creek	U	37.33722	-121.86953					X	
18	205CAL018	Calabazas Creek	Calabazas Creek	U	37.38760	-121.98690			X			
21	205STE021	Stevens Creek	Stevens Creek	U	37.40985	-122.06906			X			
10	205STQ010	San Tomas Aquino	San Tomas Aquino	U	37.38843	-121.96865			X			

U = urban, NU = non-urban

[1] Map ID applies to Figure 3.1.

[2] Temperature monitoring was conducted continuously (i.e., hourly) April through September.

[3] Continuous water quality monitoring (temperature, dissolved oxygen, pH, specific conductivity) was conducted during two 2-week periods (spring and late summer).

EXECUTIVE SUMMARY

This Urban Creeks Monitoring Report was prepared by the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) in compliance the National Pollutant Discharge Elimination System stormwater permit for Bay Area municipalities referred to as the Municipal Regional Permit (MRP; Order No. R2-2015-0049). This report, including all appendices and attachments, fulfills the requirements of Provision C.8.h.iii of the MRP for reporting of all data collected in Water Year 2018 (WY 2018; October 1, 2017 through September 30, 2018) pursuant to Provision C.8 of the MRP. Data presented in this report were also submitted in electronic SWAMP-comparable formats by SCVURPPP to the Regional Water Board on behalf of SCVURPPP Co-permittees and pursuant to Provision C.8.h.ii of the MRP.

Water quality monitoring required by Provision C.8 of the MRP is intended to assess the condition of water quality in 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.

The organization of this Executive Summary follows the sub-provisions of Provision C.8 (Water Quality Monitoring) of the MRP. Each section very briefly describes what was done and summarizes key results. More details are provided in the body of the report and in its corresponding appendices.

Compliance Options (C.8.a)

Provision C.8.a (Compliance Options) of the MRP allows Permittees to address monitoring requirements through a “regional collaborative effort,” their countywide stormwater program, and/or individually. On behalf of Co-permittees, SMCWPPP conducts creek water quality monitoring and monitoring projects in the Santa Clara Basin in collaboration with the Bay Area Stormwater Management Agency Association (BASMAA) Regional Monitoring Coalition (RMC), and actively participates in the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP), which focuses on assessing Bay water quality and associated impacts.

Monitoring Protocols and Data Quality (C.8.b)

Creek status and pesticides & toxicity monitoring data were collected in accordance with the BASMAA RMC Quality Assurance Project Plan (QAPP) and the BASMAA RMC Standard Operating Procedures (SOPs). Where applicable, and in compliance with Provision C.8.b, methods described in the QAPP and SOP are comparable with methods specified by the California Surface Water Ambient Monitoring Program (SWAMP) Quality Assurance Program Plan (QAPrP).

San Francisco Estuary Receiving Water Monitoring (C.8.c)

In accordance with Provision C.8.c of the MRP, Permittees are required to provide financial contributions towards implementing an Estuary receiving water monitoring program on an annual basis that, at a minimum, is equivalent to the monitoring conducted via the RMP. SCVURPPP Permittees comply with this provision by making financial contributions to the RMP via SCVURPPP. Additionally, SCVURPPP Program staff and other BASMAA RMC representatives actively participate in RMP committees, workgroups, and strategy teams, such as the Small Tributaries Loading Strategy (STLS) to help oversee RMP activities and provide input, consistent with MRP Permittee interests.

Creek Status Monitoring (C.8.d)

The RMC’s creek status monitoring strategy includes both a regional ambient/probabilistic monitoring design and a local “targeted” monitoring design. The probabilistic monitoring design was developed to remove bias from site selection such that ecosystem conditions can be objectively assessed on local (i.e., Santa Clara County) and regional (i.e., RMC) scales. 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. Monitoring results are compared to “triggers” listed in Provision C.8.d of the MRP. Some triggers are equivalent to regulatory Water Quality Objectives (WQOs); others are thresholds above (or below) which potential impacts to aquatic life or other beneficial uses may occur. Sites were triggers are exceeded (or not met) are considered for future stressor/source identification (SSID) projects.

During WY 2018, SCUVRPPP conducted biological assessments at twenty probabilistic sites. Bioassessments include the collection of benthic macroinvertebrate and algae samples, physical habitat measurements, water chemistry (i.e., nutrient analyses) and general water quality. The California Stream Condition Index (CSCI), a statewide tool that translates benthic macroinvertebrate data into an overall measure of stream health, was used to assess biological condition at all probabilistic sites. Of the twenty sites monitored in WY 2018, ten sites (50%) scored below the trigger CSCI score of 0.795 and were rated as altered or degraded. Low CSCI scores are related impacts to physical habitat typical for urbanized areas, such as creek channel modifications (e.g., lining with concrete) and contributing watersheds with high percentages of impervious surface.

Targeted monitoring parameters consist of water temperature, general water quality, and pathogen indicators. In WY 2018, continuous temperature data were collected at nine targeted stations in the Guadalupe River watershed and continuous general water quality data (pH, dissolved oxygen, specific conductance, and temperature) were collected at three targeted stations in the mainstem of Coyote Creek. Although there were exceedances of the temperature and dissolved oxygen triggers from the MRP, the presence of steelhead populations in these creeks suggest that the triggers may not be suited to the Lower South Bay region and/or they are not limiting to populations in the monitored reaches.

In WY 2018, pathogen indicator samples (i.e., enterococci, *E. coli*) were collected at five stations in Santa Clara County that coincide with public parks. The MRP trigger thresholds for *E. coli* and enterococci were exceeded at three sites.

Impacts to urban streams identified through creek status monitoring are likely the result of long-term changes in stream hydrology, channel geomorphology, in-stream habitat complexity, and other modifications associated with the urban development, along with pollutant discharges typically found in urban watersheds. SCVURPPP 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. 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 over time.

Stressor/Source Identification (SSID) Projects (C.8.e)

Provision C.8.e of the MRP requires that Permittees evaluate creek status (Provision C.8.d) and pesticides and toxicity (Provision C.8.g) monitoring data with respect to triggers defined in the MRP and maintain a list of all results exceeding trigger thresholds. Sites where triggers are exceeded may indicate potential impacts to aquatic life or other beneficial uses and are therefore considered as candidates for future SSID projects. The MRP requires SCVURPPP and its RMC partners to collectively initiate a region-wide minimum of eight SSID projects. In WY 2018, SCVURPPP implemented the Coyote Creek Toxicity SSID Project Work Plan. Based on monitoring results from WY 2018, sources of toxicity could not be determined. The Program will conduct another year of monitoring at a reduced number of sites (three sites rather than five) during WY 2019 to continue to evaluate sources of toxicity and appropriate management actions.

Pollutants of Concern Monitoring (C.8.f)

Pollutants of Concern (POC) monitoring is required by Provision C.8.f of the MRP. POC monitoring is intended to assess inputs of POCs to the Bay from local tributaries and urban runoff, provide information to support implementation of Total Maximum Daily Load (TMDL) water quality restoration plans and other pollutant control strategies, assess progress toward achieving wasteload allocations (WLAs) for TMDLs, and help resolve uncertainties associated with loading estimates for POCs. In WY 2018, SMCWPPP met or exceeded the MRP's minimum yearly requirements for all POC monitoring parameters.

PCBs and mercury monitoring in WY 2018 continued to focus primarily on identification of source areas of PCBs and mercury to the MS4 and San Francisco Bay. WY 2018 data are being used by SCVURPPP to implement a process to identify and prioritize watershed management areas (WMAs) and identify specific source properties in the Santa Clara Valley. WMAs are priority watersheds or catchments in the urban landscape where control measures for PCBs and mercury are currently being implemented or will be implemented during the MRP permit term, to the extent that feasible and cost-effective controls can be identified.

In WY 2018, three creeks were sampled for copper and nutrient analyses during two types of flow events (storm event and baseflow) for a total of six samples. Copper and nutrients were higher in the storm event samples, compared to the baseflow samples suggesting an influence of stormwater runoff. Similarity in the magnitude of concentrations between the sites suggest that there are no localized high priority sources of copper or nutrients in upstream areas.

Pesticides and Toxicity Monitoring (C.8.g)

In WY 2018, SCVURPPP conducted dry weather pesticides and toxicity monitoring at two stations (Stevens Creek and San Tomas Aquino Creek) and wet weather pesticides and toxicity monitoring at three stations (Calabazas Creek, Stevens Creek, and San Tomas Aquino Creek) in compliance with provision C.8.g of the MRP and in coordination with the RMC.

Statistically significant toxicity to *C. dilutus* (survival) was observed in the water sample collected from Stevens Creek during dry season sampling. However, the magnitude of the toxic effects in this sample did not exceed MRP trigger criteria of 50 Percent Effect. Statistically significant toxicity to *H.* azteca (survival) was also observed in the Calabazas Creek, San Tomas Aquino Creek, and Stevens Creek water samples during wet weather sampling. The magnitude of the toxic effects in the Stevens Creek sample did not exceed MRP trigger criteria, while the magnitude of the toxic effects in the Calabazas Creek and San Tomas Aquino Creek samples did exceed the MRP threshold for re-sampling (i.e., Percent Effect ≥ 50%). In follow-up sampling that was conducted during a storm event in March 2018, statistically significant toxicity was observed in the Calabazas Creek sample. However, the magnitude of the toxic effects was below the MRP threshold. No statistically significant toxicity was observed in the follow-up San Tomas Aquino Creek sample. The cause of the observed toxicity is unknown. Pesticide concentrations in the dry season sediment samples were all very low, most below MDLs, and calculated Toxic Unit (TU) equivalents did not exceed 0.1 in either sample, with the exception of bifenthrin in the Stevens Creek sample. Pesticide concentrations in wet weather water samples were also very low, with most values below MDLs.

Threshold Effect Concentration (TEC) and Probable Effect Concentration (PEC) quotients were calculated for all metals and total polycyclic aromatic hydrocarbons (PAHs) measured in sediment samples. Some TEC and PEC trigger exceedances were observed for chromium and nickel, but are likely related to natural occurrences of these metals associated with the area's serpentine geology.

1.0 INTRODUCTION

This Urban Creeks Monitoring Report (UCMR) was prepared by the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP or Program), on behalf of its 15 member agencies (13 cities/towns, the County of Santa Clara, and the Santa Clara Valley Water District) subject to the National Pollutant Discharge Elimination System (NPDES) stormwater permit for Bay Area municipalities referred to as the Municipal Regional Permit (MRP).

The MRP was first adopted by the San Francisco Regional Water Quality Control Board (SFRWQCB or Regional Water Board) on October 14, 2009 as Order R2-2009-0074 (SFRWQCB 2009). On November 19, 2015, the SFRWQCB updated and reissued the MRP as Order R2-2015-0049 (SFRWQCB 2015). This report fulfills the requirements of Provision C.8.h.iii of the MRP for comprehensively interpreting and reporting all monitoring data collected during the foregoing October 1 – September 30 period (i.e., Water Year 2018). Data were collected pursuant to water quality monitoring requirements in provision C.8 of the MRP. Monitoring data presented in this report were submitted electronically to the Regional Water Board by SCVURPPP and, if collected from a receiving water, may be obtained via the San Francisco Bay Area Regional Data Center of the California Environmental Data Exchange Network (CEDEN) (http://www.ceden.org).

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

1.0 Introduction

2.0 San Francisco Estuary Receiving Water Monitoring (MRP provision C.8.c)

3.0 Creek Status Monitoring (MRP provision C.8.d) and Pesticides and Toxicity Monitoring (MRP provision C.8.g) (**Appendix A**)

4.0 Stressor/Source Identification (SSID) Projects (MRP provision C.8.e) (**Appendices B, C, and D**)

5.0 Pollutants of Concern (POC) Monitoring (MRP provision C.8.f) (**Appendices E and F**)

6.0 Recommendations and Next Steps

Figure 1.1 maps locations of monitoring stations associated with provision C.8 compliance in Water Year (WY) 2018, including Creek Status Monitoring, the SSID project, Pesticides and Toxicity Monitoring, and POC Monitoring conducted by SCVURPPP and the Small Tributaries Loading Strategy (STLS). This figure illustrates the geographic extent of monitoring conducted in Santa Clara County in WY 2018.

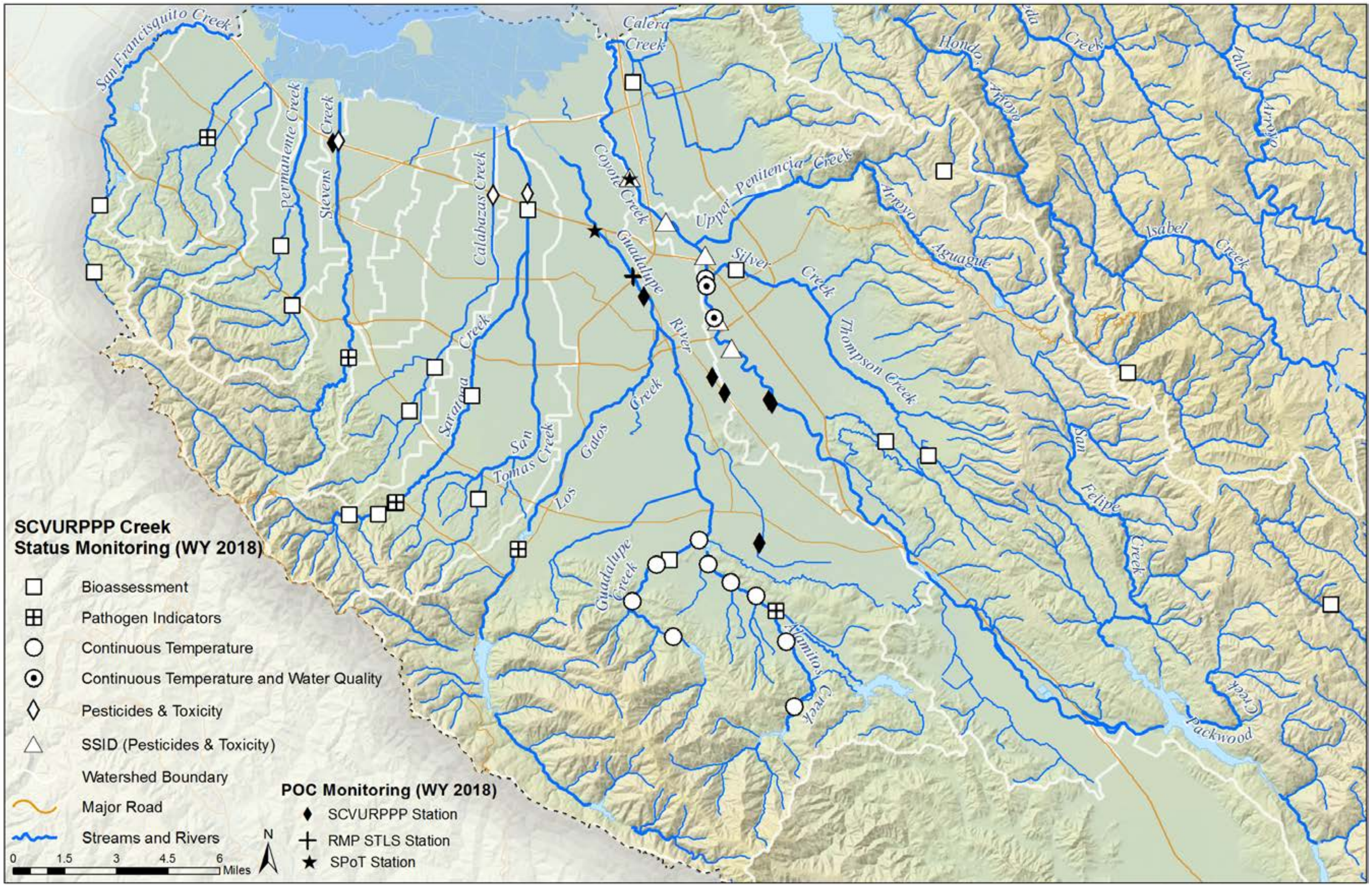

Figure 1.1. SCVURPPP Creek Status, Pollutants of Concern (POC), Pesticides and Toxicity, and Stressor/Source Identification (SSID) monitoring stations in WY 2018.

1.1 RMC Overview (C.8.a)

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

In February 2011, the RMC developed a Multi-Year Work Plan (RMC Work Plan; BASMAA 2011) to provide a framework for implementing regional monitoring and assessment activities required under provision C.8 of the 2009 MRP. The RMC Work Plan summarizes RMC projects planned for implementation between Fiscal Years 2009-10 and 2014-15. Projects were collectively developed by RMC representatives to the BASMAA Monitoring and Pollutants of Concern Committee (MPC), and were conceptually agreed to by the BASMAA Board of Directors (BASMAA BOD). Although there are no plans to update the Multi-Year Work Plan, several regional projects have already been identified and will be conducted in compliance with the 2015 MRP. Current regional projects relevant to provision C.8 compliance include (but may not be limited to) projects to maintain and update the regional database, coordinate the RMC Workgroup meetings, conduct POC monitoring, and implement an SSID study.

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

Table 1.1 Regional Monitoring Coalition (RMC) participants.

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

1.2 Coordination with Third-party Monitoring Programs

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

In WY 2018, SCVURPPP continued to coordinate with water quality monitoring programs conducted by third parties. These programs include the Regional Monitoring Program for Water Quality in San Francisco Bay's (RMP) Small Tributaries Loading Strategy (STLS) and the Stream Pollutant Trends (SPoT) monitoring conducted by the State of California's Surface Water Ambient Monitoring Program (SWAMP). Water quality data from these programs are reported in this document and were utilized to supplement SCVURPPP compliance with provision C.8 of the MRP, consistent with sub-provision C.8.a.iii.[3,4] Data are specifically referenced in section 5.0 (POC Monitoring) of this report.

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

[4] In most years, including WY 2018, the SPoT Program monitors two stations in Santa Clara County for a subset of the constituents required by provision C.8.f of the MRP.

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

As described in provision C.8.c of the MRP, Permittees are required to provide financial contributions towards implementing an Estuary receiving water monitoring program on an annual basis that at a minimum is equivalent to the Regional Monitoring Program for Water Quality in the San Francisco Bay (RMP). Since the adoption of the 2009 MRP, SCVURPPP has complied with this provision by making financial contributions to the RMP. Additionally, SCVURPPP staff actively participates in RMP committees, workgroups, and strategy teams as described in the following sections, which also provide a brief description of the RMP and associated monitoring activities conducted during WY 2018.

The RMP is a long-term (1993 – present) 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 separate stormwater sewer systems (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 2018 Detailed Workplan and Budget*[5] provides more details and establishes deliverables for each component of the current RMP budget. The RMP publishes annual summary reports. In odd years, the *Pulse of the Estuary Report* focuses on Bay water quality and summarizes information from all sources. In even years, the *RMP Update Report* has a narrower and specific focus. The *2018 Pulse of the Estuary*[6] includes: a brief summary of noteworthy findings of the multifaceted RMP; a description of the management context that guides the RMP; and a summary of progress to date and future plans for addressing priority water quality topics. It also includes an article on per- and polyfluoroalkyl substances (PFAS) in San Francisco Bay wildlife, one of the pollutants of concern identified in MRP Provision C.8.f.

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 RMP Technical Review Committee (TRC), in which SCVURPPP participates, continues to

[5] https://www.sfei.org/documents/2018-rmp-detailed-workplan-and-budget

[6] https://www.sfei.org/documents/rmp-update-2018

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. The current S&T sampling schedule, established in 2014, is listed in Table 2.1 with 2018 accomplishments and 2019 goals.

Table 2.1. RMP Status and Trends Monitoring Schedule.

Program Element	Schedule	2018 Sampling	2019 Sampling
Water	Every two years	No	Yes
Bird Eggs	Every three years	Yes	No
Sediment	Every four years	Yes	Yes
Sport Fish	Every five years	No	Yes
Bivalves	Every two years	Yes	No
Support to the USGS for suspended sediment, nutrient, and phytoplankton monitoring	Every year	Yes	Yes

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

2.2 RMP Pilot and Special Studies

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

In 2018, Pilot and Special Studies focused on the following topics:

- Nutrients Management Strategy
  - Continuous monitoring of nutrients, phytoplankton biomass, and dissolved oxygen at moored sensors
  - Continuous monitoring of dissolved oxygen in shallow margin habitats
  - Ship-based nutrient sampling
  - Data analysis and quantitative mechanistic interpretations to identify factors contributing to observed conditions
- Small Tributary Loading Strategy (see Section 5.0 for more details)
  - Watershed characterization reconnaissance monitoring for pollutants of concern
  - Advanced analysis of PCBs data
  - Planning support for alternative flame retardants conceptual model
  - Development of a trends strategy
  - Regional Watershed Spreadsheet Model (RWSM) support
- Emerging Contaminant Strategy
  - Review and update of the RMP's Tiered Risk and Management Action Framework

    - Chemicals of emerging concern (CEC) monitoring (imidacloprid, fragrance ingredients, PFAS, nonionic surfactants, pharmaceuticals) in water, sediment, and/or wastewater
    - Non-targeted analysis of Bay sediment to help identify new CECs
- Monitoring of microplastics in bivalves
- Development of toxicity reference values for screening dredged material bioassay results
- Development of conceptual PCB models for prioritized Bay margin units
- Hosting and support for Dredged Material Management Office (DMMO) database
- Improved Lower South Bay suspended sediment flux measurements
- San Leandro Bay fish diet analysis to help understand PCB accumulation
- Development of the Selenium Strategy

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

In WY 2018, a considerable amount of RMP and Stormwater Program staff time was spent overseeing and implementing Special Studies associated with the RMP's Small Tributary Loading Strategy (STLS). Pilot and Special Studies associated with the STLS are intended to fill data gaps associated with loadings of Pollutants of Concern (POC) from relatively small tributaries to the San Francisco Bay. Additional information on STLS-related studies is included in Section 5.0 (POC Loads Monitoring) of this report.

2.3 Participation in Committees, Workgroups and Strategy Teams

In WY 2018, SCVURPPP actively participated in the following RMP committees, workgroups, and strategy teams:

- Steering Committee (SC)
- Technical Review Committee (TRC)
- Sources, Pathways and Loadings Workgroup (SPLWG)
- Emerging Contaminant Workgroup (ECWG)
- Nutrient Technical Workgroup
- Strategy Teams (e.g., Small Tributaries, PCBs, Microplastics, 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 and publication, and providing general program direction to RMP staff. Representatives of the RMC also provided timely summaries and updates to and received input from, Stormwater Program representatives (on behalf of Permittees) during BASMAA Monitoring and Pollutants of Concern Committee (MPC) and/or BASMAA BOD meetings to ensure that Permittees' interests were represented.

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

This section summarizes the results of creek status monitoring and pesticides and toxicity monitoring required by provisions C.8.d and C.8.g of the MRP, respectively. Creek Status and Pesticides and Toxicity monitoring stations are listed in Table E-1 and mapped in Figure 3.1. Detailed methods and results are provided in **Appendix A.** Consistent with provision C.8.h.ii of the MRP, creek status and pesticides and toxicity monitoring data were submitted to the Regional Water Board by SCVURPPP in electronic SWAMP-comparable formats. These data were also provided to the Regional Data Center (i.e., SFEI) for upload to CEDEN.

Creek Status Monitoring (C.8.d)

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

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

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

The probabilistic monitoring design was developed to remove bias from site selection such that ecosystem conditions can be objectively assessed on local (i.e., SCVURPPP) and regional (i.e., RMC) scales. Probabilistic parameters consist of bioassessments, nutrients, and conventional analytes conducted according to methods described in the SWAMP SOP (Ode et al. 2016). Free chlorine and total chlorine residual were also measured at probabilistic sites. Twenty probabilistic sites were sampled by SCVURPPP in WY 2018 (Table E-1).

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

Pesticides and Toxicity Monitoring (C.8.g)

Provision C.8.g of the MRP requires Permittees to conduct wet weather and dry weather pesticides and toxicity monitoring. Test methods, sampling frequencies, and number of stations required are described in the MPR. In WY 2018, SCVURPPP conducted dry weather pesticides and toxicity monitoring at two bottom-of-the-watershed stations. SCVURPPP also coordinated with its RMC partners to complete the wet weather monitoring requirements.

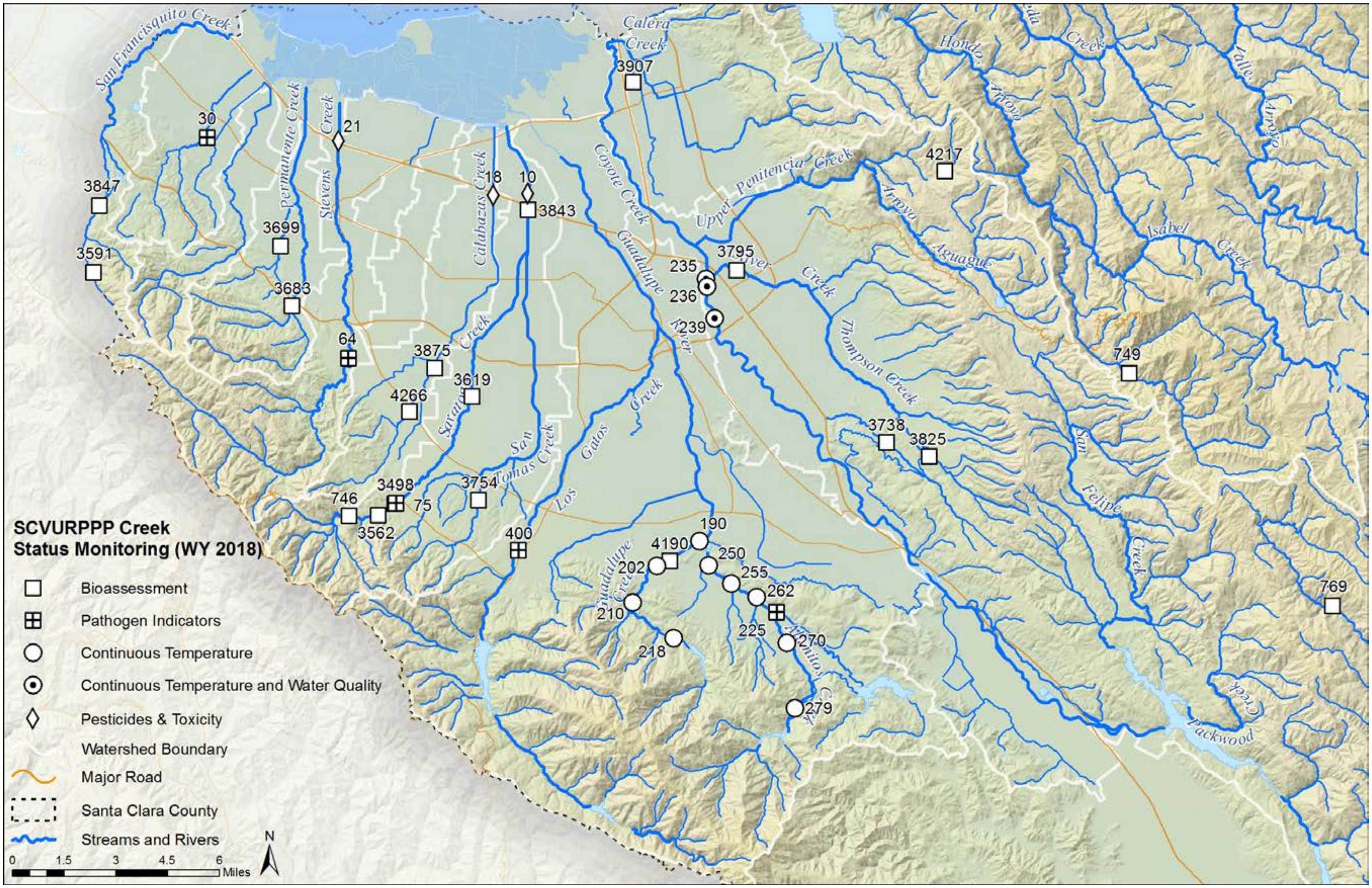

Figure 3.1. SCVURPPP Creek Status and Pesticides and Toxicity monitoring stations, WY 2018.

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

The second MRP creek status management question (*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. The indices of biological integrity based on BMI and algae data (i.e., CSCI and ASCI) are direct measures of aquatic life beneficial uses. Biological condition scores were compared to physical habitat and water quality data collected synoptically with bioassessments to evaluate whether any correlations exist that may explain the variation in biological condition scores. Continuous monitoring data (temperature, dissolved oxygen, pH, and specific conductance) are evaluated with respect to COLD and WARM Beneficial Uses. And pathogen indicator data are used to assess REC-1 (water contact recreation) Beneficial Uses. Although the total number of probabilistic sites in Santa Clara Valley that have been sampled since WY 2012 (i.e., 152) is sufficient to evaluate the condition of aquatic life within known estimates of precision, the analysis presented in **Appendix A** is limited to the 20 sites monitored in WY 2018.

The BASMAA RMC recently completed a *regional* analysis of biological condition using a five-year dataset (WY 2012 – WY 2016). The BASMAA regional study included the following analyses:

- Assess the biological condition of streams in the region and each county using indices of biological integrity (IBIs) based on benthic macroinvertebrate and algae data collected by each countywide program and SWAMP.
- Evaluate IBIs in distinct groupings such as type of stream (urban/non-urban).
- Assess stressors associated with poor stream condition using multivariate modeling analyses (i.e., random forest).
- Evaluate the five-year dataset for trends.
- Introduce the analyses that will be needed to make recommended changes to the probabilistic monitoring design.

The BASMAA RMC Five-Year Bioassessment Report (5-Year Report) is summarized and attached to **Appendix A**.

3.2 Monitoring Results and Conclusions

3.2.1 Bioassessment Monitoring

Bioassessment monitoring in WY 2018 was conducted in compliance with provision C.8.d.i of the MRP. Twenty sites were sampled for benthic macroinvertebrates (BMIs), benthic algae, physical habitat observations, and nutrients using methods consistent with the BASMAA RMC QAPP (BASMAA 2016a) and SOPs (BASMAA 2016b). Stations were randomly selected using a probabilistic monitoring design. Seventeen of the sites were classified as urban and three were classified as non-urban.

The following conclusions are made based on the WY 2018 data. An assessment of biological condition is provided and potential stressors are compared to applicable water quality objectives (WQOs) and triggers identified in the MRP. Sites with monitoring results that exceed WQOs and triggers are considered as candidates for further investigation as SSID projects, consistent with provision C.8.e of the MRP. See **Appendix A** for detailed explanations of the findings.

Biological Condition Assessment

Stream condition was assessed using three different types of indices/tools: the BMI-based California Stream Condition Index (CSCI), the draft benthic algae-based Algae Stream Condition Index (ASCI), and the Index of Physical Habitat Integrity (IPI). Of these three, the CSCI is the only tool with a MRP trigger threshold for follow-up SSID consideration.

- **CSCI** – The benthic (i.e., bottom-dwelling) macroinvertebrates collected through bioassessment monitoring are organisms that live on, under, and around the rocks and sediment in the stream bed. Examples include dragonfly and stonefly larvae, snails, worms, and beetles. Each BMI species has a unique response to water chemistry and physical habitat condition. Some are relatively sensitive to poor habitat and pollution; others are more tolerant. Therefore, the abundance and variety of BMIs in a stream indicates the biological condition of the stream. The CSCI is a statewide tool that translates the BMI taxa data into an overall measure of stream health. The CSCI is currently the most robust method of assessing aquatic biological health.
    - Ten of the twenty (50%) bioassessment sites monitored in WY 2018 had CSCI scores in the two higher condition categories - "possibly intact" and "likely intact" condition. Seven of these ten sites had scores greater than 1.0. These higher scoring sites were directly downstream of relatively undeveloped land areas, with impervious areas ranging between 1% and 6%. Five of these sites were located in two creeks: Saratoga Creek (3) and Los Trancos Creek (2).
- **ASCI** – Similar to BMI's, the abundance and type of benthic algae species living on a streambed can indicate stream health. When evaluated with the CSCI, biological indices based on benthic algae can provide a more complete picture of the streams biological condition because algae respond more directly to nutrients and water chemistry. In contrast, BMIs are more responsive to physical habitat. The State Water Board and the Southern California Coastal Water Research Project (SCCWRP) recently developed the draft ASCI which uses benthic algae data as a measure of biological condition for streams in California (Theroux et al. in prep.). The ASCI is a non-predictive scoring tool that consists of three multimetric indices: diatoms, soft algae, and the combined "hybrid." The ASCI is currently under review by the Biostimulatory-Biointegrity Policy Science Advisory Panel and the State Water Board. Therefore, scores presented in this report are considered provisional.
    - Seven of the twenty bioassessment sites had hybrid ASCI scores that were classified as "possibly intact" or "likely intact" condition. The higher scoring sites occurred in drainages with relatively low levels of urbanization, ranging from 1% to 5% impervious area. Six of the seven sites also received CSCI scores that were in two higher condition categories.
- **IPI** - The State Water Board recently developed the IPI as an overall measure of physical habitat condition. Similar to the CSCI, the IPI is calculated using a combination of physical habitat data collected in the field and environmental data generated in GIS following the methods described in Rehn et al. (2018).
    - Seventeen of the twenty sites (85%) had IPI scores in the two upper condition categories. IPI scores were positively correlated with CSCI scores, and slightly less so with hybrid ASCI scores.
- **Overall Condition** - The number of sites in the top two condition categories varied substantially by index, with as many as 17 of 20 sites for the IPI to as few as 7 of 20 sites for the hybrid ASCI. There was relatively good consistency among the indices for sites in the top two condition categories where lower urbanization (< 5% impervious area) was present. The diatom ASCI, soft algae ASCI, and IPI scores were relatively variable (i.e., both high and low scoring) at sites that drained more developed/urbanized watershed areas. Further evaluation of the newer indices and

their association with stressor data is needed to better understand how these indicators can be used to effectively assess site conditions.

  - Seven of the ten sites (70%) had IPI scores in the two upper condition categories. IPI scores were positively correlated with CSCI scores, and slightly less so with hybrid ASCI scores.

Stressor Assessment

Relationships between potential stressors (water chemistry, physical habitat, landscape variables) and biological condition were explored using the WY 2018 dataset. Sites with stressor levels exceeding applicable WQOs and triggers identified in the MRP will be considered as candidates for SSID projects. The correlations between biological conditions and stressors are not expected to be very strong due to the small sample size.

- **General water quality** (pH, temperature, dissolved oxygen, specific conductance). None of the water quality measurements exceeded water quality objectives or MRP trigger thresholds. None of the water quality measurements were correlated with CSCI or hybrid ASCI scores.
- **Nutrients and conventional analytes** (ammonia, unionized ammonia, chloride, AFDM, chlorophyll a, nitrate, nitrite, total Kjeldahl nitrogen, ortho-phosphate, phosphorus, silica). There were no water quality objective exceedances for water chemistry parameters. Total nitrogen concentrations ranged from 0.12 to 8.1 mg/L. The two highest nitrogen concentrations were measured at site 205R03795 in Lower Silver Creek (8.1 mg/L) and site 205R03699 (3.1 mg/L) on Hale Creek. Total phosphorus concentrations ranged from <0.001 to 0.22 mg/L. The highest concentration of total phosphorus occurred at site 205R03699 on Hale Creek. None of the nutrient parameters were correlated with CSCI or hybrid ASCI scores.
- **Physical habitat metric scores** were generated from the physical habitat data. CSCI scores correlated with metrics associated with substrate size and composition. Hybrid ASCI scores were poorly correlated with all 11 physical habitat metrics.
- **Landscape variables** were calculated for each of the watershed areas draining into the bioassessment sites. CSCI scores were moderately correlated (negatively) with impervious area and road density.

RMC Five Year Bioassessment Report Summary (WY 2012 – WY 2016)

A comprehensive analysis of bioassessment data collected by the RMC partners is included in the RMC Five-Year Bioassessment Report (5-Year Report) (BASMAA 2019) (Attachment 2). The BASMAA-funded study evaluated bioassessment data collected by the RMC over the first five years of monitoring (WY 2012 – WY 2016). Bioassessment data from 354 sites were compiled and evaluated to address the three study questions:

1) What is the biological condition of streams in the region?
2) What stressors are associated with poor condition?
3) Are conditions changing over time?

The findings of the BASMAA study are intended to help stormwater programs better understand the current condition of wadable streams, prioritize stream reaches in need of protection or restoration, and identify stressors that are likely to pose the greatest risk to the health of streams in the Bay Area.

The BASMAA report also evaluated the existing RMC probabilistic monitoring design and identified a range of potential options for revising the design (if desired) to better address the questions posed. The redesign options are intended to provide considerations for discussion during the planning for reissuance of the Municipal Regional Permit, which is likely to be adopted in 2021.

Biological Conditions

Results of the survey indicate that streams in the RMC area are generally in poor biological condition. As such, aquatic life uses may not be supported at a majority of sites sampled by the RMC. Two biological indicators were used to assess conditions:

- The BMI-based CSCI shows that 58% of the stream length regionwide was ranked in the lowest CSCI condition category ("very likely altered"); 74% of the of the sampled stream length exhibited CSCI scores below 0.795, the MRP trigger for potential follow-up activity.

- The Southern California algae indices for diatoms (D18) and soft algae (S2) were evaluated for biological conditions[7]. Based on D18 and S2 scores, stream conditions regionwide appear slightly less degraded, with approximately 40% ranked in the lowest algae condition category. The algal indices also had greater stream length in the "likely intact" condition class (19-21%) compared to CSCI score (15%).

These findings should be interpreted with the understanding that the survey focused on urban stream conditions. Approximately 80% of the samples (284 of 354) were collected at urban sites. Although the low non-urban sample size precludes making any definitive comparisons, bioassessment scores in the non-urban area were generally higher than scores in the urban area for each County.

Stressor Assessment

The association between biological indicators (CSCI and D18) and stressor data was evaluated in the RMC 5-Year study using random forest statistical analyses. The results indicate that each of the biological indicators respond to different types of stressors.

- Biological condition, based on CSCI scores, was correlated with physical habitat and land use variables. Overall, the largest influence on CSCI scores in the random forest model was percent impervious area in a 5 km radius.

- Biological condition, based on D18 scores, was moderately correlated with water quality variables and less associated with the physical or landscape variables.

In general, CSCI scores at urban sites were consistently low, indicating that degraded physical habitat conditions do not support healthy BMI assemblages. D18 scores at urban sites were more variable, indicating that healthy diatom assemblages potentially can occur at sites with poor habitat, but can also indicate poor water quality at sites with degraded habitat.

None of the nutrient variables (e.g., nitrate, total nitrogen, orthophosphate, phosphorus) correlated strongly with CSCI scores, or were highly ranked variables in the CSCI random forest model runs. Phosphorus and ash-free dry mass (which increases in response to biostimulation) were important in predicting D18 scores; however, no statistically significant relationships were observed. This finding suggests that the nutrient targets being developed by the State Water Board as part of the Biostimulatory/Biointegrity Project may not be appropriate in urban streams in the Bay Area.

Trend Assessment

The short time frame of the survey (five years) limited the ability to detect trends. However, the five-year bioassessment dataset does provide a baseline to compare with future assessments.

[7] The ASCI was not yet available during development of the RMC 5-Year Report.

A potential application of bioassessment monitoring may be to assess stream conditions following implementation of stormwater treatment projects. It is anticipated that peak flow volumes and intensities will be reduced following the implementation of mandatory stormwater treatment via green infrastructure and low impact development (LID). Future creek status monitoring may provide additional insight into the potential positive impacts of green infrastructure and creek restoration to support water quality objectives and beneficial uses in urban creeks as these projects get built.

<u>Assessment of the RMC Monitoring Design</u>

Over the first five years of monitoring, the RMC evaluated about 25% (1455 out of 5740) of the sites in the sample frame to obtain 354 samples. Approximately 46% (873 out of 1896) of the total number of urban sites in the sample frame were evaluated during that time. Based on rejection rates from previous years, the sample frame is anticipated to only last through WY 2019. Revision of the RMC monitoring design could seek to reduce the future rejection rate through re-evaluation of the sample frame to exclude areas of low management interest or regions that would not be candidates for sampling (such as due to lack of permissions or physical barriers to access). This would improve the spatial balance of samples that more closely represents the proportion of the sample frame that can be reliably assessed.

The RMC sample design was created to probabilistically sample all streams within the RMC area, which resulted in a master list of 33% urban sites and 67% non-urban sites. However, because participating municipalities are primarily concerned with runoff from urban areas, the RMC focused sampling efforts on urban sites (80%) over non-urban sites (20%). As a result, non-urban samples are under-represented in the dataset resulting in much lower overall biological condition scores than would be expected for a spatially balanced dataset.

Based on evaluation of data collected during the first five years of the survey, several options to revise the RMC Monitoring Design are presented below:

1) Continue to sample new probabilistic sites until the draw is exhausted
2) Probabilistic monitoring design for a trends assessment
    a. Re-visit probabilistic sites using existing RMC Sample Frame
    b. Re-design sample frame that re-weights urban/non-urban sites; over sample list
3) Monitor targeted sites for special studies
4) Combination of two and three

The RMC will assess these and other options during discussions with Regional Water Board staff during the MRP reissuance process beginning in 2019.

3.2.2 Continuous Monitoring for Temperature and General Water Quality

Continuous monitoring of water temperature and general water quality in WY 2018 was conducted in compliance with provisions C.8.d.iii – Iv of the MRP. Hourly temperature measurements were recorded at nine sites in the Guadalupe River Watershed from April through September. Continuous (15-minute) general water quality measurements (pH, DO, specific conductance, temperature) were recorded at three sites in the Coyote Creek watershed during two 2-week periods in June (Event 1) and September (Event 2). Targeted monitoring stations were deliberately selected using the Directed Monitoring Design Principle and were generally consistent with those monitored in WY 2017.

Conclusions from targeted continuous monitoring in WY 2018 are organized on the basis of two management questions:

1. *What is the spatial and temporal variability in water quality conditions during the spring and summer season?*
2. *Do general water quality measurements indicate potential impacts to aquatic life?*

Sites with targeted monitoring results exceeding the MRP trigger criteria and/or WQOs are identified as candidate SSID projects.

Spatial and Temporal Variability (Temperature)

- **Spatial**. Spatial trends in water temperatures measured at key locations along two tributaries to Guadalupe River were similar. Relatively warm conditions were observed at sites directly below reservoirs (possible influence from solar radiation on reservoir water). Water temperatures then decreased at sites in the middle of the sampled profiles, possibly due to shading from riparian vegetation. Farther downstream, temperatures gradually increased, possibly due to less shading of the creek and greater influence from urban land use and ground water return flows. These patterns were similar to WY 2017 monitoring results; however, the stations directly below the reservoirs, added in WY 2018, help paint a more complete picture of water temperature trends in Guadalupe Creek and Alamitos Creek.
- **Temporal**. Temperatures at all nine sites in the Guadalupe River Watershed increased from June (when the loggers were deployed) through mid-August 2018, followed by a gradual decline through the end of the monitoring period in late September. These patterns were similar to WY 2017 monitoring results at the same stations.

Spatial and Temporal Variability (Water Quality)

- **Spatial**. General water quality parameters measured at three stations along the mainstem of Coyote Creek were similar to each other throughout both monitoring windows, with the exception of dissolved oxygen which was consistently lower at the two downstream sites. The downstream decrease in dissolved oxygen may be associated with thermal stratification which was observed in that reach during the Coyote Creek SSID Project (SCVURPPP 2014).
- **Temporal**. Water quality at the Coyote Creek stations was relatively consistent between sampling events, with slight changes in dissolved oxygen following a rise in temperature during Event 1. The diurnal pattern was more pronounced at the upstream site (239), and less variable at the two downstream sites (235, 236). Compared to WY 2017 and WY 2013 data collected at the same stations, temperature in WY 2018 was lower and consequently dissolved oxygen was higher.

Potential Impacts to Aquatic Life

- Potential impacts to aquatic life were assessed through analysis of continuous temperature data collected at nine targeted stations in the Guadalupe River watershed from April through September and analysis of continuous general water quality data (pH, dissolved oxygen, specific conductance, and temperature) collected at three targeted stations in Coyote Creek during two two-week periods (June and September).

- All nine temperature stations in the Guadalupe River Watershed exceeded the MRP trigger threshold of having two or more weeks where the Maximum Weekly Average Temperature (MWAT) exceeded 17°C. However, none of the stations exceeded the MRP maximum instantaneous trigger threshold of 24°C for more than 20% of total recorded samples.
    - 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 locally-derived temperature thresholds developed by NMFS (NMFS 2016) suggests that temperature may not be a limiting factor for salmonid habitat (i.e., summer rearing juveniles) in the study reaches, as long as sufficient dam releases maintain longitudinal connectivity and provide cooler water temperatures and potential refugia for juvenile steelhead during the summer.
- Sites on Coyote Creek had no exceedances of the maximum temperature trigger threshold of 24°C but did exceed the MWAT trigger of 17.0 °C for two consecutive weeks during both events and will therefore be added to the list of candidate SSID projects.
- The WQO for dissolved oxygen in waters designated as having cold freshwater habitat (COLD) Beneficial Uses (i.e., 7.0 mg/L) was not met in over 20% of the measurements recorded at all three water quality stations in Coyote Creek. The results were similar to the findings from WY 2017 Creek Status Monitoring. The middle reach of Coyote Creek is a potentially important migration corridor for salmonid fish populations; however, habitat and water quality conditions in this reach are more suitable for a warm water fishery. Steelhead migration is typically during winter season, when flows are much higher and dissolved oxygen levels are expected to be much higher than what was observed during this study.
- Values for pH and specific conductance measured at the three sites in Coyote Creek during WY 2018 did not exceed their respective triggers or water quality objectives during either event.

3.2.3 Pathogen Indicator Monitoring Results/Conclusions

Pathogen indicator monitoring in WY 2018 was conducted in compliance with provision C.8.d.v of the MRP. Pathogen indicator grab samples were collected during a sampling event in July at five sites throughout Santa Clara County that coincide with public parks.

- Pathogen indicator densities were measured at five targeted sites during WY 2018. Although none of the stations could be considered "bathing beaches," monitoring locations were selected at city parks or trails that were considered to have a relatively high potential for public access. The *E. coli* concentrations did not exceed the MRP trigger threshold (410 cfu/100 ml) or the newly adopted (but not yet approved) statewide WQO (320 cfu/100 ml) at any of the five sites. Both the MRP threshold (130 cfu/100ml) and newly adopted WQO (110 cfu/100 ml) for enterococcus were exceeded at three sites: Saratoga Creek at Wildwood Park, Stevens Creek at Blackberry Farm, and Matadero Creek at Bol Park. These sites will be added to the list of candidate SSID projects.
- It is important to recognize that pathogen indicator thresholds are based on human recreation at beaches receiving bacteriological contamination from human wastewater, and may not be applicable to conditions found in urban creeks. Pathogen indicators observed at the WY 2018 stations may not be associated with human sources and therefore may not pose a threat to human health. As a result, the comparison of pathogen indicator results to water quality objectives and criteria for full body contact recreation may not be appropriate and should be interpreted cautiously.

3.2.3 Chlorine Monitoring Results/Conclusions

Free chlorine and total chlorine residual were measured concurrently with bioassessments at the twenty probabilistic sites in compliance with provision C.8.c.ii. While chlorine residual is generally not a concern in Santa Clara Valley urban creeks, prior monitoring results suggest there are occasional free chlorine and total chlorine residual exceedances in the County. Trigger exceedances that are observed are usually the result of a one-time potable water discharges that are difficult to trace. Furthermore, chlorine in surface waters can dissipate from volatilization and reaction with dirt and organic matter. In WY 2018, there were no exceedances of the MRP trigger for chlorine (0.1 mg/L). The Program will continue to monitor chlorine in compliance with the MRP and will follow-up with illicit discharge staff as needed.

3.2.4 Pesticides and Toxicity Monitoring Results/Conclusions

In WY 2018, SCVURPPP conducted dry weather pesticides and toxicity monitoring at two stations (Stevens Creek and San Tomas Aquino Creek) and wet weather pesticides and toxicity monitoring at three stations (Calabazas Creek, Stevens Creek, and San Tomas Aquino Creek) in compliance with provision C.8.g of the MRP and in coordination with the RMC.

Statistically significant toxicity to *C. dilutus* (survival) was observed in the water sample collected from Stevens Creek during dry season sampling in July 2018. However, the magnitude of the toxic effects in this sample did not exceed MRP trigger criteria of 50 Percent Effect. Statistically significant toxicity to *H.* azteca (survival) was also observed in the Calabazas Creek, San Tomas Aquino Creek, and Stevens Creek water samples during wet weather sampling in January 2018. The magnitude of the toxic effects in the Stevens Creek sample did not exceed MRP trigger criteria, while the magnitude of the toxic effects in the Calabazas Creek and San Tomas Aquino Creek samples did exceed the MRP threshold for re-sampling (i.e., Percent Effect ≥ 50%). In follow-up sampling that was conducted during a storm event in March 2018, statistically significant toxicity was observed in the Calabazas Creek sample. However, the magnitude of the toxic effects was below the MRP threshold. No statistically significant toxicity was observed in the follow-up San Tomas Aquino Creek sample. The cause of the toxicity observations is unknown. Pesticide concentrations in the dry season sediment samples were all very low, most below MDLs, and calculated TU equivalents did not exceed 0.1 in either sample with the exception of bifenthrin in the Stevens Creek sample. Pesticide concentrations in wet weather water samples were also very low, with most values below MDLs.

Sediment chemistry results are evaluated as potential stressors based on TEC quotients and PEC quotients according to criteria in provision C.8.g.iv of the MRP. SCVURPPP also evaluated TU equivalents of pyrethroids and fipronil. TEC and PEC quotients were calculated for all metals and total PAHs measured in sediment samples. Both sites had at least one TEC or PEC quotient exceeding 1.0. In compliance with the MRP, both stations will therefore be placed on the list of candidate SSID projects. Decisions about which SSID projects to pursue should be informed by the fact that most of the TEC and PEC quotient exceedances are related to naturally occurring chromium and nickel due to serpentine soils in the watersheds. No TU equivalents exceeded 1.0. The highest TU equivalents in both samples were for bifenthrin and deltamethrin. Bifenthrin is considered to be the leading cause of pyrethroid-related toxicity in urban areas (Ruby 2013) and the most-commonly detected insecticide monitored by the DPR SWPP (Ensminger 2017).

Pesticide analytes targeted by wet weather monitoring in WY 2018 were generally found at concentrations below the MDL, except for bifenthrin and fipronil compounds. As no water quality objectives are specified in the Basin Plan for these pollutants, they are not currently being used to identify SSID project locations. The wet weather pesticide monitoring data in WY 2018 was compared to pesticide data collected by the DPR SWPP and the USEPA aquatic benchmarks used in DPR SWPP studies to allow for interpretation of the WY 2018 results in the context of larger statewide datasets. However, sites sampled during the WY 2018 wet weather pesticide monitoring where exceedances of the USEPA benchmarks were observed were not added to the list of candidate SSID projects. In future years, data collected by the DPR SWPP and contained on the DPR SURF database can be queried to allow for further comparison of MRP pesticide monitoring results.

SCVURPPP will continue to sample the same two stations for dry weather pesticides and toxicity throughout the permit term.

3.3 Trigger Assessment

The MRP requires analysis of the monitoring data to identify candidate sites for SSID projects. Trigger thresholds against which to compare the data are provided for most monitoring parameters in the MRP and are described in the foregoing sections of this report. Stream condition was based on CSCI scores that were calculated using BMI data. Nutrient data were evaluated using applicable water quality standards from the Basin Plan. 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 the MRP, all monitoring results exceeding trigger thresholds are added to a list of candidate SSID projects that will be maintained throughout the permit term. Follow-up SSID projects will be selected from this list. Table 3.1 lists candidate SSID projects based on WY 2018 Creek Status and Pesticides/Toxicity monitoring data.

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

Table 3.1. Summary of SCVURPPP trigger threshold exceedance analysis in WY 2018. "No" indicates samples were collected, but did not exceed the MRP trigger threshold. "Yes" and shading indicates an exceedance of the MRP trigger threshold.

Station ID	Creek	Bioassessment [1]	Nutrients [2]	Chlorine [3]	Water Toxicity [4]	Sediment Toxicity [4]	Water Chemistry [5]	Sediment Chemistry [5]	Continuous Temperature [6]	Dissolved Oxygen [7]	pH [8]	Specific Conductance [9]	Pathogen Indicators [10]
204R00749	Smith Creek	No	No	No	--	--	--	--	--	--	--	--	--
205R00746	Saratoga Creek	No	No	No	--	--	--	--	--	--	--	--	--
205R00769	MF Coyote Creek	Yes	No	No	--	--	--	--	--	--	--	--	--
205R03498	Saratoga Creek	No	No	No	--	--	--	--	--	--	--	--	--
205R03562	Saratoga Creek	No	No	No	--	--	--	--	--	--	--	--	--
205R03591	Los Trancos Creek	No	No	No	--	--	--	--	--	--	--	--	--
205R03619	Saratoga Creek	Yes	No	No	--	--	--	--	--	--	--	--	--
205R03683	Permanente Creek	No	No	No	--	--	--	--	--	--	--	--	--
205R03699	Hale Creek	Yes	No	No	--	--	--	--	--	--	--	--	--
205R03738	Upper Silver Creek	Yes	No	No	--	--	--	--	--	--	--	--	--
205R03754	San Tomas Aquino	No	No	No	--	--	--	--	--	--	--	--	--
205R03795	Lower Silver Creek	Yes	No	No	--	--	--	--	--	--	--	--	--
205R03825	Thompson Creek	Yes	No	No	--	--	--	--	--	--	--	--	--
205R03843	San Tomas Aquino	Yes	No	No	--	--	--	--	--	--	--	--	--
205R03847	Los Trancos Creek	No	No	No	--	--	--	--	--	--	--	--	--
205R03875	Calabazas Creek	Yes	No	No	--	--	--	--	--	--	--	--	--
205R03907	Lower Penitencia	Yes	No	No	--	--	--	--	--	--	--	--	--
205R04190	Guadalupe Creek	No	No	No	--	--	--	--	--	--	--	--	--
205R04217	Upper Penitencia	No	No	No	--	--	--	--	--	--	--	--	--
205R04266	Calabazas Creek	Yes	No	No	--	--	--	--	--	--	--	--	--
205LGA400	Guadalupe River	--	--	--	--	--	--	--	--	--	--	--	No
205MAT030	Matadero Creek	--	--	--	--	--	--	--	--	--	--	--	Yes
205STE064	Stevens Creek	--	--	--	--	--	--	--	--	--	--	--	Yes
205GUA225	Arroyo Calero	--	--	--	--	--	--	--	--	--	--	--	No
205SAR075	Saratoga Creek	--	--	--	--	--	--	--	--	--	--	--	Yes
205GUA190	Guadalupe Creek	--	--	--	--	--	--	--	Yes	--	--	--	--
205GUA202	Guadalupe Creek	--	--	--	--	--	--	--	Yes	--	--	--	--
205GUA210	Guadalupe Creek	--	--	--	--	--	--	--	Yes	--	--	--	--
205GUA218	Guadalupe Creek	--	--	--	--	--	--	--	Yes	--	--	--	--
205GUA250	Alamitos Creek	--	--	--	--	--	--	--	Yes	--	--	--	--
205GUA255	Alamitos Creek	--	--	--	--	--	--	--	Yes	--	--	--	--
205GUA262	Alamitos Creek	--	--	--	--	--	--	--	Yes	--	--	--	--
205GUA270	Alamitos Creek	--	--	--	--	--	--	--	Yes	--	--	--	--
205GUA279	Alamitos Creek	--	--	--	--	--	--	--	Yes	--	--	--	--
205COY235	Coyote Creek	--	--	--	--	--	--	--	Yes	Yes	No	No	--
205COY236	Coyote Creek	--	--	--	--	--	--	--	Yes	Yes	No	No	--
205COY239	Coyote Creek	--	--	--	--	--	--	--	Yes	Yes	No	No	--
205CAL010	Calabazas Creek	--	--	--	No	--	No	--	--	--	--	--	--
205STE021	Stevens Creek	--	--	--	No	No	No	Yes	--	--	--	--	--
205STQ010	San Tomas Aquino	--	--	--	No	No	No	Yes	--	--	--	--	--

Notes:

1. CSCI score ≤ 0.795.
2. Unionized ammonia (as N) ≥ 0.025 mg/L, nitrate (as N) ≥ 10 mg/L, chloride > 250 mg/L.
3. Free chlorine or total chlorine residual ≥ 0.1 mg/L.
4. Test of Significant Toxicity = Fail and Percent Effect ≥ 50 %.
5. TEC or PEC quotient ≥ 1.0 for any constituent.
6. Two or more MWAT ≥ 17.0°C or 20% of results ≥ 24°C.
7. DO < 7.0 mg/L in COLD streams or DO < 5.0 mg/L in WARM streams.
8. pH < 6.5 or pH > 8.5.
9. Specific conductance > 2000 uS.
10. Enterococcus ≥ 130 cfu/100ml or *E. coli* ≥ 410 cfu/100ml.

3.4 Recommendations

The following recommendations are based on findings from WY 2018 Creek Status and Pesticides and Toxicity monitoring conducted by SCVURPPP, as well as reflections on other monitoring, data analysis, and policy development projects being conducted in the region (e.g., RMC 5-Year Report) and statewide.

- In WY 2019, the Program will continue to coordinate with RMC partners on implementation of monitoring requirements in MRP provisions C.8.d and C.8.g.
- A major component of the WY 2019 monitoring will be bioassessment surveys and data assessment. In WY 2019, SCVURPPP will conduct biological assessments at both probabilistic and targeted sites. To date, a total of 152 probabilistic sites have been monitored by SCVURPPP (n=140) and SWAMP (n=12). This exceeds the number of samples necessary for a statistically representative dataset. Therefore, SCVURPPP is eligible to select up to 20 percent of sample locations on a targeted basis to evaluate trends or address other aquatic life related concerns.
- In WY 2018, BASMAA funded a study to evaluate five years of regional bioassessment data (WY 2012 – WY 2016). Findings from the RMC 5-Year Report are summarized in this report is included as Attachment 2 to Appendix A. In WY 2019, SCVURPPP will apply some of the tools used in the RMC 5-Year Report (i.e., random forest models) to analyze bioassessment data collected in Santa Clara County over all eight years of MRP monitoring (WY 2012 – WY 2019). Results of the analyses will be described in the Integrated Monitoring Report (IMR) which will be developed following WY 2019 and submitted by March 31, 2020 (the fifth year of the Permit term) in lieu of an annual UCMR.
- Biological condition and stressor data will also be evaluated in the IMR at finer spatial scales (e.g., watersheds). In addition, historical (pre-MRP) bioassessment data may be incorporated to evaluate spatial and temporal trends of biological condition.
- For the past two years (WY 2017 and WY 2018), SCVURPPP has conducted continuous temperature monitoring in the Guadalupe River Watershed and continuous water quality monitoring on the mainstem of Coyote Creek. During WY 2019, SCVURPPP will collect continuous temperature and water quality (sondes) data at the same locations that were monitored in WY 2017 and WY 2018. Monitoring activities will include continuous temperature monitoring at 4 to 5 sites on Alamitos Creek and 4 sites on Guadalupe Creek and continuous water quality monitoring at 3 sites on Coyote Creek mainstem. A third year of monitoring at these locations will provide additional data to evaluate inter-annual variability in water quality conditions across range of water years.
- Provision C.8.g Pesticides and Toxicity monitoring will be conducted during the dry season at the same two stations targeted in WY 2016, WY 2017, and WY 2018: Stevens Creek and San Tomas Aquino Creek. In WY 2019, the full dataset from these stations (WY 2016 – WY 2019) will be evaluated in the IMR.

3.5 Management Implications

The Program's Creek Status and Pesticides and Toxicity Monitoring programs (consistent with MRP provisions C.8.d and C.8.g, respectively) focus on assessing the water quality condition of urban creeks in the Santa Clara Valley and identifying stressors and sources of impacts observed. The sample size from WY 2018 (overall n=20; urban n=17) is not sufficient to develop statistically representative conclusions regarding the overall condition of all creeks. A more comprehensive bioassessment data analyses for the entire eight years of monitoring under the MRP (WY 2012 through WY 2019) will be conducted as part of the Integrated Monitoring Report during WY 2019.

Like previous years, WY 2018 data suggest that most urban streams have likely or very likely altered populations of aquatic life indicators (e.g., benthic macroinvertebrates). These conditions are likely the result of long-term changes in stream hydrology, channel geomorphology, in-stream habitat complexity, and other modifications to the watershed and riparian areas associated with the urban development that has occurred over the past 50 plus years. Additionally, episodic or site-specific increases in temperature (particularly in lower creek reaches or reaches directly below reservoirs) may not be optimal for aquatic life in some local creeks.

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

- In compliance with MRP provision C.3, new and redevelopment projects in the Bay Area are now designed to more effectively reduce water quality and hydromodification impacts associated with urban development. Low impact development (LID) methods, such as rainwater harvesting and use, infiltration and biotreatment are required as part of development and redevelopment projects. In addition, Green Infrastructure planning is now part of all municipal projects. These LID measures are expected to reduce the impacts of urban runoff and associated impervious surfaces on stream health.
- In compliance with MRP provision C.7, the Program and its Co-permittees are implementing stormwater outreach activities through the Watershed Watch Campaign (Campaign) that directly engages citizens and youth to make watershed-friendly choices. Pollution prevention messages are delivered at 8 to 10 community events per year, communicating the value and protection of creeks' natural resources to citizens both in plain non-scientific wording and multiple native languages (e.g., Spanish, Vietnamese, Chinese). Media advertising, such as the Earthquakes' and Sharks' collaborations, teach citizens how to dispose properly of litter, hazardous wastes, and car wash water. The Campaign also conducts numerous activities and sessions to educate children about watersheds and urban runoff pollution prevention through the Don Edwards San Francisco Bay National Wildlife Refuge, including watershed-focused field trips, marsh walks, gardening events, bird watching, and wildlife observation. Additionally, the Campaign supports the musical assembly program, ZunZun that engages students through music and theatre while teaching them about stormwater, watersheds, and pollution prevention topics. These efforts are expected to encourage watershed-positive behavior change in Santa Clara Valley residents.
- In compliance with MRP provision C.9, the Program and Co-permittees are implementing pesticide toxicity control programs that focus on source control and pollution prevention measures. The control measures include the implementation of integrated pest management (IPM) policies/ordinances, public education and outreach programs, pesticide disposal programs, the adoption of formal State pesticide registration procedures, and sustainable landscaping requirements for new and redevelopment projects. Through these efforts, it is estimated that the amount of pyrethroids observed in urban stormwater runoff will decrease by 80-90% over time, and in turn significantly reduce the magnitude and extent of toxicity in local creeks.
- Trash loadings to local creeks have been reduced through implementation of new control measures in compliance with MRP provision C.10 and other efforts by Co-permittees to reduce the impacts of illegal dumping directly into waterways. These actions include the installation and maintenance of trash capture systems, the adoption of ordinances to reduce the impacts of litter prone items, enhanced institutional controls such as street sweeping, and the on-going removal and control of direct dumping. The MRP establishes a mandatory trash load reduction schedule, minimum areas to be treated by trash full capture systems, and requires development of receiving water monitoring programs for trash.
- In compliance with MRP provisions C.2 (Municipal Operations), C.4 (Industrial and Commercial Site Controls), C.5 (Illicit Discharge Detection and Elimination), and C.6 (Construction Site Controls) Co-permittees continue to implement programs that are designed to prevent non-stormwater discharges during dry weather and reduce the exposure of contaminants to stormwater and sediment in runoff during rainfall events.

- In compliance with MRP provision C.13, copper in stormwater runoff is reduced through implementation of controls such as architectural and site design requirements, prohibition of discharges from water features treated with copper, and industrial facility inspections.
- Mercury and polychlorinated biphenyls (PCBs) in stormwater runoff are being reduced through implementation of the respective TMDL water quality restoration plans. In compliance with MRP provisions C.11 (mercury) and C.12 (PCBs), the Program will continue to identify sources of these pollutants and will implement control actions designed to achieve new minimum load reduction goals. Monitoring activities conducted in WY 2018 that specifically target mercury and PCBs are described in the Pollutants of Concern Monitoring Data Report that is included as Appendix E to the WY 2018 UCMR.

In addition to the Program and Co-permittee controls implemented in compliance with the MRP, numerous other efforts and programs designed to improve the biological, physical and chemical condition of local creeks are underway. For example, the Santa Clara Valley Water District's Integrated Water Resources Master Plan (IWRMP) or "One Water Plan" is an ongoing, multi-year process to develop a framework for long-term management of Santa Clara County water resources. The One Water Plan identifies, prioritizes and implements activities at a watershed scale to meet flood protection, water supply, water quality and environmental stewardship goals and objectives. Additionally, SCVURPPP, via a Proposition 1 grant awarded to the Santa Clara Valley Water District, continued to develop a Storm Water Resource Plan for the Santa Clara Basin in 2018 that will support the development and implementation of MRP-required Green Stormwater Infrastructure Plans and produce a list of prioritized runoff capture and use projects that will be eligible for future State implementation grant funds. Through the continued implementation of MRP-associated and other watershed stewardship programs, SCVURPPP anticipates that stream conditions and water quality in local creeks will continue to improve over time. 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 "gray" 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 STRESSOR/SOURCE IDENTIFICATION (C.8.E)

Provision C.8.e of the MRP requires that Permittees evaluate creek status (provision C.8.d) and pesticides and toxicity (provision C.8.g) monitoring data with respect to triggers defined in the MRP, and maintain a list of all results exceeding trigger thresholds. Table 3.1 lists the results of the trigger evaluation for WY 2018 data. Sites where triggers are exceeded may indicate potential impacts to aquatic life or other beneficial uses and are therefore considered as candidates for future Stressor/Source Identification (SSID) projects. SSID projects are selected from the list of trigger exceedances based on criteria such as magnitude of threshold exceedance, parameter, and likelihood that stormwater management action(s) could address the exceedance. Pollutants of concern monitoring results (provision C.8.f) may be considered as appropriate.

The MRP requires that Permittees initiate a minimum number of SSID projects during the permit term, with a minimum of one for toxicity. As a regional collaborative, SCVURPPP and its RMC partners must collectively initiate a region-wide minimum of eight new SSID projects during the permit term, with a minimum of one for toxicity. RMC programs have agreed that the distribution of the eight required SSID projects will be as follows, with most projects conducted by individual Programs addressing local needs and one conducted regionally:

- 2 each: ACCWP and SCVURPPP
- 1 each: CCCWP and SMCWPPP
- 1 jointly: FSURMP and Vallejo Permittees
- 1 regionally: all RMC partners

In compliance with Provision C.8.e.iii, half of the required number of SSID projects (i.e., four) were initiated with a work plan by the third year of the permit term (i.e., 2018). All SSID projects initiated in compliance with the 2015 MRP are summarized in the BASMAA RMC Regional SSID Report (**Appendix B**).

SSID projects must identify and isolate potential sources and/or stressors associated with observed water quality impacts. They are intended to be oriented to taking action(s) to alleviate stressors and reduce sources of pollutants. The 2015 MRP describes the stepwise process for conducting SSID projects initiated under the current permit:

- Step 1: Develop a work plan for each SSID project that defines the problem to the extent known, describes the SSID project objectives, considers the problem within a watershed context, lists candidate causes of the problem, and establishes a schedule for investigating the cause(s) of the trigger. The MRP recommends study approaches for specific triggers. For example, toxicity studies should follow guidance for Toxicity Reduction Evaluations (TRE) or Toxicity Identification Evaluations (TIE), physical habitat and conventional parameter (e.g., dissolved oxygen, temperature) studies should generally follow Step 5 (Identify Probable Causes) of the Causal Analysis/Diagnosis Decision Information System (CADDIS), and pathogen indicator studies should generally follow the California Microbial Source Identification Manual (SCCWRP 2013).

- Step 2: Conduct SSID investigation according to the schedule in the SSID work plan and report on the status of SSID investigations annually in the UCMR.

- Step 3: Conduct follow-up actions based on SSID investigation findings. These may include development of an implementation schedule for new or improved best management practices (BMPs). If a Permittee determines that MS4 discharges are not contributing to an exceedance of a water quality standard, the Permittee may end the SSID project upon written concurrence of the Executive Officer. If the SSID investigation is inconclusive, the Permittee may request that the Executive Officer consider the SSID project complete.

In 2017, SCVURPPP developed a work plan for the Coyote Creek Toxicity SSID Project which fulfills the regional requirement of one toxicity project. In 2018, BASMAA began development of a regional SSID project addressing releases and spills of PCBs from electrical utility equipment. The status of these projects are summarized below.

4.1 Coyote Toxicity

In WY 2017, SCVURPPP initiated an SSID project in Coyote Creek to investigate sources of sediment toxicity. This SSID project was triggered by the recent listing (303(d) List/305(b) Report) of Coyote Creek for toxicity in sediment in the 2016 Integrated Report for the San Francisco Bay Region. It satisfies the regional requirement for one toxicity SSID project. The Coyote Creek SSID Work Plan (SCVURPPP 2018a) was submitted with the SCVURPPP WY 2017 UCMR on March 31, 2018. The goals of the project are to:

1. Identify the magnitude and extent of toxicity in a reach of the Coyote Creek mainstem where previous data were collected; and
2. Identify potential causes of sediment toxicity (if observed).

In July 2018, Program collected sediment samples at five locations in the Coyote Creek mainstem (Figure 4.1). The monitoring results showed that sediment samples were not toxic, with the exception of site COY080 at Oakland Rd, which had 76% survival compared to control (<80% is considered toxic). The sediment chemistry at site COY080 was inconclusive (i.e., pyrethroid or metal concentrations were not at levels that are known to cause toxic effects). At other sites, pyrethroid concentrations were at levels that may cause effects, but toxicity was not observed. The Program subsequently conducted a Toxicity Investigation Evaluation (TIE) for sediment collected at site COY080. Results from the TIE showed no toxicity (survival > 80%).

Based on monitoring results from WY 2018, sources of toxicity and identification of potential management actions could not be determined. The Program will conduct another year of monitoring at a reduced number of sites (three sites rather than five) during WY 2019. Monitoring will follow the same monitoring approach used in WY 2018, that is described in the SSID work plan. The Program will prepare a Final Report with data results and interpretation for both years of monitoring. It is anticipated that the report will be submitted to the Regional Water Board with the Integrated Monitoring Report on March 31, 2020.

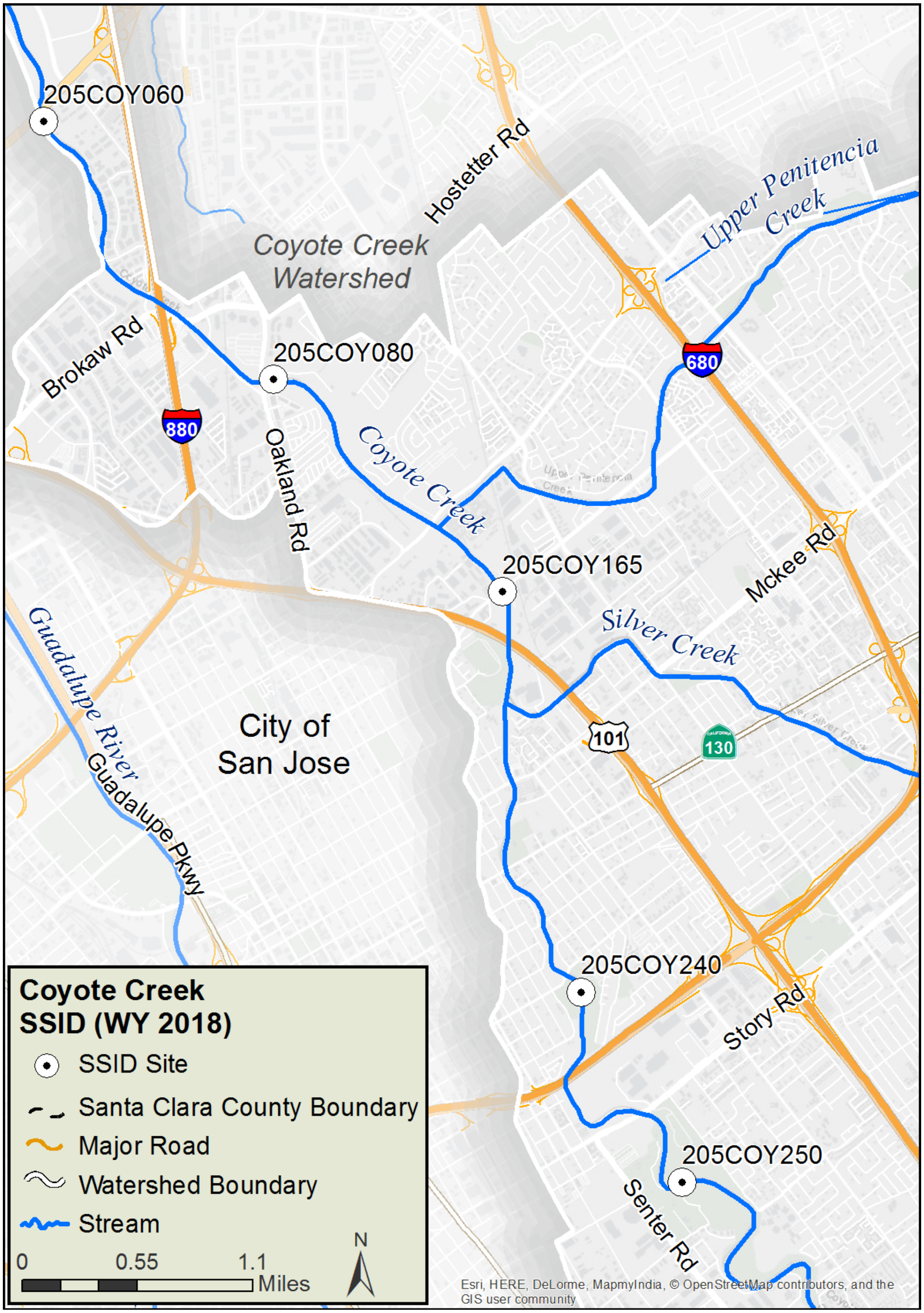

Figure 4.1. Sampling locations in WY 2018 for sediment chemistry and toxicity testing in Coyote Creek mainstem as part of the Coyote Toxicity SSID Project.

4.2 Regional PCBs from Electrical Utility Equipment

In late-2018, BASMAA contracted with EOA, Inc. to develop a work plan for a regional SSID project addressing releases and spills of PCBs from electrical utility equipment. The Regional SSID Project - Electrical Utilities as a Potential PCBs Source to Stormwater in the San Francisco Bay Area – was triggered by fish tissue monitoring in the Bay that led to the Bay being designated as impaired on the Clean Water Act (CWA) Section 303(d) list and the adoption of a TMDL for PCBs in 2008. Subsequent PCBs monitoring by the BASMAA RMC partners and the RMP suggests that diffuse sources of PCBs are present throughout the region. One potential source of PCBs to stormwater is releases and spills from electrical utility equipment.

PCBs were historically used in several types of electrical utility equipment, some of which still contain PCBs. Although much of the PCB-containing equipment has been removed from service, some remains in use, and releases and spills from the equipment may be occurring at levels approaching the TMDL waste load allocation. However, the information currently available is not adequate to fully quantify the scope and magnitude of electrical utility applications as a source of PCBs to stormwater. The information gap is partially due to state and federal regulatory levels for reporting and clean-up of PCBs spills that are higher than the PCB levels needed to comply with the PCBs TMDL requirements. Furthermore, stormwater Programs have neither the authority to compel electrical utilities to provide information about spills, equipment replacement programs, and clean-up protocols, nor the authority to require additional controls. Therefore, BASMAA identified a need to develop and implement a regional SSID work plan to further understand the magnitude and extent of this potential PCBs source, and identify controls (if necessary) that could be put into place to reduce the water quality impacts of this source.

The work plan is included with this WY 2018 UCMR as **Appendix G**. It presents a framework for working with the Regional Water Board, which does have jurisdictional authority over electrical utility companies. Implementation of the regional SSID work plan will begin in WY 2019.

5.0 POLLUTANTS OF CONCERN MONITORING (C.8.F)

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

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

Provision C.8.f of the MRP requires POC monitoring of polychlorinated biphenyls (PCBs), mercury, copper, emerging contaminants, and nutrients.[8] The MRP defines yearly and total (i.e., permit term) minimum number of samples for each POC and specifies the minimum number of samples for each POC that must address each information need. Progress toward POC monitoring requirements accomplished in WY 2018 and the planned allocation of effort for WY 2019 are described in the SCVURPPP POC Monitoring Report (SCVURPPP 2018b) that was submitted to the Regional Water Board on October 15, 2018 in compliance with provision C.8.h.iv of the MRP.

In WY 2018, SCVURPPP complied with provision C.8.f of the MRP through the following activities:

- Implementation of a catchment-scale storm sampling program for PCBs and mercury (n=8);
- Collection of wet and dry weather samples for nutrients and copper analysis (n=6);
- Participation in BASMAA regional study to analyze infrastructure caulk and sealant samples for PCBs (n=5; ¼ of project total);
- Participation in BASMAA regional study to evaluate the PCBs and mercury removal effectiveness of hydrodynamic separator (HDS) units and biochar-amended bioretention soil media (BSM) (n = 8; ¼ of project total);
- Participation in SWAMP's Stream Pollutant Trends monitoring program; and
- Participation in the RMP Small Tributaries Loading Strategy Team (STLS).[9]

A report describing the results of all POC monitoring conducted by SCVURPPP is included as **Appendix C** to this report. Reports describing the results of BASMAA's BMP effectiveness studies are included as

[8] Emerging contaminant monitoring requirements will be met through participation in RMP special studies and will address at least PFOS, PFAS, and alternative flame retardants being used to replace PBDEs.

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

Appendices D and **E**. A report describing the results of POC monitoring conducted by the STLS is included as **Appendix F**. Appendices C, D, E, and F are summarized in the sections below.

5.1 SCVURPPP POC Monitoring (C.8.f)

In compliance with provision C.8.f of the MRP, the Program conducted POC monitoring in WY 2018 for PCBs, mercury, copper, and nutrients. The MRP-required yearly minimum number of samples was exceeded for all POCs. Results are summarized in the sections below and described in more detail in **Appendix C**.

5.1.1 PCBs and Mercury

PCBs and mercury monitoring in WY 2018 continued to focus primarily on identification of source areas of PCBs and mercury to the MS4 and San Francisco Bay. WY 2018 data are being used by SCVURPPP to implement a process to identify and prioritize watershed management areas (WMAs) and identify specific source properties in the Santa Clara Valley. This process is generally consistent with the approaches currently being implemented by other RMC partners. WMAs are priority watersheds or catchments in the urban landscape where control measures for PCBs and mercury are currently being implemented or will be implemented during the MRP permit term, to the extent that feasible and cost-effective controls can be identified.

WMA Prioritization

Wet weather samples were collected from MS4 outfalls or manholes to provide information to identify WMAs where control measures could be implemented to comply with MRP requirements for load reductions of PCBs and mercury. This is the same approach that was implemented in WY 2016 – WY 2017, and monitoring was conducted in accordance with the Water Year 2016 Pollutant of Concern Monitoring - Sampling and Analysis Plan (SCVURPPP 2015). The sampling was focused on collection of storm composite samples from high interest WMAs that may contain PCB and/or mercury source properties. High interest WMAs were identified and prioritized for sampling by evaluating several types of data, including: PCBs and mercury concentrations from prior sediment and water sampling efforts, land use data showing old industrial parcels, municipal storm drain data showing pipelines and access points (e.g., manholes, outfalls, pump stations), catchment areas delineated from municipal storm drain data, and logistical/safety considerations (SCVURPPP 2015).

During WY 2018, the Program collected eight samples for PCBs and mercury analysis. Each sample was a composite consisting of four to eight aliquots collected during the rising limb and peak of the storm hydrograph (as determined through field observations). Samples were analyzed for the “RMP 40” PCB congeners[10] (method EPA 1668C), total mercury (method EPA 1631E), and suspended sediment concentration (SSC; method ASTM D3977-97).

In summary, WY 2018 results included:

- Total PCB concentrations, calculated as the sum of the “RMP 40” congeners, ranged from 0.15 ng/L to 57.3 ng/L; and PCB particle ratios, calculated by dividing total PCB concentrations by SSC, ranged from 4.0 ng/g to 623 ng/g.
- Mercury concentrations ranged from 1.07 ng/L to 31.6 ng/L; and mercury particle ratios ranged from 27.6 ng/g to 344 ng/g.

Although WY 2018 monitoring results did not result in identification of WMAs with “known high source areas” where source investigations should be considered. However, review of data from prior years

[10] The RMP 40 PCB congeners include: PCB-8, PCB-18, PCB-28, PCB-31, PCB-33, PCB-44, PCB-49, PCB-52, PCB-56, PCB-60, PCB-66, PCB-70, PCB-74, PCB-87, PCB-95, PCB-97, PCB-99, PCB-101, PCB-105, PCB-110, PCB-118, PCB-128, PCB-132, PCB-138, PCB-141, PCB-149, PCB-151, PCB-153, PCB-156, PCB-158, PCB-170, PCB-174, PCB-177, PCB-180, PCB-183, PCB-187, PCB-194, PCB-195, PCB-201, PCB-203.

during WY 2018 did result in updates to the WMA map. Figure 5.1 illustrates the current state of knowledge about WMAs in Santa Clara County.

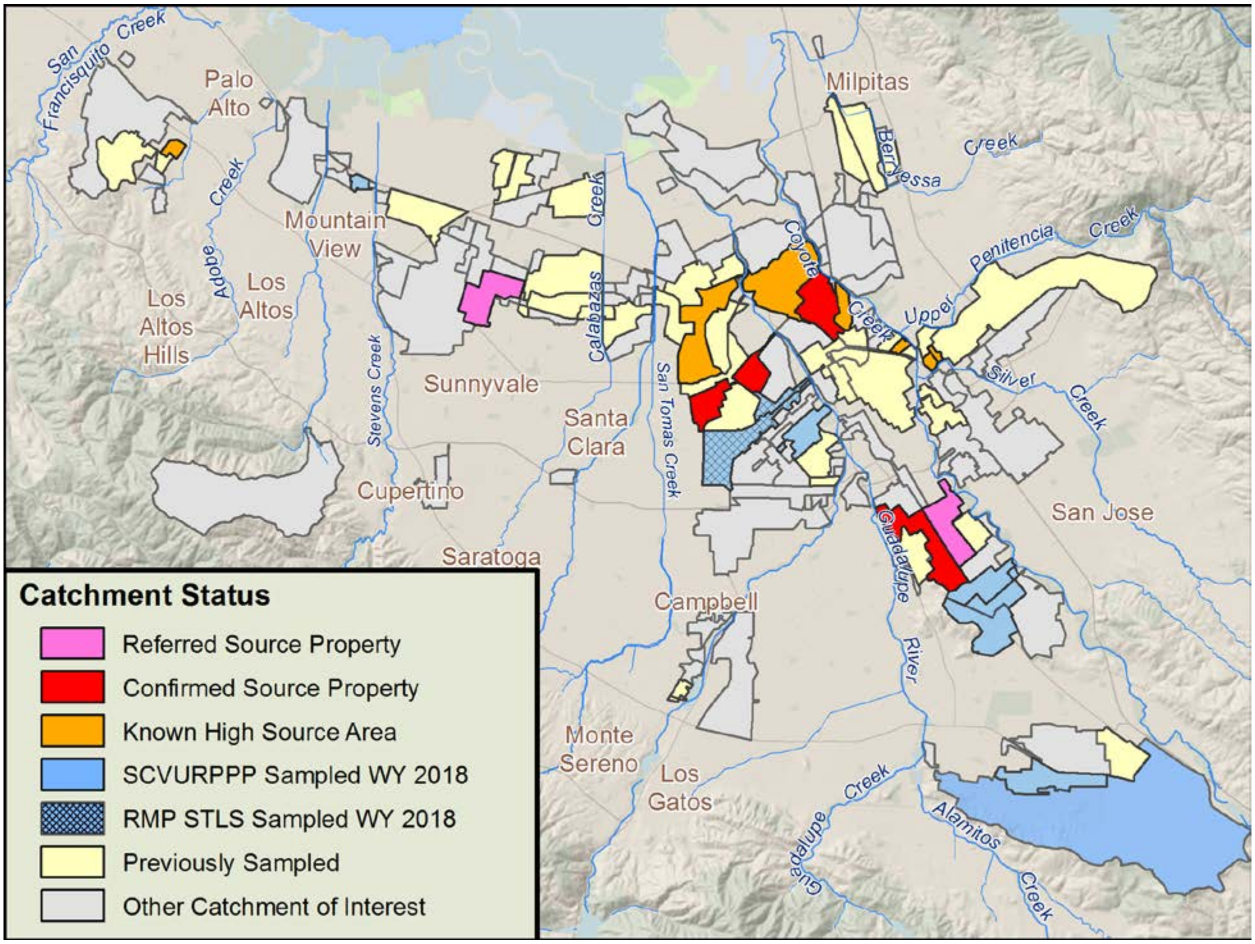

Figure 5.1. WMA map of Santa Clara County, showing catchments sampled in WY 2018.

The wet weather characterization data collected by SCVURPPP in WY 2018 were compiled with similar data collected throughout the region by the RMP STLS and SMCWPPP (Figure 5.2). The full dataset includes samples collected from 127 MS4 catchments and 28 receiving waters.

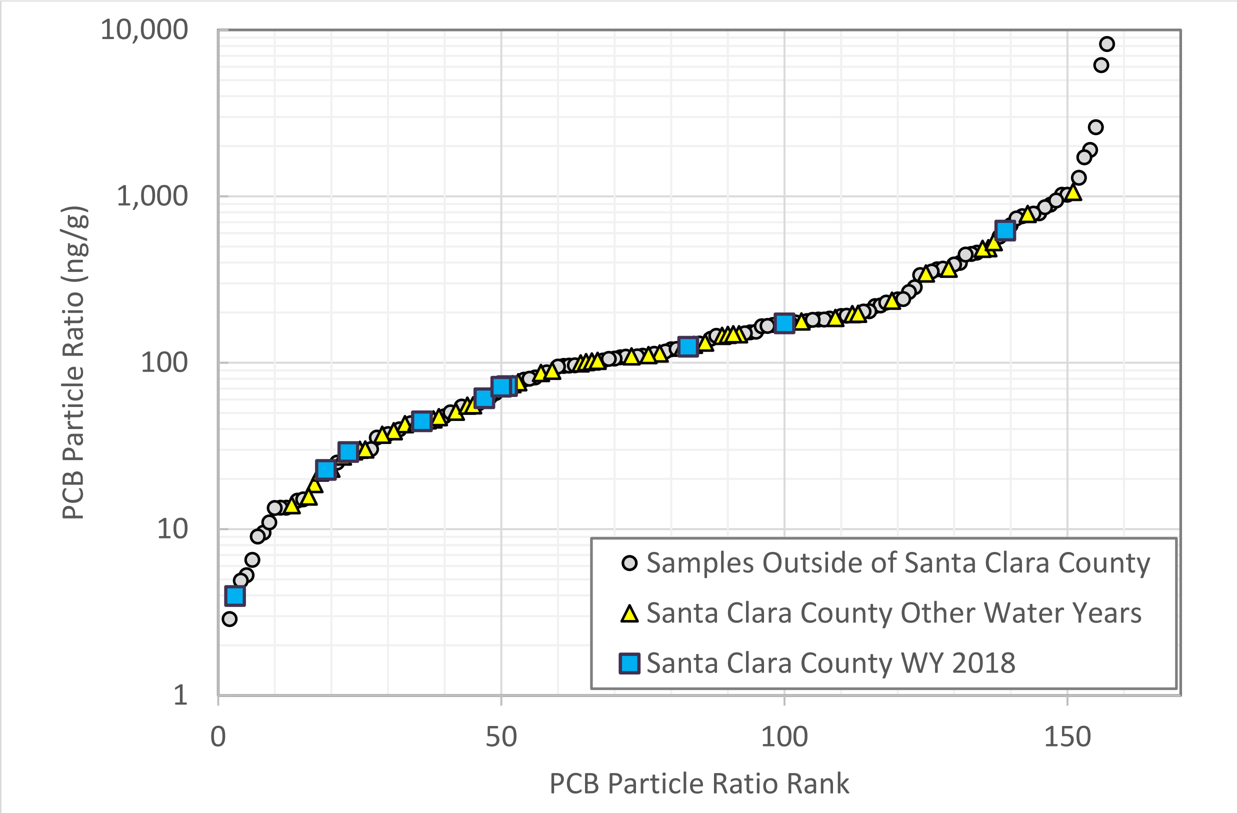

Figure 5.2. PCB particle ratios for water samples collected in MS4s and receiving waters draining to the Bay.

SCVURPPP plans to continue working with other Bay Area countywide stormwater programs (through the BASMAA MPC Committee) and the RMP STLS to evaluate the results of the ongoing efforts in the Bay Area to identify PCBs and mercury source areas and plan next steps in Santa Clara County.

5.1.2 Copper

In WY 2018, the Program collected a total of six samples for copper analysis (i.e., total and dissolved copper, and hardness). Three bottom-of-the-watershed stations (Stevens Creek, San Tomas Aquino Creek, and Calabazas Creek) were sampled during a large storm event on January 8, 2018, concurrent with nutrient monitoring and Provision C.8.g.iii Wet Weather Pesticides and Toxicity Monitoring. The three sites were sampled again on May 21, 2018 during spring baseflows. The goal of this approach is to address Management Question #5 (Trends) by comparing copper concentrations during different seasons. Management Question #4 (Loads and Status) is also addressed by characterizing copper concentrations in mixed-use watersheds.

Based on the laboratory results, the following findings are noted:

- Copper concentrations were higher in the storm samples compared to the spring baseflow samples. Conversely, hardness concentrations were lower in the storm samples compared to the spring baseflow samples.

- Copper concentrations are similar (i.e., within the same order of magnitude) in all three creeks sampled. There do not appear to be localized sources of copper.

- In general, dissolved copper concentrations were below calculated acute and chronic WQOs[11]; however, one dissolved copper sample (collected from San Tomas Aquino on Jan. 8, 2018) exceeded the calculated WQOs. Because the total copper concentration from this sample was much lower (14 ug/L) than the dissolved copper concentration (30 ug/L), a scenario not possible due to the nature of the analyte types, this result has been flagged as questionable in the electronic data deliverable (EDD). It is possible that contamination was introduced during the laboratory filtration process.

5.1.3 Nutrients

In WY 2018, the Program collected samples for nutrients analysis (i.e., ammonium[12], nitrate, nitrite, total Kjeldahl nitrogen (TKN), dissolved orthophosphate, and total phosphorus) from three bottom-of-the-watershed locations on Stevens Creek, San Tomas Aquino Creek, and Calabazas Creek concurrent with copper monitoring and Provision C.8.g.iii Wet Weather Pesticides and Toxicity Monitoring to address Management Question #4 (loads and status). Samples were collected during a large storm event on January 8, 2018 and during dry season baseflows on May 21, 2018.

Based on the laboratory results, the following findings are noted:

- Concentrations of all nutrients were similar at all three stations during the January event. In contrast, there was high variability among the stations during the May event, particularly for nitrate and phosphorus which varied by an order of magnitude.

- Inorganic nitrogen (nitrate and nitrite) concentrations were higher in May compared to the January storm event (with the exception of San Tomas Aquino Creek) and organic nitrogen (TKN) concentrations were lower in May compared to the January storm event.

- Organic nitrogen (TKN) made up a greater proportion of the total nitrogen concentration during the January storm event compared to the May event. It is likely that organically-bound nitrogen washed off surfaces during the January storm had not yet had time to cycle through the ammonification and nitrification processes before samples were collected.

- Phosphorus concentrations were higher during the January storm runoff sampling event compared to the May baseflow event. This finding is consistent with the draft conceptual model developed by the NMS which suggests that nutrient loads to San Francisco Bay from creeks are highest during the wet season, although considerably less than loads from publicly owned wastewater treatment works (POTWs) (Senn and Novick 2014). However, nutrient concentrations (primarily nitrate) were higher during the baseflow event at two of the three stations. The nitrate patterns were not consistent with the NMS model but were consistent with SCVURPPP POC monitoring conducted in WY 2017 in Silver Creek.

- No applicable WQOs were exceeded.

5.1.4 Recommendations for SCVURPPP POC Monitoring in WY 2019

As described in **Appendix C**, the Program identified the following recommendations for POC monitoring in WY 2019 and beyond:

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[11] Acute (1-hour average) and chronic (4-day average) WQOs for copper are expressed in terms of the dissolved fraction of the metal in the water column and are hardness dependent. The copper WQOs were calculated using the base e exponential functions described in the California Toxics Rule (40 CFR 131.38) which apply hardness values measured at the sample station.

[12] Ammonium was calculated as the difference between ammonia and un-ionized ammonia. Un-ionized ammonia was calculated using the formula provided by the American Fisheries Society Online Resources (http://fishculture.fisheries.org/resources/fish-hatchery-management-calculators/).

- SCVURPPP and the RMP's STLS will continue to conduct PCBs and mercury monitoring with the goal of identifying WMAs and specific source properties where new PCB and mercury control measures can be implemented during the permit term.

- SCVURPPP will continue to participate in the STLS Trends Strategy Team in developing a regional monitoring strategy to assess trends in POC loading to San Francisco Bay from small tributaries (see Section 5.2.3). The STLS Trends Strategy will initially focus on PCBs and mercury, but will not be limited to those POCs. Analysis of recent and historical data collected at region-wide loadings stations suggests that PCB concentrations are highly variable. Therefore, a monitoring design to detect trends with statistical confidence may require more samples than is feasible with current resources. The STLS Trends Strategy Team is continuing to evaluate available data from the Guadalupe River watershed to explore more economical monitoring opportunities. The Team is also considering modeling options that could be used in concert with monitoring to detect and predict trends in POC loadings.

- SCVURPPP will continue to work with the SPoT Program to address Management Question #5 (Trends). The *SPoT Monitoring Program* conducts annual dry season monitoring (subject to funding constraints) of sediments collected from a statewide network of large rivers. The goal of the SPoT Program is to investigate long-term trends in water quality (Management Question #5 – Trends). Sites are targeted in bottom-of-the-watershed locations with slow water flow and appropriate micromorphology to allow deposition and accumulation of sediments, including two stations in Santa Clara County (Coyote Creek and Guadalupe River). In most years, sediments are analyzed for PCBs, mercury, other metals, toxicity, pesticides, and organic pollutants (Phillips et al. 2014).

- A minimum of two copper samples will be collected from old industrial catchments concurrent with PCBs and mercury storm composite samples.

- A minimum of two nutrient samples will be collected from mixed land use watersheds during baseflow to address Management Question # 4 (Loads and Status).

- SCVURPPP will continue to participate in the RMP's STLS and the RMP's CEC Strategy.

5.2 BASMAA Monitoring

In WY 2018, SCVURPPP participated in the BASMAA "POC Monitoring Project for Source Identification and Management Action Effectiveness" project. This regional project includes two somewhat independent monitoring studies designed during WY 2017 and implemented during WY 2018. BASMAA developed two study designs to implement these projects and a shared Sampling and Analysis Plan and Quality Assurance Project Plan (SAP/QAPP). The SAP/QAPP describes field and laboratory methods, measurement quality objectives, quality control procedures, and data management aspects. As one of four Countywide Programs subject to provision C.8.f POC Monitoring requirements, SCVURPPP's POC monitoring accomplishments include ¼ of the total number of samples collected through this regional project.

5.2.1 PCBs in Infrastructure Caulk Study

The BASMAA Regional Infrastructure Caulk and Sealant Sampling Program was developed to satisfy the provision C.12.e requirement to collect 20 composite caulk/sealant samples throughout the MRP permit area and evaluate (at a screening level) whether PCBs are present in right-of-way infrastructure caulk and sealants in the Bay Area. This study also addresses Management Question #1 (Source Identification). The sampling program was designed to specifically target roadway and storm drain structures that were constructed during the most recent time period when PCBs were potentially used in caulk and sealant materials (i.e., prior to 1980, with a focus on the 1960's and 1970's).

In WY 2018, the BASMAA project team collected 54 samples of caulk/sealant materials from ten types of roadway and storm drain infrastructure in the public right-of-way (ROW). Structures sampled included concrete bridges/overpasses, sidewalks, curbs and gutters, roadway surfaces, above and below ground storm drain structures (i.e., flood control channels and storm drains accessed from manholes), and electrical utility boxes or poles attached to concrete sidewalks. The individual samples were grouped by structure type and sample appearance (color and texture) into 20 composites and analyzed for the RMP 40 PCB congeners using a modified method EPA 8270C.

Total PCBs concentrations across the 20 composite samples ranged from non-detect (ND) to > 4,000 mg/Kg. The majority of the composites had PCBs concentrations that were below 0.2 mg/Kg. PCBs were not detected in ten of the composite samples, representing nearly 60% of the individual samples collected during the program. PCBs in twenty-five percent (5 of 20) of the composites were above 1 mg/Kg. Of these, two composites had very high PCBs concentrations (> 1,000 mg/Kg) that indicate PCBs were likely part of the original caulk or sealant formulations. Both of these composites were comprised of black, pliable joint filler materials that were collected from concrete bridges/overpasses. These results demonstrate that PCBs-containing caulks and sealants were used to some degree in Bay Area roadway and storm drain infrastructure in the past, but the full extent and magnitude of this use is unknown. The conclusions from this sampling program are primarily limited by the small number of structures that were sampled (n=54), compared with the vast number of roadway and storm drain structures throughout the Bay Area that were originally constructed during the peak period of PCBs production and use (1950 – 1980).

Given the limitations of the project, much more information would be needed to estimate the total mass of PCBs in infrastructure caulk and sealant materials, to better understand the fate and transport of PCBs in these materials, and to calculate stormwater loading estimates. Nevertheless, this screening-level sampling program was the first step towards understanding if infrastructure caulk and sealants are a potential source of PCBs to urban stormwater. Although limited by the small sample number, the results of this sampling program indicate:: (1) the majority of roadway and storm drain structure types that were sampled in this project did not have PCBs-containing caulks or sealants at concentrations of concern, and (2) only black, pliable joint fillers found on concrete bridges/overpasses sampled had PCBs concentrations of potential concern to stormwater. If further investigation is conducted, focus on this type of application may be a reasonable place to continue such efforts.

The final project report was included with the Program’s Fiscal Year 2017/18 Annual Report, submitted to the Regional Water Board on September 30, 2018 (EOA, SFEI, KLI 2018).

5.2.2 Best Management Practices (BMP) Effectiveness Study

The BASMAA Best Management Practices (BMP) Effectiveness Study was developed to satisfy provision C.8.f requirements to collect at least eight PCBs and mercury samples (per participating county) that address Management Question #3 (Management Action Effectiveness). A major consideration of the study was collection of data in support of conducting the Reasonable Assurance Analysis (RAA) that is required by provision C.12.c.iii.(3) which must be submitted with the 2020 Annual Report (September 30, 2020). The study design, developed in September 2017, describes monitoring and sample collection activities designed to evaluate, at a pilot scale, the effectiveness of two treatment options that have the potential reduce PCB discharges: biochar- enhanced bioretention filters and hydrodynamic separator (HDS) units. In WY 2018 the BASMAA project team implemented the BMP Effectiveness Study by collecting a total of 34 samples. Results of the study are summarized in two reports addressing the two targeted treatment options. These reports are submitted with this WY 2018 Urban Creeks Monitoring Report as **Appendices D and E**.

Biochar-Amended Bioretention Soil Media Column Study (Appendix D)

This regional study evaluated the effectiveness of biochar-amended bioretention soil media (BSM) to remove PCBs and mercury from stormwater collected within the region covered by the MRP. A prior BASMAA study, the Clean Watershed for a Clean Bay (CW4CB) project, found that BSM amended with biochar substantially improved PCBs removal compared to the standard BSM specified in MRP Provision C.3 at the same location (BASMAA 2017a). Only one biochar source was tested in the CW4CB study, so it was unknown whether there would be substantial performance differences among differing biochar sources.

The goal of this study was to identify readily available biochar media amendments that improve PCB and mercury load removal by bioretention BMPs. Stormwater was collected in March and April of 2018, and the BSM testing was conducted in April and May of 2018. Twenty-six samples consisting of influent/effluent pairs from column tests of biochar-enhanced BSM were analyzed. Stormwater was run through six columns with five different biochar-enhanced BSM mixes and one standard BSM as a control to evaluate which mix was most effective at removing PCBs and mercury. Dilutions were run on two columns to assess removal efficiencies with decreasing influent pollutant concentrations. Samples were analyzed for the RMP 40 PCB congeners (method EPA 1668C), total mercury (method EPA 1631E), SSC (method ASTM D3977-97), and total organic carbon (method EPA 9060).

All five biochar-BSM blends showed evidence of overall improved PCB and mercury performance compared to the standard BSM; however, the increased benefit relative to increased cost was not analyzed. Hydraulics were found to be a critical factor in achieving good pollutant removal in the columns suggesting that outlet controls could be used to enhance performance of BMPs. Furthermore, this study suggests that an irreducible minimum concentration of PCBs may be 1,000 pg/L.

The final project report is included as **Appendix D**.

HDS Unit Study (Appendix E)

The goal of the BASMAA Evaluation of Mercury and PCBs Removal Effectiveness of Full Trash Capture HDS Units study was to evaluate the mercury and PCBs removal effectiveness of HDS units due to removal of solids captured within the sumps. The information provided by this monitoring effort will be used by MRP Permittees and the Regional Water Board to better quantify the pollutant load reductions achieved by existing and future HDS units installed in urban watersheds of the Bay Area.

The study combined sampling and modeling efforts to evaluate the mercury and PCBs removal performance of HDS units as follows.

- First samples of the solids captured and removed from eight HDS unit sumps during cleanouts were collected and analyzed for the RMP 40 PCB congeners (method EPA 1668), total mercury (method EPA 1631E), total solids[13] (method EPA 160.3), total organic carbon (method EPA 415.1), and bulk density (method ASTM E1109-86). If the sample was comprised of sediments only, it was also analyzed for grain size (method ASTM D422M/PSEP). If the sample contained organic/leaf debris, it was also analyzed for total organic matter (method EPA 160.4) in order to calculate the inorganic fraction (i.e., the mineral fraction assumed to be associated with POCs).

- Second, maintenance records and construction plans for the HDS units were reviewed to develop estimates of the average volume of solids removed per cleanout. This information was combined with the monitoring data to calculate the mass of POCs removed during cleanouts.

- Third, the annual mercury and PCBs loads discharged from each HDS unit catchment were estimated under two different loading scenarios. For the first loading scenario (Land Use x Yields), the POC loads discharged from each catchment were calculated from land-use based POC yields. For the second loading scenario (Flow x EMC), the POC loads discharged from each catchment were calculated from modeled stormwater volumes and POC event mean

[13] Samples were analyzed for total solids so that dry weight calculations could be made.

concentrations (EMCs) for a given land-use type.

- Finally, HDS unit performance was evaluated under each loading scenario by calculating the average annual percent removal of POCs due to cleanout of solids from the HDS unit sumps

Across all eight units, the median percent PCBs removal for calculated catchment loads ranged from 5% to 32%. These results will be considered in the update to the Interim Accounting Methodology that is being conducted as part of a separate BASMAA regional study in support of Reasonable Assurance Analysis development

The final project report is included as **Appendix E**.

5.3 Small Tributaries Loading Strategy

The RMP Small Tributaries Loading Strategy was developed in 2009 by the STLS Team, which includes representatives from BASMAA, Regional Water Board staff, RMP staff, and technical advisors and is overseen by the Sources, Pathways, and Loadings Workgroup (SPLWG). The objective of the STLS is to develop a comprehensive planning framework to coordinate POC monitoring/modeling between the RMP and RMC participants. In 2018, the following management policies and decisions were identified:

- Refining pollutant loading estimates for future TMDL updates,
- Informing provisions of the current and future versions of the MRP,
- Identifying small tributaries to prioritize for management actions, and
- Informing decisions on the best management practices for reducing concentrations and loads.

Work conducted by the STLS is framed by the same five priority POC management information needs identified in the MRP (see beginning of Section 5.0).

The sections below describe the tasks implemented by the RMP STLS in 2018 to address the relevant management policies.

5.3.1 Wet Weather Characterization

With a goal of identifying watershed sources of PCBs and mercury, STLS field monitoring in WYs 2015 - 2018 focused on collection of storm composite samples in the downstream reaches of catchments located throughout the Bay Area. In WY 2018, 10 catchments were sampled during storm events. The 10 catchments range in size from 0.02 km^2 to 36.67 km^2 and represent engineered MS4 drainage areas, flood control channels, and creeks. Half of the WY 2018 samples were collected at previously sampled stations in order to validate concentrations previously measured. Storm composite water samples were analyzed for concentrations of PCBs (i.e., RMP 40 congeners), total mercury, and suspended sediment concentration. In addition, a pilot study was continued at a subset of locations (two stations) to collect fine sediments using specialized settling chambers. A full description of the methods and results from WY 2015 through WY 2018 monitoring is included in **Appendix F** (Pollutants of Concern Reconnaissance Monitoring Final Progress Report, Water Years 2015 - 2018).

In WY 2018 two previously unsampled catchments were targeted in Santa Clara County based on recommendations by Program staff evaluating land uses in the County that have the highest likelihood of generating PCBs in stormwater runoff. Both of the Santa Clara County sampling stations were located at MS4 outfalls to the Guadalupe River. Results of these STLS stations are summarized with SCVURPPP monitoring results in **Appendix E**. Wet weather characterization monitoring by the RMP STLS is planned to continue in WY 2019.

Findings

The RMP STLS has a growing database, now consisting of 83 stations that have been sampled at least once during wet weather events for PCBs, mercury, and SSC since 2003. Some stations have also been sampled for a larger suite of constituents. Prior to WY 2015, most of the stations were located in natural creeks, whereas the 49 of the 60 stations sampled in WY 2015 through WY 2018 were primarily located in small catchments draining primarily old industrial land uses. At 15 of the stations, a second sample was collected with either a Hamlin or Walling tube (or both) remote sediment sampler.

Acknowledging that dynamic climatic conditions and individual storm characteristics may affect data interpretation, the following conclusions have been identified:

- PCBs positively correlate with impervious cover, old industrial land use, and mercury. They inversely correlate with watershed area. Although mercury and PCBs positively correlate, the relationship is relatively weak, probably due to the larger role of atmospheric recirculation in the mercury cycle and the differences in use history of each POC.

- Neither PCBs nor mercury have strong correlations with other trace metals (As, Cu, Cd, Pb, and Zn). Therefore, there is no support for the use of trace metals as surrogate investigative tools for either PCBs or mercury sources.

- Remote samplers generally characterized sites similarly to the composite stormwater sampling methods and could be used exclusively for preliminary screening of new stations to identify watershed sources of PCBs and mercury.

- Continued focus on resampling of some stations (i.e., those that return lower than expected concentrations) is recommended to test for false negatives.

5.3.2 STLS Trends Strategy

In 2018, the STLS Trends Strategy team continued to meet. The STLS Trends Strategy was initiated in 2015 by recommendation of from the SPLWG which advised the STLS to define where and how trends may be most effectively measured in relation to management effort so that data collection methods deployed over the next several years will support this management information need. The STLS Trends Strategy team is comprised of SFEI staff, RMC participants, and Regional Water Board staff. Invitations to key meetings are extended to additional interested parties (e.g., EPA), and technical advisors (e.g., USGS) are consulted to review specific technical work products.

The Trends Strategy document (and Technical Appendix), initially drafted in WY 2016, serves as a foundation for this team. The main document summarizes the background, management questions, and guiding principles of the Trends Strategy. It also describes coordination between the RMP and BASMAA within the context of the MRP, proposed tasks to answer the management questions, anticipated deliverables, and the overall timeline. The current priority POCs are PCBs and mercury and trend indicators under consideration (i.e., PCB concentrations and particle-ratios) were identified within the context of existing datasets (e.g., POC loading stations) and TMDL timelines. However, the Strategy recognizes that priorities can change in the future. The Technical Appendix (Melwani et al. 2016) presents an evaluation of variability and statistical power[14] for detecting trends based on POC loading station PCBs data. It presents sample size and revisit frequency scenarios needed to detect declining trends in PCBs in 25 years with > 80% statistical power. Due to high variability in baseline PCB concentrations, the modeled sampling scenarios would likely not be practical to implement. Therefore, the Technical Appendix recommends additional analyses and monitoring that should be considered prior to developing a trends monitoring design.

[14] Power is defined as the probability of detecting a trend of a certain magnitude during a specified monitoring period (years), where a Type I error rate is set at 5%.

In 2018, the STLS Trends Strategy team followed up on some of the recommendations from the Technical Appendix. A statistical model for trends in PCB loads in the Guadalupe River (as a case study) was finalized. The model incorporates the significant turbidity-PCB relationships that exist and evaluates climatic, seasonal, and inter-annual factors as potential drivers of PCB loads. More intensive review of the Guadalupe River dataset resulted in two main findings: 1) No trends in PCB loads were apparent for the period of 2003 through 2014: 2) A monitoring design that includes sampling at least two storms in 13 out of 20 years (with 4 to 6 grab samples per storm) would detect inter-annual trends of 25% or more over 20 years with > 80% power (Melwani et al. 2018). Results of the statistical analyses were presented at key stages in the analysis to USGS technical advisors with expertise in trends analysis of water data. It is uncertain how the Guadalupe River model and analysis could be applied to other watersheds which have distinct characteristics.

In 2018, the Trends Strategy team updated the Trends Strategy document to include an evaluation of how various tasks to date have and could be used to address the five POC information needs from the MRP (see list at the beginning of Section 5.0). This review included empirical data collection (i.e., POC loads monitoring (loading stations and wet weather characterization), BASMAA source identification and BMP effectiveness monitoring, SPoT monitoring) and modeling approaches (i.e., RWSM, the Guadalupe River statistical analysis, Reasonable Assurance Analysis). The updated document describes the pros and cons of various methods available to identify and predict trends. Due to concerns about the limitations of extrapolating monitoring results from a relatively small number of watersheds to the entire region, regional modeling was proposed as the most efficient tool to estimate POC loading over time and space for trends evaluation at the desired spatial scales. The 2018 Trends Strategy document reviews and compares currently available models and modeling platforms relative to their ability to answer key management questions, including Countywide RAA modeling efforts, the Bay Area Hydrological Model (BAHM), the RWSM, and HSPF and SWMM platforms. Based on the goals of the STLS Trends Strategy team, the BAHM (which is based on the HSPF platform) is recommended as the most suitable starting point to develop a regional POC trends model.

A preliminary multi-year workplan for regional POC trends assessment, with estimates of annual budget allocations, was developed in 2018. The workplan recommends development of a Model Implementation Plan in 2019, model development beginning in 2020, and “no-regrets” monitoring based on the Model Implementation Plan beginning in 2020.

5.3.3 Advanced Data Analysis

In 2018, the STLS began a new task to provide a deeper analysis of the growing set of PCBs data collected by BASMAA and the RMP. The Advanced Data Analysis task includes two parallel lines of investigation: site inter-comparison methodologies and PCB congener profile comparisons.

Site Inter-Comparison Methodologies

Most of the wet weather characterization data used by the Program and other BASMAA RMC partners to identify and prioritize Watershed Management Areas where PCB source investigations will be conducted are based on composite samples collected during a single storm event. See Section 5.1.1 for more information on the wet weather sampling programs implemented by the Program and the WMA characterization process. While cost effective, interpretation of the data collected through these sampling techniques has been challenging. Since only one storm was sampled at most sites, differing storm characteristics (intensity, duration, antecedent rainfall conditions) interplay with differing PCB source characteristics to confound comparisons between watersheds. For example, if the targeted storm was relatively small, it is possible that measured PCB concentrations (and/or PCB particle ratios) will be lower than they would be in a sample collected at the same station during a larger storm. The main goal of this investigation was to develop a method to account for the differences in targeted storm characteristics at the various sampled stations.

In 2018, the STLS began development of a method to generate comparable yield estimates for small industrial watersheds where only a single storm has been sampled. The draft method includes five steps:

1. Estimate storm runoff volume in the sampled watershed.
2. Compute estimates of storm PCBs load for the sampled storm.
3. Adjust estimates of storm load to a standard sized storm.
4. Normalize standardized storm loads to the land uses and source areas of interest to generate storm yields.
5. Compare these yields between watersheds taking into account all the uncertainties associated with the field conditions and the methods used to interpret the data.

This stepwise method was developed using Santa Clara County as a case study and pilot tested with a focus on nested sites within the Guadalupe River watershed. Further development, review, and testing in a greater number of areas, with a wider range of conditions, is recommended for 2019. A report describing the loads-based site inter-comparison method is anticipated in 2019.

PCB Congener Profile Comparisons

PCB samples collected by BASMAA and the STLS are routinely analyzed for 40 individual PCB congeners (i.e., the “RMP 40”). Although most data analyses are conducted using the sum of those congeners, BASMAA and the STLS recognize the value of generating the more robust RMP 40-based dataset and the potential for future data exploration possibilities. For example, PCB congener profiles can be used to help identify source areas that contribute most to the PCB mass exported from the watershed via stormwater, and to illustrate variability in PCB mobilization from source areas over time.

In 2018, the STLS began development of a method to estimate the contributions of different Aroclor[15] mixtures (see note on Aroclors below) to the congener profiles of samples of stormwater and sediment. The method is based on the use of indicator congeners that are representative of each of the four most commonly used Aroclors. Data from the Pulgas Pump Station watershed were used to pilot test the method. At this station, stormwater and sediment had high concentrations with a relatively unique pattern, dominated by congeners indicative of a combination of Aroclors 1242 and 1260. The concentrations and congener profiles in sediment suggest that there are two distinct source areas in the watershed that combine to create the mix of 1242 and 1260 that is dominant in stormwater at the Pump Station (Figure 5.3). The data suggest that if PCB flux from one of these areas could be eliminated, loads from the watershed would be reduced by 50% or more. For the Coyote Creek watershed, the similarity in congener profiles between the highest concentration sediment samples and the stormwater samples suggest that the important source areas in the watershed have been identified, and that reduction of loading from an area at the south end of the Charcot Avenue Storm Drain watershed would yield the greatest reduction in export at the Coyote Creek station. The concentrations and congener profiles in stormwater and sediment from the Guadalupe River watershed indicate the presence of one source area that is likely a significant contributor to PCB export from the watershed, but suggest that all of the significant sources areas may not yet have been identified.

A report describing the PCB congener profile comparison method is anticipated in 2019.

[15] PCBs were manufactured and used as complex mixtures of individual PCBs (referred to as PCB congeners). In North America, the only producer was the Monsanto Company, which marketed PCBs under the trade name Aroclor from 1930 to 1977. A series of different Aroclor mixtures was produced, with varying degrees of overall chlorine content, and these different mixtures were used for different purposes. The congener composition of the various Aroclor mixtures has been reported in the literature (e.g., Schulz et al. 1989, Frame et al. 1996a,b). As a consequence of the use of Aroclor mixtures, PCBs are also present in the environment as complex mixtures of congeners.

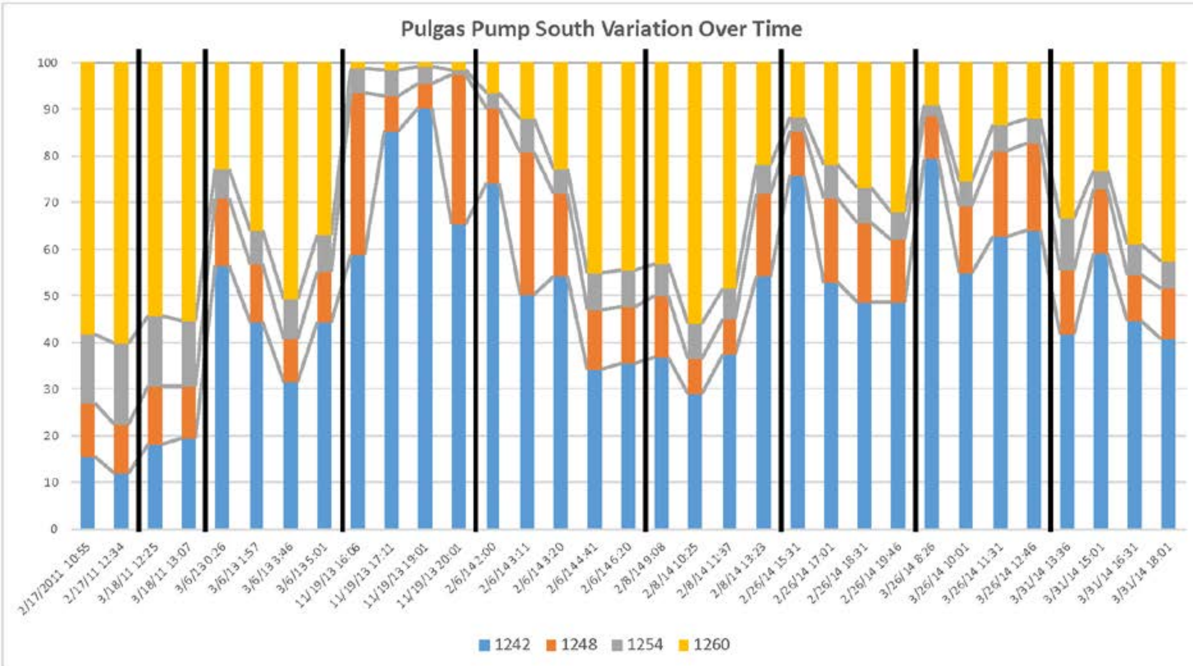

Figure 5.3. Aroclor fractions in stormwater at the outlet of Pulgas Pump Station South over time (figure produced by SFEI, 2018).

5.3.4 Alternative Flame Retardant Conceptual Model

Alternative flame retardants (AFRs) came into use following state bans and nationwide phase-outs of polybrominated diphenyl ether (PBDE) flame retardants in the early 2000's. They include many categories of compounds, including organophosphate esters. In 2018 the RMP STLS and the Emerging Contaminant Workgroup worked together to conduct a special study to inform ECWG's planning activities related to AFRs. The special study compiled and reviewed available data and previously developed conceptual models for PBDE to support a stormwater-related AFR conceptual model being developed by the ECWG. Organophosphate esters were prioritized for further investigation due to their increasing use, persistent character, and ubiquitous detections at concentrations exceeding PBDE concentrations in the Bay. Limited stormwater data from two watersheds in Richmond and Sunnyvale suggest that urban runoff may be an important source of these compounds. Additional monitoring and modeling were recommended. Results of the AFR special study were published in a Technical Report in 2018 (Lin and Sutton 2018).

5.3.5 Regional Watershed Spreadsheet Model

The Regional Watershed Spreadsheet Model (RWSM) is a land use based planning tool for estimation of annual POC loads from small tributaries to San Francisco Bay at a regional scale. Development of the RWSM began in 2010 and, in 201, the STLS Team continued to provide support of the RWSM tool-kit that was published in 2017.

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 inexpensive means of 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.

The RWSM is based on the assumption that an estimate of mean annual **volume** for each land use type within a watershed can be combined with an estimate of mean annual **concentration** for that same land use type to derive a **load** which can be aggregated for a watershed or many watersheds within a region of interest. It may be used to provide hypotheses about which sub-regions or watersheds export relatively higher or lower loads to the Bay relative to area. It can also serve as a baseline for analyzing changes in loadings due to large scale changes in land use (e.g., associated with redevelopment and new development) and runoff (e.g., associated with climate change and changes in impoundment). However, the RWSM is less reliable for predicting real loadings for individual watersheds and for estimating load changes in relation to implementation of treatment BMPs.

The RWSM beta tool-kit, published in June 2017 includes:

- Hydrology Model coded using ArcPy and drawing on a user interface accessible through ArcGIS;
- Pollutant Model Spreadsheet for taking the outputs from the Hydrology Model and inputting land use coefficients to estimate pollutant loads;
- Two optional calibration tools – a spreadsheet for manual calibration, and an R script for an optimized automated calibration; and
- User Manual

Testing of the RWSM beta tool-kit by some of the BASMAA RMC partners began in WY 2017 and continues into WY 2018. The STLS will continue to support the RWSM in WY 2019. If warranted, and in consultation with the STLS and the SPLWG, a more sophisticated dynamic simulation model (i.e., SWMM, HSPF) may be developed in future years. As the modeling team at SFEI becomes more proficient with alternative water-based platforms (i.e., SWMM, HEC-RAS) through development of the Green Plan-IT tool, a more sophisticated basis may be adopted in future years. Decisions on model improvements will be made in consultation with the STLS and the SPLWG.

6.0 NEXT STEPS

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

In WY 2019, SCVURPPP will continue to comply with water quality monitoring requirements of the MRP. The following list of next steps will be implemented in WY 2019:

- SCVURPPP will continue to collaborate with the RMC (MRP provision C.8.a).
- Where applicable, monitoring data collected and reported by SCVURPPP will continue to be SWAMP comparable (MRP provision C.8.b).
- SCVURPPP will continue to provide financial contributions towards the RMP and to actively participate in the RMP committees and work groups described in Sections 2.0 and 5.0 (MRP provision C.8.c).
- SCVURPPP will continue to conduct probabilistic and targeted Creek Status Monitoring consistent with the specific requirements in the MRP (MRP provision C.8.d).
- SCVURPPP will continue to implement Pesticides and Toxicity Monitoring consistent with MRP provision C.8.g.
- SCVURPPP will continue to review monitoring results and maintain a list of all results exceeding trigger thresholds (MRP provision C.8.e.i). SCVURPPP will coordinate with the RMC to initiate a region wide goal of eight new SSID projects by the end of the permit term (MRP provision C.8.e.iii). This will include implementation of the Coyote Creek Toxicity SSID Project, identification and initiation of one new SCVURPPP SSID project, and participation in the regional SSID project addressing releases of PCBs from electrical utility equipment.
- SCVURPPP will continue to participate in the STLS and SPLWG which address MRP provision C.8.f POC management information needs and monitoring requirements through wet weather characterization monitoring, refinement of the RWSM, and advancement of the STLS Trends Strategy.
- SCVURPPP will continue to support mercury monitoring at the Guadalupe River loading stations which is now conducted through the Coordinated Monitoring Program for the Guadalupe River watershed, a collaboration of entities subject to the Guadalupe River Mercury TMDL.
- SCVURPPP will implement a POC monitoring framework to comply with provision C.8.f of the MRP. The monitoring framework will address the annual and total minimum number of samples required for each POC (i.e., PCBs, mercury, copper, emerging contaminants, nutrients) and each management information need (i.e., Source Identification, Contributions to Bay Impairment, Management Action Effectiveness, Loads and Status, Trends). WY 2019 monitoring will include collection of wet weather composite water samples from catchments and collection of dry weather sediment samples from the public right-of-way to identify areas where PCB and mercury control measures may be implemented. WY 2019 monitoring will also include sampling for nutrients and copper.
- WY 2019 POC monitoring accomplishments and allocation of sampling efforts for POC monitoring in WY 2020 will be submitted in the Pollutants of Concern Monitoring Report that is due to the Water Board by October 15, 2019 (MRP provision C.8.h.iv).

Results of WY 2019 monitoring will be described in the Programs Integrated Monitoring Report (IMR) that is due to the Water Board by March 31, 2020 in lieu of the annual Urban Creeks Monitoring Report (MRP provision C.8.h.v). This report will be part of the Report of Waste Discharge for the reissuance of the MRP. The IMR will contain a comprehensive analysis of all data collected pursuant to provision C.8 since the previous IMR which was submitted on March 31, 2014 and included WY 2012 and WY 2013 monitoring data. A major component of the IMR will be evaluation of eight years (WY 2012 – WY 2019) of probabilistic bioassessment monitoring data. Overall stream condition in the Santa Clara Basin will be evaluated using the BMI-based CSCI and other available IBIs. Comparisons between major watersheds and land use (urban/non-urban) will be conducted. Stressors associated with poor condition will be evaluated using the statistical tools implemented by BASMAA in the RMC 5-Year Report.

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Appendix A

SCVURPPP Creek Status Monitoring Report, Water Year 2018

Appendix B

Regional Stressor/Source Identification (SSID) Report

Appendix C

SCVURPPP Pollutants of Concern Data Report, Water Year 2018

Appendix D

BASMAA Pollutant Removal from Stormwater with Biochar Amended BSM

Appendix E

Evaluation of Mercury and PCBs Removal Effectiveness of Full Trash Capture HDS Units

Appendix F

RMP STLS POC Reconnaissance Monitoring Progress Report, Water Years 2015 – 2018

Appendix G

PCBs from Electrical Utilities in San Francisco Bay Area Watersheds,
Stressor/Source Identification (SSID) Project Work Plan