clean water PROGRAM

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Protecting Alameda County Creeks, Wetlands & the Bay

March 31, 2018

Bruce Wolfe
Executive Officer
San Francisco Bay Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

SUBJECT: **SUBMITTAL OF THE ALAMEDA COUNTYWIDE CLEAN WATER PROGRAM URBAN CREEKS MONITORING REPORT**

Dear Bruce:

As you know, various submission and reporting provisions of the Municipal Regional Stormwater Permit (MRP) authorize Permittee implementation and compliance though coordination of the countywide storm water programs. The member agency Permittees of the Alameda Countywide Clean Water Program (ACCWP) through their Management Committee, and in conformance with the Memorandum of Agreement signed by their governing bodies, have authorized and directed me to prepare and submit certain reports as part of their compliance with submission of MRP-required reports.

Therefore, with this letter, I am submitting this ACCWP Urban Creeks Monitoring Report for Water Year 2017 on behalf of and for the benefit of the ACCWP member agency Permittees. By signing this letter on behalf of ACCWP, I certify under penalty of law that these documents and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who managed the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. [40CFR 122.22(d)].

Sincerely,

James Scanlin
Program Manager

Attachments: Certification Statement (1 page)
ACCWP Urban Creeks Monitoring Report

Certification Statement

Report components

This submittal by the Alameda Countywide Clean Water Program includes the main body of the Urban Creeks Monitoring Report (UCMR) for October 2016 through September 2017 and the following appendices and attachments:

- A.1 Creek Status Monitoring Report - Regional Parameters, Pesticides and Toxicity
- A.2 Creek Status Monitoring Report -Targeted Parameters
- A.3 ACCWP Pollutants of Concern Monitoring 2017 Sediment Sampling Report
- A.4A Dublin Creek Biological Community and Sediment Quality WY 2017 Progress Report
- A.4B Castro Valley Creek Sediment Quality WY 2017 Progress Report
- A.4C Crow Creek Low Dissolved Oxygen WY 2017 Final Report
- Attachment A: Electronic Data Submittal Transmittal Letter dated March 31, 2018 with attached file list
- Attachment B: BASMAA Regional Monitoring Coalition: Status of Regional Stressor/Source Identification (SSID) Projects, Updated March 2018

Third party monitoring

Please note that consistent with provision C.8.a.iii of the reissued MRP, portions of the Pollutants of Concern monitoring requirements were fulfilled or partially fulfilled by third party monitoring in Water Year 2017, as described in Section 6.2 of the attached UCMR and in the ACCWP Pollutants of Concern Monitoring Report for Water Year 2017 (submitted October 2017):

- The Regional Monitoring Program for Water Quality in San Francisco Bay (RMP) conducted a portion of the data collection in Water Year 2017 on behalf of Permittees, pursuant to provision C.8.f- Pollutants of Concern Monitoring. The results of that monitoring are reported in Appendix A.3B of the attached Urban Creeks Monitoring Report.
- Data addressing the Trends monitoring information need described in Provision C.8.f were collected by the State of California's Surface Water Ambient Monitoring Program (SWAMP) through its Stream Pollutant Trend (SPoT) Monitoring Program at two Alameda County locations in WY 2017. As stated in provision C.8.a.iii, Permittees may use these data to comply with the monitoring requirements included in this provision, provided the data meet the data quality objectives described in C.8.b, i.e. SWAMP comparable. However, the schedule for SWAMP's review and reporting of data collected for the SPoT Program differs from the schedule described in the MRP.

Electronic Data Submittal

Under separate cover ACCWP is also submitting a CD-ROM containing the Program's monitoring data for Water Year 2017, as listed in Attachment A of the UCMR.

ALAMEDA COUNTYWIDE CLEAN WATER PROGRAM

URBAN CREEKS MONITORING REPORT

OCTOBER 2016 THROUGH SEPTEMBER 2017

MEMBER AGENCIES:

Alameda
Albany
Berkeley
Dublin
Emeryville
Fremont
Hayward
Livermore
Newark
Oakland
Piedmont
Pleasanton
San Leandro
Union City
County of Alameda
Alameda County Flood Control and Water Conservation District
Zone 7 Water Agency

Report prepared by
Alameda Countywide Clean Water Program
399 Elmhurst Street,
Hayward, California 94544

Submitted to:
California Regional Water Quality Control Board, San Francisco Bay Region

FINAL
March 31, 2018

ACKNOWLEDGEMENTS

ACCWP acknowledges the contributions of Mr. Paul Salop and other staff of Applied Marine Sciences in planning, implementation and reporting of Creek Status Monitoring, Pesticides and Toxicity Monitoring and Pollutants of Concern sediment sampling. Horizon Water and Environment, LLC contributed substantially to the preparation of this report, in preparation of the data analysis, and discussion of results. Additional acknowledgements for preparation of specific Appendices are included in those documents.

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Attachment B. BASMAA Regional Monitoring Coalition: Status of Regional Stressor/Source Identification (SSID) Projects, Updated March 2017

LIST OF APPENDICES

A.1 Creek Status Monitoring Report - Regional Parameters, Pesticides and Toxicity
A.2 Creek Status Monitoring Report -Targeted Parameters
A.3 ACCWP Pollutants of Concern (POC) Monitoring 2017 Sediment Sampling Report

STRESSOR-SOURCE IDENTIFICATION PROJECT REPORTS

A.4A Dublin Creek Biological Community and Sediment Quality WY 2017 Progress/Final Report
A.4B Castro Valley Creek Sediment Quality WY 2017 Progress Report
A.4C Crow Creek Low Dissolved Oxygen WY 2017 Progress/Final Report

LIST OF ACRONYMS

Acronym	Definition
ACCWP	Alameda Countywide Clean Water Program
AFDM	Ash Free Dry Mass
AMS	Applied Marine Sciences
BASMAA	Bay Area Stormwater Management Agencies Association
BMI	Benthic Macroinvertebrate
BOD	Board of Directors of BASMAA
CCC	Criterion Continuous Concentration
CCCWP	Contra Costa Clean Water Program
CEC	Contaminants of Emerging Concern
CEDEN	California Environmental Data Exchange Network
CMC	Criteria Maximum Concentration
CSCI	California Stream Condition Index
CTR	California Toxics Rule
CWA	Clean Water Act
DEM	Digital Elevation Model
DO	Dissolved oxygen
DQO	Data Quality Objective
DW	Dry Weight
E. coli	Escherichia coli
ECWG	Emerging Contaminant Workgroup of the RMP
EDD	Electronic Data Deliverable
EEWG	Exposure and Effects Workgroup of the RMP
FIB	Fecal Indicator Bacteria
FSURMP	Fairfield-Suisun Urban Runoff Management Program
GIS	Geographic Information System
GRTS	Generalized Random Tessellated Stratified
HVF	Highly Variable Flow
IBI	Index of Biological Integrity
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
MPC	Monitoring and Pollutants of Concern Committee
MPN	Most Probable Number
MQO	Measurement Quality Objective
MRP	Municipal Regional Stormwater Permit
MRP1	Municipal Regional Permit, issued 2009
MRP2	Reissued Municipal Regional Stormwater Permit (2015)
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MUN	Municipal Beneficial Use
MWAT	Maximum Weekly Average Temperature

MYP	Multi Year Plan
ND	Non-detect
NPDES	National Pollutant Discharge Elimination System
NT	Non-Target
PAH	Polycyclic Aromatic Hydrocarbon
PEC	Probable Effects Concentrations
PHab	(Bioassessment) Physical Habitat Assessment
POC	Pollutants of Concern
PR	Percent Recovery
PSA	Perennial Streams Assessment
PSD	Particle Size Distribution
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
RL	Reporting Limit
RMC	Regional Monitoring Coalition
RMP	Regional Monitoring Program for Water Quality in San Francisco Bay
RWQCB	Regional Water Quality Control Board
SCCWRP	Southern California Coastal Water Research Project
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board (California Regional Water Quality Control Board, San Francisco Bay Region)
SFEI	San Francisco Estuary Institute
SMC	Southern California Stormwater Monitoring Coalition
SMCWPPP	San Mateo County Wide Water Pollution Prevention Program
SOP	Standard Operating Procedure
SPLWG	Sources, Pathways and Loadings Workgroup of the RMP
SPoT	Statewide Stream Pollutant Trend Monitoring
SSC	Suspended Sediment Concentration
SSID	Stressor/Source Identification
STV	Statistical Threshold Value
SWAMP	Surface Water Ambient Monitoring Program
TEC	Threshold Effect Concentrations
TKN	Total Kjeldahl Nitrogen
TNS	Target Not Sampled
TOC	Total Organic Carbon
TRC	Technical Review Committee of the RMP
TS	Target Sampleable
UCMR	Urban Creeks Monitoring Report
USEPA	United States Environmental Protection Agency
WQO	Water Quality Objective
WY	Water Year

WY 2017 Summary of Creek Status and Pesticides/Toxicity Monitoring Sites and Parameters Sampled (See Legend below for abbreviations, Section 3 of this Urban Creeks Monitoring Report and its Appendices A.1 and A.2 for definitions, monitoring results and discussion).

Site ID	Creek Name	Land Use	Latitude	Longitude	Creek Status Monitoring Parameter							
					BA	N	Cl	WQ Tox	SED	PATH	TEMP	GWQ
204R00711	Old Alameda Creek	Urban	37.59311	-122.05220	X	X	X					
204R00831	San Leandro Creek	Urban	37.72617	-122.16095	X	X	X					
204R01199	Tributary to Eden Creek	Urban	37.71509	-122.01335	X	X	X					
204R01310	Arroyo de la Laguna	Urban	37.62023	-121.88251	X	X	X					
204R01343	Palo Seco Creek	Urban	37.81122	-122.18439	X	X	X					
204R01375	Crow Creek	Urban	37.74952	-122.03203	X	X	X					
204R01497	Arroyo Mocho	Urban	37.67194	-121.76688	X	X	X					
204R01748	Dublin Creek	Urban	37.69925	-121.93799	X	X	X					
204R02367	Palo Seco Creek	Urban	37.81388	-122.18865	X	X	X					
204R02759	Crandall Creek	Urban	37.56746	-122.04675	X	X	X					
204R02975	Cull Creek	Urban	37.70231	-122.05502	X	X	X					
204R03033	Arroyo las Positas	Urban	37.69413	-121.71130	X	X	X					
204R03135	Sausal Creek	Urban	37.80391	-122.21677	X	X	X					
204R03183	Ward Creek	Urban	37.65836	-122.03920	X	X	X					
204R03199	San Lorenzo Creek	Urban	37.68566	-122.11197	X	X	X					
204R03295	Ward Creek	Urban	37.64627	-122.07660	X	X	X					
204R03327	Arroyo Las Positas	Urban	37.69840	-121.82968	X	X	X					
204R03391	Arroyo Viejo	Urban	37.75895	-122.18205	X	X	X					
204R03399	Ward Creek	Urban	37.61923	-122.07284	X	X	X					
204R03481	Altamont Creek	Urban	37.71668	-121.74737	X	X	X					
205R02782	Morrison Creek	Urban	37.57018	-121.95373	X	X	X					
205R02862	Toroges Creek	Urban	37.48029	-121.92377	X	X	X					

(continued on next page)

Site ID	Creek Name	Land Use	Latitude	Longitude	Creek Status Monitoring Parameter							
					BA	N	Cl	WQ Tox	SED	PATH	TEMP	GWQ
205R01198	Zone 6 Line G	Urban	37.50872	-121.9665				X	X			
204WRD002	Ward Creek	Urban	37.61729	-122.07366				X	X			
204CRW040	Crow Creek	Urban	37.70143	-122.05467							X	X
204CRW041A	Crow Creek	Urban	37.70150	-122.05451							X	
204CRW041B	Crow Creek	Urban	37.70204	-122.05398							X	
204CRW041C	Crow Creek	Urban	37.70272	-122.0501							X	
204CRW041D	Crow Creek	Urban	37.70265	-122.0501							X	
204CRW041E	Crow Creek	Urban	37.70189	-122.04912							X	X
204CRW042	Crow Creek	Urban	37.69996	-122.0492							X	X
204CRW044	Crow Creek	Urban	37.70442	-122.04369							X	
204SAU055	Sausal Creek	Urban	37.80357	-122.21658						X		
204SAU090	Sausal Creek	Urban	37.81195	-122.21363						X		
204SAU110	Palo Seco Creek	Urban	37.81888	-122.20754						X		
204SAU130	Palo Seco Creek	Urban	37.81572	-122.20127						X		
204SAU200	Sausal Creek	Urban	37.81900	-122.20760						X		

Legend:
BA = Bioassessment (C.8.d.i); N = Nutrients (C.8.d.i); Cl = Chlorine (C.8.d.ii); WQ Tox = Water Column Toxicity (C.8.g.i&iii); SED = Sediment Toxicity and Chemistry (C.8.g.ii); PATH = Pathogen Indicators (C.8.d.v); TEMP = Continuous Temperature Monitoring (C.8.d.iii); GWQ = Continuous General Water Quality Monitoring (C.8.d.iv).
Note: Coordinates at first visit are reported where multiple sampling events were conducted at a particular site.

SECTION 1 - INTRODUCTION

This Urban Creeks Monitoring Report (UCMR) is submitted by the Alameda Countywide Clean Water Program (Program, ACCWP), on behalf of the Program's member agencies[1](i.e., Permittees) subject to the Municipal Regional Stormwater NPDES Permit (reissued on November 19, 2015 (Order R2015-0049) with effective date January 1, 2016. The term "MRP" refers to the current, reissued MRP. Where it is necessary to distinguish between the 2009 MRP and reissued MRP, the former is referred to as "MRP1", and the latter as "MRP2".

This report (including all appendices and attachments) fulfills the requirements of MRP Provision C.8.h for interpreting and reporting monitoring data collected during Water Year 2017 (WY 2017, October 1, 2016- September 30, 2017).Monitoring data presented in this report were submitted electronically to the Water Board by the Program on behalf of the represented Permittees and may be obtained via the San Francisco Bay Area Regional Data Center of the California Environmental Data Exchange Network (CEDEN) at http://www.ceden.org/, for those types of data accepted by CEDEN[2].

This report follows the organization of the C.8 requirements in MRP2, and is organized into two main parts – the main body and appendices. The main body provides brief summaries of accomplishments made in Water Year 2017 in compliance with MRP provision C.8. Summaries are organized by sub-provisions of the MRP and grouped into the sections listed in Table 1-1.

Appendices include data analyses for interpretive reporting focused on specific types of water quality monitoring required by the MRP. Appendices are also grouped together by sub-provision as shown in Table 1-1and referenced within the applicable sections of the report's main body.

[1] The 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 Alameda County Flood Control and Water Conservation District, Zone 7 (Zone 7 Water Agency).

[2] In September 2016 the Program and other MRP permittees became aware of a decision by the State Water Resources Control Board that in the future CEDEN will display certain types of non-receiving water data previously excluded from its scope. Due to uncertainties regarding implementation of this decision, The Program's submittal of WY 2016 data conforms to the definition of CEDEN in effect at the time the reissued MRP was adopted.

Table 1-1. UCMR Report Sections and Applicable MRP Provisions and Report Appendices

Urban Creeks Monitoring Report Section		**MRP provision**	**UCMR Appendix with detailed reporting**
1. Introduction		n/a	n/a
2. Monitoring Protocols and Data Quality		C.8.b	A.1- A.4 as applicable
3. San Francisco Estuary Receiving Water Monitoring		C.8.c	n/a
4. Creek Status Monitoring	Biological, Chlorine, Nutrients,	C.8.d	A.1
	General Water Quality, Temperature, Bacteria	C.8.d	A.2
5. Stressor/Source Identification Projects		C.8.e	A.4
6. Pollutants of Concern Monitoring		C.8.f	A.3
7. Pesticides and Toxicity Monitoring (including dry weather sediment chemistry)		C.8.g	A.1
8. Reporting		C.8.h	n/a

The main body of this report and associated appendices address the following reporting requirements for the annual Urban Creeks Monitoring Report (Provision C.8.h.iii) including as appropriate for each type of monitoring in Provision C.8:

- Descriptions of monitoring purpose and study design rationale
- QA/QC summaries for sample collection and analytical methods, including a discussion of any limitations of the data;
- Descriptions of sampling protocols and analytical methods;
- Tables and Figures describing: Sample location descriptions (including waterbody names, and lat/long coordinates); sample ID, collection date (and time where relevant), media (e.g., water, filtered water, bed sediment, tissue); concentrations detected, measurement units, and detection limits;
- Data assessment, analysis, and interpretation for Provision C.8.d.;
- Pollutant load and concentration at each mass emissions station;
- A listing of third party entities whose data are included in the report;
- Assessment of compliance with applicable water quality standards; and,
- A signed certification statement.

Regional collaborative monitoring (BASMAA RMC)

Provision C.8.a (Compliance Options) of the MRP allows Permittees to address monitoring requirements through a Regional Collaboration, their countywide 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[3]. The regional monitoring collaborative is

[3] See Appendix A.1 for a list of all participants in the collaborative Regional Monitoring Coalition.

referred to as the Bay Area Stormwater Management Agencies (BASMAA) Regional Monitoring Coalition (RMC). The goals of the RMC are to:

1. Assist Permittees in complying with requirements in MRP Provision C.8 (Water Quality Monitoring);
2. Develop and implement regionally consistent creek monitoring approaches and designs in the Bay Area, through the improved coordination among RMC participants and other agencies such as the Regional Water Quality Control Board (RWQCB) that share common goals; and
3. Stabilize the costs of creek monitoring by reducing duplication of effort and streamlining

In February 2011, the RMC developed a Multi-Year Work Plan (RMC Work Plan) to provide a framework for implementing regional monitoring and assessment activities required under MRP provision C.8. The RMC Work Plan summarized RMC-related 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 (BOD). A total of 27 regional projects were identified in the RMC Work Plan, based on the requirements described in provision C.8 of MRP1, most of which have continued with minor changes in MRP2.

Regionally-implemented activities to provide standardization and coordination for the RMC Work Plan were conducted under the auspices of the Bay Area Stormwater Management Agencies Association (BASMAA), a 501(c)(3) non-profit organization comprised of the municipal stormwater programs in the San Francisco Bay Area. Scopes, budgets, and contracting 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 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. ACCWP and other RMC participants coordinate their monitoring activities through meetings and communications of the RMC Work Group and the MPC.

SECTION 2 - MONITORING PROTOCOLS AND DATA QUALITY

Provision C.8.b requires monitoring data collected by Permittees in compliance with the MRP to be of a minimum data quality consistent with the applicable State of California's Surface Water Ambient Monitoring Program (SWAMP) standards, set forth in the SWAMP Quality Assurance Project Plan (QAPP). To assist Permittees in meeting SWAMP data quality standards and developing data management systems that allow for easy access of water quality monitoring data by Permittees, the RMC coordinated guidance for SWAMP comparable data collection through several regional projects:

Standard Operating and Quality Assurance Procedures

For Creek Status Monitoring the RMC adapted existing creek status monitoring SOPs and QAPP developed by SWAMP to document the field procedures necessary to maintain comparable, high quality data among RMC participants. Version 1of these documents (BASMAA 2012a, 2012b) were completed in Water Year 2012 prior to field work. All interpretative issues or concerns raised during the initial two years of monitoring were resolved through the RMC Work Group and were documented in Version 2 (BASMAA 2014a, 2014b) along with minor revisions addressing lessons learned. The RMC produced Version 3 (BASMAA 2016a, 2016b) to reflect changes in the reissued MRP, which were finalized for use starting in WY 2016.[4]

Information Management

For Creek Status and related Monitoring, the RMC participants developed an Information Management System (IMS) to provide SWAMP-compatible storage and import/export of data for all RMC programs. A data management subgroup of the RMC Work Group met periodically for training and review of data management issues, and to suggest enhancements for data checking and to increase efficiency.

For POC Loads Monitoring in MRP 1 BASMAA contracted with SFEI to design and maintain an IMS for management of data from stations operated by the RMC programs. During WY 2015 stormwater programs initiated upgrades to the Creek Status Monitoring IMS to accommodate new sample types for POC Monitoring begun in WY 2014 and receiving increased emphasis during MRP2.

The IMSs provide standardized data storage formats, thus providing a mechanism for sharing data among RMC participants and efficient submittal of data electronically to the Water Board per provision C.8.h, as described in Section 8, Reporting.

Monitoring Data Quality Review

All Creek Status findings and data reported during Water Year 2017 were reviewed against RMC measurement quality objectives (BASMAA, 2016a). Appendices A.1 and

[4] Available at
http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/SWAMP/BASMAA_RMC_QAPP_v3_final-2016-0331_r2_signed.pdf
http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/SWAMP/BASMAA_RMC_SOP_V3_Final%20March%202016.pdf

A.2 contain statements of data quality resulting from data quality review for Creek Status and Pesticides/Toxicity Monitoring data.

Additional evaluations of data quality for data collected pursuant to provision C.8.f are provided in Appendix A.3.

SECTION 3 - SAN FRANCISCO ESTUARY RECEIVING WATER MONITORING (C.8.c)

As described in MRP provision C.8.c, 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 San Francisco Bay (RMP). Since the adoption of the MRP1, Permittees have complied with this provision by making financial contributions to the RMP directly or through stormwater programs. Additionally, Permittees actively participated in RMP committees and work groups through Permittee and/or stormwater program staff as described in the following sections, which also provide a brief description of the RMP and associated monitoring activities conducted during this reporting period.

The RMP is a long-term monitoring program that is discharger funded and shares direction and participation by regulatory agencies and the regulated community with the goal of assessing water quality in the San Francisco Bay.[5] The regulated community includes Permittees, publicly owned treatment works (POTWs), dredgers and industrial dischargers. The RMP is intended to answer the following core management questions:

- Are chemical concentrations in the Estuary potentially at levels of concern and are associated impacts likely?
- What are the concentrations and masses of contaminants in the Estuary and its segments?
- What are the sources, pathways, loadings, and processes leading to contaminant related impacts in the Estuary?
- Have the concentrations, masses, and associated impacts of contaminants in the Estuary increased or decreased?
- 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 paragraphs provide a brief overview of these programs.

<u>RMP Status and Trends Monitoring Program</u>

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

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[5] The RMP Annual Work Plans and other documents are available at http://www.sfei.org/programs/sf-bay-regional-monitoring-program

1989 and redesigned in 2007 based on a more rigorous statistical design that enables the detection of trends. In Water Year 2017 the S&T Program was comprised of the following program elements that collect data to address RMP management questions described above:

- Water/Sediment/Biota Chemistry and Toxicity Monitoring
- Sediment Benthos Monitoring
- Small and Large Tributary Loading Studies and Small Fish and Sport Fish Contamination Studies
- Studies to Determine the Causes of Sediment Toxicity
- Suspended Sediment, Hydrography and Phytoplankton Monitoring
- Bird Egg Monitoring

In fall 2011 the RMP Steering Committee, as part of a 5-year Master Planning process reviewed the S&T Program and agreed to reduce the frequency of some of the data collection activities or elements in future years so that more funding will be available for pilot and special studies. Beginning in 2015, a component was added to the S&T program to characterize surface sediments through monitoring in nearshore Bay margin areas that have been largely unsampled by the RMP and were excluded from the previous S&T redesign. Additional information on the S&T Program and associated monitoring data are available for downloading via the RMP website using the Contaminant Data Download and Display (CD3) at http://www.sfei.org/rmp/data.

RMP Pilot and Special Studies

The RMP also conducts Pilot and Special Studies (P/S Studies) on an annual basis. Studies usually are 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 and standing workgroups identify as priority for further study. These studies are developed through an open selection process at the workgroup level and selected for funding through RMP committees. Results and summaries of the most pertinent P/S Studies can be found on the RMP website (www.sfei.org/rmp/).

Water Year 2017 saw a continuation of special studies associated with the RMP's Small Tributary Loading Strategy (STLS), which 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 is provided on STLS-related studies under Section 6.1 of this Report.

Participation in Committees, Workgroups and Strategy Teams

In Water Year 2017, RMC Permittees actively participated in the following RMP Committees and work groups:

- Steering Committee (SC)
- Technical Review Committee (TRC)
- Sources, Pathways and Loadings Workgroup (SPLWG)
- Exposure and Effects Workgroup (EEWG)

- Strategy Teams for PCBs, Mercury, Small Tributaries, Sport Fish and Nutrients)

Committee and workgroup representation was provided by Permittee or stormwater program staff and/or individuals designated by RMC participants and the BASMAA BOD. During Water Year 2017 ACCWP Program staff actively participated in the SPLWG, EEWG, Small Tributaries Loading Strategy Team (see Section 6, POC Monitoring, below) and the PCB Strategy Team. Representation included participating in meetings or conference calls, reviewing technical reports and work products, reviewing articles included in the RMP's annual update, and providing general program direction to RMP staff. RMC representatives to the RMP also provided timely summaries and updates to other stormwater program representatives (on behalf of Permittees) during MPC and/or BOD meetings and solicited timely input as needed to ensure Permittees' interests were adequately represented.

SECTION 4 - CREEK STATUS MONITORING (C.8.d)

Provision C.8.d requires Permittees to conduct Creek Status Monitoring that is intended to answer the following management questions:

- Are water quality objectives, both numeric and narrative, being met in local receiving waters, including creeks, rivers and tributaries?
- 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. Based on the implementation schedule described in Provision C.8.a.ii of MRP1, Creek Status Monitoring coordinated through the RMC began in October 2011. While MRP2 designates a separate section for Pesticides and Toxicity Monitoring, these parameters were originally included in the design for Creek Status Monitoring as described below, and are reported together for purposes of this report.

Regional and Local Monitoring Designs

The RMC's regional monitoring strategy for complying with MRP provision C.8.d - Creek Status Monitoring is described in its *Creek Status and Long-Term Trends Monitoring Plan* (BASMAA 2011). 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)[6].

[6]Provision C.8.a.i of MRP1stated in reference to all subsections of C.8 that "provided these datatypes, quantities, and quality are obtained, a regional monitoring collaborative may develop its own sampling design" Provision C.8.a.i of MRP2 encourages Permittees to continue contributing to the RMC.

The Program submitted its Creek Status Monitoring data for Water Year 2016 to the Water Board by March 31, 2017. The analyses of results from Creek Status and Pesticides/Toxicity Monitoring conducted by the Program in Water Year 2017 are presented in Appendices A.1 and A.2 to this report. Table 4-1provides a list of which monitoring parameters are included in specific appendices.

Table 4-1. Location of result analyses for each monitored parameter in MRP Provisions C.8.d and C.8.g.

Biological Response and Stressor Indicators	Monitoring Design		Reporting
	Regional Ambient (Probabilistic)	Local (Targeted)	
Bioassessment & Physical Habitat Assessment	X		Appendix A.1
Chlorine	X		Appendix A.1
Nutrients (with Bioassessment)[a]	X		Appendix A.1
Water Toxicity	n/a		Appendix A.1
Sediment Toxicity	n/a		Appendix A.1
Sediment Chemistry	n/a		Appendix A.1
General Water Quality		X	Appendix A.2
Temperature		X	Appendix A.2
Bacteria		X	Appendix A.2

[a]Nutrients sampled for Pollutants of Concern Monitoring are reported in Section 6 below.

SECTION 5 - STRESSOR/SOURCE IDENTIFICATION PROJECTS (C.8.e)

As described in MRP Provision C.8.e, Permittees who conduct Creek Status monitoring through a regional collaborative are required to collectively initiate a minimum of eight new Stressor/Source Identification (SSID) projects (minimum one for toxicity) during the MRP 2 permit term. Potential SSID projects are identified when monitoring results reach criteria or thresholds for follow-up action as indicated for each data type in MRP provision C.8.d or C.8.g.

To ensure consistency in interpretation of the SSID requirements (C.8.e) and a coordinated approach to compliance with that provision, RMC Permittee efforts in the previous permit term included a collaborative evaluation of Water Year 2012 Creek Status monitoring results and joint decision-making process for selecting sites for SSID follow-up by individual programs. RMC Program representatives reviewed the list of candidate SSID projects with Water Board staff in the April 2013 meeting of the RMC Work Group. Attachment B is a summary table of RMC SSID projects with their locations, rationales, and current status.

In consultation with Permittees, the Program developed workplans and initiated the first follow-up action for three Alameda County SSID projects in FY2013-14. As required by Provision C.8.d.i of MRP1 (Stressor/Source Identification), this first step was to conduct a site-specific study in a stepwise process to identify and isolate the cause(s) of the trigger stressor/source originally identified through Creek Status Monitoring results. Initial study design, data collection and results for the following stressor/source identification projects were provided in progress reports attached to the March 2014 Integrated Monitoring Report (IMR) for three studies. Three SSID projects continued in WY 2017. WY 2017 is the final year for two of the projects, and one project will continue into WY 2018. The progress report and final reports provided in Appendix 4 are summarized below:

- Appendix A.4A for Dublin Creek trigger results for biological community condition and sediment quality at probabilistic site 204R00084. The site-specific study began in 2013 with sediment sampling, watershed records review and bioassessment sampling at an additional RMC site plus a supplemental site along an urbanization gradient. Bioassessment impacts were strongly associated with channel alteration and habitat quality. Review of inspection information from the catchment area identified no specific sources of pesticides or metals to sediment. The WY 2017 progress report is presented as the final report for this SSID project. It presents the understanding of how the Dublin Creek sediment chemistry and bioassessment data compare relative to that obtained from other watersheds within Alameda County, and describes the basis, in accordance with provision C.8.e.iii(3)(b), for requesting that the Executive Officer consider this SSID project complete. No additional follow-up is indicated. Future resources are proposed to be put toward SSID efforts following up on other management priorities or indicators of potential water quality concern generated through other ACCWP monitoring efforts.

- Appendix A.4B for Castro Valley Creek WY2012 trigger results for sediment quality at probabilistic site 204R00047SSID. The site-specific study began in 2013 with sediment sampling and watershed records review. No specific sources to local MS4 were identified during 2014. In WY 2015, no aquatic or sediment toxicity was observed in the Castro Valley Creek samples, although the pyrethroid equivalent Toxicity Units in sediment were high enough to potentially cause toxicity according to the thresholds established in MacDonald et al. (2000). In WY 2016 the integrator site 204CVY010 also reached triggers according to MacDonald et al. (2000), with no associated toxicity observed. The WY 2017 progress report provides an update confirming that the pollutant concentrations in Castro Valley Creek sediments are typical of urbanized areas in California. Program staff will incorporate results and findings from WY 2018 in a final report by September 2018.

- Appendix A.4C for Crow Creek trigger results for Low Dissolved Oxygen from General Water Quality measurements at targeted site 204CRW030. The site-specific Project began in 2013 with further DO and water sampling; the initial hypothesis regarding reservoir runoff was not supported by the first year's results. Further monitoring in WY 2014 and 2015 indicated there may have been episodic contributions from urban runoff to low DO incidents observed in WY2014 but not during WY 2015. The progress report for WY 2017 serves as the final report, and documents the monitoring to evaluate summer inflows from culvert outfalls using continuous monitoring of conductivity as well as temperature. In WYs 2016 and 2017, in contrast to the previous drought years there were no DO problems at the downstream site that originally triggered the SSID project. The WY 2017 final report shows that there were no obvious episodic patterns of low DO evident at other stations monitored along the creek. As multiple years of intensive monitoring at the study site have not been able to replicate the 2012 findings of multiple instances where DO concentrations fell below objectives, the trigger threshold exceedance was found to be episodic, and reasonable methods have not revealed a stressor/source. Based on these inconclusive findings, in accordance with provision C.8.e.iii(3)(b), it is requested that the Executive Officer consider this SSID project complete. No additional follow-up indicated. No additional follow-up is indicated. Future resources are proposed to be put toward SSID efforts following up on other management priorities or indicators of potential water quality concern generated through other ACCWP monitoring efforts.

SECTION 6 - POLLUTANTS OF CONCERN MONITORING (C.8.f)

The POC Monitoring provision of the reissued MRP reflects the evolution of knowledge and data needs achieved during the first MRP term. The management questions for this new permit term have become more articulated and monitoring priorities are shifting towards increased support of management decisions relating to implementation of TMDL load reductions for PCBs and mercury. In October 2017, the Program submitted a separate Pollutants of Concern (POC) Monitoring Report describing accomplishments during Water Year 2017 and the allocation of POC monitoring sampling effort planned for WY 2017. As required in provision C.8.h.iv, the POC Monitoring Report included monitoring locations, number and types of samples collected for each purpose of sampling (management question addressed), and analytes measured. POC monitoring activities and data for WY 2017 are summarized below.

Provision C.8.f of the MRP lists five priority POC management information needs 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.

However, not all of the five information needs apply to all POCs. Table 8.2 of the MRP identifies the applicability of the five information needs to specific POC or POC groups. The Program's WY 2017 POC Monitoring activities are described in Section 6.1 below and in Appendix A.3A to this report.

MRP Provision C.8.a.iii allows Permittees to use data collected by a third-party organization to fulfill a monitoring requirement, provided the data are demonstrated to meet data quality objectives comparable to those of the statewide Surface Water Ambient Monitoring Program (SWAMP) as described in Provision C.8.b. Section 6.2 summarizes third-party data collection activities by two programs that meet these criteria and are relevant to ACCWP's POC Monitoring objectives.

6.1 POC MONITORING BY ACCWP

The Program conducted POC Monitoring activities focused on the following POCs, for sample numbers and management information needs shown in Table 6-1:

- Polychlorinated Biphenyls (PCBs) and total mercury, for information needs 1-5;
- Copper and Nutrients (Ammonium, Nitrate, Nitrite, Total Kjeldahl Nitrogen, Orthophosphate and Total Phosphorus), for information needs 4 and 5.

Table 6-1. Types and Numbers of POC monitoring samples collected by ACCWP in WY 2017

Information Need	Sample Matrix	Type of Sampling Event/ Location	Target POCs	No. of WY 2017 Samples
1	Sediment, urban	Dry weather / on or near ROW surface receiving runoff from potential / likely source	PCBs, mercury	8
1,2	Sediment, bedded	Dry weather / in MS4 facilities or local channels	PCBs, mercury	2*
4,5	Runoff	Dry weather grab sample / lower watershed integrative site	Copper, nutrients	2 (Appendix A.1)
4,5	Sediment, bedded in channel	Dry weather / fine grained at lower watershed integrative site	Copper	2 (Appendix A.1)

* Archived samples of UPRR Channel Sediments originally collected in 2014.

As required by MRP Table 8.2, data on Ancillary Parameters such Total Organic Carbon, Suspended Sediment Concentration or hardness were collected as necessary for each sample to address management questions or information needs.

PCB Source Area Identification

In WY 2017 the Program continued sampling urban sediment in street right-of-ways for identification of potential source areas for TMDL pollutants to address Management Information Need 1), based on a multi-step PCB Implementation Planning process to identify watersheds or management areas for PCB load reduction activities. Background, goals, and progress on this effort are described in separate reports submitted by the Permittees on April 1, 2017 and in the 2017 Annual Report as required by Provision C.12.a of the MRP. Appendix A.3 reports the monitoring locations, numbers and types of samples collected by the Program during 2017 sediment sampling.

Copper and Nutrient POC monitoring -
Copper and nutrients were sampled in July 2017 at two creek sites in conjunction with dry weather sampling for Pesticides and Toxicity Monitoring. Locations of sites, methods of sampling and analysis and results of sediment sampling are reported in Appendix A.1. Table 6-2 shows the results for water column sampling on the same date.

Table 6-2. Results of copper and nutrients water column monitoring at sites 204WRD002 and 205R01198 in Water Year 2017.

Analyte	Results		Units
	204WRD002	205R01198	
Copper (dissolved)	1.4	0.52	ug/L
Hardness (as $CaCO_3$)	290	320	mg/L
Ammonia as N	0.086	0.055	mg/L
Nitrate	3.4	0.24	mg/L
Nitrite	0.67	0.012	mg/L
Total Kjeldahl Nitrogen	1	0.4	mg/L
Orthophosphate	0.024	0.048	mg/L
Total Phosphorus	0.069	0.089	mg/L

<u>Comparisons to Numeric Water Quality Objectives/Criteria for Specific Analytes</u>

Provision C.8.h.iii requires RMC participants to assess all data collected pursuant to provision C.8 for compliance with applicable water quality standards. In compliance with this requirement, an assessment of data collected for ACCWP's POC monitoring of copper and nutrients in Water Year 2017 is provided below.

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

<u>Freshwater vs. Saltwater</u>- POC monitoring data were collected in freshwater receiving water bodies above tidal influence and therefore comparisons were made to freshwater water quality objectives/criteria.

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

Acute vs. Chronic Objectives/Criteria - For POC monitoring required by provision C.8.e, data were collected in an attempt to develop more robust loading estimates from small tributaries. Therefore, detecting the concentration of a constituent in any single sample was not the primary driver of POC monitoring. Monitoring was conducted during episodic storm events and results do not likely represent long-term (chronic) concentrations of monitored constituents. POC monitoring data were therefore compared to "acute" water quality objectives/criteria for aquatic life that represent the highest concentrations of an analyte to which an aquatic community can be exposed briefly (e.g., 1-hour) without resulting in an unacceptable effect. For analytes for which no water quality objectives/criteria have been adopted, comparisons were not made.

It is important to note that acute water quality objectives or criteria have only been promulgated for a small set of analytes collected in the POC monitoring station, including objectives for trace metals, i.e. copper.

Water samples collected in WY 2017 were below applicable numeric water quality objectives (i.e., freshwater acute objective for aquatic life) for copper. Nitrate as N and Nitrite as N were below water quality objectives for MUN supply although these objectives were not applicable to the sites sampled.

Data Quality - In general, QA/QC procedures were implemented as specified in the RMC QAPP (BASMAA, 2016a). However, as described in Section 4.1 of Appendix A.3, some lab results led to an inability to assess precision for certain parameters. Monitoring was performed according to protocols specified in the RMC SOPs (BASMAA, 2016b), developed for C.8 monitoring and in conformity with SWAMP protocols as described in Section 2 above.

6.2 POC MONITORING BY THIRD PARTIES

As discussed in the POC Monitoring Report, two third-party organizations met the criteria for their data to be used to partially fulfill POC monitoring requirements in WY 2017, as described below:

Regional Monitoring Program (RMP)

As described in Section 3 above, the RMP conducts pilot and special studies to support water quality management in the Bay and its tributary watersheds. These studies are overseen by different RMP work Groups or teams as described below:

Small Tributaries Loading Strategy (STLS): To assist participants in effectively and efficiently conducting POC monitoring required by the MRP and answer POC loads management questions listed in MRP1, an RMP Small Tributaries Loading Strategy (STLS) was developed in 2009 by the STLS Team, which included representatives from BASMAA, Water Board staff, RMP/SFEI and technical advisors. The objective of the STLS is to develop a comprehensive planning framework to coordinate POC loads monitoring and modeling (Management Information Needs 2, 4 and 5) between the RMP and RMC participants. This framework and a summary of activities and products to date were provided in an initial STLS Multi-Year Plan (STLS-MYP) under oversight of the STLS Team and the associated RMP Sources Pathways Loadings Work Group (SPLWG). Active elements of the STLS Work Plan and during the period from October 2016 through September 2017 included.

- Watershed Modeling –In WY 2017 the Permittees continued oversight of refinements to Regional Watershed Spreadsheet Model for estimating regional-scale pollutant loads to the Bay, through participation in the STLS Team and SPLWG.
- Watershed Characterization “Reconnaissance” Monitoring is based on collaboration with stormwater programs to identify and rank catchments with possible PCB and/or mercury sources, to address management information need 1.

RMP PCB Strategy is engaged in a multi-year effort to develop Conceptual Models of PCB fate and transport in selected nearshore portions of SF Bay called Priority Margin Units (PMUs), in order to clarify contributions from adjacent watersheds to Bay impairment, inform future management decisions and tracking of trends in PCB loads from those watersheds. The RMP published the Conceptual Model to Support PCB Management and Monitoring in the Emeryville Crescent Priority Margin Unit in April 2017 (Davis et al 2017). The report provides a technical foundation and identifies additional information needed to support decision-making regarding the potential for decline in the compartments of the PMU in response to projected load reductions in the PMU watershed, the management of tributary loads to maximize PMU recovery, and the monitoring of the Crescent to detect the expected reduction.

Emerging Contaminants Special Study - Provision C.8.e.vii of MRP1required Permittees to develop a work plan and schedule for initial loading estimates and source analyses for contaminants of emerging concern (CECs). Contaminants that were mentioned in MRP1include: endocrine-disrupting compounds, PFOS/PFAS (Perfluorooctanesulfonates (PFOS), Perfluoroalkylsulfonates (PFAS), and NP/NPEs (nonylphenols/nonylphenol esters - estrogen-like compounds). The Permittees addressed this requirement through the CECs Strategy developed by the Emerging Contaminants Work Group (ECWG) of the RMP. For MRP 2, Table 8.2 of the MRP requires one or more special studies that address relevant management information needs for emerging contaminants to include at least PFOs, PFAs, and alternative flame retardants being used to replace polybrominated diphenyl ethers (PBDEs). The Permittees will cause this study to be conducted through the SPLWG and the ECWG by the end of the permit.

SWAMP Stream Pollution Trends (SPoT) Monitoring Program

The SPoT element of the SWAMP program aims to determine long-term trends in stream contaminant concentrations and effects statewide. For this purpose the program has established a network of approximately 100 sites throughout the state where it samples depositional stream sediments collected near the base of watersheds, including two sites in Alameda County that were sampled in WY 2016. Results of SPoT 2013 and 2014 monitoring were included in a 7-year report released in late 2016, with a future 10-year synthesis report planned to include data collected through 2017.

SECTION 7 - PESTICIDES AND TOXICITY MONITORING (C.8.g)

Provision C.8.g, requires Permittees to conduct wet weather and dry weather monitoring of pesticides and toxicity in urban creeks. This includes monitoring of toxicity in the water column (dry weather), monitoring of toxicity and other pollutants in sediment (dry weather), and wet weather pesticides and toxicity monitoring. Appendix A.1 to this UCMR reports the results of ACCWP's dry weather monitoring under this provision in WY 2017. Per Provision C.8.g.iii(3) wet weather pesticides and toxicity monitoring will be conducted by the RMC on behalf of all Permittees, with a minimum of 6 samples collected across the region in WY 2018 (the third WY of the permit term). During WY 2017 the RMC selected sites for collecting a total of 10 samples during the permit term, with concurrence of Water Board staff in the RMC Work Group.

Provision C.8.g describes pesticide and toxicity monitoring parameters, methods, occurrences, durations and minimum number of sampling sites for each stormwater program while recognizing a trend towards development of a coordinated statewide monitoring program. Due to previous inclusion of these parameters in the RMC's regional monitoring strategy as described in its *Creek Status and Long-Term Trends Monitoring Plan* (BASMAA 2011), the analyses of results from pesticide and toxicity monitoring conducted by the Program in Water Year 2017 are presented along with other regionally designed Creek Status Monitoring parameters in Appendix A.1.

SECTION 8 - REPORTING (C.8.h)

Provision C.8.h requires Permittees to report annually on water quality data collected in compliance with the MRP. Annual reporting requirements include: 1) water quality standard exceedances; 2) electronic reporting; 3) Urban Creeks Monitoring Reports; 4) Pollutants Of Concern Monitoring Reports, Integrated Monitoring Report; and 4) standard report content.

Data are submitted in SWAMP format, as described in more detail in Section 2, Monitoring Protocols and Data Quality. Data are submitted with quality controls required by CEDEN, in accordance with the electronic reporting requirements in MRP provision C.8.h.ii.

In accordance with the reporting schedule of the reissued MRP, the Program's WY 2017 creek status monitoring electronic data are being submitted to the Water Board by March 31, 2018, concurrent with the UCMR. Additionally, a separate Pollutants of Concern Monitoring Report was submitted to the Water Board by October 16, 2017. In the fifth year of the permit term, an Integrated Monitoring Report will be submitted in lieu of the annual Urban Creeks Monitoring Report.

This report includes the standard report content required in MRP provision C.8.h.vi.

SECTION 9 - REFERENCES

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BASMAA. 2012b. Creek Status Monitoring Program Standard Operating Procedures. Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program. 196 pp.

BASMAA. 2014a. Creek Status Monitoring Program Quality Assurance Project Plan, Final Version 2. Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program. 81 pp plus appendices.

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SECTION 10 - ATTACHMENTS

Attachment A. Electronic Data Submittal Transmittal Letter dated March 31, 2018 with attached file list.

Attachment B. BASMAA Regional Monitoring Coalition: Status of Regional Stressor/Source Identification (SSID) Projects, Updated March 2018

MEMBER AGENCIES:

Alameda

Albany

Berkeley

Dublin

Emeryville

Fremont

Hayward

Livermore

Newark

Oakland

Piedmont

Pleasanton

San Leandro

Union City

County of Alameda

Alameda County Flood Control and Water Conservation District

Zone 7 Water Agency

ALAMEDA COUNTYWIDE CLEAN WATER PROGRAM

CREEK STATUS MONITORING REPORT - REGIONAL PARAMETERS, PESTICIDES AND TOXICITY

APPENDIX A.1

URBAN CREEKS MONITORING REPORT

OCTOBER 2016 THROUGH SEPTEMBER 2017

Report prepared by

Alameda Countywide Clean Water Program
399 Elmhurst Street,
Hayward, California 94544

Submitted to:

California Regional Water Quality Control Board, San Francisco Bay Region

FINAL

March 31, 2018

Protecting Alameda County Creeks, Wetlands & the Bay

Acknowledgements

EOA, Inc. contributed substantially to this report in preparation of the data analysis and discussion for bioassessment data. Matthew R. Cover, working as a subconsultant to Horizon, Water and Environment, LLC, provided additional review of the bioassessment data and findings. Horizon Water and Environment, LLC contributed substantially to the preparation of this report in preparation of the data analysis and discussion for water quality, pesticides and sediment chemistry/toxicity. Applied Marine Sciences, Inc. contributed substantially to the site evaluation, implementation of monitoring and preparation of the data analysis and discussion for all other regionally designed parameters.

Preface

The Bay Area Stormwater Management Agencies Association (BASMAA) Regional Monitoring Coalition (RMC) collaboratively developed a framework for preparation of the Urban Creeks Monitoring Report (UCMR) used by ACCWP and other stormwater programs to comply with the Municipal Regional Stormwater Permit (MRP)[1] requirements for reporting on monitoring data collected under the MRP Monitoring provision C.8.

The following participants make up the RMC and are responsible for preparing UCMR documents on behalf of their respective member agencies:

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

This report was prepared by ACCWP to fulfill reporting requirements for a portion of the Creek Status Monitoring data collected in Water Year 2017 (October 1, 2016 through September 30, 2017) in accordance with the RMC's Monitoring Plan (BASMAA 2011) for certain "regionally designed" parameters required by the MRP and conducted using a probabilistic monitoring design. Results of Pesticide and Toxicity Monitoring are also reported here since the sampling design is still driven by regional considerations under the reissued "MRP2", although no longer associated with the probabilistic design. This report is an Appendix to the full UCMR submitted by ACCWP on behalf of the following Permittees:

[1] Unless otherwise noted references to the MRP are to the reissued "MRP2" (SFBRWQCB, 2015) which became effective January 1, 2016. Most of the monitoring requirements addressed in this Appendix have not changed substantially from the original "MRP1" (SFBRWQCB, 2009)

- The 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 of the Alameda County Flood Control and Water Conservation District.

Other data collected in Alameda County during this period pursuant to MRP provision C.8 are reported in the main body and other appendices of ACCWP's UCMR for Water Year (WY) 2017.

As described in the RMC Creek Status and Long-Term Trends Monitoring Plan (BASMAA 2011), RMC participants collected data by implementing BASMAA RMC Standard Operating Procedures (SOPs, BASMAA, 2012b, 2014b and 2016b) in accordance with the BASMAA RMC Quality Assurance Project Plan (QAPP; BASMAA, 2012a, 2014a and 2016a). Analytical laboratory analyses were also coordinated among all RMC participants.

In accordance with the reissued MRP (SFBRWQCB, 2015) ACCWP will also submit the data included in this report by March 31, 2018 to the California Environmental Data Exchange Network and San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) in electronic SWAMP-comparable format.

In addition to the RMC participants, San Francisco Bay Regional Water Quality Control Board staff, Kevin Lunde and Jan O'Hara, also participated in RMC workgroup meetings that contributed to design and implementation of the RMC Monitoring Plan. Additionally, these staff also provided input regarding previous Urban Creeks Monitoring Reports and threshold "trigger" criteria for stressor analyses conducted therein.

List of Acronyms

Acronym	Definition
AFDM	Ash Free Dry Mass
AMS	Applied Marine Sciences, Inc.
ACCWP	Alameda Countywide Clean Water Program
BASMAA	Bay Area Stormwater Management Agencies Association
BMI	Benthic Macroinvertebrate
CCC	Criterion Continuous Concentration
CCCWP	Contra Costa Clean Water Program
CMC	Criteria Maximum Concentration
CSCI	California Stream Condition Index
CTR	California Toxics Rule
CWA	Clean Water Act
DEM	Digital Elevation Model
DW	Dry Weight
FSURMP	Fairfield-Suisun Urban Runoff Management Program
GIS	Geographic Information System
GRTS	Generalized Random Tessellated Stratified
HVF	Highly Variable Flow
IBI	Index of Biological Integrity
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
MQO	Measurement Quality Objective
MRP	Municipal Regional Stormwater Permit
MRP2	Reissued Municipal Regional Stormwater Permit (2015)
MUN	Municipal Beneficial Use
MWAT	Maximum Weekly Average Temperature
ND	Non-detect
NPDES	National Pollutant Discharge Elimination System
NT	Non-Target
PAH	Polycyclic Aromatic Hydrocarbon
PEC	Probable Effects Concentrations
PHab	(Bioassessment) Physical Habitat Assessment
PR	Percent Recovery
PSA	Perennial Streams Assessment
PSD	Particle Size Distribution
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
QAO	Quality Assurance Officer
RL	Reporting Limit

RMC	Regional Monitoring Coalition
RWQCB	Regional Water Quality Control Board
SCCWRP	Southern California Coastal Water Research Project
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board (California Regional Water Quality Control Board, San Francisco Bay Region)
SFEI	San Francisco Estuary Institute
SMC	Southern California Stormwater Monitoring Coalition
SMCWPPP	San Mateo County Wide Water Pollution Prevention Program
SOP	Standard Operating Procedure
SSID	Stressor Source Identification
SWAMP	Surface Water Ambient Monitoring Program
TEC	Threshold Effect Concentrations
TKN	Total Kjeldahl Nitrogen
TNS	Target Not Sampled
TOC	Total Organic Carbon
TS	Target Sampleable
UCMR	Urban Creeks Monitoring Report
WY	Water Year

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Executive Summary

In 2010, the seventeen member agencies of the Alameda Countywide Clean Water Program (ACCWP) joined other members of the Bay Area Stormwater Agencies Association (BASMAA) to form the BASMAA Regional Monitoring Coalition (RMC), as a collaborative effort to coordinate and oversee water quality monitoring required by provision C.8 of the Municipal Regional Stormwater Permit (MRP). This report is an appendix to the Urban Creeks Monitoring Report (UCMR) prepared to assist ACCWP member agencies in complying with the MRP Reporting provision C.8.h, reporting the results of data collected by ACCWP during the Water Year (WY) 2017 extending from October 1, 2016 through September 30, 2017 pursuant to the following MRP provisions:

- Creek Status Monitoring (C.8.d) parameters that were sampled according to a regional probabilistic design; and
- Pesticides and Toxicity Monitoring (C.8.g) which also assesses problems widespread across the region.

Other Creek Status Monitoring parameters were addressed using a targeted design, with regional coordination and common methodologies and are reported in a separate Targeted Appendix A.2[2] to the UCMR.

During WY 2017, ACCWP monitored 22 sites under the regional probabilistic design for bioassessment, physical habitat, and related water chemistry parameters. Another two sites were monitored for water and sediment toxicity and sediment chemistry, to fulfill the dry season monitoring requirements in MRP provision C.8.g.i and ii.

The bioassessment data were used to evaluate potential stressors that may affect aquatic habitat quality and beneficial uses through a preliminary condition assessment for the monitored sites. The probabilistic design requires at least three years to produce sufficient data to develop a statistically-robust characterization of regional creek conditions, so the analysis and interpretation that can be completed with the first three years of data are necessarily limited.

The reissued MRP contains a separate provision C.8.g to combine all pesticide and toxicity monitoring into one section, instead of being distributed between Creek Status and Pollutants of Concern Monitoring provisions. For WY 2017 monitoring, ACCWP selected two sites to

[2] Similar methods and QA/QC procedures are being implemented for Stressor-Source Identification (SSID) studies reported in Appendix A.4 to the UCMR.

monitor for toxicity based on a low bioassessment score at one, and proximity to potential sources of toxicity at the other.

The following MRP reporting requirements (per provision C.8.h.vi) are addressed within this report or other portions of the UCMR, as applicable:

- Descriptions of monitoring purpose and study design rationale
- QA/QC summaries for sample collection and analytical methods, including a discussion of any limitations of the data;
- Descriptions of sampling protocols and analytical methods;
- Tables and Figures describing: Sample location descriptions (including waterbody names, and lat/long coordinates); sample ID, collection date (and time where relevant), media (e.g., water, filtered water, bed sediment, tissue); concentrations detected, measurement units, and detection limits;
- Data assessment, analysis, and interpretation for provision C.8.c.;
- Pollutant load and concentration at each mass emissions station;
- A listing of volunteer and other non-Permittee entities whose data are included in the report;
- Assessment of compliance with applicable water quality standards; and
- A signed certification statement.

In this report, the results of the stressor assessments are used to determine whether potential follow-up actions may be warranted to address the management questions underlying the RMC design (BASMAA 2011).

Biological community conditions were evaluated using the California Stream Condition Index (CSCI) which considers watershed attributes to identify comparable reference sites, along with several new algae indices of biological integrity. The stressor analysis of bioassessment data revealed the following observations about ACCWP's WY 2017 sampling sites:

- Data from the sites show alteration of biological communities, and channel modification and other habitat changes associated with urbanization is a likely stressor for benthic macroinvertebrate communities. The site with the highest CSCI score had 1% impervious area and a non-heavily modified channel. Two additional sites had CSCI scores above the 0.795 threshold. The remainder of the sites had CSCI scores below the threshold.

The stressor analysis for water quality, sediment chemistry and water and sediment toxicity data revealed the following indications of potential stressors for WY 2017 sites:

- **Water Quality –** Of 11 parameters[3] sampled in association with WY 2017 bioassessment monitoring, applicable water quality standards were only identified for ammonia, chloride, and nitrate + nitrite (for sites with MUN beneficial use only). Of the results generated at the 22 sites monitored by ACCWP reporting herein for those three parameters, two chloride, one un-ionized ammonia, and no nitrate + nitrite[4] concentrations exceeded the applicable water quality standard or threshold.
- **Water Toxicity –** For WY 2017, 14 aquatic toxicity endpoints were derived through testing of 5 species at 2 sites county-wide during one dry season event. Of these endpoints, one sample / test combination exhibited statistically-significant toxicity as reported by the analytical laboratory (C. dubia reproduction at site 205R01198). Neither sites' samples exhibited toxicity with survival, growth, or reproduction beyond the threshold of >50% Effect.
- **Sediment Toxicity –** Of the bedded sediment collected from 2 sites, a toxic response of greater than 50% effect for *C. dilutus* survival was observed at site 205R01198 for both a field sample and field duplicate. Follow-up sampling triggered by these results returned responses below the threshold of >50% Effect.
- **Sediment Chemistry –** At site 205R01198, 1 constituent was present above the Probable Effect Concentration (PEC). Site 204WRD002 had 6 constituents above Threshold Effect Concentration (TEC) and site 205R01198 had 4.

The stressor analyses identified a number of sites that may deserve follow-up investigation to provide better understanding of the sources/stressors likely contributing to reduced ecological condition in Bay Area creeks.

[3] Algal mass (ash-free dry weight), Chlorophyll a, Ammonia, Nitrate, Nitrite, TKN, Total Nitrogen, OrthoPhosphate, Phosphorus, Silica and Chloride

[4] One site exceeded the Nitrate + Nitrite threshold, but it is not counted as an exceedance because that threshold does not apply to sites that do not have the MUN beneficial use. Table 4-13 contains nutrient and beneficial use information for the 22 sites sampled.

1. Introduction

This report fulfills a portion of the reporting requirements of provision C.8.h.iii of the Bay Area Municipal Regional Stormwater Permit (MRP[5]) for monitoring data collected during Water Year (WY) 2017 (October 1, 2016 - September 30, 2017) pursuant to the following MRP provisions:

- Creek Status Monitoring (C.8.d) parameters that were sampled according to a regional probabilistic design; and
- Pesticides and Toxicity Monitoring (C.8.g).

The regional probabilistic design was developed and implemented by the Bay Area Stormwater Management Agencies Association (BASMAA) Regional Monitoring Coalition (RMC). Additional data required by provision C.8.are reported in other appendices and portions of ACCWP's Urban Creeks Monitoring Report (UCMR), of which this is Appendix A.1.

The RMC was formed in early 2010 as a collaboration among several BASMAA members representing all MRP Permittees (Table 1-1) to focus on development and implementation of a regionally-coordinated water quality monitoring program. The intent of the regional monitoring effort is to improve stormwater management in the region and address water quality monitoring required by the MRP[6]. Implementation of the RMC's Creek Status and Long-Term Trends Monitoring Plan allowed Permittees and the Water Board to effectively modify their existing creek monitoring programs, and improve their ability to collectively answer core management questions in a cost-effective and scientifically rigorous way. Participation in the RMC is facilitated through the BASMAA Monitoring and Pollutants of Concern Committee (MPC) and its associated RMC Work Group, a subgroup of the MPC that meets and communicates regularly to coordinate planning and implementation of monitoring-related activities. This workgroup includes staff from the SF Bay RWQCB at two levels – those generally engaged with the MRP as well as those working regionally with the State of California's Surface Water Ambient Monitoring Program (SWAMP).

[5] The San Francisco Bay Regional Water Quality Control Board (SFRWQCB) issued the first five-year MRP to 76 cities, counties and flood control districts (i.e., Permittees) in the Bay Area on October 14, 2009 (SFRWQCB 2009) and reissued the permit on November 19, 2015 (SFRWQCB 2015) with an effective date of January 1, 2016. Unless otherwise noted references in this report to the MRP are to the reissued "MRP2"

6. The RMC includes all MRP Permittees as well as the cities of Antioch, Brentwood, and Oakley, which are not named as Permittees under the MRP but have voluntarily elected to participate in MRP-related regional activities. Note that the RMC regional monitoring design was expanded to include the portion of eastern Contra Costa County that drains to the San Francisco Bay in order to assist the CCCWP in fulfilling parallel provisions in their NPDES permit from the Region 5 Central Valley RWQCB.

Table 1-1. Regional Monitoring Coalition Participants.

Stormwater Programs	RMC Participants
Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP)	Cities of Campbell, Cupertino, Los Altos, Milpitas, Monte Sereno, Mountain View, Palo Alto, San Jose, Santa Clara, Saratoga, Sunnyvale, Los Altos Hills, and Los Gatos; Santa Clara Valley Water District; and, Santa Clara County
Alameda Countywide Clean Water Program (ACCWP)	Cities of Alameda, Albany, Berkeley, Dublin, Emeryville, Fremont, Hayward, Livermore, Newark, Oakland, Piedmont, Pleasanton, San Leandro, and Union City; Alameda County; Alameda County Flood Control and Water Conservation District; and, Zone 7
Contra Costa Clean Water Program (CCCWP)	Cities of Antioch, Brentwood, Clayton, Concord, El Cerrito, Hercules, Lafayette, Martinez, Oakley, Orinda, Pinole, Pittsburg, Pleasant Hill, Richmond, San Pablo, San Ramon, Walnut Creek, Danville, and Moraga; Contra Costa County; and, Contra Costa County Flood Control and Water Conservation District
San Mateo Countywide Water Pollution Prevention Program (SMCWPPP)	Cities and towns 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

This report presents the results of the portions of Creek Status Monitoring that were conducted using a regional ambient (probabilistic) monitoring design to comply with portions of provision C.8.d, and the closely related Pesticides and Toxicity Monitoring required by provision C.8.g (Table 1-2). The list of parameters in Table 1-2 derive from the MRP provisions C.8.d and C.8.g (SFBRWQCB 2015) and BASMAA's Creek Status Monitoring Standard Operating Procedures (BASMAA 2016a, 2016b).

Table 1-2. Creek Status and Pesticide/Toxicity Monitoring Parameters sampled in compliance with MRP provisions C.8.d and g, and the associated design approach and Appendix of the ACCWP UCMR.

Biological Response and Stressor Indicators	MRP Provision	Monitoring Design		Reporting
		Regional Ambient (Probabilistic)	Local (Targeted)	
Bioassessment & Physical Habitat Assessment	C.8.d.i	X		Appendix A.1
Nutrients[7]	C.8.d.i	X		Appendix A.1
Chlorine	C.8.d.ii	X		Appendix A.1
Water Toxicity	C.8.g.i&iii	X		Appendix A.1
Sediment Toxicity	C.8.g.ii	X		Appendix A.1
Sediment Chemistry	C.8.g.ii	X		Appendix A.1
General Water Quality	C.8.d.iv		X	Appendix A.2
Temperature	C.8.d.iii		X	Appendix A.2
Bacteria	C.8.d.v		X	Appendix A.2

Prior to formation of the RMC, San Francisco Bay Area stormwater programs implemented monitoring designs that targeted creek reaches of interest to address site-specific management questions. Because the representativeness of such targeted data was unknown, the overall condition of all creek reaches in the Bay Area was also unknown. The RMC addressed this issue by augmenting targeted monitoring designs with an ambient (probabilistic) creek status design that integrates many elements of the individualized monitoring programs that currently exist in the region.

The probabilistic monitoring design described in subsequent sections of this report complies with MRP provision C.8.d[8] by addressing the core monitoring questions listed below, which are further elaborated upon later in this report and in the main UCMR. This monitoring design allow each individual RMC participating program to assess stream ecosystem conditions within its program area (e.g., county boundary) while contributing data to answer regional management questions about water quality and beneficial use condition in San Francisco Bay Area creeks.

1. What is the condition of aquatic life in creeks in the San Francisco Bay Area; are water quality objectives met and are beneficial uses supported?

[7] Results of nutrient sampling conducted pursuant to provision C.8.f are reported in the main UCMR.

[8] The MRP states that provision C.8.d monitoring is intended to answer the following questions: "Are water quality objectives, both numeric and narrative, being met in local receiving waters, including creeks, rivers and tributaries?"; "Are conditions in local receiving waters supportive of or likely to be supportive of beneficial uses?".

2. What are the major stressors[9] to aquatic life?
3. What are the long-term trends in water quality in creeks over time?

The remainder of this report addresses Study Area and Monitoring Design (Section 2), data collection and analysis methods (Section 3), results and discussion including Stressor Assessment (Section 4), and Conclusions and Next Steps (Section 5). More specifically, this report includes the standard report content as required by MRP provision C.8.h.vi in the respective sections referenced in Table 1-3. Additional details or discussion may also be found in other Appendices or in the main UCMR.

Table 1-3. Index to Standard Report Content per MRP Provision C.8.h.vi.

Report Section	Standard Report Content
2.0	Monitoring purpose and study design rationale
3.0	Sampling protocols and analytical methods
4.1	QA/QC summaries for sample collection and analytical methods
2.1	Sample location descriptions, sample dates, IDs
4.0	Sample concentrations detected, measurement units, detection limits
4.0	Data assessment, analysis and interpretation
5.0	List of volunteer and other non-Permittee entities whose data are included in the report
6.0	Assessment of compliance with applicable water quality standards

2. Study Area & Monitoring Design

2.1 RMC Area

Creek Status and Pesticide and Toxicity monitoring was conducted in non-tidally influenced, flowing water bodies (i.e., creeks, streams and rivers) interspersed among 3,407 square miles of land in the RMC area. The water bodies monitored were drawn from a master list that included all perennial and non-perennial creeks and channels that run through urban and non-urban areas within the portions of the five participating counties that fall within the SF Bay RWQCB boundary, and the eastern portion of Contra Costa County that drains to the Central Valley Regional Board (Figure 2-1). This report presents data collected by ACCWP during WY 2017.

[9] Stressors are interpreted per MRP provision C.8.d (SFBRWQCB 2015) as results that "trigger" action based upon comparison with an identified threshold.

2.2 Regional Monitoring Design

In 2011, the RMC developed a regional probabilistic monitoring design to identify ambient conditions of creeks in the five main counties subject to the requirements of the MRP[10] (SFBRWQCB 2009). The regional design was developed using the Generalized Random Tessellation Stratified (GRTS) approach developed by the United States Environmental Protection Agency (USEPA) and Oregon State University (Stevens and Olson 2004). GRTS offers multiple benefits for coordinating amongst monitoring entities including the ability to develop a spatially balanced design that produces statistically representative data with known confidence intervals. The GRTS approach has been implemented recently in California by several agencies including the statewide Perennial Streams Assessment (PSA) conducted by SWAMP (Ode et al. 2011) and the Southern California Stormwater Monitoring Coalition's (SMC) regional monitoring program conducted by municipal stormwater programs in Southern California (SMC 2007). For the purpose of developing the RMC's probabilistic design, the RMC area is considered to represent the "sample universe".

2.2.1 Site Selection

Bioassessment sample sites were selected and attributed using the GRTS approach from a sample frame consisting of a creek network geographic information system (GIS) data set within the RMC boundary[11] (BASMAA 2011). This approach was agreed to by SF Bay RWQCB staff during RMC workgroup meetings although it differed from that specified in provision C.8.c.iv of MRP 1, e.g., sampling on the basis of individual watersheds in rotation and selecting sites to characterize segments of a waterbody(s).The sample frame includes non-tidally influenced perennial and non-perennial creeks within five management units representing areas managed by the storm water programs associated with the RMC. The sample frame was stratified by management unit to ensure that provision C.8.c of MRP1 sample size requirements (SFBRWQCB 2009) would be achieved.

The National Hydrography Plus Dataset (1:100,000) was selected as the creek network data layer to provide consistency with both the Statewide PSA and the SMC, and the opportunity for future data coordination with these programs. The RMC sample frame was classified by county and

[10] The San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) issued the first five-year MRP (MRP1) to 76 cities, counties and flood control districts (i.e., Permittees) in the Bay Area on October 14, 2009 (SFRWQCB 2009) and reissued the permit on November 19, 2015 (MRP2, SFBRWQCB 2015) with an effective date of January 1, 2016. Unless otherwise noted references in this report to the MRP are to the reissued "MRP2"

[11] Based on discussion during RMC Workgroup meetings, with SF Bay RWQCB staff present, the sample frame was extended to include the portion of Eastern Contra Costa County that drains to the San Francisco Bay in order to address parallel provisions in CCCWP's Region 5 Permit for Eastern Contra Costa County. The rest of the sample frame is within the boundaries of SFBRWQCB jurisdiction.

land use (i.e., urban and non-urban) to allow for comparisons between these strata. Urban areas were delineated by combining urban area boundaries and city boundaries defined by the U.S. Census (2000). Non-urban areas were defined as the remainder of the areas within the sample universe (i.e., RMC area). Based on discussion during RMC Workgroup meetings, with SF Bay RWQCB staff present, RMC participants weighted their sampling efforts so that annual sampling efforts are approximately 80% in urban areas and 20% in non-urban areas for the purpose of comparison. During WYs 2012-2015 RMC participants coordinated with the SF Bay RWQCB by identifying additional non-urban sites from their respective counties for SWAMP sampling.

Bioassessment sites sampled by ACCWP during the reporting period are shown in Figure 2-1 and Table 2-1.

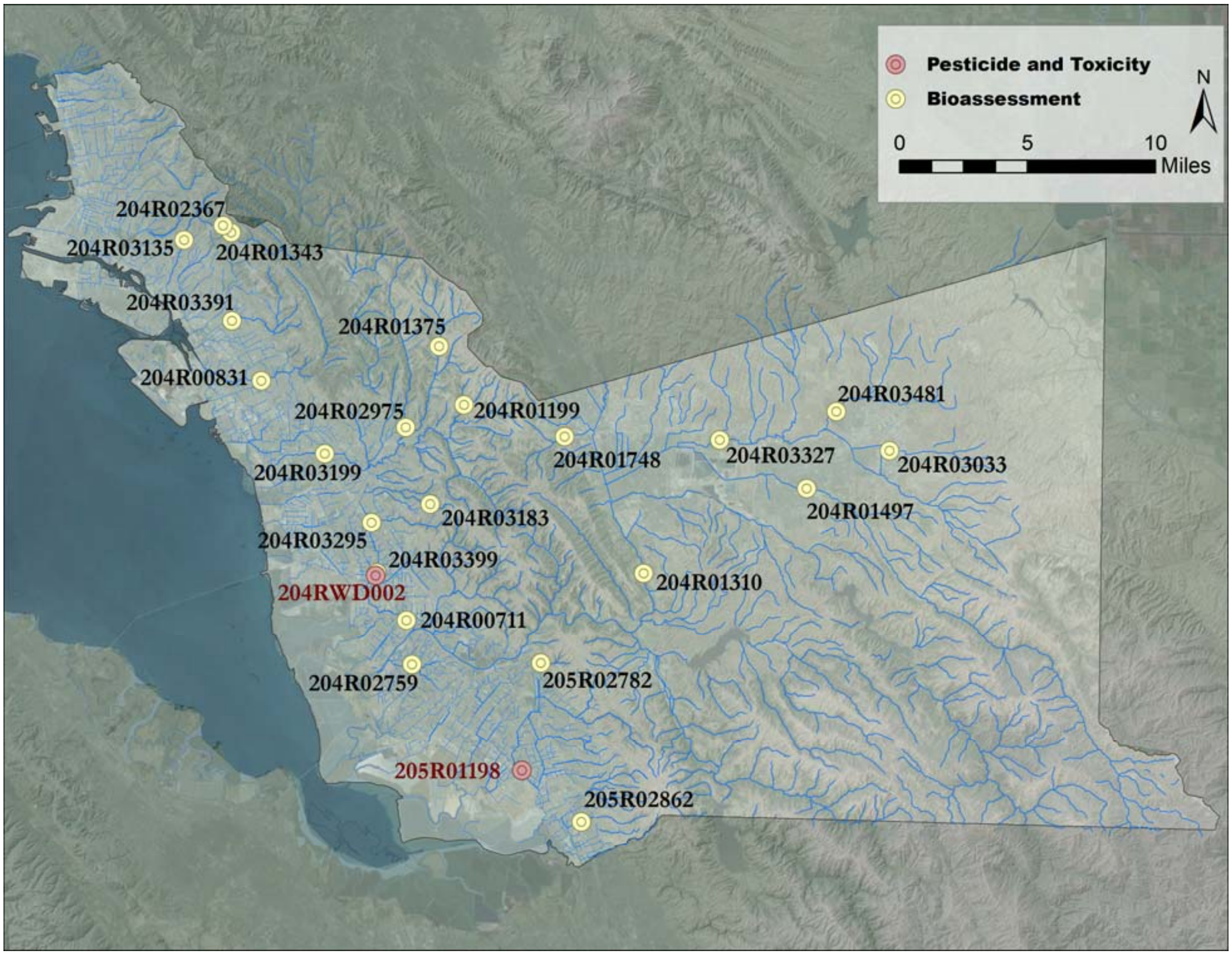

Figure 2-1. Alameda County sites sampled from the RMC probabilistic monitoring design and for Pesticides and Toxicity Monitoring in Water Year 2017.

Table 2-1. Alameda County Bioassessment Sites Sampled in Water Year 2017 by ACCWP.

Site ID	Creek Name	Land Use	Latitude	Longitude	Sampling Date
204R00711	Old Alameda Creek	Urban	37.59311	-122.05220	5/24/17
204R00831	San Leandro Creek	Urban	37.72617	-122.16095	6/6/17
204R01199	Tributary to Eden Creek	Urban	37.71509	-122.01335	6/7/17
204R01310	Arroyo de la Laguna	Urban	37.62023	-121.88251	6/13/17
204R01343	Palo Seco Creek	Urban	37.81122	-122.18439	6/5/2017
204R01375	Crow Creek	Urban	37.74952	-122.03203	6/8/2017
204R01497	Arroyo Mocho	Urban	37.67194	-121.76688	6/12/2017
204R01748	Dublin Creek	Urban	37.69925	-121.93799	6/14/2017
204R02367	Palo Seco Creek	Urban	37.81388	-122.18865	6/5/2017
204R02759	Crandall Creek	Urban	37.56746	-122.04675	5/9/2017
204R02975	Cull Creek	Urban	37.70231	-122.05502	5/11/2007
204R03033	Arroyo las Positas	Urban	37.69413	-121.71130	6/12/2017
204R03135	Sausal Creek	Urban	37.80391	-122.21677	6/8/2017
204R03183	Ward Creek	Urban	37.65836	-122.03920	5/23/2017
204R03199	San Lorenzo Creek	Urban	37.68566	-122.11197	5/22/2017
204R03295	Ward Creek	Urban	37.64627	-122.07660	5/8/2017
204R03327	Arroyo Las Positas	Urban	37.69840	-121.82968	6/14/2017
204R03391	Arroyo Viejo	Urban	37.75895	-122.18205	5/22/2017
204R03399	Ward Creek	Urban	37.61923	-122.07284	5/24/2017
204R03481	Altamont Creek	Urban	37.71668	-121.74737	5/25/2017
205R02782	Morrison Creek	Urban	37.57018	-121.95373	5/10/2017
205R02862	Toroges Creek	Urban	37.48029	-121.92377	5/9/2017

2.2.2 Management Questions

The RMC regional monitoring design was developed to address the management questions listed below. Those appearing in bolded font are addressed in this report in a preliminary manner. Those in normal font could not be addressed in this report due to the limited sample size from the Program's annual monitoring, but can be answered through collaborative review of cumulative data from all counties.

1. **What is the condition of aquatic life in creeks in the RMC area; are water quality objectives met and are beneficial uses supported?**
    a. **What is the condition of aquatic life in the urbanized portion of the RMC area; are water quality objectives met and are beneficial uses supported?**
    b. What is the condition of aquatic life in RMC participant counties; are water quality objectives met and are beneficial uses supported?
    c. **To what extent does the condition of aquatic life in urban and non-urban creeks differ in the RMC area?**

   d. To what extent does the condition of aquatic life in urban and non-urban creeks differ in each of the RMC participating counties?

2. **What are major stressors to aquatic life in the RMC area?**
   a. **What are major stressors to aquatic life in the urbanized portion of the RMC area?**
3. What are the long-term trends in water quality in creeks over time?

During the current Fiscal Year, BASMAA is conducting a regional project to analyze bioassessment monitoring data collected during five years (WY 2012 – WY 2016) by all participating RMC programs. The resulting integrative report will compile, analyze and map data and evaluate the usefulness of the data and may recommend changes to the probabilistic design of the RMC Multi-year Monitoring Plan and/or outline a redesign process that will address changes in other regional and state monitoring programs.

2.2.3 Pesticide and Toxicity Monitoring

The reissued MRP contains a separate provision C.8.g to combine all pesticide and toxicity monitoring into one section, instead of being distributed between Creek Status and Pollutants of Concern Monitoring provisions. This format is intended to provide for sampling designs that may provide more meaningful data for the region and potentially for statewide studies[12]. C.8.g requires Permittees to select monitoring sites where toxicity could be likely, so for WY 2017 ACCWP selected the following two sites shown on Figure 2-1:

- 205R01198, Zone 6 Line G west of Grimmer, is located at the bottom of an urbanized subwatershed in Fremont east of I-880 for which bioassessment monitoring conducted in 2013 had identified a California Stream Condition Index (CSCI) within the poor condition category (ACCWP 2014).
- 204WRD002, Ward Creek upstream of Ameron Pump Station, is the lowest non-tidal site within an urbanized subwatershed adjacent to auto storage and dismantling operations along the I-880 corridor.

While this approach for pesticide and toxicity monitoring site selection is not explicitly linked to the probabilistic design used to select bioassessment sites, water quality problems due to pesticide-related toxicity are similar in urban waterways across the region and state and sampling will continue to be coordinated in a regional context.

[12] This provision may also be modified in the future in response to changes in pesticide use and efforts to develop a statewide coordinated program for monitoring pesticides and pesticide-related toxicity.

2.2.4 Monitoring Design Implementation

Sampling was conducted in accordance with the RMC Multi-year Monitoring Plan (BASMAA 2011).

3. Monitoring Methods

This section describes the methods used to evaluate monitoring sites identified in the regional sample draw, consistent with the Southern California Coastal Water Research Project (SCCWRP) Bioassessment Program (SCCWRP 2012), and to sample field data, consistent with the RMC workplan (BASMAA 2011), Field parameters sampled at all sites included benthic macroinvertebrate community, algal community and biomass, and physical habitat. Physico-chemical measurements (dissolved oxygen, temperature, conductivity, and pH), chlorine, and nutrients were sampled concurrently as required by the SWAMP protocol or MRP.

3.1 Site Evaluation

Sites identified in the regional sample draw were evaluated by each RMC participant in chronological order using a two-step process, consistent with that described by SCCWRP[13] (2012). Each site was evaluated to determine if it met the following RMC sampling location criteria:

1. The location (latitude/longitude) provided for a site is located on or is within 300 meters of a non-impounded receiving water body;
2. Site is not tidally influenced;
3. Site is wadeable during the sampling index period;
4. Site has sufficient flow during the sampling index period to support standard operating procedures for biological and nutrient sampling.
5. Site is physically accessible and can be entered safely at the time of sampling;
6. Site may be physically accessed and sampled within a single day;
7. Landowner(s) grant permission to access the site[14].

In the first step, these criteria were evaluated to the extent possible using a "desktop analysis." Site evaluations were completed during the second step via field reconnaissance visits. Based on the outcome of site evaluations, sites were classified into one of three categories:

- **Target** - Sites that met all seven criteria were classified as **target sampleable** status **(TS),** and sites that met criteria 1 through 4, but did not meet at least one of criteria 5 through 7 were classified as **target non-sampleable (TNS)**.

[13]Communication with managers for the SMC and the PSA are ongoing to ensure consistency of site evaluation protocols.

[14]If landowners who did not respond to at least two attempts to contact them either by written letter, email, or phone call, permission to access the respective site was effectively considered to be denied.

- **Non-Target (NT)** - Sites that did not meet at least one of criteria 1 through 4 were classified as non-target status.
- **Unknown (U)** -Sites were classified with unknown status when it could be reasonably inferred either via desktop analysis or a field visit that the site was a valid receiving water body and information for any of the seven criteria was unconfirmed.

During the site evaluation field visits flow status was recorded as one of five categories:

- **Wet Flowing** - Continuously wet or nearly so, flowing water.
- **Wet Trickle** - Continuously wet or nearly so, very low flow (trickle, less than 0.1 L/second).
- **Majority Wet** - Discontinuously wet, greater than 25% by length of stream bed covered with water (isolated pools).
- **Minority Wet** - Discontinuously wet, less than 25% of stream bed by length covered with water (isolated pools).
- **No Water -** No surface water present.

Observations of flow status occurring during fall site reconnaissance events prior to occurrence of significant precipitation, and spring sampling occurring post- wet weather season were combined to classify sites as perennial or non-perennial as follows:

- **Perennial -** Fall flow status either Wet Flowing or Wet Trickle and spring flow sufficient to sample.
- **Non-Perennial** - Fall flow status either Majority Wet, Minority Wet, or No Water, and spring flow sufficient to sample.

3.2 Field Data Collection Methods

Field data were collected in accordance with existing SWAMP-comparable methods and procedures, as described in the RMC Quality Assurance Project Plan (QAPPv3) and the associated Standard Operating Procedures which were updated to maintain their currency and optimal applicability (BASMAA 2016a, 2016b). The SOPs were developed using a standard format that describes health and safety cautions and considerations, relevant training, site selection, and sampling methods/procedures, including pre-fieldwork mobilization activities to prepare equipment, sample collection, and de-mobilization activities to preserve and transport samples. The SOPs relevant to the monitoring discussed in this report are listed in Table 3-1.

Table 3-1 RMC Standard Operating Procedures (SOPs) pertaining to regional creek status monitoring.

SOP #	SOP
FS-1	Benthic Macroinvertebrate and Algae Bioassessments, and Physical Habitat Measurements
FS-2	Water Quality Sampling for Chemical Analysis, Pathogen Indicators, and Toxicity Testing
FS-3	Field Measurements, Manual
FS-4	Field Measurements, Continuous General Water Quality
FS-6	Collection of Bedded Sediment Samples
FS-7	Field Equipment Cleaning Procedures
FS-8	Field Equipment Decontamination Procedures
FS-9	Sample Container, Handling, and Chain of Custody Procedures
FS-10	Completion and Processing of Field Datasheets
FS-11	Site and Sample Naming Convention
FS-12	Ambient Creek Status Monitoring Site Evaluation
FS-13	QA/QC Data Review

3.2.1 Bioassessments

In accordance with the RMC QAPP (BASMAA 2016a), bioassessments are intended to be conducted during the spring index period (approximately April 15 – June 15) and at a minimum of 30 days after any significant storm (roughly defined as at least 0.5-inch of rainfall within a 24-hour period).

In WY 2017 sampling at all sites was conducted between 5/8/2017 and 6/14/2017 and conformed with the relevant protocols listed above. Five reaches had to be shortened and one was longer than standard. Their lengths, and explanations for the modified reach lengths, are shown in Table 3-2 below.

Table 3-2. 2016 ACCWP Sites with Modified Reach Lengths

SiteCode	Length (m)	Rationale for Modified Reach
205R02862	100	Located between two roadway overpasses
204R02975	120	Upstream concrete channel
204R01343	100	Fit between culvert sections
204R01199	120	Fit between culvert sections
204R01748	120	Permissions
204R01310	250	Average wetted width exceeded 10 m

Benthic Macroinvertebrates

The BMI samples were collected using the Reachwide Benthos (RWB) method described in SOP FS-1 (BASMAA2016b).

Each bioassessment sampling site consisted of an approximately 150-meter stream reach that was divided into 11 equidistant transects placed perpendicular to the direction of flow. The sampling position within each transect alternated between 25%, 50% and 75% distance of the wetted width of the stream. Benthic macroinvertebrates (BMIs) were collected from a 1 ft^2 area approximately 1 m downstream of each transect. The benthos were disturbed by manually rubbing coarse substrate followed by disturbing the upper layers of substrate to a depth of 4-6 inches to dislodge any remaining invertebrates into the net. Slack water habitat procedures were used at transects with deep and/or slow moving water (Ode 2007). Material collected from the eleven subsamples was composited in the field by transferring entire sample into one to two 1000 ml wide-mouth jar(s) and preserved with 95% ethanol.

Algae

Filamentous algae and diatoms were collected using the Reach-wide Benthos (RWB) method described in SOP FS-1 (BASMAA 2016b). Algae samples were collected synoptically with BMI samples. The sampling position within each transect was the same as used for BMI sampling, however, samples were collected six inches upstream of the BMI sampling position and prior to BMI collection from that location. The algae were collected using a range of methods and equipment, depending on the particular substrate occurring at the site (i.e., erosional, depositional, large and/or immobile, etc.) per SOP FS-1. Erosional substrates included any material (substrate or organics) that was small enough to be removed from the stream bed, but large enough in size to isolate an area equal in size to a rubber delimiter (12.6 cm2 in area). When a sample location along a transect was too deep to sample, a more suitable location was selected, either on the same transect or from one further upstream. Algae samples were collected at each transect prior to moving on to the next transect. Sample material (substrate and water) from all eleven transects was combined in a sample bucket, agitated, and a suspended algae sample was then poured into a 500 mL cylinder, creating a composite sample for the site. A 45 mL subsample was taken from the algae composite sample and combined with 5 mL glutaraldehyde into a 50 mL sample tube for taxonomic identification of soft algae. Similarly, a 40 mL subsample was extracted from the algae composite sample and combined with 10 mL of 10% formalin into a 50 mL sample tube for taxonomic identification of diatoms. Laboratory processing included identification and enumeration of 300 natural units of soft algae and 600 diatom valves to the lowest practical taxonomic level.

The algae composite sample was also used for collection of chlorophyll *a* and ash free dry mass (AFDM) samples following methods described in Fetscher et al. (2009). For chlorophyll *a* samples, 25 mL of the algae composite volume was removed and run through glass fiber filter (47 mm, 0.7 um pore size) using a filtering tower apparatus. The AFDM sample was collected using a similar process using pre-combusted filters. Both samples were placed in whirlpaks, covered in aluminum foil and immediately placed on ice for transportation to the laboratory.

3.2.2 Physical Habitat

Physical habitat assessments (PHab) were conducted at each BMI bioassessment sampling event using the PHab protocols described in Ode (2007) and augmented by Fetscher et al. (2009) (see SOP FS-1, BASMAA 2016b). Physical habitat data were collected at each of the 11 transects and at 10 additional inter-transects (located between each main transect) by implementing the “Basic” level of effort, with the following additional measurements/assessments as defined in the “Full” level of effort (as prescribed in the MRP): water depth and pebble counts, cobble embeddedness, flow habitat delineation, and instream habitat complexity. At algae sampling locations, additional assessment of presence of micro- and macroalgae was conducted during the pebble counts. In addition, water velocities were measured at a single location in the sample reach (when possible) using protocols described in Ode (2007).

3.2.3 Physico-chemical Measurements

Field personnel measured dissolved oxygen, temperature, conductivity, and pH during bioassessment sampling using a multi-parameter probe (see SOP FS-3, BASMAA 2016b). Dissolved oxygen, specific conductivity, water temperature and pH measurements were made either by direct submersion of the instrument probe into the sample stream, or by collection and immediate analysis of grab sample in the field. Water quality measurements were taken approximately 0.1 m below the water surface at locations of the stream that appears to be completely mixed, ideally at the centroid of the stream. Measurements should occur upstream of sampling personnel and equipment and upstream of areas where bed sediments have been disturbed, or prior to such bed disturbance.

3.2.4 Other Water Quality Analytes

Chlorine

Field personnel collected and analyzed water grab samples for free and total chlorine using CHEMetrics test kits (K-2511 for low range, and K-2504 for high range). Chlorine measurements in water were conducted during bioassessments and during dry season monitoring for sediment chemistry, sediment toxicity, and water toxicity.

Nutrients and Conventional Analytes

Concurrent with bioassessments, field personnel collected water samples for nutrient analyses using the Standard Grab Sample Collection Method as described in SOP FS-2 (BASMAA 2016b). Sample containers were rinsed, as appropriate, using ambient water and completely filled and recapped below water surface whenever possible. An intermediate container was used to collect water for all sample containers pre-preserved by the laboratory. Syringe filtration method was used to collect samples for analyses of Dissolved Ortho-P, with Dissolved Organic Carbon now filtered in the lab within the requisite 48-hr hold time. Sample container size and type, preservative type and associated holding times for each analyte are described in Table 1 of FS-9 (BASMAA 2016b). All sample containers were labeled and stored on ice for transportation to laboratory, with exception of analysis of Ash Free Dry Mass and Chlorophyll *a* samples, which were field-frozen on dry ice by sampling teams upon collection.

3.2.5 Water Toxicity

Field personnel collected water samples using the Standard Grab Sample Collection Method described above, filling the required number of 4-L amber glass bottles with ambient water, putting them on ice to cool to 4 ±2 °C, and delivering to the laboratory within the required hold time. Bottle labels and COCs included station ID, sample code, matrix type, analysis type, project ID, and date and time of collection. The laboratory was notified of the impending sample delivery to meet the 36-hour sample delivery time requirement. Procedures used for sampling and transporting samples are described in SOP FS-2 (BASMAA 2016b).

3.2.6 Sediment Chemistry & Sediment Toxicity

In the case where sediment samples and water samples / measurements were collected at the same event, sediment samples were collected after any water samples were collected. Before conducting sampling, field personnel surveyed the proposed sampling area to identify appropriate fine-sediment depositional areas, to avoid disturbing possible sediment collection sub-sites. Personnel carefully entered the stream and started sampling at the closest appropriate reach, continuing upstream. Sediment samples were collected from the top 2 cm of sediment in a compositing container, thoroughly homogenized, and then aliquotted into separate jars for chemical and toxicological analysis using standard clean sampling techniques (see SOP FS-6, BASMAA 2016b). Sample jars were submitted to respective laboratories per SOP FS-9 (BASMAA 2016b).

3.3 Laboratory Analysis Methods

ACCWP and other RMC participants agreed to use the same laboratories for individual parameters, developed standards for contracting with the labs, and coordinated quality assurance issues. All samples collected by RMC participants that were sent to laboratories for analysis were analyzed and reported per SWAMP-comparable methods as described in the RMC QAPP (BASMAA 2016a). Analytical laboratory methods, are also reported in BASMAA (2012a). Analytical laboratory contractors used for analysis of benthic macroinvertebrate and algae taxonomic identification, chemistry, and toxicity included:

- BioAssessment Services, Inc. – BMI identification
- EcoAnalysts, Inc. – Algae identification
- CalTest, Inc. – Sediment Chemistry, Nutrients, Chlorophyll *a*, Ash Free Dry Mass
- Pacific EcoRisk, Inc. - Water and Sediment Toxicity

The laboratory analytical methods identified BMIs at a Level 1 Standard Taxonomic Level of Effort, with the additional effort of identifying chironomids (midges) to subfamily/tribe instead of family (Chironomidae). Soft algae and diatom samples were analyzed following Surface Water Ambient Monitoring Program (SWAMP) protocols (SWRCB 2011a, SWRCB 2011b, Stancheva et al. 2015). The taxonomic resolution for all data was compared and revised when necessary to match the SWAMP master taxonomic list.

3.4 Data Analysis

This section describes methods used to analyze bioassessment data collected during Water Year 2017 to address management questions related to condition of aquatic life and report on these per MRP provision C.8.h.iii.

3.4.1 Biological Condition

The California Stream Condition Index (CSCI) is a biological index, developed by the State Water Resources Control Board (State Board), used to score the condition of BMI communities in perennial wadeable rivers and streams. The CSCI translates benthic macroinvertebrate data into an overall measure of stream health. The CSCI was developed using a large reference data set that represents the full range of natural conditions in California (Rehn et al. 2015). The CSCI combines two types of indices: 1) taxonomic completeness, as measured by the ratio of observed-to-expected taxa (O/E); and 2) ecological structure and function, measured as a predictive multi-metric index (pMMI) that is based on reference conditions. The CSCI score is computed as the average of the sum of O/E and pMMI.

The State Board is continuing to evaluate the performance of CSCI in a regulatory context. In the re-issued MRP 2.0 (adopted on November 19, 2015), the Regional Water Board defined a CSCI score of 0.795 as a threshold for identifying sites with degraded biological condition that may be considered as candidates for Stressor Source Identification (SSID) projects.

The State Water Board is also developing and testing a statewide index using benthic algae data as a measure of biological condition and identification of potential stressors. The statewide Algal Stream Condition Index (ASCI) is expected to be completed in 2018. Because the ASCI is not yet available, this report applies selected algal indices of biological integrity (IBIs) that were developed and tested using algae data collected in Southern California (Fetscher et al. 2014). The IBIs were developed from data comprised of either single-assemblage metrics (i.e., either diatoms or soft algae) or combinations of metrics presenting both assemblages (i.e., “hybrid” IBI).

Bioassessment Data Analysis

For BMI samples collected at 22 sites in Alameda County in WY 2017, the laboratory analytical methods identified BMIs at a Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT) Level 1 Standard Taxonomic Level of Effort, with the additional effort of identifying chironomids (midges) to subfamily/tribe instead of family (Chironomidae).

Soft algae and diatom samples were analyzed following Surface Water Ambient Monitoring Program (SWAMP) protocols (Stancheva et al. 2015). The taxonomic resolution for all data was compared and revised when necessary to match the SWAMP master taxonomic list.

California Stream Condition Index Score

The CSCI is calculated using a combination of biological and environmental data following methods described in Rehn et al. (2015). Biological data include BMI data collected and analyzed using protocols described in the previous section. The environmental predictor data are generated in geographic information system (GIS) using drainage areas upstream of each BMI sampling location. The environmental predictors and BMI data were formatted into comma delimited files and used as input for the RStudio statistical package and the necessary CSCI program scripts, developed by Southern California Coastal Water Research Project (SCCWRP) staff (Mazor et al. 2016).

EOA staff compiled and/or created drainage areas in ArcGIS using 10-meter Digital Elevation Model (DEM) data and the Arc Hydro tool. In most cases, the watershed/catchment polygons created with the Arc Hydro tool required editing to adjust the downstream edge of the drainage area to the sampling locations. When necessary, other existing data sources, including watershed/catchment data developed by the San Francisco Estuary Institute (SFEI) and the Oakland Museum and storm drain network data provided by municipalities, were used to modify the DEM-derived watershed boundaries. These modifications were typical in the low gradient urban areas along the San Francisco Bay and in Livermore Valley. All delineations were independently reviewed for accuracy using Google Earth.

To develop the CSCI scores, eight GIS datasets from the California Department of Fish and Wildlife were analyzed in ArcGIS to calculate a range of environmental predictors for each sampling location. Site elevation, temperature, and annual precipitation values were obtained directly at the sampling location. Elevation range was calculated from the difference in elevation between the top and the bottom of the watershed/catchment. Mean monthly precipitation, bulk soil density, soil erodibility, and phosphorous geology are predictors that are averaged across each watershed, and are calculated in ArcGIS using zonal statistics.

The CSCI scores were evaluated using condition categories described in Rehn et al. (2015). Four classes representing a range of biological conditions were defined using a distribution of scores at reference calibration sites throughout the State of California (Table 3-3). The categories are described as “likely intact” (greater than 30th percentile of reference site scores); “possibly intact” (between the 10th and the 30th percentiles); “likely altered” (between the 1st and 10th percentiles; and “very likely altered” (less than the 1st percentile). The likely altered category coincides with the threshold identified in MRP 2.0.

Algae Index of Biological Integrity Scores

Algae data collected in Alameda County were evaluated using an online calculator available on the Southern California Coastal Water Research Project (SCCWRP) website (http://www.sccwrp.org/Data/DataTools/algaeIBI.aspx). The Algae IBI Assessment Tool analyzes benthic algae data. The IBIs were developed from data comprised of either single-assemblage metrics (i.e., either diatoms or soft algae) or combinations of metrics presenting both assemblages (i.e, “hybrid” IBI). Three of these algal IBIs were used to evaluate algae data collected in Alameda County; including a soft algae index (S2), a diatom index (D18) and a hybrid index (H20). Algae IBI Scores condition categories developed by Fetscher et al (2014) for the 30th, 10th and 1st percentile of reference sites are listed in Table 3-3.

Table 3-3. Condition categories used to evaluate CSCI and Algae IBI (D18 and S2) scores.

Index	Likely Intact (>30th)	Possibly Intact (10th – 30th)	Likely Altered (1st – 10th)	Very Likely Altered (< 1st)
Benthic Macroinvertebrates				
CSCI	≥ 0.92	≥ 0.795 to < 0.92	≥ 0.63 – < 0.795	< 0.63
Benthic Algae				
S2	≥ 60	≥ 47 to < 60	≥ 29 to < 47	< 29
D18	≥ 72	≥ 62 to < 72	≥ 49 to < 62	< 49
H20	≥ 70	≥ 63 to < 70	≥ 54 to < 63	< 54

3.4.2 Physical habitat condition

BASMAA (2013) prepared a data analysis of physical habitat scores from all RMC bioassessment sites monitored in WY 2012, based on the combination of scores for three physical habitat sub-categories. While these scores can be useful in interpreting results from individual sites, their interpretation did not add substantially to the information from the IBI scores. The CSCI uses characteristics of the watershed draining to each site to develop the score for that site and thus integrates larger-scale physical habitat structure into the condition assessment.

3.4.3 Water and Sediment Chemistry and Toxicity

As part of the Stressor Assessment for this report, water and sediment chemistry and toxicity data generated during WY 2017 were analyzed and evaluated to identify potential stressors that may be contributing to degraded or diminished biological conditions. Creek status monitoring and pesticides and toxicity data must be evaluated with respect to thresholds or "triggers" specified in the MRP to identify whether a site is a candidate for SSID project followup. The trigger criteria listed in provisions C.8.d and C.8.g were used to identify sites where water quality impacts may have occurred. For water and sediment chemistry and toxicity data, the relevant trigger criteria are identified in provision C.8.g.iv and listed below as follows:

1) A toxicity test of growth, reproduction, or survival of any test organism is reported as "fail" in both the initial sampling and a second, followup sampling, and both have ≥ 50% Percent Effect;
2) A pollutant is present at a concentration exceeding its water quality objective (WQO) in the Basin Plan[15];
3) For pollutants without WQOs, results exceed Probable Effects Concentrations (PECs) or Threshold Effects Concentrations (TECs).

For sediment chemistry trigger criteria, threshold effect concentrations (TECs) and probable effect concentrations (PECs) are as defined in MacDonald et al. (2000). For all applicable contaminants specified in MacDonald et al. (2000), the ratio of the measured concentration to the respective TEC value was computed as the TEC quotient. PEC quotients were also computed for those same sediment chemistry constituents using PEC values from MacDonald et al. (2000). All results where a TEC or PEC quotient was equal to or greater than 1.0 were identified.

Criterion (1) above applies to toxicity results of water column and sediment monitoring in both dry weather and wet weather. Criterion (2) applies to results of water column chemistry

[15] The San Francisco Basin Water Quality Control Plan, SFBRWQCB (2013) does not contain water quality objectives for pollutants in sediment. Environmental screening levels or sediment target concentrations defined by Total Maximum Daily Loads for specific pollutants are not considered applicable to Criterion (2).

monitoring in both dry weather and wet weather, and is also appropriate for water quality samples collected at regional bioassessment monitoring sites per provision C.8.d.i, which does not specify trigger criteria for those parameters. Criterion (3) applies to chemical results of sediment monitoring in dry weather.

3.5 Quality Assurance and Control

Data quality assessment and quality control procedures are described in detail in the BASMAA RMC QAPP (BASMAA 2016a). They generally involved the following:

Measurement Quality Objectives (MQOs) were established to ensure that data collected were of sufficient and adequate quality for the intended use. MQOs include both quantitative and qualitative assessment of the acceptability of data. The qualitative goals include representativeness and comparability. The quantitative goals include completeness, sensitivity (detection and quantitation limits), precision, accuracy, and contamination. To ensure consistent and comparable field techniques, pre-monitoring field training and in-situ field assessments were conducted.

Data were collected according to the procedures described in the relevant SOPs (BASMAA 2016b), including appropriate documentation of data sheets and samples, and sample handling and custody. Laboratories providing analytical support to the RMC were selected based on demonstrated capability to adhere to specified protocols.

All data were thoroughly reviewed for conformance with QAPP requirements and field procedures were reviewed for compliance with the methods specified in the relevant SOPs. Data quality was assessed and qualifiers were assigned as necessary in accordance with SWAMP requirements. See Section 7 for evaluations of Program-specific data quality associated with monitoring conducted in WY 2017.

4. Results & Discussion

The MRP places an emphasis on minimizing sources of pollutants that could impair water quality as a central purpose of urban runoff management programs. The MRP requires monitoring to address the management question,

- ***"What are the sources to urban runoff that contribute to receiving water problems?"***

The RMC accomplishes this through a multi-step process that involves conducting monitoring to provide data to inform an assessment of conditions and identification of stressors that may be impacting water quality and/or biological conditions. The information generated through the condition assessment and stressor assessment will then be used to help direct efforts to identify sources of problematic pollutants or other stressors in urban runoff discharges.

In this section, following a brief statement of data quality, the bioassessment data are evaluated against the trigger criteria found in C.8.d, and data for toxicity and sediment chemistry are evaluated against trigger criteria in C.8.g of the MRP (SFBRWQCB 2015) to provide a preliminary identification of potential stressors. The results of the initial stressor assessment evaluation (BASMAA 2013) were used to initiate a stressor-source identification project as described in the 2014 Integrated Monitoring Report (ACCWP 2014).

4.1 Statement of Data Quality

The RMC established a set of guidance and tools to help ensure data quality and consistency implemented through collaborating Programs. Additionally, the RMC participants continue to meet and coordinate in an ongoing basis to plan and coordinate monitoring, data management, and reporting activities, among others.

A comprehensive QA/QC program was implemented by each of the RMC Programs, which is solely responsible for the quality of the data submitted on its behalf, covering all aspects of the regional/probabilistic monitoring. In general, QA/QC procedures were implemented as specified in the RMC QAPP (BASMAA, 2016a), and monitoring was performed according to protocols specified in the RMC SOPs (BASMAA, 2016b), and in conformity with SWAMP protocols. Details of the results of evaluations of laboratory-generated QA/QC results are included elsewhere in the ACCWP UCMR and other appendices if applicable. Issues noted by the laboratories and/or RMC field crews are summarized below.

4.1.1 Sediment Chemistry

Several issues were identified by the analytical laboratory (Caltest) as being noncompliant with Project Measurement Quality Objectives (MQOs), and the sediment chemistry data were qualified accordingly. These issues included:

- The lab blank for analysis of lead exhibited contamination.
- Matrix Spike recoveries were reported as either not calculable or outside of control limits for multiple trace elements (chromium, copper, lead, nickel, zinc), PAHs (benzo(e)pyrene, benzo(b)fluouranthene, benzo(k)fluouranthene, fluoranthene, methylphenanthrene, 1-, and phenanthrene), and the pyrethroid deltamethrin/tralomethrin.

Other issues in conflict with RMC QAPP MQOs were not identified by the laboratory, but were identified during QA review and were qualified as appropriate. These issues included:

- The lab duplicates for analysis of TOC and two particle size categories were reported outside QAPP control limits.
- Surrogates associated with analysis of a small number of PAH compounds were reported outside of control limits.
- ACCWP was responsible for collection and reporting of field duplicate samples for the RMC Programs in WY 2017. As is typical for sediment sampling with its inherent matrix homogeneity, several analytical pairs exceeded the 25% RPD control limits specified by the QAPP. For the chemistry samples, these included three categories off particle size distribution (PSD) and one PAH (benzo(e)pyrene). For the toxicity samples, these included *C. dubia* reproduction and *C. dilutus* survival.

4.1.2 Water Chemistry

Several issues were identified with respect to water chemistry analyses by either the laboratory or the QAO review, including:

- A small number of analyses of nitrate were reported below the reporting limit (RL) with laboratory RLs that exceeded QAPP target.
- Percent recovery (PR) reported for MS/MSD analyses of silica, Total Kjeldahl Nitrogen (TKN), ammonia, and nitrite fell outside of control limits.
- Calculated field RPDs associated with analysis of blind field duplicate samples for several analytes exceeded QAPP MQOs. As the control limits for field duplicates are identical to those of lab duplicate analyses, this is not a surprising occurrence. Data were qualified as dictated by comparison with QAPP control limits.
- Laboratory equipment failures associated with analysis of chlorophyll-a at site 204R03183 and nitrate 204R01375 required additional data qualification.

4.1.3 Sediment Toxicity

Only one issue was identified associated with review of sediment toxicity data.

- As described previously, ACCWP was responsible for collection and reporting of field duplicate samples for the RMC Programs in WY 2017. As is typical for sediment sampling with its inherent matrix homogeneity, several analytical pairs exceeded the 25% RPD control limits specified by the QAPP. For the toxicity samples, these included *C. dubia* reproduction and *C. dilutus* survival.

4.1.4 Water Toxicity

There were no issues identified associated with aquatic toxicity analyses.

4.1.5 Taxonomy

There were no issues identified associated with taxonomic analyses.

4.2 Condition Assessment

Condition assessment addresses the RMC core management question

- ***"What is the condition of aquatic life in creeks in the RMC area; are aquatic life beneficial uses supported?"***

Table 4-1 lists the beneficial uses of creeks sampled during WY 2017. By default creeks and other fresh water bodies not listed or included in larger creeks by the "tributary rule" are assigned the WARM and WILD presumptive uses in the Basin Plan (SFBRWQCB 2013).

Table 4-1. ACCWP creeks sampled in WY 2017 and associated designated beneficial uses listed in the San Francisco Bay Region Basin Plan. Sites not in or tributary to creeks listed in Chapter 2 of the Basin Plan do not appear in this table.

		← Human Consumptive Uses →							← Aquatic Life Uses →								Wildlife Use	Recreational Uses		
Site ID	**Waterbody**	**AGR**	**MUN**	**FRSH**	**GWR**	**IND**	**PROC**	**COMM**	**SHELL**	**COLD**	**EST**	**MAR**	**MIGR**	**RARE**	**SPWN**	**WARM**	**WILD**	**REC-1**	**REC-2**	**NAV**
ALAMEDA COUNTY																				
204R00711	Old Alameda Creek										E						E	E	E	
204R03183, 204R03295, 204R03399, 204WRD002	Ward Creek															E	E	E	E	
204R00831	San Leandro Creek (Lower)			E						E			E	E	E	E	E	E	E	
204R01310	Arroyo de la Laguna				E					E			E		E	E	E	E	E	
204R01497	Arroyo Mocho				E					E			E		E	E	E	E	E	
204R03033, 204R03327	Arroyo las Positas				E					E			E	E	E	E	E	E	E	
204R03481	Altamont Creek				E					E				E		E	E	E	E	
204R03199	San Lorenzo Creek		E	E	E					E			E		E	E	E	E	E	
204R01375, 204CRW040, 204CRW041A, 204CRW041B, 204CRW041C, 204CRW041D, 204CRW041E, 204CRW042, 204CRW044,	Crow Creek									E			E	E	E	E	E	E	E	
204R02975	Cull Creek									E				E	E	E	E	E	E	
204R01748	Dublin Creek															E	E	E	E	
204R02759	Crandall Creek															E	E	E	E	
204R03135, 204SAU055, 204SAU090, 204SAU200 204R01343, 204R02367, 204SAU110, 204SAU130	Sausal Creek & tributary Palo Seco Creek									E				E	E	E	E	E	E	
204R03391	Arroyo Viejo									E						E	E	E	E	
205R02862	Toroges Creek													E		E	E	E	E	

Abbreviations:

COLD = Cold Fresh Water Habitat
FRSH = Freshwater Replenishment
GWR - Groundwater Recharge
MIGR = Fish Migration
MUN = Municipal and Domestic Water
NAV = Navigation
RARE= Preservation of Rare & Endangered Species
REC-1 = Water Contact Recreation
REC-2 = Non-contact Recreation
WARM = Warm Freshwater Habitat
WILD = Wildlife Habitat
P = Potential Use
E = Existing Use
L = Limited Use
* = "Water quality objectives apply; water contact recreation is prohibited or limited to protect public health" (SFBRWQCB 2013).

4.2.1 Assessing Biological Condition

Table 4-2 summarizes the numbers of WY 2017 sites assigned to various condition categories by CSCI and algae assessments.

Table 4-2. Distribution of CSCI and Algae IBI condition categories for 22 probabilistic urban sites sampled in Alameda County during WY 2017.

Condition Category	CSCI	Diatom D18 IBI	Algae S2 IBI*	Hybrid "H20" Algae IBI*
Likely Intact (LI)	1	0	4	0
Possibly Intact (PI)	2	2	2	0
Likely Altered (LA)	6	4	1	2
Very Likely Altered (VLA)	13	16	10	15

*5 sites had no Algae S2 IBI scores and 5 sites had no H20 score due to an insufficient number of soft algae taxa needed to calculate a score.

Table 4-3 and Figure 4-1 show the condition categories assigned to the 22 sites sampled in Alameda County during WY 2017. Biological condition scores for CSCI and algae IBIs (S2, D18, and H20) are listed in Table 4-4. Site characteristics related to impervious area, flow status, and channel modification status are also presented in the table for reference.

Using the algae IBI and CSCI condition categories shown in Table 3-3, the WY 2017 sites were rated as follows:

- CSCI - Thirteen sites (60%) were rated as "very likely altered" condition, six sites (27%) were rated as "likely altered" condition, two sites (9%) ranked as "possibly intact," and one site (4%) ranked as "likely intact" condition (Figure 1).
- D18 – Sixteen sites (73%) rated as "very likely altered" condition, four sites (18%) rated as "likely altered" condition, and two sites (9%) rated as "possibly intact" condition.
- S2 - Ten sites (46%) rated as "very likely altered" condition, one site (4%) rated as "likely altered" condition, two sites (9%) rated as "possibly intact" and four sites (18%) rated as "likely intact". Three of the "very likely altered" sites had a score of zero. Five sites (23%) had no Algae S2 IBI scores due to an insufficient number of soft algae taxa needed to calculate a score. There were no apparent spatial patterns among sites with low species richness. Sites with no or low numbers of soft algae taxa occurred in both highly urban sites at the bottom of the watershed, as well as in upper elevation areas with minimal urban impacts.
- H20 - Fifteen sites (88%) were rated as "very likely altered" condition for H20 IBI score and the remaining two sites (12%) were classified as "likely altered". There were no H20 IBI scores for the five sites classified as "unknown" due to inadequate presence of soft algae taxa.

Table 4-3. CSCI and Algae IBI condition categories for 22 probabilistic urban sites sampled in Alameda County during WY 2017.

Station Code	Creek	CSCI Category	Hybrid H20 Category	Diatom D18 Category	Algae S2 Category
204R00711	Old Alameda Creek	Very Likely Altered	Possibly Intact	Very Likely Altered	Very Likely Altered
204R00831	San Leandro Creek	Likely Altered	Very Likely Altered	Very Likely Altered	Very Likely Altered
204R01199	Tributary to Eden Cr	Likely Altered	Likely Intact	Very Likely Altered	Likely Altered
204R01310	Arroyo de la Laguna	Likely Altered	Very Likely Altered	Very Likely Altered	Very Likely Altered
204R01343	Palo Seco Creek	Likely Altered	NA	Very Likely Altered	NA
204R01375	Crow Creek	Likely Altered	NA	Very Likely Altered	NA
204R01497	Arroyo Mocho	Very Likely Altered	Very Likely Altered	Possibly Intact	Very Likely Altered
204R01748	Dublin Creek	Possibly Intact	Very Likely Altered	Very Likely Altered	Very Likely Altered
204R02367	Palo Seco Creek	Likely Intact	NA	Possibly Intact	NA
204R02759	Crandall Creek	Very Likely Altered	Very Likely Altered	Very Likely Altered	Very Likely Altered
204R02975	Cull Creek	Very Likely Altered	Likely Intact	Very Likely Altered	Very Likely Altered
204R03033	Arroyo las Positas	Very Likely Altered	Very Likely Altered	Very Likely Altered	Very Likely Altered
204R03135	Sausal Creek	Very Likely Altered	Very Likely Altered	Likely Altered	Very Likely Altered
204R03183	Ward Creek	Possibly Intact	NA	Very Likely Altered	NA
204R03199	San Lorenzo Creek	Very Likely Altered	Very Likely Altered	Likely Altered	Very Likely Altered
204R03295	Ward Creek	Very Likely Altered	Possibly Intact	Very Likely Altered	Very Likely Altered
204R03327	Arroyo Las Positas	Very Likely Altered	Likely Intact	Very Likely Altered	Very Likely Altered
204R03391	Arroyo Viejo	Very Likely Altered	Very Likely Altered	Likely Altered	Very Likely Altered
204R03399	Ward Creek	Very Likely Altered	Likely Altered	Very Likely Altered	Very Likely Altered
204R03481	Altamont Creek	Very Likely Altered	Very Likely Altered	Very Likely Altered	Very Likely Altered
205R02782	Morrison Creek	Likely Altered	Likely Intact	Likely Altered	Likely Altered
205R02862	Toroges Creek	Very Likely Altered	NA	Very Likely Altered	NA

Table 4-4. CSCI and Algae IBI scores for 22 probabilistic urban sites sampled in Alameda County during WY 2017. Site characteristics related to impervious area, flow status, and channel modification status are also presented in the table.

Station Code	Creek	Impervious Area%	Flow Status	Highly Modified Channel	CSCI Score	Hybrid H20	Diatom D18	Algae S2	CSCI Condition Category
204R00711	Old Alameda Creek	77%	P	Y	0.19	26	22	50	Very Likely Altered
204R00831	San Leandro Creek	9%	P	N	0.65	32	48	0	Likely Altered
204R01199	Tributary to Eden Cr	3%	NP	N	0.67	55	48	67	Likely Altered
204R01310	Arroyo de la Laguna	11%	P	N	0.65	32	48	3	Likely Altered
204R01343	Palo Seco Creek	1%	NP	N	0.69	NR	36	NR	Likely Altered
204R01375	Crow Creek	1%	P	N	0.79	NR	42	NR	Likely Altered
204R01497	Arroyo Mocho	2%	HVF	N	0.56	51	66	20	Very Likely Altered
204R01748	Dublin Creek	10%	NP	N	0.88	35	48	10	Possibly Intact
204R02367	Palo Seco Creek	1%	NP	N	1.00	NR	62	NR	Likely Intact
204R02759	Crandall Creek	53%	NP	Y	0.29	0	0	17	Very Likely Altered
204R02975	Cull Creek	4%	P	N	0.51	25	0	67	Very Likely Altered
204R03033	Arroyo las Positas	5%	P	N	0.49	38	32	25	Very Likely Altered
204R03135	Sausal Creek	32%	P	Y	0.56	34	56	7	Very Likely Altered
204R03183	Ward Creek	20%	P	Y	0.81	NR	26	NR	Possibly Intact
204R03199	San Lorenzo Creek	15%	P	Y	0.44	32	52	0	Very Likely Altered
204R03295	Ward Creek	38%	P	Y	0.17	32	36	50	Very Likely Altered
204R03327	Arroyo Las Positas	13%	HVF	N	0.48	36	18	67	Very Likely Altered
204R03391	Arroyo Viejo	34%	P	Y	0.41	31	52	0	Very Likely Altered
204R03399	Ward Creek	39%	P	Y	0.38	22	26	30	Very Likely Altered
204R03481	Altamont Creek	8%	P	N	0.38	9	0	13	Very Likely Altered
205R02782	Morrison Creek	1%	NP	N	0.71	61	58	67	Likely Altered
205R02862	Toroges Creek	14%	P	Y	0.35	NR	32	NR	Very Likely Altered
U = urban, Y = yes, N = no, P = perennial, NP = nonperennial, HVF – highly variable flow, NR = not calculated due to insufficient soft algae									

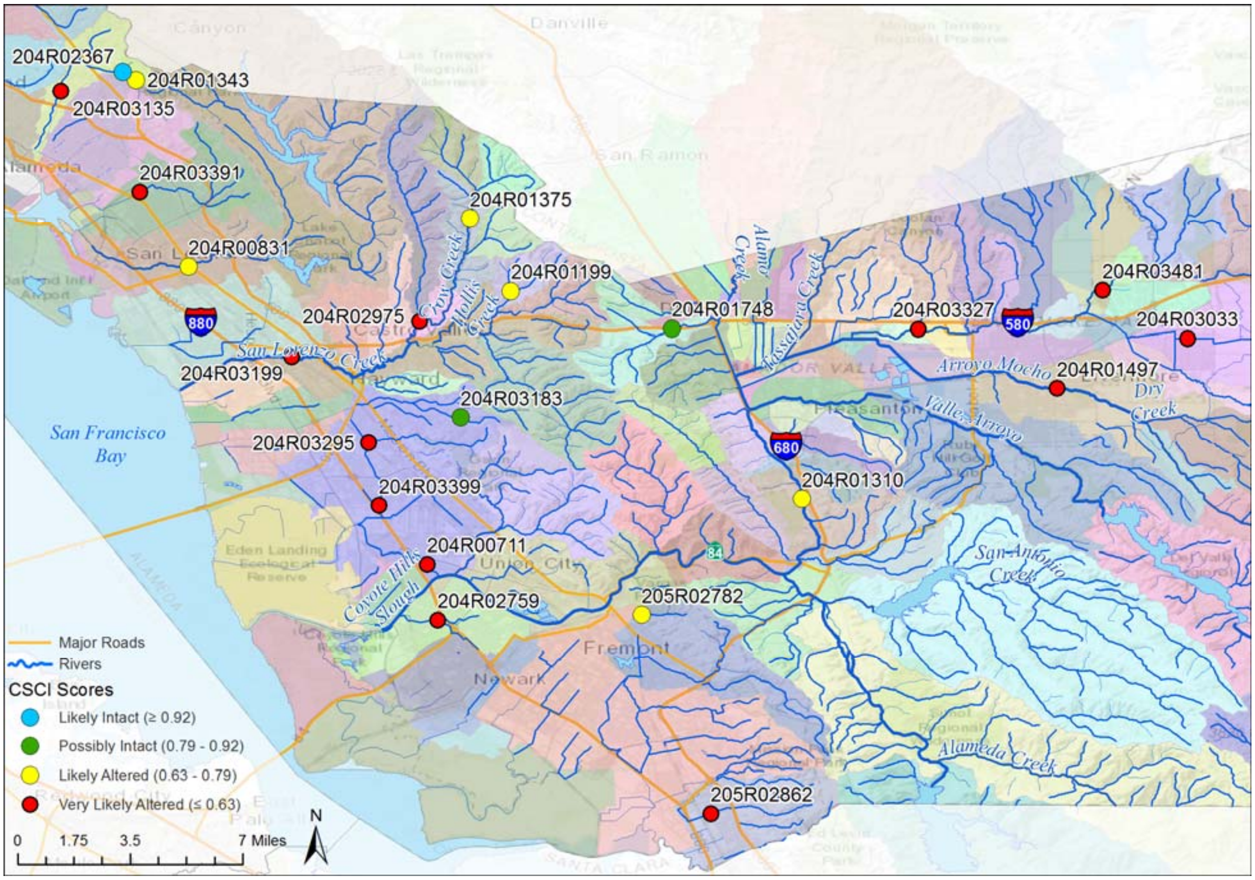

Figure 4-1. Condition categories for CSCI scores for 22 bioassessment locations sampled by ACCWP during WY 2017.

4.2.2 Stressor Indicators: Biological Assessment

Benthic Macroinvertebrates

Descriptive statistics for CSCI and algae IBI scores are shown in Table 4-5.

Table 4-5. Descriptive statistics for CSCI and algae IBI scores for the 22 probabilistic sites sampled in Alameda County during Water Year 2017.

Statistic	CSCI (>0)	Hybrid “H20” Algae IBI (0-100)	Diatom D18 IBI (0-100)	Algae S2 IBI (0-100)
Min	0.17	0	0	0
Median	0.54	32	39	20
Mean	0.55	32.4	36.7	29.0
Max	1	61	66	67

Site characteristic information presented in Table 4-4. CSCI and Algae IBI scores for 22 probabilistic urban sites sampled in Alameda County during WY 2017.

Site characteristics related to impervious area, flow status, and channel modification status are also presented in the table.

This indicates that the majority of the 22 bioassessment sites are highly impacted by human disturbance. Nine of the 22 sites (41%) were characterized as having modified channels. Sixteen of the 22 sites (73%) had watersheds/catchments with percent impervious area that was greater than 3%. Percent impervious area was moderately correlated to CSCI scores across all bioassessment sites sampled during WY 2017 (Figure 4-2).

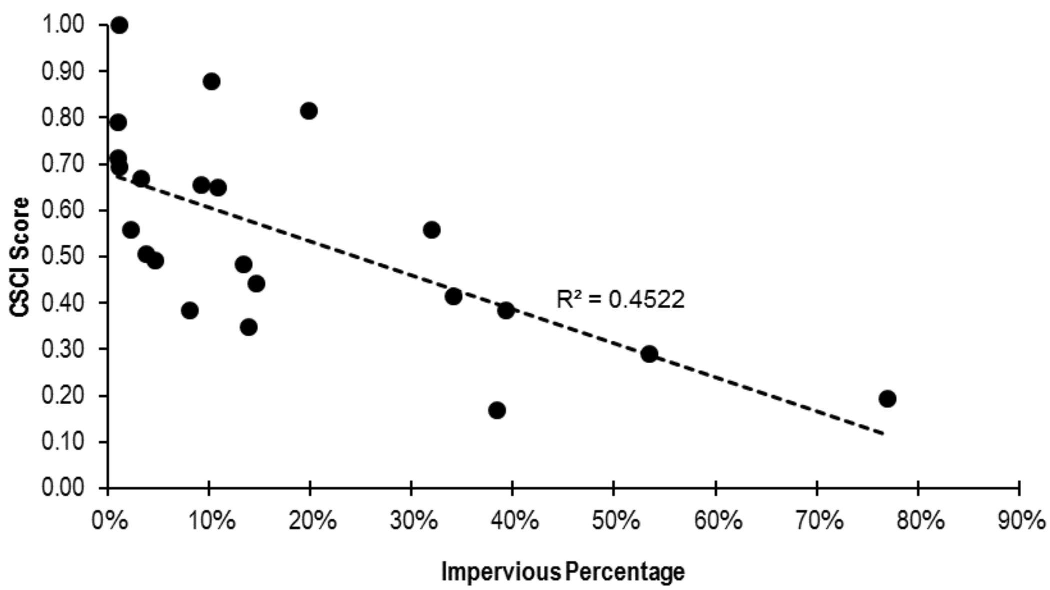

Figure 4-2. Linear regression between CSCI scores and percent watershed imperviousness for the 22 sites sampled in Alameda County during WY 2017.

Summary statistics for CSCI, S2, D18, and H20 scores at non-perennial (n=6) and perennial sites (n=14) are presented in Table 4-6. Two sites were classified as "highly variable flow" (HVF) due to frequent changes in flow conditions, presumably due to human activity (e.g., dam operations). Flow status was evaluated by ACCWP during site observations conducted in the dry season. In general, higher biological condition scores occurred at the non-perennial sites compared to the perennial sites. This pattern may not be related to flow conditions and instead is likely associated with better habitat conditions found at minimally disturbed sites (i.e., unmodified channel and low percent impervious area). The distribution of biological condition scores is presented as box plots in Figure 4-3.

Table 4-6. Descriptive statistics of CSCI, D18, S2, and H20 in relation to stream flow for data collected in WY 2017 in Alameda County.

Flow		CSCI	S2	D18	H20
Non-Perennial (n=6)	Min	0.29	10	36	0
	Max	1.00	67	62	61
	Mean	0.71	40	50	38
Perennial (n=14)	Min	0.17	0	22	9
	Max	0.81	67	56	38
	Mean	0.49	22	39	28

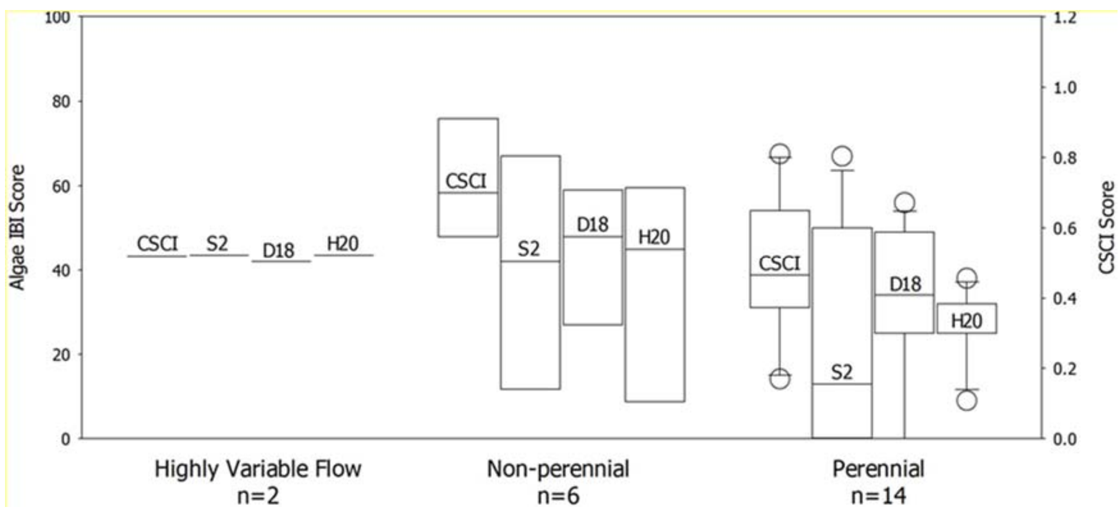

Figure 4-3. Box plots showing distribution of CSCI, S2, D18, and H20 scores for non-perennial (NP) (n=6), perennial (P) (n=14), and HVF (n=2) sites sampled in Alameda County during WY 2017.

There is a weak correlation between algae IBI scores (H20 and D18) and CSCI scores, shown in Figure 4-4. This is likely due to the different responses from benthic macroinvertebrate communities and algal and diatom communities to the various environmental stressors present in streams. There is no significant correlation between S2 IBI scores and CSCI scores.

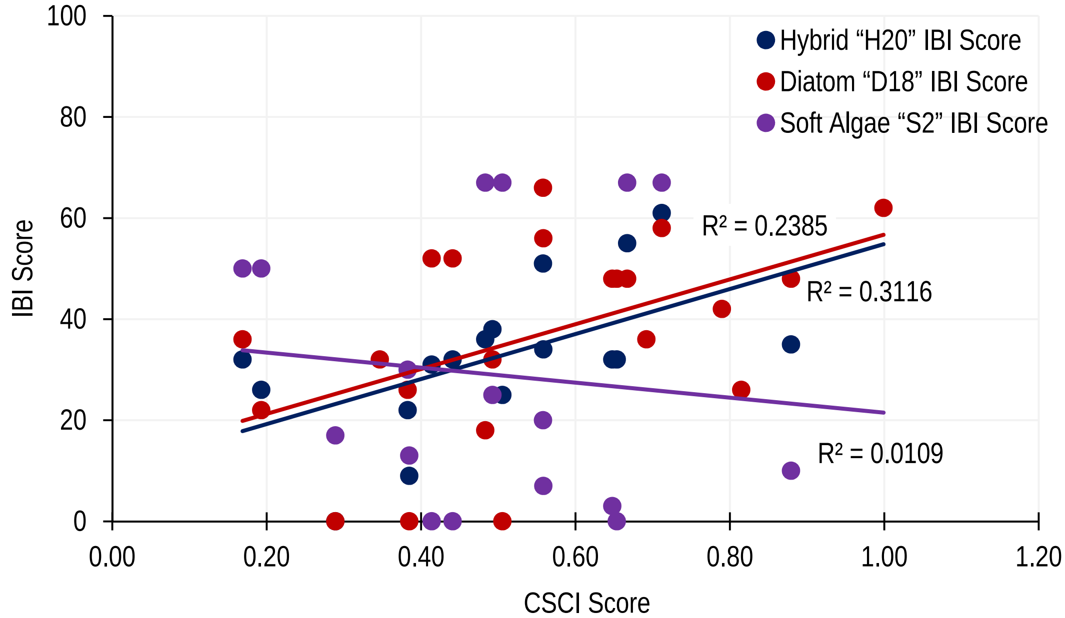

Figure 4-4. Linear regression between H20, D18, and S2 scores with CSCI scores for the 22 sites sampled in Alameda County during WY 2017.

During WY 2017 Alameda County staff sampled 13 streams with unmodified channels and 9 channels that were categorized as being highly modified or engineered. Box plots showing the distribution of the CSCI, S2, D18, and H20 scores for the two channel types are shown in Figure 4-5. The results show that CSCI (p-value = 0.005) is responsive to changes in the physical habitat, while S2, D18, and H20 (p-values = 0.4, 0.5, and 0.1 respectively) are not as significantly affected by modifications to the channel.

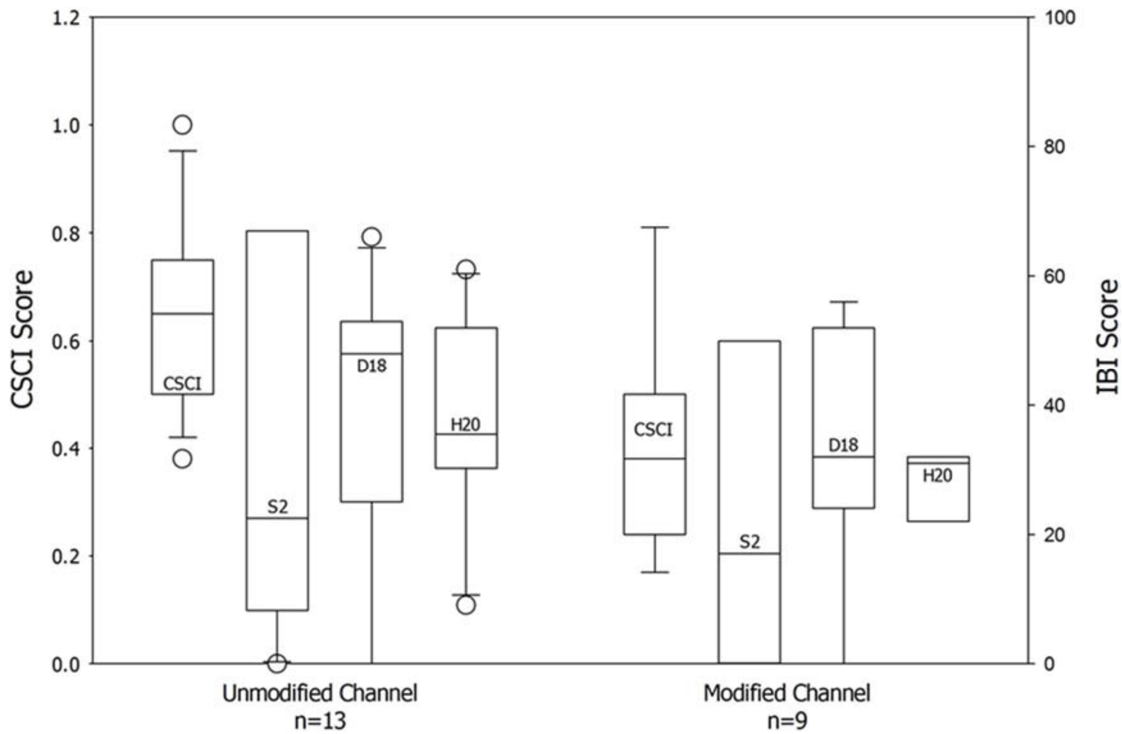

Figure 4-5. Box plots showing distribution of CSCI, S2, D18, and H20 scores for Unmodified Channel (n=13) and Modified Channel (n=9) sites sampled in Alameda County during WY 2017. Note: 5 sites (3 in unmodified channels and 2 in modified channels) did not have enough soft algae species to calculate S2 or H20 scores.

4.2.3 Stressor Indicators: Chemistry and Toxicity

Water Chemistry Parameters associated with bioassessment

Table 4-7 provides a summary of descriptive statistics for the nutrients[16] and algae-related analytes[17] collected in association with the bioassessment samples in receiving waters. For the purposes of data analysis, Total Nitrogen was calculated as the sum of nitrate + nitrite + Total Kjeldahl Nitrogen (TKN).

Table 4-7. Descriptive statistics for water chemistry results collected at RMC sites during WY 2017.

Nutrients and Algal analytes	N	N ≥ RL	Min	Max	Max Detected	Mean
Ammonia as N (mg/l)	22	22	0.036	0.4	0.4	0.113
Nitrate as N (mg/l)	22	20	< 0.02	11	11	1.2
Nitrite as N (mg/l)	22	12	0.001	0.064	0.064	0.014
Nitrogen, Total Kjeldahl (mg/l)	22	22	0.26	1.5	1.5	0.83
Nitrogen, Total (calculated) (mg/l)	22	NA	NA	11.36	11.36	2.17
OrthoPhosphate as P (mg/l)	22	21	< 0.006	0.2	0.2	0.063
Phosphorus as P(mg/l)	22	22	0.036	0.47	0.47	0.119
Silica as SiO_2 (mg/l)	22	22	11	53	53	24
Chloride (mg/l)	22	22	26	550	550	104
Ash Free Dry Mass (mg/m^3)	22	22	37.8	707	707	330
Chlorophyll a (mg/l)	22	21	< 1.92	225	225	71.7

Water and Sediment Testing for Toxicity and Pesticides

The laboratory determines whether a sample is "toxic" by statistical comparison of the results from multiple test replicates of selected aquatic species in the environmental sample to multiple test replicates of those species in laboratory control water. The threshold for determining statistical significance between environmental samples and control samples is fairly small, with statistically significant toxicity often occurring for environmental test results that are as high as 90% of the Control. Therefore, there is a wide range of possible toxic effects that can be observed – from 0% to approximately 90% of the Control values.

[16] Listed in C.8.d.i(4).

[17] Required in C.8.d.i(1) along with taxonomic and habitat-related parameters.

For water and sediment sample toxicity and pesticide tests, provision C.8.g.iv requires Permittees to identify a site as a candidate SSID project when analytical results indicate any of the following, with applicability considerations noted in Section 3.4.3 above:

1) A toxicity test (of growth, reproduction, and/or survival depending on species) of any test organism is reported as “fail” if both the initial sampling and a second, followup sampling both have ≥ 50% Percent Effect;
2) A pollutant is present at a concentration exceeding its water quality objective (WQO) in the Basin Plan;
3) For pollutants without WQOs, results exceed Probable Effects Concentrations or Threshold Effects Concentrations.

The following sections discuss the results of WY 2017 monitoring in the context of MRP triggers. The tables that follow present the results of pesticide and toxicity tests conducted in WY 2017 evaluating the growth, reproduction, or survival of test organisms. Where the initial sampling was reported as “fail,” results are also shown for a second, followup sampling.

Dry Weather Aquatic Toxicity

Field personnel collected water samples during summer 2017 from two sites and these were tested for aquatic toxicity using five test species: an aquatic plant (*Selenastrum capricornutum*), three aquatic invertebrates (*Ceriodaphnia dubia, Hyalella azteca, and Chironomous dilutus*), and one fish species (*Pimephales promelas* or fathead minnow). The following sections discuss the results of WY 2017 monitoring in the context of MRP triggers. The results are summarized in Table 4-8. In comparison to the control samples, none of the samples surpassed the toxicity threshold therefore no follow-up sampling was required.

Table 4-8. Summary of WY 2017 dry season aquatic toxicity results.

Dry Weather Water Samples		Pass or fail in the initial sampling, and percent effect if toxic						
Sample Station	Collection Date	*S. capricornutum*	*C. dubia*		*H. azteca*	*P. Promelas*		*C. dilutus*
		Growth	Survival	Reproduction	Survival	Survival	Growth	Survival
204WRD002	7/13/2017	Pass	Pass	Pass	Pass	Pass	Pass	Pass
205R01198	7/13/2017	Pass	Pass	Fail (15%)	Pass	Pass	Pass	Pass

Dry Weather Sediment Toxicity

During the dry season, field personnel collected sediment samples concurrently with water toxicity samples, and tested sample material for both sediment toxicity and the sediment chemistry constituents identified in provision C.8.g.ii. As required in provision C.8.g.ii, for sediment toxicity, testing was performed with two species, *H. azteca*, a common benthic invertebrate, and C. *dilutus*. Acute (survival) endpoints were reported.

The results of the ACCWP WY 2017 sediment toxicity testing are summarized in Table 4-9. In comparison to the control samples, one of the samples surpassed the toxicity threshold therefore follow-up sampling at that site (205R01198) for that species (*C. dilutus*) was required.

Table 4-9. Summary of WY 2017 dry season sediment toxicity results.

Dry Season Sediment Samples		Pass or fail in the initial sampling, and % effect if toxic	
Sample Station	Collection Date	*H. azteca*	*C. dilutus*
		Survival	Survival
204WRD002	7/13/2017	Pass	Fail (24%)
205R01198	7/13/2017 8/17/2017	Fail (38%)	Fail (67%) Fail (43%)

Sediment Chemistry Parameters

Descriptive statistics for sediment chemistry data for samples collected in WY 2017 are provided in Table 4-10. Analytes are presented in alphabetical order. Table 4-10 lists additional properties of the sediment samples.

It should be noted that a number of the sediment chemistry constituents assessed per the list in MacDonald et al. (2000) required some grouping of analytes. For example, the MacDonald list includes 10 individual PAH compounds, as well as "Total PAHs". For this report, "Total PAHs" was computed as the sum of all 24 PAH compounds reported by the laboratory.

Table 4-10. Descriptive statistics for ACCWP WY 2017 sediment chemistry results

Analyte (units)	N	N ≥ MDL	Min	Max	Max Detected	Mean[1]
Arsenic (mg/Kg dw)	2	2	4.2	5.4	5.4	4.8
Bifenthrin (ng/g dw)	2	2	3.1	3.5	3.5	3.3
Cadmium (mg/Kg dw)	2	2	0.27	0.55	0.55	0.41
Carbaryl (mg/Kg dw)	2	0	0.06*	0.06*	0	0.06
Chromium (mg/Kg dw)	2	2	27	45	45	36
Copper (mg/Kg dw)	2	2	27	35	35	31
Cyfluthrin, total (ng/g dw)	2	2	0.38	0.49	0.49	0.44
Cyhalothrin, Total lambda- (ng/g dw)	2	2	0.13	0.18	0.18	0.16
Cypermethrin, total (ng/g dw)	2	2	0.14	0.34	0.34	0.24
Deltamethrin/Tralomethrin (ng/g dw)	2	1	0.07*	7.5	7.5	3.8
Esfenvalerate/Fenvalerate, total (ng/g dw)	2	0	0.075*	0.075*	0	0.075
Fipronil (ng/g dw)	2	0	0.06*	0.06*	0	0.06
Lead (mg/Kg dw)	2	2	29	38	38	34
Nickel (mg/Kg dw)	2	2	30	56	56	43
Permethrin (ng/g dw)	2	1	0.065*	0.47	0.47	0.27
Total Organic Carbon (% dw)	2	2	7.0	7.2	7.2	7.1
Total PAHs (ng/g dw)	2	NA	696	1336	1336	1016
Zinc (mg/Kg dw)	2	2	130	130	130	130

Notes:

[1]As described below, the mean is calculated using a substitution of ½ MDL for non-detects.

* Indicates non-detect, a value that was below the detection limit.

Table 4-11. Total Organic Carbon and grain size statistics for ACCWP WY 2017 dry weather sediment samples.

Sample Station	Total Organic Carbon (% dw)	Percentages of sieved sample in small size classes			Percent of bulk sample in granule & pebble (> 2 mm)
		Silt & clay (<0.0625 mm)	Very. fine to coarse sand (0.0625 - <1.0 mm)	Very coarse sand (1.0 - <2.0 mm)	
204WRD002	7.0	47.0	50.8	2.2	5.1
205R01198	7.2	66.0	33.2	0.8	1.2

4.3 Stressor Assessment

This section addresses the question:

- "What are major stressors to aquatic life in the RMC area?"

The monitoring requirements of MRP provisions C.8.d and C.8.g include evaluation of results with respect to specified trigger thresholds to identify whether a site is a candidate for a SSID project followup as required by provision C.8.e. The trigger criteria for each provision are listed below:

Bioassessment - Sites scoring less than 0.795 according to the California Stream Condition Index (CSCI), or sites where there is a substantial difference in CSCI score observed at a location relative to upstream or downstream sites, as described in provision C.8.d.i.(8).

Chlorine - A procedural follow-up is described in provision C.8.d ii(4) for chlorine samples when the initial field measurement is greater than 1.0 mg/L; the trigger is noted but not required to be listed as a candidate for SSID.

Pesticides and Toxicity – Sites at which any of the following criteria in provision C.8.g.iv are met (as applicable, see discussion in Section 3.4.3 above):

1) A toxicity test of growth, reproduction, or survival of any test organism is reported as "fail" in both the initial sampling and a second, followup sampling, and both have ≥ 50% Percent Effect;
2) A pollutant is present at a concentration exceeding its water quality objective (WQO) in the Basin Plan;
3) For pollutants without WQOs, results exceed Probable Effects Concentrations (PECs) or Threshold Effects Concentrations (TECs).

The biological, physical, chemical and toxicity testing data produced by ACCWP during WY 2017 were compiled and evaluated against these trigger criteria. When the data analysis indicated that the associated trigger criteria were reached, those sites and results were identified as potentially warranting further investigation.

When interpreting analytical chemistry results, laboratory data often contain a relatively high proportion that is reported as either below method detection limits (MDLs) or between detection and reporting limits (RLs). Dealing with data in this range of the analytical spectrum introduces some level of uncertainty, especially when attempting to generate summary statistics for a dataset. In the compilation of statistics for analytical chemistry that follow, non-detect data (ND) were substituted with a concentration equal to one-half of the respective MDL as reported by the laboratory. This follows procedures agreed on for reporting the WY 2012 UCMR prepared for the four collaborating RMC Programs. The use of one-half of the MDL is the most common substitution in environmental science (e.g., Helsel 2010), and is thought to be more representative of laboratory results. Some of the results may therefore be slightly biased high or low with this associated analytical uncertainty, but this is not expected to affect the conclusions to any great extent.

4.3.1 Stressor Analysis: Bioassessment

Biological assessment condition categories (e.g., good, fair, poor) can assist in the presentation of bioassessment data and may or may not be tied to regulatory outcomes. 19 of the 22 sites sampled in WY 2017 had CSCI scores below the threshold of 0.795.

The stressor analysis revealed that most sites show alteration of biological communities, and channel modification and other habitat changes associated with urbanization are likely stressors for benthic macroinvertebrate communities. The low scores and condition categories for most sites sampled in WY 2017 are consistent with results from of previous years of monitoring in Alameda County and also supported by studies elsewhere.

Geomorphic changes to stream systems are commonly considered to begin as the effective impervious area of their catchment reaches approximately 10% (e.g. Schuler, 2004, SFBRWQCB 2012). However, Coleman et al. (2005) found that much lower thresholds of imperviousness initiated channel enlargement in the Southern California streams they studied, suggesting that arid-climate ephemeral to intermittent streams are very sensitive to slight changes in impervious area within their watersheds.

4.3.2 Stressor Analysis: Chemistry and Toxicity

Stressor analysis provides an analysis of water and sediment chemistry and toxicity testing results in comparison to various “trigger” thresholds included in the MRP. This analysis is intended to provide a means of identifying potential stressors that may impact beneficial uses at the Creek Status and Pesticide/Toxicity monitoring locations.

All monitoring conducted per provision C.8.g is subject to trigger criteria listed in C.8.g.iv:

(1) A toxicity test (of growth, reproduction, and/or survival depending on species) of any test organism is reported as “fail” if both the initial sampling and a second, followup sampling, have ≥ 50% Percent Effect;
(2) A pollutant is present at a concentration exceeding its water quality objective in the Basin Plan;
(3) For pollutants without WQOs, results exceed Probable Effects Concentrations or Threshold Effects Concentrations”

As noted in Section 3.4.3 above, Criterion (1) applies to toxicity results of water column and sediment monitoring in both dry weather and wet weather. Criterion (2) can apply to results of water column chemistry monitoring in both dry weather and wet weather, and also to water quality and chemistry samples collected at bioassessment sites. Criterion (3) applies to chemical results of sediment monitoring in dry weather.

Water Chemistry Parameters

Water chemistry parameters were analyzed using the trigger criterion in MRP provision C.8.g.iv(2) to compare each analyte's concentration with an applicable water quality objective (WQO) in the Basin Plan.

For consistency with bioassessment monitoring data analyses in previous years, this criterion was interpreted to include other relevant water quality standards or accepted thresholds developed from available sources beyond the SF Basin Water Quality Control Plan (Basin Plan) (SFBRWQCB 2013), including the California Toxics Rule (CTR) (USEPA 2000a), and various USEPA sources. Of the nine nutrient-related water quality constituents monitored in association with the bioassessment monitoring, water quality standards or established thresholds are available only for ammonia (unionized form), chloride, and nitrate plus nitrite, the latter two for waters with MUN beneficial use only, as indicated in Table 4-12.

For ammonia, the standard provided in the Basin Plan (pp. 3-7) applies to the un-ionized fraction, as the underlying criterion is based on un-ionized ammonia, which is the more toxic form. Conversion of RMC monitoring data from the measured total ammonia to un-ionized ammonia was therefore necessary. The conversion was based on a formula provided by the American Fisheries Society[18], and calculates un-ionized ammonia in freshwater systems from analytical results for total ammonia and field-measured pH, temperature, and electrical conductivity.

For chloride, a Secondary Maximum Contaminant Level (MCL) of 250 mg/L applies to those waters with MUN beneficial use, per the Basin Plan (Table 3-5), Title 22 of the California Code of Regulations (CDPH, internet source), and the USEPA Drinking Water Quality Standards (USEPA, internet source). This same threshold is additionally established in the Basin Plan (Table 3-7) for waters in the Alameda Creek watershed above Niles. For all other waters, the Criteria Maximum Concentration (CMC) water quality criterion of 860 mg/L (acute) and the

[18]http://fisheries.org/hatchery

Criterion Continuous Concentration (CCC) of 230 mg/L (USEPA Water Quality Criteria[19]) for the protection of aquatic life were used for comparison purposes.[20]

The nitrate + nitrite primary MCL applies to those waters with MUN beneficial use, per the Basin Plan (Table 3-5), Title 22 of the California Code of Regulations, and the USEPA Drinking Water Quality Standards.

Table 4-12. Water quality thresholds available for comparison to ACCWP WY 2017 water chemistry constituents

Sample Parameter	Threshold	Units	Frequency/ Period	Application	Source
Ammonia	0.025	mg/L	Annual median	Unionized ammonia, as N. [Maxima also apply to Central Bay and u/s (0.16) and Lower Bay (0.4)]	SF Bay Basin Plan Ch. 3, p. 3-7
Chloride	230	mg/L	Criterion Continuous Concentration	Freshwater aquatic life	USEPA Nat'l. Rec. WQ Criteria, Aquatic Life Criteria
Chloride	860	mg/L	Criteria Maximum Concentration	Freshwater aquatic life	USEPA Nat'l. Rec. WQ Criteria, Aquatic Life Criteria Table
Chloride	250	mg/L	Secondary Maximum Contaminant Level	Alameda Creek Watershed above Niles and MUN waters, Title 22 Drinking Waters	SF Bay Basin Plan Ch. 3, Tables 3-5 and 3-7; CA Code Title 22; USEPA Drinking Water Stds. Secondary MCL
Nitrate + Nitrite (as N)	10	mg/L	Maximum Contaminant Level	Areas designated as Municipal Supply	SF Bay Basin Plan Ch. 3, Table 3-5

[19]National Recommended Water Quality Criteria**.** USEPA's compilation of national recommended water quality criteria is presented as a summary table containing recommended water quality criteria for the protection of aquatic life and human health in surface water for approximately 150 pollutants. These criteria are published pursuant to Section 304(a) of the Clean Water Act (CWA) and provide guidance for states and tribes to use in adopting water quality standards.

http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm

[20]As agreed by RMC members for the first UCMR (BASMAA (2012) the RMC participants used the 230 mg/L threshold as a conservative benchmark for comparison purposes for all locations not specifically identified within the Basin Plan, i.e. sites not within the Alameda Creek watershed above Niles nor identified as MUN; rather than the maximum concentration criterion of 830mg/L .

The comparisons of the measured nutrients data to the thresholds listed in Table 4-120 are shown in Table 4-13. The results for these three constituents are plotted against the prevailing thresholds in Figure 4-6 through Figure 4-8.

Of the 22 sites monitored in 2017, the water quality standard was exceeded at one site for un-ionized ammonia and ammonia and unionized ammonia concentrations averaged 0.11 mg/L and 7.4 µg/L, respectively. In 2016, ammonia and unionized ammonia concentrations averaged 0.06 mg/L and 2.9 µg/L, respectively; an improvement over 2015 results where ammonia and un-ionized ammonia concentrations averaged 0.16 mg/L and 10.6 µg/L, respectively.

For chloride, the water quality standard was exceeded at two sites (9% of sites) in 2017 and averaged 104 mg/L across all sites. The water quality standard was exceeded at one site (5% of sites) in 2016 (204R02116) and averaged 77.9 mg/L across all sites. There were four sites (18% of sites) above the threshold in 2015, with an average concentration of 172 mg/L.[21] There were 3 measurements of chloride (17% of sites) above the threshold in 2014.

One site (204R03295) exceeded the nitrate + nitrite standard in 2017, however the threshold did not apply to this site given its designated beneficial uses. In 2016, 2015, and 2014 no samples exceeded the nitrate + nitrite standard.

Based upon the above information, one or more water quality standards or applicable thresholds were exceeded at 1 of the 20 sites (5%) which is less than the 23% of sites in 2015 and 17% of sites in 2014 with at least one result above identified thresholds.

[21] This assessment would drop to two sites above the standard with usage of the CMC (860 mg/L) in place of the CCC of 230 mg/L, as two of the instances occurred sites within Alameda Creek above Niles, and would therefore be measured against the criterion of 250 mg/L.

Table 4-13. Comparison of water quality (nutrient) data to associated water quality thresholds for WY 2017 water chemistry results. (NDs estimated as ½ MDL).

Site Code	Alameda Creek Above Niles	MUN	Parameter and Threshold			# of Parameters >Threshold/ Waterbody	% of Parameters >Threshold/ Waterbody
			Un-ionized Ammonia (as N)	Chloride	Nitrate + Nitrite (as N)		
			25 µg/L	230/250 mg/L [1]	10 mg/L [2]		
204R00711			0.36	100	1.5	0	0%
204R00831			2.96	30	0.2	0	0%
204R01199			0.49	63	0.01	0	0%
204R01310	X		4.96	190	0.2	0	0%
204R01343			14.75	43	0.5	0	0%
204R01375			3.21	90	0.6	0	0%
204R01497	X		19.38	26	0.2	0	0%
204R01748	X		1.31	75	0.4	0	0%
204R02367			1.73	39	0.5	0	0%
204R02759			2.20	110	2.2	0	0%
204R02975			3.23	49	0.4	0	0%
204R03033	X		3.48	180	2.5	0	0%
204R03135			2.86	40	0.1	0	0%
204R03183			11.04	79	0.3	0	0%
204R03199		X	0.77	64	0.3	0	0%
204R03295			6.65	33	**11.0**[4]	0	0%
204R03327	X		6.65	**280**	2.6	1	33%
204R03391			1.71	62	0.9	0	0%
204R03399			4.83	53	0.8	0	0%
204R03481	X		18.55	**550**	1.4	1	33%
205R02782			19.30	62	0.3	0	0%
205R02862			**32.12**	62	0.01	1	33%
# Values >Threshold:			1	2	0		
% Values >Threshold:			5%	9%	0%		
Overall Number and % of Sites Meeting Trigger Criterion [3]:						**3**	**14%**

[1] 250 mg/L threshold applies for sites with MUN beneficial use and Alameda Creek above Niles per Basin Plan.

[2] Nitrate + nitrite threshold applies only to sites with MUN beneficial use.

[3] Sites where >20% of results exceed one or more water quality standard or established threshold.

[4] The 10 mg/L threshold does not apply to site 204R03295 because it does not have MUN beneficial use. The N value for this site, and other sites that do not have MUN beneficial use, is shown for information purposes.

NA = threshold does not apply

Bolded value exceeds threshold

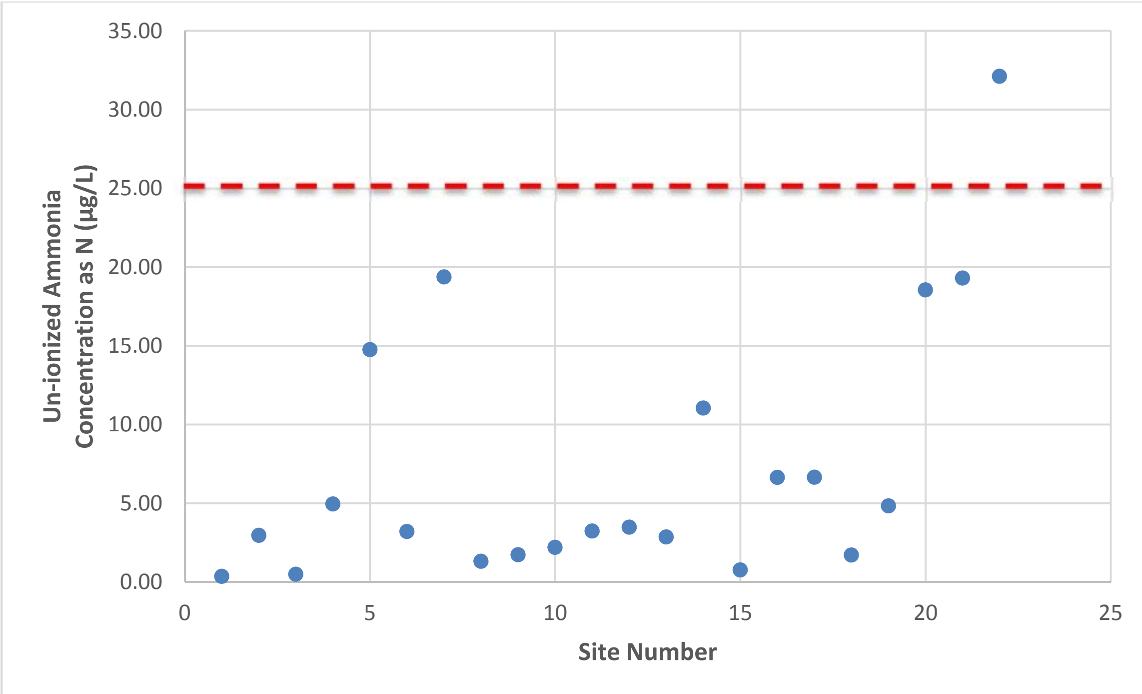

Figure 4-6. Plot of ACCWP WY 2017 unionized ammonia data (calculated from total ammonia, pH, temperature, and electrical conductivity) with threshold of 25 µg/L indicated.

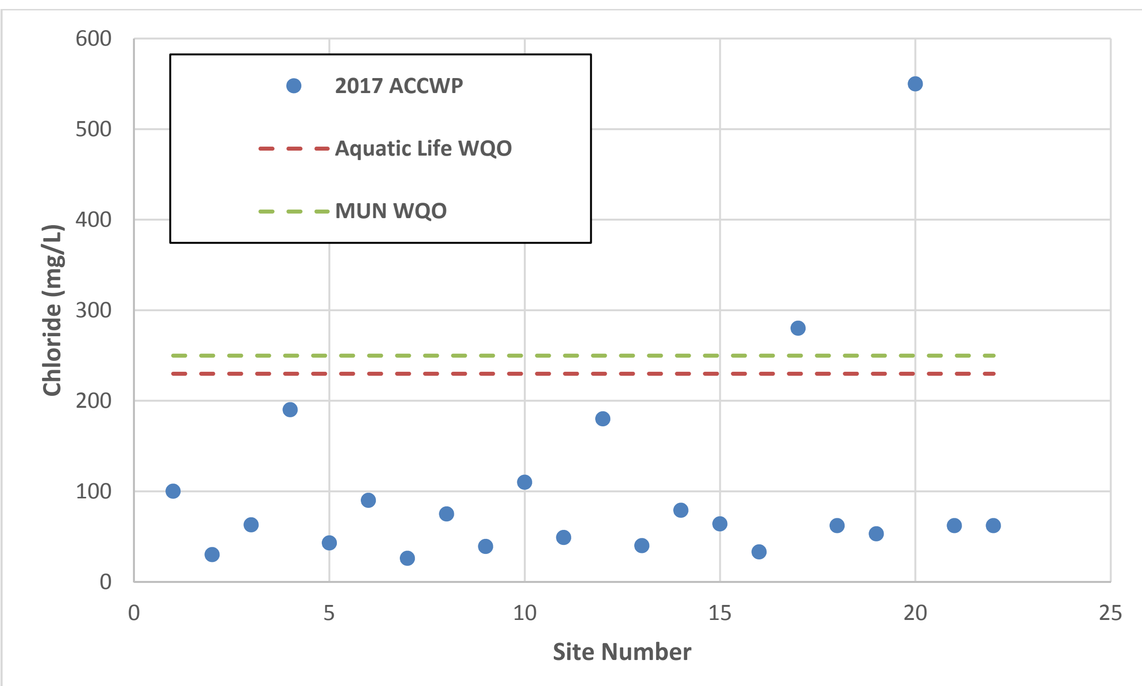

Figure 4-7. Plot of ACCWP WY 2017 chloride data with relevant Aquatic Life and MUN thresholds indicated.

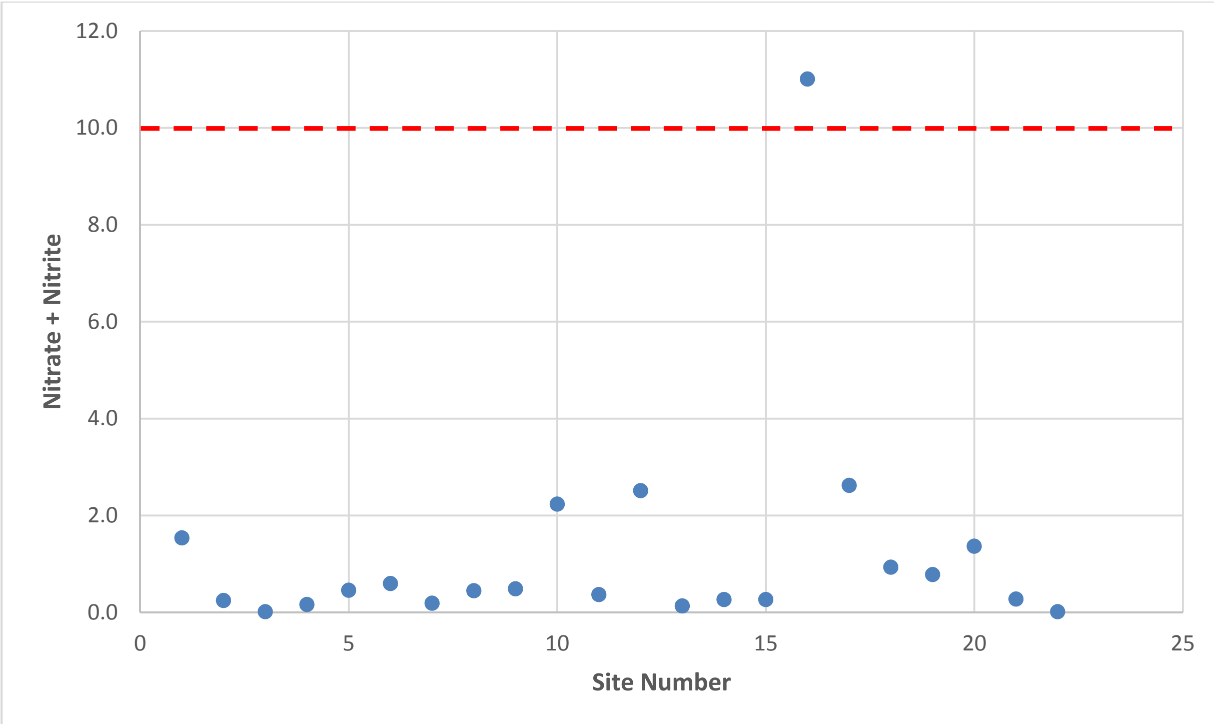

Figure 4-8. Plot of ACCWP WY 2017 nitrate + nitrite as N data, WY 2017 data (threshold = 10 mg/L for MUN only).

Free and Total Chlorine Testing

The results of field testing for free and total chlorine and comparisons to the MRP trigger threshold are summarized in Table 4-14. The MRP trigger criterion for chlorine states, "After immediate resampling, concentrations remain >0.10 mg/L." If the resample is still greater than 0.1 mg/L, the observation is reported to the appropriate Permittee central contact point for illicit discharges, so that the illicit discharge staff can investigate and abate the associated discharge in accordance with its provision C.5.e – Spill and Dumping Complaint Response Program.

There were 22 site measurements for free and total chlorine collected by ACCWP in WY 2017. As was the case in 2016 and 2015, none of the sites exceeded the thresholds for free and total chlorine that would trigger follow-up testing.

Table 4-14. Summary of ACCWP WY 2017 chlorine testing results in comparison to Municipal Regional Permit trigger criteria.

Site Code	Sample Date	Chlorine, Free	Chlorine, Total	Meets Trigger Threshold?
204R00711	5/24/2017	<0.04	<0.04	No
204R00831	6/6/2017	<0.04	<0.04	No
204R01199	6/7/2017	<0.04	<0.04	No
204R01310	6/13/2017	<0.04	<0.04	No
204R01343	6/5/2017	<0.04	<0.04	No
204R01375	6/7/2017	<0.04	<0.04	No
204R01497	6/12/2017	<0.04	<0.04	No
204R01748	6/14/2017	<0.04	<0.04	No
204R02367	6/5/2017	<0.04	<0.04	No
204R02759	5/9/2017	0.04	<0.04	No
204R02975	5/11/2017	<0.04	<0.04	No
204R03033	6/12/2017	<0.04	<0.04	No
204R03135	6/8/2017	<0.04	<0.04	No
204R03183	5/23/2017	<0.04	<0.04	No
204R03199	5/22/2017	<0.04	<0.04	No
204R03295	5/8/2017	0.04	<0.04	No
204R03327	6/14/2017	<0.04	<0.04	No
204R03391	5/22/2017	<0.04	<0.04	No
204R03399	5/24/2017	<0.04	0.02	No
204R03481	5/25/2017	0.04	0.04	No
205R02782	5/10/2017	<0.04	<0.04	No
205R02862	5/9/2017	0.1	0.1	No
Number of samples exceeding 0.1 mg/L:		0	0	0
Percentage of samples exceeding 0.1 mg/L:		0%	0%	0%

Water and Sediment Toxicity Testing

The analysis of toxicity testing results and comparisons to MRP trigger thresholds, as presented in detail earlier in this section, are summarized in Table 4-15 for those WY 2017 samples that exhibited statistically-significant toxicity.

The MRP provision C.8.g.iv trigger criteria for water column and sediment toxicity stipulates: The Permittees shall identify a site as a candidate SSID project when analytical results indicate any of the following:

(1) A toxicity test (of growth, reproduction, and/or survival depending on species) of any test organism is reported as "fail" if both the initial sampling and a second, followup sampling, have ≥ 50% Percent Effect;

(2) A pollutant is present at a concentration exceeding its water quality objective in the Basin Plan;
(3) For pollutants without WQOs, results exceed Probable Effects Concentrations or Threshold Effects Concentrations"

For the dry season sampling, one of the samples collected, either water or sediment, exhibited statistically-significant toxicity above the 50% threshold for followup sampling. Results from followup sampling at that site (205R01198) for that species (*C. dilutus)* fell below the 50% trigger threshold.

Table 4-15. Overall summary of WY 2017 aquatic and sediment toxicity samples with toxic response in comparison to Municipal Regional Permit trigger criteria.

Test Initiation Date	Species Tested	Test Regimen	Treatment/ Sample ID	Comparison to Provision C.3.g.iv Trigger Criteria
Water				
7/13/2017	*C. dubia*	Reproduction	205R01198	< 50% Effect
Sediment				
7/13/2017	*H. azteca*	Survival	205R01198	< 50% Effect
7/13/2017	*C. dilutus*	Survival	204WRD002	< 50% Effect
7/13/2017	*C. dilutus*	Survival	205R01198	**> 50% Effect**
8/17/2017	*C. dilutus*	Survival	205R01198	< 50% Effect

Sediment Chemistry Parameters

Sediment chemistry results could potentially be evaluated as potential stressors in two ways, based upon the criteria (2) and (3) from MRP provision C.8.g.iv:

(2) A pollutant is present at a concentration exceeding its water quality objective in the Basin Plan;
(3) For pollutants without WQOs, results exceed Probable Effects Concentrations or Threshold Effects Concentrations.

The Basin Plan currently contains no WQOs for bedded sediment.

Table 4-16 provides Threshold Effect Concentration (TEC) quotients and Probable Effects Concentrations (PEC) quotients as available for sediment chemistry constituents, calculated as the measured concentration divided by the TEC or PEC value given in MacDonald et al. (2000)[22]. This table also provides a count of the number of constituents that exceed TEC or PEC values for each site, as evidenced by a TEC or PEC quotient greater than or equal to 1.0.

For WY 2017 samples, the number of TEC quotients greater than or equal to 1.0 for each site, was 6 for site 204WRD002 and 4 for site 205R01198, out of the 17 measured constituents that were included in MacDonald et al. (2000). Site 205R01198 had a PEC quotient greater than one for one constituent.

Some of the calculated numbers for TEC and PEC quotients may be artificially elevated due to the method used to account for filling in non-detect data (as discussed previously, concentrations equal to one-half of the respective laboratory MDLs were substituted for non-detect data so these statistics could be computed). This, however, is not expected to greatly influence interpretation.

[22] TEC and PEC values were not available in MacDonald et al. (2000) for the measured pesticides (pyrethroids, carbaryl and fipronil) and none were found in more recent literature.

Table 4-16. Threshold Effect Concentration (TEC) or Probable Effect Concentration (PEC) quotients for WY 2017 sediment chemistry constituents. Bolded values indicate individual TEC or PEC quotients > 1.0.

Site ID	TEC		PEC	
	204WRD002	205R01198	204WRD002	205R01198
Metals (mg/kg DW)				
Arsenic	0.55	0.43	0.16	0.13
Cadmium	0.27	0.56	0.05	0.11
Chromium	0.62	**1.04**	0.24	0.41
Copper	**1.11**	0.85	0.23	0.18
Lead	0.81	**1.06**	0.23	0.30
Nickel	**1.32**	**2.47**	0.62	**1.15**
Zinc	**1.07**	**1.07**	0.28	0.28
PAHs (µg/kg DW)				
Anthracene	0.38	0.03	0.03	0.00
Fluorene	0.02	0.02	0.00	0.00
Naphthalene	0.01	0.01	0.00	0.00
Phenanthrene	0.54	0.24	0.09	0.04
Benz(a)anthracene	0.52	0.02	0.05	0.00
Benzo(a)pyrene	0.37	0.24	0.04	0.02
Chrysene	**1.33**	0.72	0.17	0.09
Fluoranthene	**1.06**	0.57	0.20	0.11
Pyrene	**1.13**	0.62	0.14	0.08
Total PAHs	0.83	0.43	0.06	0.03
Number of constituents with TEC or PEC quotient ≥ 1.0	**6**	**4**	**0**	**1**

5. Conclusions and Next Steps

During WY 2017, ACCWP monitored 22 sites under the RMC regional probabilistic design for bioassessment, physical habitat, and related water chemistry parameters. Two additional sites were monitored for water and sediment toxicity and sediment chemistry. The water and sediment chemistry and toxicity data were used to evaluate potential stressors that may affect aquatic habitat quality and beneficial uses. Each program also used bioassessment and related data to develop a preliminary condition assessment for the monitored sites, to be used in conjunction with the stressor assessment based on sediment chemistry and toxicity.

The following MRP reporting requirements (Provision C.8.h.vi) were addressed within this report as applicable:

- Descriptions of monitoring purpose and study design rationale
- QA/QC summaries for sample collection and analytical methods, including a discussion of any limitations of the data;
- Descriptions of sampling protocols and analytical methods;
- Tables and Figures describing: Sample location descriptions (including waterbody names, and lat/longs coordinates); sample ID, collection date (and time where relevant), media (e.g., water, filtered water, bed sediment, tissue); concentrations detected, measurement units, and detection limits;
- Data assessment, analysis, and interpretation for each monitoring program component;
- A listing of volunteer and other non-Permittee entities whose data are included in the report;
- Assessment of compliance with applicable water quality standards;

5.1 Summary of Stressor Analyses

The stressor analysis revealed the following potential stressors or stress conditions at WY 2017 sites:

- **Water Quality –** Of 11 parameters[23] sampled in association with WY 2017 bioassessment monitoring, applicable water quality standards were only identified for ammonia, chloride, and nitrate + nitrite (for sites with MUN beneficial use only). Of the results generated at

[23] Algal mass (ash-free dry weight), Chlorophyll a, Ammonia, Nitrate, Nitrite, TKN, Total Nitrogen, OrthoPhosphate, Phosphorus, Silica and Chloride

the 22 sites monitored by ACCWP reporting herein for those three parameters, two chloride, one un-ionized ammonia, and no nitrate + nitrite concentrations exceeded the applicable water quality standard or threshold. One nitrate + nitrite concentration was over 10 mg/L, however the site was not on a MUN designated waterbody.

- **Water Toxicity –** For WY 2017, 14 aquatic toxicity endpoints were derived through testing of 5 species at 2 sites county-wide during one dry season event. Of these endpoints, one sample / test combination exhibited statistically-significant toxicity as reported by the analytical laboratory (*C. dubia* reproduction at site 205R01198). Neither sites' samples exhibited toxicity with survival, growth, or reproduction beyond the threshold of >50% Effect.
- **Sediment Toxicity –** Of the bedded sediment collected from 2 sites, a toxic response for *C. dilutus* survival was observed at both sites, but was only above the threshold for followup sampling at site 205R01198. Followup sampling showed a toxic response as well, however it was below the threshold of >50% Effect. A toxic response for H. Azteca survival was also observed at site 205R01198, but was below the threshold of >50% effect.
- **Sediment Chemistry –** At site 205R01198, 1 constituent was present above the PEC threshold. Site 204WRD002 had 6 constituents above TEC thresholds and site 205R01198 had 4.
- **Bioassessment –** 19 of the 22 sites sampled in WY 2017 had CSCI scores below the threshold of 0.795.

5.2 Next Steps

MRP provisions C.8.d and C.8.g require monitoring results to be evaluated for triggers according to the criteria in these provisions of the MRP as shown above. During WY 2018, the RMC will collaboratively review trigger results from WYs 2015 and 2016, and select a minimum of four sites from among the triggers identified from all five counties for initiation of stressor/source identification (SSID) projects by WY 2018 as required by provision C.8.e.ii(1) for regionally conducted projects. Attachment B of the main UCMR provides a status update on SSID projects initiated during MRP1, and progress reports on SSID projects in Alameda County are provided in Appendix A.4A.

ACCWP and other RMC participants will continue to implement the regional probabilistic monitoring design in WY 2018. Site evaluation is underway for new bioassessment sites for WY 2017. Candidate sites classified with unknown sampling status as of WY 2017 may continue to be evaluated for potential sampling in WY 2018.

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MEMBER AGENCIES:

Alameda

Albany

Berkeley

Dublin

Emeryville

Fremont

Hayward

Livermore

Newark

Oakland

Piedmont

Pleasanton

San Leandro

Union City

County of Alameda

Alameda County Flood Control and Water Conservation District

Zone 7 Water Agency

ALAMEDA COUNTYWIDE CLEAN WATER PROGRAM

CREEK STATUS MONITORING REPORT - TARGETED PARAMETERS

APPENDIX A.2

URBAN CREEKS MONITORING REPORT

OCTOBER 2016 THROUGH SEPTEMBER 2017

Report prepared by

Alameda Countywide Clean Water Program
399 Elmhurst Street,
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Submitted to:

California Regional Water Quality Control Board, San Francisco Bay Region

FINAL

March 31, 2018

Protecting Alameda County Creeks, Wetlands & the Bay

Acknowledgements

Horizon Water and Environment, LLC contributed substantially to the preparation of this report. Applied Marine Sciences, Inc. contributed substantially to the implementation of monitoring activities and preparation of the data analysis and discussion for this report.

Preface

The Bay Area Stormwater Management Agencies Association (BASMAA) Regional Monitoring Coalition (RMC) collaboratively developed framework for preparation of the Urban Creeks Monitoring Report (UCMR) used by ACCWP and other stormwater programs to comply with the Municipal Regional Stormwater Permit (MRP)[1] requirements for reporting on monitoring data collected under the MRP Monitoring Provision C.8.

The following participants make up the RMC and are responsible for preparing UCMR documents on behalf of their respective member agencies:

- 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); and
- City of Vallejo and Vallejo Sanitation and Flood Control District (Vallejo).

This report was prepared by ACCWP to fulfill reporting requirements for a portion of the Creek Status Monitoring data collected in Water Year 2017 (October 1, 2016 through September 30, 2017) in accordance with the RMC's Monitoring Plan (BASMAA, 2011) for certain parameters monitored according to Provision C.8.d of the MRP. This report is an Appendix to the full UCMR submitted by ACCWP on behalf of the following Permittees:

- The 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 of the Alameda County Flood Control and Water Conservation District.

Data presented in this report were produced under the direction of the ACCWP using a targeted (non-probabilistic) monitoring design. Other data collected in Alameda County during this period

[1] Unless otherwise noted references to the MRP are to the reissued "MRP2" (SFBRWQCB, 2015) which became effective January 1, 2016. Most of the monitoring requirements addressed in this Appendix have not changed substantially from the original "MRP1" (SFBRWQCB, 2009)

pursuant to MRP Provision C.8 are reported in the main body and other appendices of ACCWP's UCMR for Water Year (WY) 2017.

As described in the RMC Creek Status and Long-Term Trends Monitoring Plan (BASMAA, 2011), targeted monitoring data were collected in accordance with the BASMAA RMC Quality Assurance Project Plan (QAPP; BASMAA, 2012a, 2014a and 2016a) and BASMAA RMC Standard Operating Procedures (SOPs, BASMAA, 2012b, 2014b and 2016b).

In accordance with the reissued MRP (also "MRP2", SFBRWQCB, 2015a) ACCWP will also submit the data included in this report by March 31, 2018 to the California Environmental Data Exchange Network and San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) in electronic SWAMP-comparable format.

In addition to the RMC participants, San Francisco Bay Regional Water Quality Control Board staff, Kevin Lunde and Jan O'Hara, also participated in RMC workgroup meetings that contributed to design and implementation of the RMC Monitoring Plan. Additionally, these staff also provided input regarding previous Urban Creeks Monitoring Reports and threshold "trigger" criteria for stressor analyses conducted therein.

List of Acronyms

Acronym	Definition
AMS	Applied Marine Sciences
ACCWP	Alameda Countywide Clean Water Program
BASMAA	Bay Area Stormwater Management Agencies Association
CCCWP	Contra Costa Clean Water Program
DO	Dissolved oxygen
DQO	Data Quality Objective
E.coli	*Escherichia coli*
EPA	United States Environmental Protection Agency
FIB	Fecal Indicator Bacteria
FSURMP	Fairfield Suisun Urban Runoff Management Program
MPC	Monitoring and Pollutants of Concern Committee
MPN	Most Probable Number
MRP	Municipal Regional Permit
MRP1	Municipal Regional Permit, issued 2009
MRP2	MRP, reissued 2015
MWAT	Maximum Weekly Average Temperature
NPDES	National Pollution Discharge Elimination System
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance Quality Control
RMC	Regional Monitoring Coalition
RWQCB	Regional Water Quality Control Board
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board; (California Regional Water Quality Control Board, San Francisco Bay Region)
SMCWPPP	San Mateo County Water Pollution Prevention Program
SOP	Standard Operating Protocol
SSID	Stressor/Source Identification
STV	Statistical Threshold Value
SWAMP	Surface Water Ambient Monitoring Program
UCMR	Urban Creek Monitoring Report
WQO	Water Quality Objective
WY	Water Year

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Executive Summary

In 2010, the seventeen members of the Alameda Countywide Clean Water Program (ACCWP) joined other members of the Bay Area Stormwater Agencies Association (BASMAA) to form the Regional Monitoring Coalition (RMC), to coordinate and oversee water quality monitoring required by Provision C.8 of the Municipal Regional Stormwater Permit (MRP). This report is an appendix to the Urban Creeks Monitoring Report (UCMR) prepared to assist ACCWP member agencies in complying with the MRP Reporting Provision C.8.h, reporting details of the Creek Status Monitoring for parameters that use a targeted (non-probabilistic) monitoring design. Other parameters were addressed using a regional probabilistic design, and are reported in a separate Regional Appendix A.1[2] to the UCMR.

The ACCWP Targeted Creek Status Monitoring in Water Year 2017 (WY 2017) focused on the Sausal Creek Watershed and the Crow Creek subwatershed of the San Lorenzo Creek watershed. Overall targeted monitoring activities included:

- Continuous temperature monitoring at eight[3] locations at hourly intervals over six months;
- General Water Quality monitoring at three locations with assessment of temperature, dissolved oxygen (DO), pH and specific conductivity at 15-minute intervals during three one- to two-week periods in Spring, Midsummer, and late Summer/Fall; and
- Pathogen indicator (*E. coli* and Enterococci) quantification at five sites;

The results of the targeted Urban Creek Monitoring are summarized below:

Continuous Temperature

The temperature "trigger" described in the MRP for a candidate SSID project is defined as when two or more weekly average temperatures, calculated as non-overlapping periods, exceed a Maximum Weekly Average Temperature (MWAT) of 17.0°C for a steelhead stream, or when 20% of the results at one sampling station exceed the instantaneous maximum of 24°C. All WY 2017 temperature monitoring sites were in streams with COLD Beneficial use, and experienced at least two MWATs above 17.0°C but none exceeded the 24°C instantaneous maximum in 20% of the results.

[2] Similar methods and QA/QC procedures are being implemented for Stressor-Source Identification (SSID) studies reported in Appendices A.4 to the UCMR;

[3] The minimum required number of temperature monitoring sites was eight.

General Water Quality

Results of the General Water Quality assessment are presented in Table E-1. MWATs reached a temperature trigger at two sites in midsummer and three sites in late summer. High pH surpassed trigger thresholds at all three stations. For additional discussion of these results, see the report of the ongoing Stressor Source Identification Study in UCMR Appendix A.4C.

Table E-1. Comparison of General Water Quality Observations to Trigger Thresholds at Sites 204CRW040, 204CRW041E, 204CRW042 in WY 2017.

Station	Monitoring Season (No of MWATs)	Applicable threshold or water quality standard					
		Temperature MWATs > 17˚C (> 19°C)	Temp % > 24˚C	Specific Cond. >2000 µS/cm	pH < 6.5	pH > 8.5	DO < 7 mg/L (COLD)
204CRW040	Spring (2)	0(0)	0%	0%	0%	82%	0%
	Summer-Fall (2)	2(1)	0%	0%	0%	12%	2%
204CRW041E	Spring (2)	0(0)	0%	0%	0%	49%	0%
	Midsummer (2)	1(0)	0%	0%	0%	0%	0%
	Summer-Fall (2)	2(1)	0%	0%	0%	1%	7%
204CRW042	Spring (2)	0(0)	0%	0%	0%	19%	0%
	Midsummer (2)	1(0)	0%	0%	0%	50%	0%
	Summer-Fall (2)	2(1)	0%	0%	0%	0%	12%

Pathogen Indicator Bacteria

Sampling of the required five sites was successfully completed on July 24, 2017. The results are presented in Table E-2. Of the 10 datapoints generated through ACCWP monitoring in 2017, only one, a reported enterococcus concentration of 173 MPN/100 mL at site 204SAU110, exceeded the STV. It should be noted, however, that in general results fell well below those recorded in prior years. For example, in 2016, the only other year for which the same two tests were run, results for samples collected in Castro Valley Creek watershed for *E. coli* ranged from 800 to 3000 MPN/100 mL and those for enterococcus ranged from 800 to 9000 MPN/100 mL. During the prior permit term, *E. coli* results were also higher than 2017 results. Sausal Creek is designated for both contact (REC-1) and non-contact (REC-2) recreation, and the three of the five sampling sites are located in areas with easy access along public trails adjacent to the creek (Bridgeview Trail and Palos Colorados Trail).

Table E-2: Comparison of WY 2017 Pathogen Indicator Concentrations to Water Quality Objectives and Triggers – ACCWP July 24, 2017 FIB Monitoring.

Site ID	Site Description	Creek Name	Enterococci (MPN*/100mL)	*E. coli* (MPN*/100 mL)
204SAU055	Sausal above Whipple Creek outfall	Sausal Creek	53.7	90
204SAU090	Sausal at Leimert Ave.	Sausal Creek	107.1	170
204SAU110	Palo Seco above Sausal	Palo Seco Creek	**172.5**	220
204SAU130	Palo Seco approx 70 m east of Mountain Blvd	Palo Seco Creek	57.1	50
204SAU200	Sausal above Palo Seco	Sausal Creek	68.1	220

*Most Probable Number per 100mL

BOLD font indicates result meets trigger conditions.

Stressor Evaluation

Where applicable, targeted monitoring data were evaluated against numeric Water Quality Objectives or other applicable thresholds described for each parameter to determine whether "trigger" results qualify a site for a potential Stressor/Source Identification monitoring project as described in provision C.8.e of the MRP. The following trigger conditions were identified as the basis for potential SSID projects:

- **Temperature**[4]
    - For Temperature Monitoring data: Two or more weekly average temperatures exceed the Maximum Weekly Average Temperature of 17.0°C for a Steelhead stream, or when 20% of the results at one sampling station exceed the instantaneous maximum of 24°C
    - For Continuous Monitoring data: Maximum Weekly Average Temperature exceeds 17.0°C for a Steelhead stream, or 20 percent of the instantaneous results exceed 24°C
- pH – <6.5 or >8.5 for ≥20% of results
- DO – <7 mg/L for ≥20% of results
- Conductivity - >2000 µS/cm for ≥20% of results
- Pathogen Indicators: Per the MRP, analytical results generated are to be compared against EPA's statistical threshold value (STV) for 36 per 1000 primary contact recreators. The STVs identified by EPA (2012) are 130 MPN/100 mL for enterococci and 410 MPN/ 100 mL for *E. coli*.

Where triggers or potential trigger conditions have been identified in WY 2017 results, ACCWP will work with local stormwater managers to identify appropriate follow-up activities.

[4] The MRP's use of a 17°C trigger criterion may be overly conservative for steelhead in central California. See discussion in 4.2 for more information.

1 Introduction

This report fulfills a portion of the reporting requirements of Provision C.8.h.iii of the Bay Area Municipal Regional Stormwater Permit (MRP[5]) for Creek Status Monitoring data collected pursuant to MRP Provision C.8.d during Water Year (WY) 2017 (October 1, 2016 - September 30, 2017) under a targeted (non-probabilistic) monitoring design. Additional data required by Provision C.8 are reported in other appendices and portions of ACCWP's Urban Creeks Monitoring Report (UCMR), of which this is Appendix A.2.

The RMC was formed in early 2010 as a collaboration among a number of BASMAA members representing all MRP Permittees listed in

[5] The San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) issued the first five-year MRP to 76 cities, counties and flood control districts (i.e., Permittees) in the Bay Area on October 14, 2009 (SFRWQCB 2009) and reissued the permit on November 19, 2015 (MRP2, SFBRWQCB 2015) with an effective date of January 1, 2016. Unless otherwise noted references in this report to the MRP are to the reissued "MRP2"

Table 1-1. The RMC's focus is developing and implementing a regionally coordinated water quality monitoring program to improve stormwater management and address water quality monitoring required by the MRP[6]. Implementation of the RMC's Creek Status and Long-Term Trends Monitoring Plan allowed Permittees and the Water Board to effectively modify their existing creek monitoring programs, and improve their ability to collectively answer core management questions in a cost-effective and scientifically rigorous way. Participation in the RMC is facilitated through the BASMAA Monitoring and Pollutants of Concern Committee (MPC) and its associated RMC Work Group, a subgroup of the MPC that meets and communicates regularly to coordinate planning and implementation of monitoring-related activities. This workgroup includes staff from the SF Bay RWQCB at two levels – those generally engaged with the MRP as well as those working regionally with the State of California's Surface Water Ambient Monitoring Program (SWAMP).

[6] The RMC includes all MRP Permittees as well as the cities of Antioch, Brentwood, and Oakley, which are not named as Permittees under the MRP but have voluntarily elected to participate in MRP-related regional activities. Note that the RMC regional monitoring design was expanded to include the portion of eastern Contra Costa County that drains to the San Francisco Bay in order to assist the CCCWP in fulfilling parallel provisions in their NPDES permit from the Region 5 Central Valley RWQCB.

Table 1-1. Regional Monitoring Coalition Participants.

Stormwater Programs	RMC Participants
Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP)	Cities of Campbell, Cupertino, Los Altos, Milpitas, Monte Sereno, Mountain View, Palo Alto, San Jose, Santa Clara, Saratoga, Sunnyvale, Los Altos Hills, and Los Gatos; Santa Clara Valley Water District; and, Santa Clara County.
Alameda Countywide Clean Water Program (ACCWP)	Cities of Alameda, Albany, Berkeley, Dublin, Emeryville, Fremont, Hayward, Livermore, Newark, Oakland, Piedmont, Pleasanton, San Leandro, and Union City; Alameda County; Alameda County Flood Control and Water Conservation District; and, Zone 7 of the Alameda County Flood Control and Water Conservation District (Zone 7 Water Agency).
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 Countywide 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.

This report includes the standard report content as required by MRP Provision C.8.h.vi and presents the results of the portions of Creek Status Monitoring that were conducted to comply with Provision C.8.d (Table 1-2) using a targeted (non-probabilistic) monitoring design as described in the RMC's Status and Long-Term Trends Monitoring Plan (BASMAA, 2011).

Table 1-2. Creek Status Monitoring and Pesticide/Toxicity Parameters Monitored in Compliance with MRP Provisions C.8.d and g. and the associated design approach and Appendix of the ACCWP UCMR.

Biological Response and Stressor Indicators	MRP Provision	Monitoring Design		Reporting
		Regional Ambient (Probabilistic)	Local (Targeted)	
Bioassessment & Physical Habitat Assessment	C.8.d.i	X		Appendix A.1
Nutrients	C.8.d.i	X		Appendix A.1
Chlorine	C.8.d.ii	X		Appendix A.1
Water Toxicity	C.8.g.i&iii	X		Appendix A.1
Sediment Toxicity	C.8.g.ii	X		Appendix A.1
Sediment Chemistry	C.8.g.ii	X		Appendix A.1
General Water Quality	C.8.d.iv		X	Appendix A.2
Temperature	C.8.d.iii		X	Appendix A.2
Bacteria	C.8.d.v		X	Appendix A.2

The remainder of this report describes the Study Area and Monitoring Design (Section 2), the Monitoring Methods (Section 3), the Results (Section 4), the preliminary Stressor Assessment (Section 5), and the Conclusions & Next Steps (Section 6). More specifically, this report includes the standard report content as required by MRP Provision C.8.h.vi in the respective sections referenced in Table 1-3. Additional details or discussion may also be found in other Appendices or in the main UCMR.

Table 1-3. Index to Standard Report Content per MRP Provision C.8.h.vi.

Report Section	Standard Report Content
2.0	Monitoring purpose and study design rationale
3.0	Sampling protocols and analytical methods
4.1	QA/QC summaries for sample collection and analytical methods
2.1	Sample location descriptions, sample dates, IDs
4..2-4.4	Sample concentrations detected, measurement units, detection limits
4.2-4.4, 5.1-5.3	Data assessment, analysis and interpretation
N/A	List of volunteer and other non-Permittee entities whose data are included in the report
5.1-5.3	Assessment of compliance with applicable water quality standards

2 Study Area & Design

2.1 Regional Monitoring Coalition Area

The RMC area encompasses 3,407 square miles of land in the San Francisco Bay Area. This includes the portions of the five participating counties that fall within the San Francisco Bay RWQCB boundary, as well as the eastern portion of Contra Costa County that drains to the Central Valley region (Figure 2-1). Creek Status monitoring is being conducted in flowing water bodies (i.e., creeks, streams and rivers) interspersed among the RMC area, including perennial and non-perennial creeks and channels that run through both urban and non-urban areas.

2.2 Alameda County Targeted Monitoring Areas

Alameda County occupies 739 square miles (1,914 sq. km) of land area in the East Bay region of the San Francisco Bay Area, and discharges to portions of the Central Bay, South Bay and Lower South Bay. Its population of 1,510,271 (as of April 2010[7]) is densest in the Bay Plain western portion of the County, where the largest cities include Oakland, Fremont, Berkeley and Hayward. The eastern portion of the county includes the cities of Dublin, Livermore and Pleasanton occupying the Livermore-Amador Valley, a portion of the very large and mostly undeveloped Alameda Creek Watershed.

In WY 2017, ACCWP's targeted monitoring focused on the Sausal Creek and Crow Creek watersheds. The Crow Creek watershed is a subwatershed of the San Lorenzo Creek watershed. San Lorenzo Creek Watershed

The overall San Lorenzo Creek Watershed drains approximately 48 square miles (30,000 acres) of land and extends from the San Francisco Bay to the ridge-tops of the East Bay hills (Figure 2-2). The watershed encompasses both urban and non-urban areas, mostly in unincorporated portions of Alameda County. In WY 2017, targeted monitoring was conducted in the Crow Creek subwatershed. Within the San Lorenzo Creek watershed are over 81 linear miles of natural creeks including some segments of Crow Creek spanning both rural and suburban development.

Crow Creek Subwatershed

The upper tributaries of Crow Creek lie in grasslands and oak woodlands. Much of this estimated 11.2 square mile (29.1 km2) square mile watershed is heavily grazed, and also has the most equine facilities of any of the subwatersheds of San Lorenzo Creek. The Unincorporated Alameda County Clean Water Program and the District have worked with the Alameda Resource Conservation District on outreach and inspection for these facilities. Most ownership of creeks is private. In

[7] Census 2016 population estimate for Alameda County is 1,647,704 https://www.census.gov/quickfacts/fact/table/alamedacountycalifornia/PST045216

the lower, suburban reaches of Crow Creek it receives sporadic inputs from Cull Creek, a primarily non-urban watershed that is partially detained in Cull Reservoir just above the confluence. Based on General Water Quality monitoring results in WY 2012, a Stressor-Source Identification (SSID) project was initiated for low Dissolved Oxygen (DO) in Crow Creek during WY2013 (see UCMR Appendix A.4A). Figures 2-3 and 2-4 show the locations of WY 2017 temperature and general water quality monitoring in this subwatershed.

Sausal Creek Watershed

The Sausal Creek watershed begins as a series of ephemeral creeks 1,300 to 1,500 feet above sea level in the Oakland Hills. Its three main tributaries drain the western slope of the East Bay hills and are bounded by Snake Road and Montclair Village to the north, Skyline Boulevard to the east, and Joaquin Miller Road, Lincoln Avenue, and Fruitvale Boulevard to the south. Its natural channels course through Dimond Canyon and Dimond Park and then under Interstate 580. In the Oakland flatlands, culverted sections of the creek channel alternate with open stretches of creek before disappearing into the last culvert at East 22nd Street. The creek emerges from this culvert into the Oakland Estuary at the tidal channel that separates the city and island of Alameda from the mainland.

Palo Seco Creek

Palo Seco Creek is in the least developed of the four sub-basins of the Sausal Creek watershed. The majority of trees here are coastal redwoods and willows with blackberry in the understory. The creek channels for the most part remain open and unculverted. Palo Seco Creek has high quality aquatic habitat due to a great diversity of aquatic insects. A small population of rainbow trout lives in lower Palo Seco Creek.

Sausal Creek

Sausal Creek starts at the confluence of Shephard Creek and Palo Seco Creek, flowing almost straight south until it reaches the Oakland Estuary in San Francisco Bay. It makes its way through 100-foot deep Dimond Canyon, lined with California bay laurels, oaks, willows, and many native and invasive plant species. Above the Leimert Bridge, the creek is marred by grade control structures, culverts, and cement linings. Below the bridge is a restoration site where grade control structures were removed and thousands of native plants replaced invasive non-natives. At El Centro Avenue, the creek flows through a culvert into Dimond Park. In the Oakland flatlands, culverted sections alternate with open stretches of creek before disappearing into the final culvert at East 22nd Street.

Table 2-1 shows the Beneficial Uses assigned to these creeks in the Basin Plan (SFBRWQCB 2015b).

Watersheds were chosen considering accessibility of creek and channels, in conjunction with management issues and stakeholder concerns as described in the sections below.

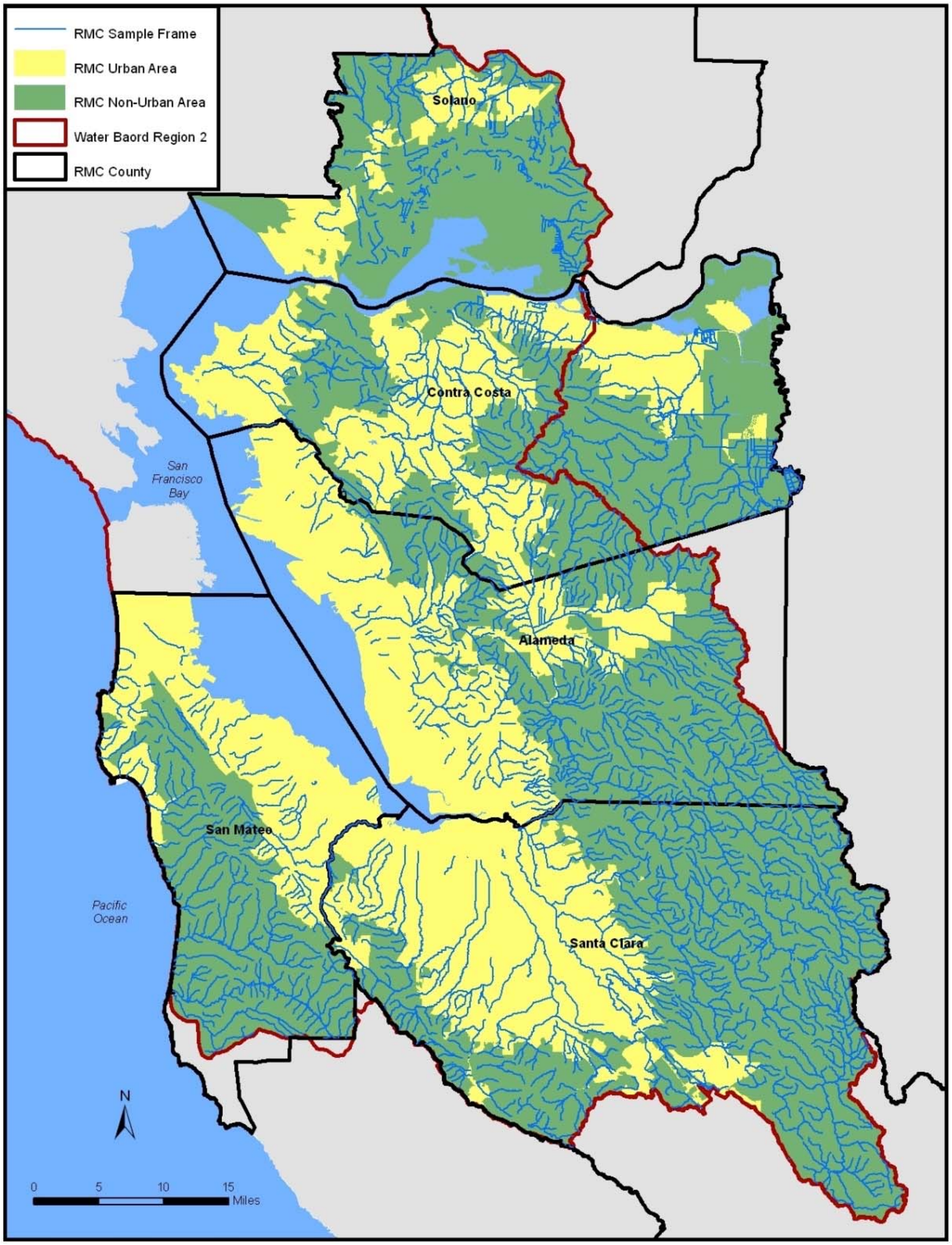

Figure 2-1. Map of BASMAA RMC Area and Major Creeks.

San Lorenzo Creek Watershed

The overall San Lorenzo Creek Watershed drains approximately 48 square miles (30,000 acres) of land and extends from the San Francisco Bay to the ridge-tops of the East Bay hills (Figure 2-2). The watershed encompasses both urban and non-urban areas, mostly in unincorporated portions of Alameda County. In WY 2017, targeted monitoring was conducted in the Crow Creek subwatershed. Within the San Lorenzo Creek watershed are over 81 linear miles of natural creeks including some segments of Crow Creek spanning both rural and suburban development.

Crow Creek Subwatershed

The upper tributaries of Crow Creek lie in grasslands and oak woodlands. Much of this estimated 11.2 square mile (29.1 km^2) square mile watershed is heavily grazed, and also has the most equine facilities of any of the subwatersheds of San Lorenzo Creek. The Unincorporated Alameda County Clean Water Program and the District have worked with the Alameda Resource Conservation District on outreach and inspection for these facilities. Most ownership of creeks is private. In the lower, suburban reaches of Crow Creek it receives sporadic inputs from Cull Creek, a primarily non-urban watershed that is partially detained in Cull Reservoir just above the confluence. Based on General Water Quality monitoring results in WY 2012, a Stressor-Source Identification (SSID) project was initiated for low Dissolved Oxygen (DO) in Crow Creek during WY2013 (see UCMR Appendix A.4A). Figures 2-3 and 2-4 show the locations of WY 2017 temperature and general water quality monitoring in this subwatershed.

Sausal Creek Watershed

The Sausal Creek watershed begins as a series of ephemeral creeks 1,300 to 1,500 feet above sea level in the Oakland Hills. Its three main tributaries drain the western slope of the East Bay hills and are bounded by Snake Road and Montclair Village to the north, Skyline Boulevard to the east, and Joaquin Miller Road, Lincoln Avenue, and Fruitvale Boulevard to the south. Its natural channels course through Dimond Canyon and Dimond Park and then under Interstate 580. In the Oakland flatlands, culverted sections of the creek channel alternate with open stretches of creek before disappearing into the last culvert at East 22nd Street. The creek emerges from this culvert into the Oakland Estuary at the tidal channel that separates the city and island of Alameda from the mainland.

Palo Seco Creek

Palo Seco Creek is in the least developed of the four sub-basins of the Sausal Creek watershed. The majority of trees here are coastal redwoods and willows with blackberry in the understory. The creek channels for the most part remain open and unculverted. Palo Seco Creek has high quality aquatic habitat due to a great diversity of aquatic insects. A small population of rainbow trout lives in lower Palo Seco Creek.

Sausal Creek

Sausal Creek starts at the confluence of Shephard Creek and Palo Seco Creek, flowing almost straight south until it reaches the Oakland Estuary in San Francisco Bay. It makes its way through 100-foot deep Dimond Canyon, lined with California bay laurels, oaks, willows, and many native and invasive plant species. Above the Leimert Bridge, the creek is marred by grade control structures, culverts, and cement linings. Below the bridge is a restoration site where grade control structures were removed and thousands of native plants replaced invasive non-natives. At El Centro Avenue, the creek flows through a culvert into Dimond Park. In the Oakland flatlands, culverted sections alternate with open stretches of creek before disappearing into the final culvert at East 22nd Street.

Table 2-1. Selected Beneficial Uses Assigned to the Watersheds/Subwatersheds Monitored in Water Year 2017.

Creek	COLD	MIGR	WARM	WILD	REC-1, REC2
Crow Creek (San Lorenzo Creek)	X	X	X	X	X
Sausal Creek	X	X	X	X	X

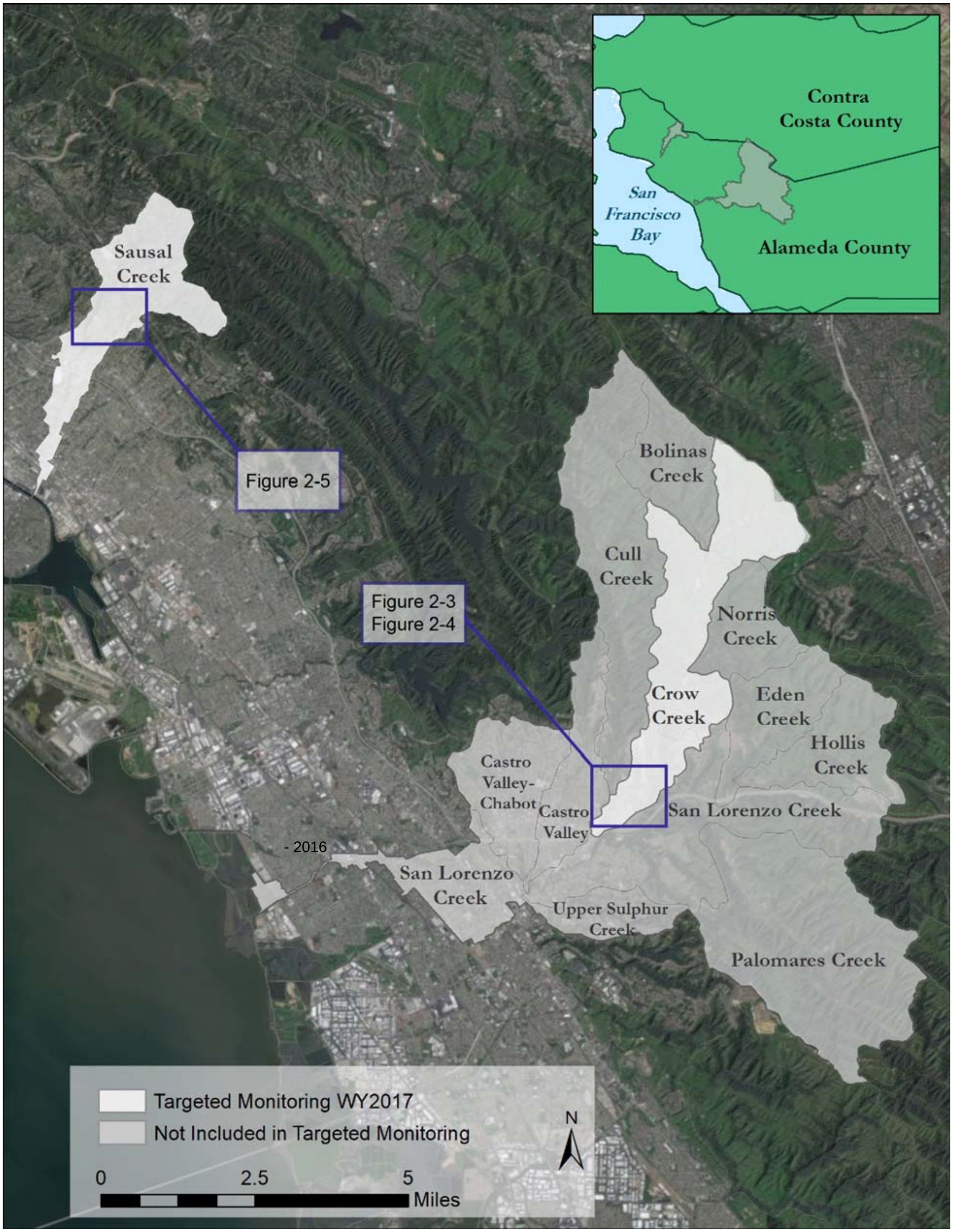

Figure 2-2. Map of the Sausal Creek Watershed and San Lorenzo Creek Watershed and its Major Subwatersheds, showing locations of Figures 2-3, 2-4 and 2-5.

2.3 Targeted Monitoring Design

In the targeted monitoring program design, site locations were identified based on the directed principle[8] to address the following management questions:

1) *What is the range of general water quality measurements at targeted sites of interest?*
2) *Do general water quality measurements indicate potential impacts to aquatic life?*
3) *What are the pathogen indicator concentrations at creek sites where water contact recreation may occur?*
4) *What are the overall physical and/or ecological conditions of creek reaches and specific point impacts within each reach?*

Table 2-2 summarizes ACCWP targeted monitoring conducted during WY 2017 including:

- Eight Continuous Water Temperature monitoring locations[9] shown in Figure 2-3;
- Three General Water Quality monitoring locations shown in Figure 2-4;
- Five Pathogen Indicator monitoring locations shown in Figure 2-5;[10]

[8]The Directed Monitoring Design Principle is a deterministic approach in which points are selected deliberately based on knowledge of their attributes of interest as related to the environmental site being monitored. This principle is also known as “judgmental” “authoritative” “targeted” or “knowledge-based”.

[9] One more site than the required 8 was monitored to account for potential loss or creek drying out. Concurrent measurements of conductivity at 5 of these sites are reported in UCMR Appendix A.4C.

[10] Includes initial tests plus follow-up.

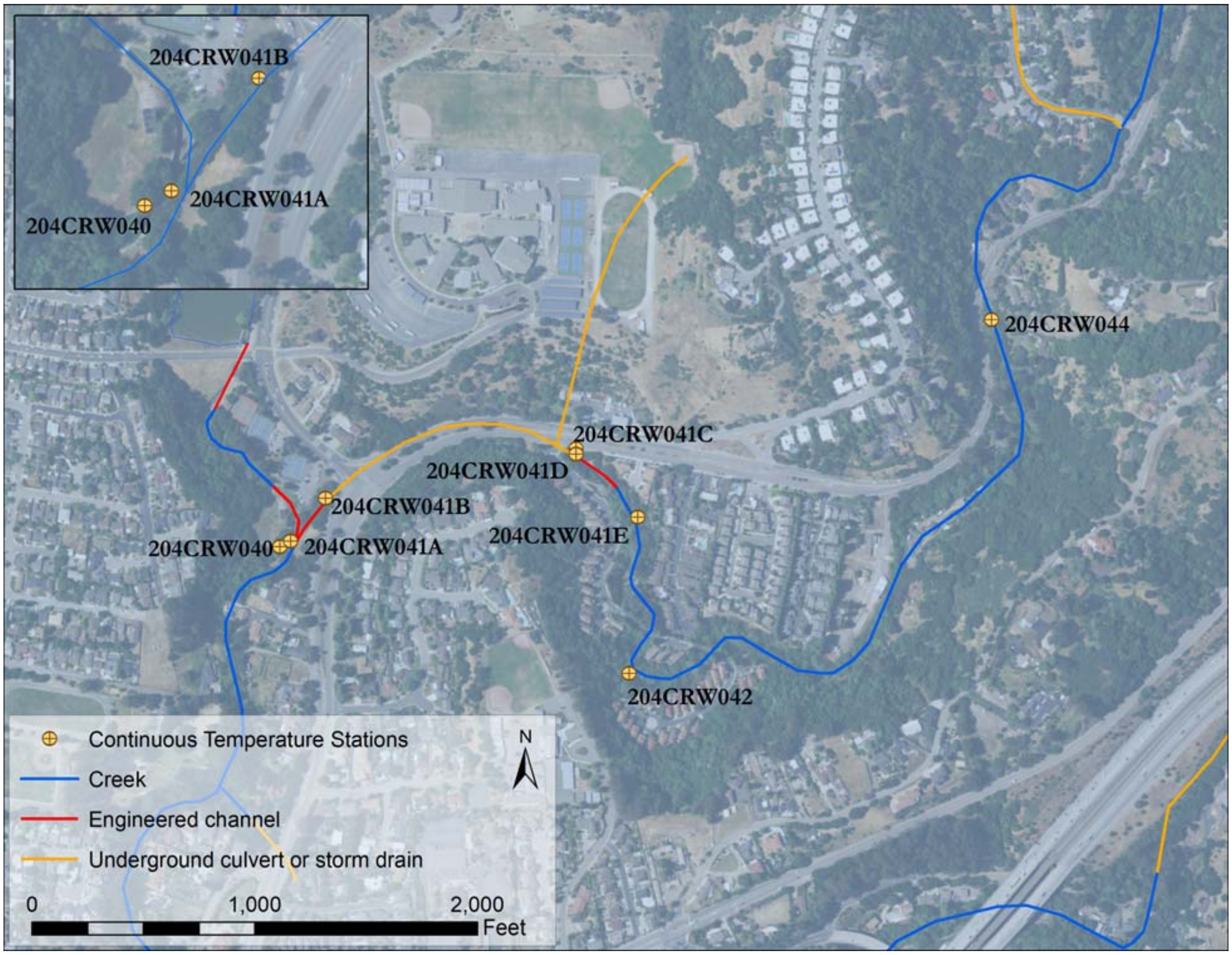

Figure 2-3. Temperature Monitoring Locations, Crow Creek, WY 2017.

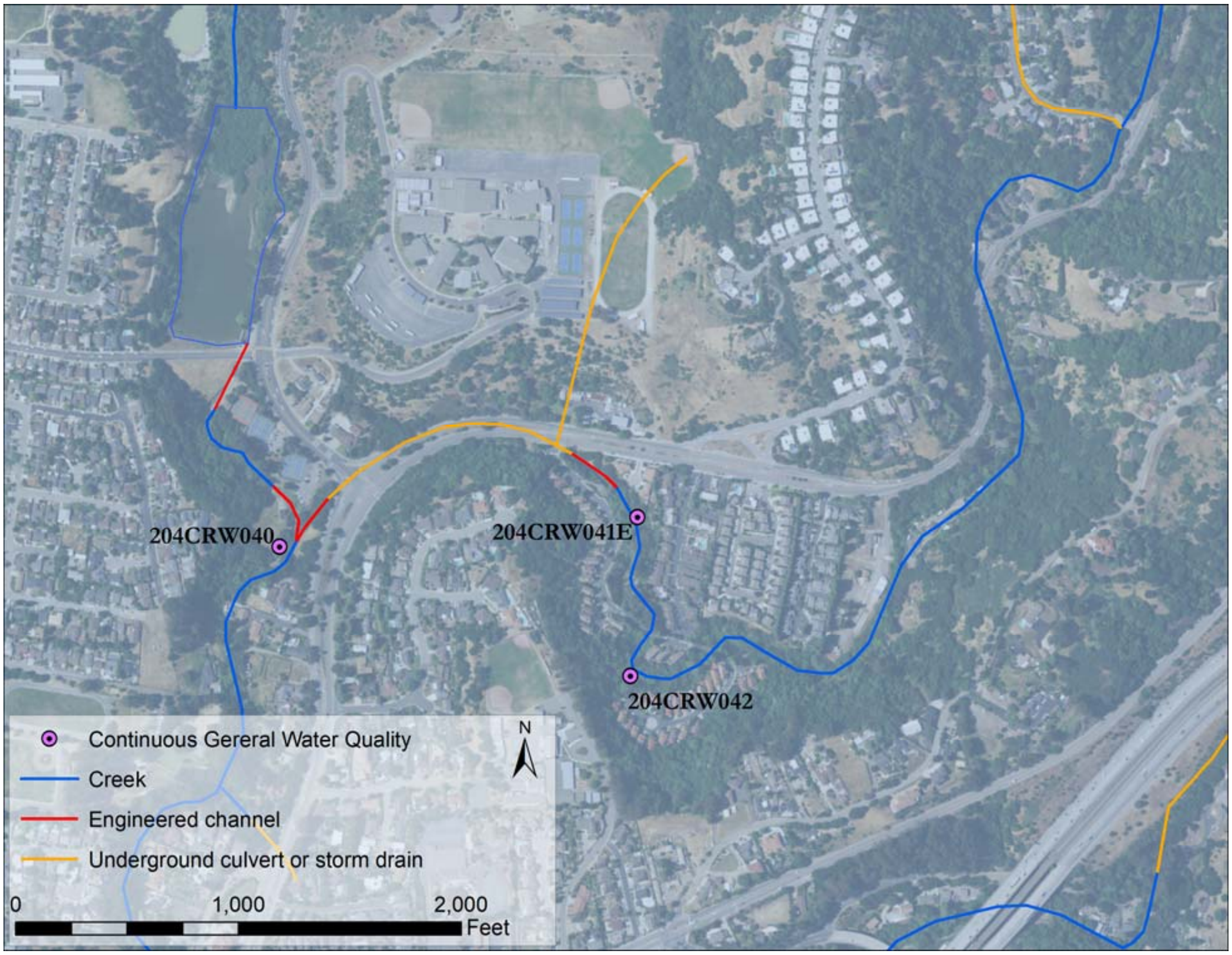

Figure 2-4. General Water Quality Monitoring Locations, Crow Creek, WY 2017.

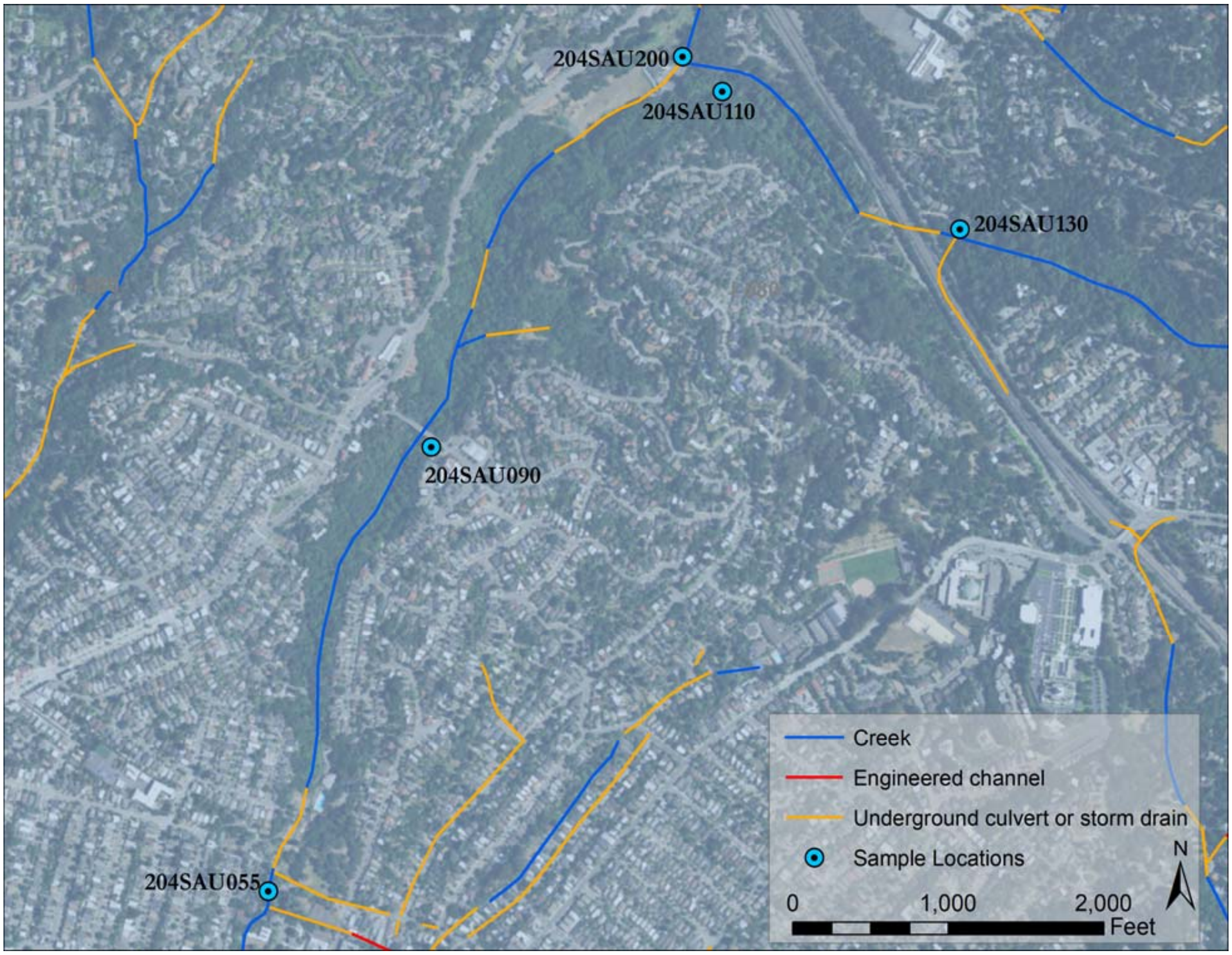

Figure 2-5. Pathogen Indicator Sampling Locations, Sausal Creek, WY 2017.

Table 2-2. Summary of Targeted Monitoring Locations and Parameters for Water Year 2017 in Alameda County

Site Characteristics					Parameters		
Creek/Sub-watershed	**Site Code (RMC No)**	**Site Description**	**Latitude**	**Longitude**	**Pathogen Indicators**	**Water Temperature (continuous)**	**General Water Quality**
Crow Creek	204CRW040	Crow Creek, concrete channel segment below confluence with Cull	37.70143	-122.05467		X	Spring, Summer-Fall
Crow Creek	204CRW041A	Crow Creek, above outfall in eastern side of box culvert	37.70150	-122.05451		X	
Crow Creek	204CRW041B	Crow Creek, downstream end of box culvert under Crow Canyon Rd.	37.70204	-122.05398		X	
Crow Creek	204CRW041C	Crow Creek, upstream end of box culvert under Crow Canyon Rd., downstream of 48” outfall	37.70272	-122.05010		X	
Crow Creek	204CRW041D	Crow Creek, upstream end of box culvert under Crow Canyon Rd., upstream of 48” outfall	37.70265	-122.05010		X	
Crow Creek	204CRW041E	Crow Creek, upstream of box culvert	37.70189	-122.04912		X	Spring, Midsummer, Summer-Fall
Crow Creek	204CRW042	Crow Creek at Crow Creek HOA property	37.69996	-122.04920		X	Spring, Midsummer, Summer-Fall
Crow Creek	204CRW044	Crow Creek East of culvert under Crow Canyon Rd.	37.70442	-122.04369		X	
Sausal Creek	204SAU055	Sausal above Whipple Creek outfall	37.80357	-122.21658	X		
Sausal Creek	204SAU090	Sausal at Leimert Ave.	37.81195	-122.21363	X		
Palo Seco Creek	204SAU110	Palo Seco above Sausal	37.81888	-122.20754	X		
Palo Seco Creek	204SAU130	Palo Seco approx 70 m east of Mountain Blvd	37.81572	-122.20127	X		
Sausal Creek	204SAU200	Sausal above Palo Seco	37.81900	-122.20760	X		

Criteria for Site Selection

All target sampling sites were selected by the ACCWP Monitoring Program Coordinator, in coordination with others as described below. Specific considerations applied to selection of locations for the different parameters as described below:

Continuous Temperature

Each monitoring year, a minimum of eight continuous water quality monitoring locations are chosen based on a combination of criteria. In general, a predominant criterion is that the streams have COLD beneficial use designation for which these parameters are important indicators.

For WY 2017, ACCWP chose sites on Crow Creek to support the ongoing SSID study, and also deployed sensors capable of collecting electrical conductivity data as well as temperature data at seven of the eight temperature stations (for study design and discussion of results see Appendix A.4C to the main UCMR).

Sampling sites were adjusted in the field in order to deploy continuous monitoring equipment at locations where (1) water level was expected to be of sufficient depth to cover loggers over the course of the entire dry season, and (2) avoid highly trafficked areas.

General Water Quality

The goal of site selection for the three general water quality monitoring locations was to support the SSID follow-up by characterizing summertime DO conditions within a smaller target area for portions of the main stem above and below tributary or storm drain inputs.

Pathogen Indicators

In WY 2017, five pathogen indicator sampling sites were distributed along an approximately 2.6 km segment of Sausal Creek and a tributary, Palo Seco Creek. Sausal Creek is an urban watershed and multiple reaches have public access.

3 Monitoring Methods

This section provides a brief overview of methods employed to measure each parameter in the targeted monitoring design. Greater detail on each method is included in the referenced SOPs.

3.1 Data Collection Methods

Field data were collected in accordance with SWAMP-comparable methods and procedures described in the BASMAA RMC Quality Assurance Project Plan (QAPP) (BASMAA 2016a) and Standard Operating Procedures (SOP) (BASMAA 2016b), updated in 2013 from the earlier 2012 versions to reflect lessons learned through 2012 implementation; these revisions also incorporated updated data Quality Assurance procedures consistent with added data checking functions of the RMC database to supplement the tools available from SWAMP[11]. The SOPs relevant to the monitoring discussed in this report are listed in Table 3-1.

Table 3-1: Standard Operating Procedures for BASMAA RMC Monitoring at Targeted Sites.

SOP #	SOP Title
FS-1	BMI and Algae Bioassessments, and Physical Habitat Measurements
FS-2	Water Quality Sampling for Chemical Analysis, Pathogen Indicators, and Toxicity
FS-3	Field Measurements, Manual
FS-4	Field Measurements, Continuous General Water Quality
FS-5	Temperature, Automated, Digital Logger
FS-7	Field Equipment Cleaning Procedures
FS-8	Field Equipment Decontamination Procedures
FS-9	Sample Container, Handling, and Chain of Custody Procedures
FS-10	Completion and Processing of Field Datasheets
FS-11	Site and Sample Naming Convention
FS-12	Ambient Creek Status Monitoring Site Evaluation
FS-13	QA/QC Data Review

Continuous Temperature Monitoring

All sampling conformed to protocols identified in the RMC QAPP and SOPs (Table 3-1). Field crews deployed digital temperature loggers in April at nine sites as shown in Table 3-2. Temperature loggers were programmed to record temperature data at sixty-minute intervals.

AMS personnel conducted a mid-term maintenance of deployed temperature probes on June 16th and July 28th, 2017.

[11] See http://waterboards.ca.gov/water_issues/programs/swamp/data_management_resources/index.shtml

Table 3-2. Water Year 2017 Continuous Water Temperature Monitoring at Alameda County Targeted Monitoring Locations.

Site Code (RMC No)	Site Name / Location	Latitude	Longitude	Install Date	Mid-term Re-install	Removal Date
204CRW040	Crow Creek, concrete channel segment below confluence with Cull	37.70143	-122.05467	April 28	June 16/ July 28	October 11
204CRW041A	Crow Creek, above outfall in eastern side of box culvert	37.70150	-122.05451	April 28	June 16/ July 28	October 11
204CRW041B	Crow Creek, downstream end of box culvert under Crow Canyon Rd.	37.70204	-122.05398	April 28	June 16/ July 28	October 11
204CRW041C	Crow Creek, upstream end of box culvert under Crow Canyon Rd., downstream of 48" outfall	37.70272	-122.05010	April 28	June 16/ July 28	October 11
204CRW041D	Crow Creek, upstream end of box culvert under Crow Canyon Rd., upstream of 48" outfall	37.70265	-122.05010	April 28	June 16/ July 28	October 11
204CRW041E	Crow Creek, upstream of box culvert	37.70189	-122.04912	April 28	June 16/ July 28	October 11
204CRW042	Crow Creek at Crow Creek HOA	37.69996	-122.04920	April 28	June 16/ July 28	October 11
204CRW044	Crow Creek East of culvert under Crow Canyon Rd.	37.70442	-122.04369	April 28	June 16/ July 28	October 11

General Water Quality Measurements

General water quality monitoring included continuous measurements for temperature, DO, pH and specific conductivity for deployment at three sites. Parameters were measured for a period of between one and two weeks twice per year, once during the spring index period for bioassessment sampling and again during the August – September timeframe (

). For purposes of the SSID study design (see Appendix A.4C of the UCMR) an additional deployment period was implemented at two sites in midsummer. All sampling conformed to protocols identified in the RMC QAPP and SOPs.

Automated monitoring equipment (YSI 6600 Sonde) was deployed with the data recorded automatically at fifteen-minute intervals.

Table 3-3. General Water Quality Monitoring at Alameda County Targeted Monitoring Locations, WY 2017.

Site Code (RMC No)	Description	Deployment	Latitude	Longitude	Dates
204CRW040	Crow Creek, concrete channel segment below confluence with Cull	Spring	37.70143	-122.05467	5/5/17 to 5/15/17
		Summer-Fall	37.70143	-122.05467	9/8/17 to 9/19/17
204CRW041E	Crow Creek, upstream of box culvert	Spring	37.70189	-122.04912	4/17/17 to 4/27/17
		Midsummer	37.70189	-122.04912	6/30/17 to 7/12/17
		Summer-Fall	37.70189	-122.04912	8/25/17 to 9/8/17
204CRW042	Crow Creek at Crow Creek HOA property	Spring	37.69993	-122.04918	4/17/17 to 4/27/17
		Midsummer	37.69993	-122.04918	6/30/17 to 7/12/17
		Summer-Fall	37.69993	-122.04918	8/25/17 to 9/8/17

Pathogen Indicators Sampling

Single samples were collected for pathogen indicator enumeration in accordance with the requirements of provision C.8.d.v of the permit. Field crews conducted pathogen indicator sampling using the RMC SOPs (Table 3-1). Sampling techniques included direct filling of containers, and immediate transfer of samples to analytical laboratories within specified holding time requirements.

Field crews collected water samples for analysis of *Escherichia coli* (*E. coli*) and Enterococci at five sites on July 24, 2017 (Table 3-4).

Table 3-4. Pathogen Indicator Monitoring at Alameda County Targeted Monitoring Locations, July 24, 2017.

Site Code	Description	Latitude	Longitude
204SAU055	Sausal above Whipple Creek outfall	37.80357	-122.21658
204SAU090	Sausal at Leimert Ave.	37.81195	-122.21363
204SAU110	Palo Seco above Sausal	37.81888	-122.20754
204SAU130	Palo Seco approx 70 m east of Mountain Blvd	37.81572	-122.20127
204SAU200	Sausal above Palo Seco	37.81900	-122.20760

Quality Assurance/Quality Control

Data quality assessment and quality control procedures are described in detail in the BASMAA RMC QAPP (BASMAA 2016a). Data Quality Objectives (DQOs) were established to ensure that data collected are of adequate quality and sufficient for the intended uses. DQOs address both quantitative and qualitative assessment of the acceptability of data. The qualitative goals include representativeness and comparability. The quantitative goals include specifications for completeness, sensitivity (detection and quantization limits), precision, accuracy, and contamination. To ensure consistent and comparable field techniques, pre-survey field training and *in-situ* field assessments were conducted. Data were collected according to the procedures described in the relevant SOPs, including appropriate documentation of data sheets and samples, and sample handling and custody. Laboratories providing analytical support to the RMC were selected based on demonstrated capability to adhere to specified protocols.

3.2 Data Quality Assessment Procedures

Following completion of the field and laboratory work, the field data sheets and laboratory reports were reviewed by the Local Monitoring Coordinator or Quality Assurance Officer, and compared both against the methods and protocols specified in the SOPs and QAPP. The findings and results then were evaluated against the relevant DQOs to provide the basis for an assessment of programmatic data quality. The data quality assessment included the following elements:

- Conformance with field and laboratory methods as specified in SOPs and QAPP, including sample collection and analytical methods, sample preservation, sample holding times, etc.;
- Numbers of measurements/samples/analyses completed vs. planned, and identification of reasons for any missed samples;
- Results of duplicate analyses based on calculation of relative percent differences (precision results);
- Results of field blanks associated with filtered samples (bias results);
- Results of spiked sample analyses based on spike percent recovery (accuracy results); and

- Identification of any contamination issues based on analyses of lab blanks and field blanks.

3.3 Data Analysis and Interpretation

Continuous temperature (C.8.d.iii) and General Water Quality (C.8.d.iv) data from each deployment were graphed for each site. As specified in MRP Provision C.8.d.iii, Maximum Weekly Average Temperatures (MWATs) were calculated throughout the deployment from all data recorded for each seven-day, non-overlapping deployment period. For General Water Quality parameters the frequency of measurements was higher (15 minutes for General Water Quality vs. one hour for continuous temperature) and most analyses focused on comparing all available instantaneous values from a deployment to specified thresholds. By using the non-overlapping data averaging technique specified in the MRP, the number of weekly averages for General Water Quality temperature measurements was limited to a maximum of two for a one- to two-week deployment. Where these deployments extended for longer than a week, the weekly average for the 2nd week was calculated from data available for the subset of the week beginning after the initial seven-day calculation period.

Targeted monitoring data were evaluated against Water Quality Objectives (WQO) or other applicable thresholds, as described in Section 5, to determine whether results may “trigger” a site for a candidate stressor/source identification monitoring project (per MRP Provisions C.8.d.iii and C.8.d.iv).

4 Results

This section presents monitoring results based on each program component. Each section addresses the study question:

> *What are the ranges of general water quality, continuous water temperature, pathogen indicators, and stream ecosystem conditions at locations sampled in the Program area?*

4.1 Statement of Data Quality

The RMC established a set of guidance and tools to help ensure data quality and consistency implemented through collaborating Programs. Additionally, the RMC participants continue to meet and coordinate in an ongoing basis to plan and coordinate monitoring, data management, and reporting activities, among others.

A comprehensive QA/QC program was implemented by each of the RMC Programs, which is solely responsible for the quality of the data submitted on its behalf, covering all aspects of the regional/probabilistic monitoring. In general, QA/QC procedures were implemented as specified in the RMC QAPP (BASMAA, 2016a), and monitoring was performed according to protocols specified in the RMC SOPs (BASMAA, 2016b), and in conformity with SWAMP protocols.

Details of the results of evaluations of laboratory-generated QA/QC results are included elsewhere in the ACCWP UCMR and other appendices if applicable. Issues noted by the laboratories and/or RMC field crews are summarized below.

4.1.1 Continuous Temperature

In general, continuous hourly temperature and conductivity monitoring sites exhibited fairly smooth, predictable curves, suggesting few quality assurance concerns or perturbations to the system. There are, however, a few exceptions:

- Site 204CRW040 exhibited an unexplained spike in conductivity on July 25, 2017 at 23:00 and an unexplained dip in conductivity on July 26, 2017 at 16:00; the latter of these short-term changes is also associated with a short-term spike in water temperature. For each of these measurements, conductivity measurements regained consistent magnitude within one hour of the datapoint in question.

- The HOBO unit deployed at site 204CRW040 became partially buried in sediment sometime between a maintenance check conducted on July 28, 2017 and retrieval on October 11, 2017. Beginning at approximately noon on August 26, 2017, the conductivity measurements at 204CRW040 experience a rapid decline to near 0 ms/cm^2, which indicates the likely timing for burial. As we are unable to post-correct conductivity data using standard methods prescribed by the instrument manufacturer for the period after July 28, all conductivity data collected after the maintenance visit has been rejected. Temperature data, however, does not appear to be affected in the same manner. Temperature measurements remain fairly consistent and follow the same curve as the other sites monitored on Crow Creek. For this reason, the temperature data collected during the period in question beginning on August 26, 2017 is qualified, but not rejected.

- Temperature measurements across stations typically exhibit a similar pattern over the deployment period. Temperature measurements recorded at station CRW041B, at the downstream end of the box culvert under Crow Canyon Rd, appear to decrease concurrent with increasing water temperatures recorded at upstream locations beginning approximately September 1, 2017. There does not appear to be a QA concern with temperature monitoring equipment that could explain these differences, therefore no data were qualified or rejected.

- Immediately following a maintenance visit on June 16, 2017, conductivity measurements at site 204CRW041C exhibited a marked decline that extended until approximately 4:00 am on June 28, 2017. These data are not supported by similar changes in measurements at upstream of downstream stations and do not appear indicative of a perturbation to the system from an intermediate input and are therefore believed to be erroneous. AMS qualified affected data within this range with the “FIF” flag, indicating instrument failure. Temperature data appear unaffected.

4.1.2 Continuous Water Quality

For all deployment periods, Sondes achieved all associated data quality checks, including pre-deployment calibration and post-deployment drift checks. It should be noted, however, that there are short-lived decreases in conductivity associated with rainfall events occurring on April 17th, 20th, and 25th during concurrent deployments at Spring sites 204CRW041E and 204CRW040.

4.1.3 Fecal Indicator Bacteria

There were no issues identified associated with fecal indicator bacteria analyses.

4.2 Continuous Water Temperature Monitoring

Data were collected over an approximately six-month period from the end of April through October 2017 with measurements recorded at 60-minute intervals at the eight sites.

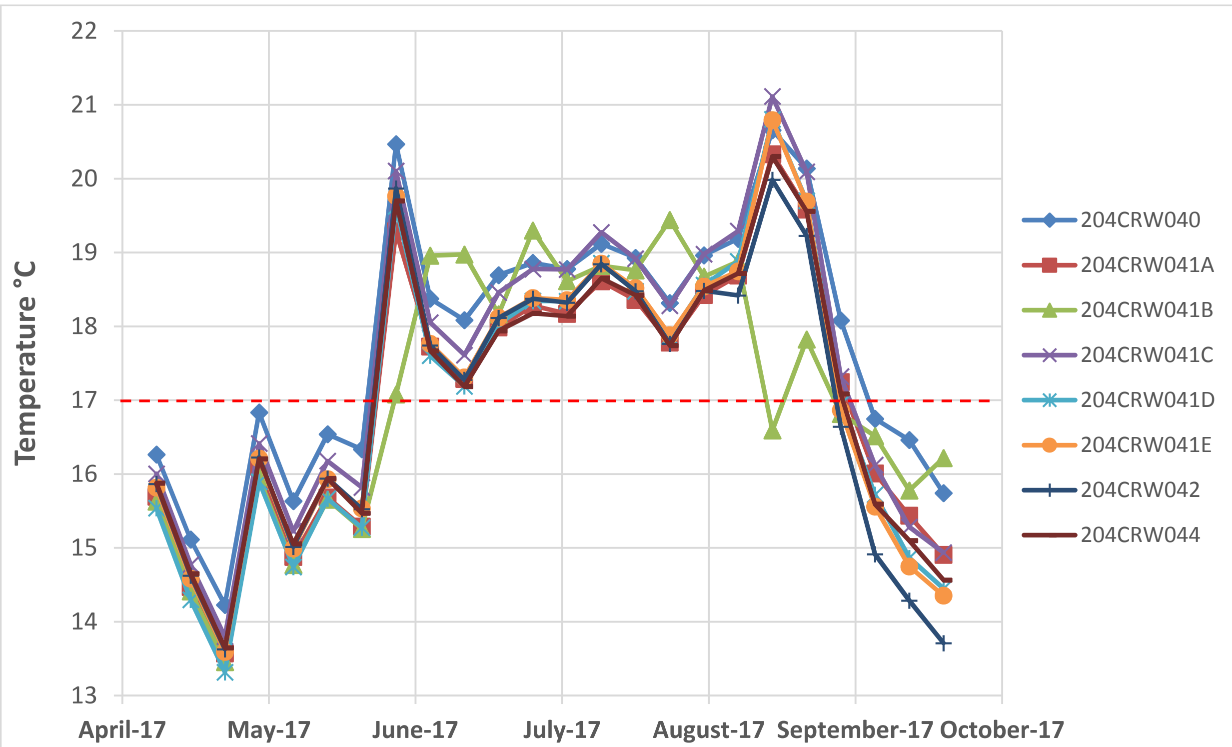

Figure 4-1 presents the results of the continuous monitoring results for WY 2017, and box plots[12] of the temperature data are shown in

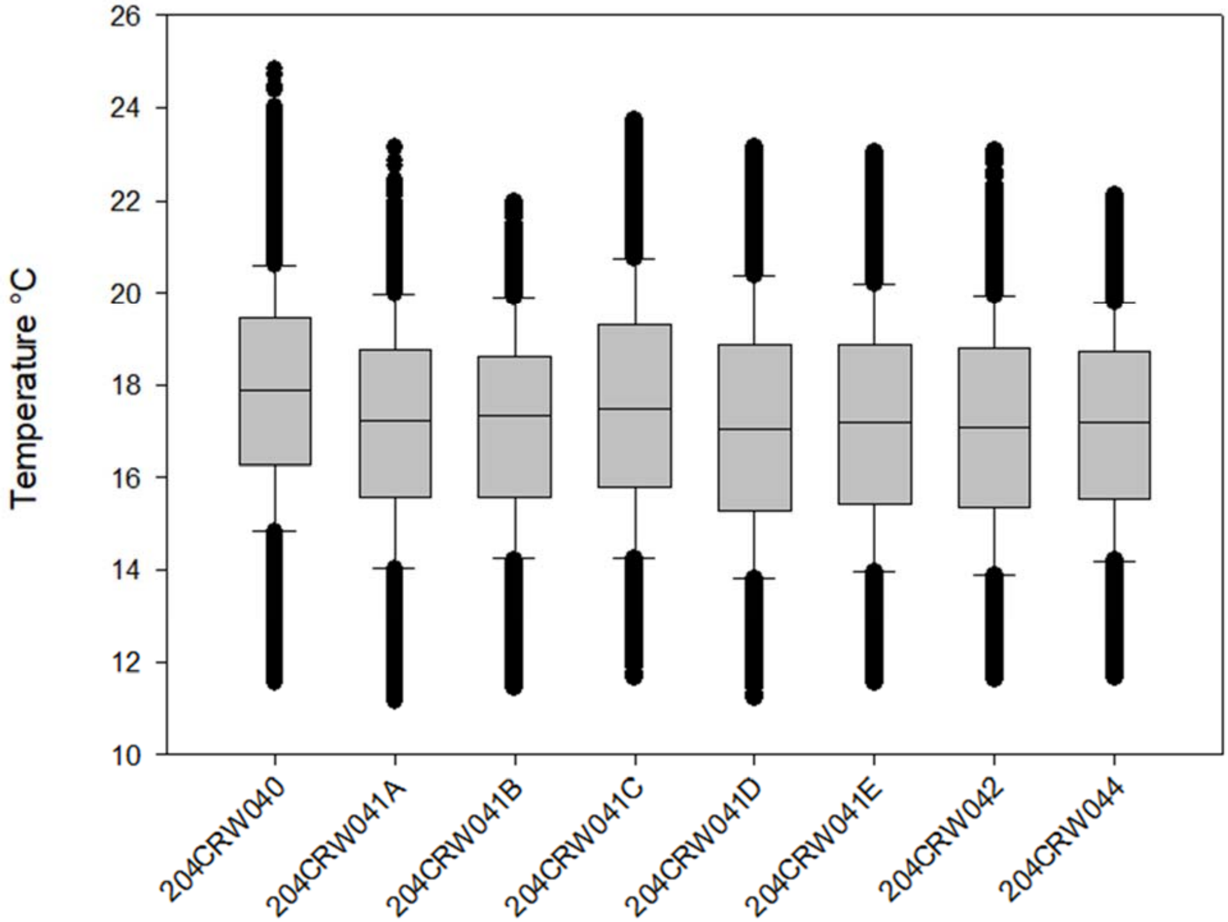

Figure 4-2.

[12] A box plot splits the data set into quartiles. The body of the plot consists of a "box", which goes from the first quartile to the third quartile. Within the box, a vertical line is drawn at the median of the data set. Two horizontal lines, called whiskers, extend from the front and back of the box. The front whisker goes from the first quartile to the smallest non-outlier in the data set, and the back whisker goes from the third quartile to the largest non-outlier. If the data set includes one or more outliers, they are plotted separately as points.

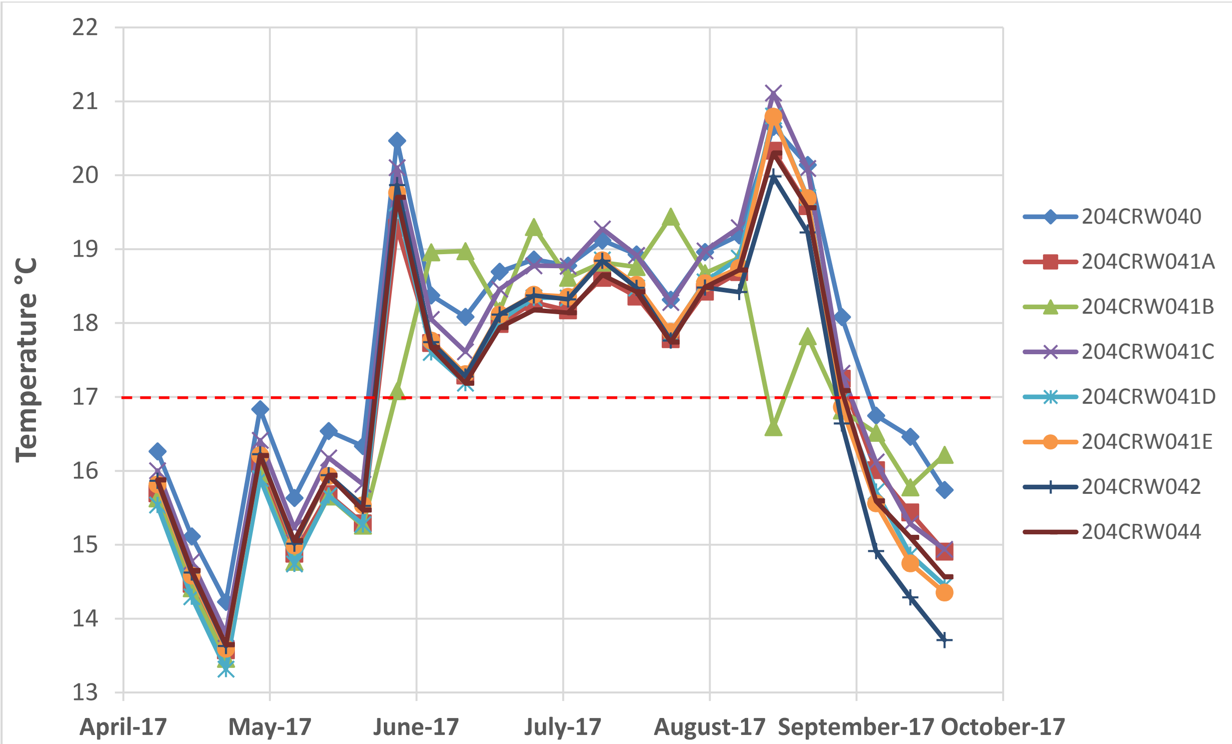

Figure 4-1. Temperature (Discrete 7-Day Average) Line Graph at Crow Creek Sites, April 28 through October 10, 2017.

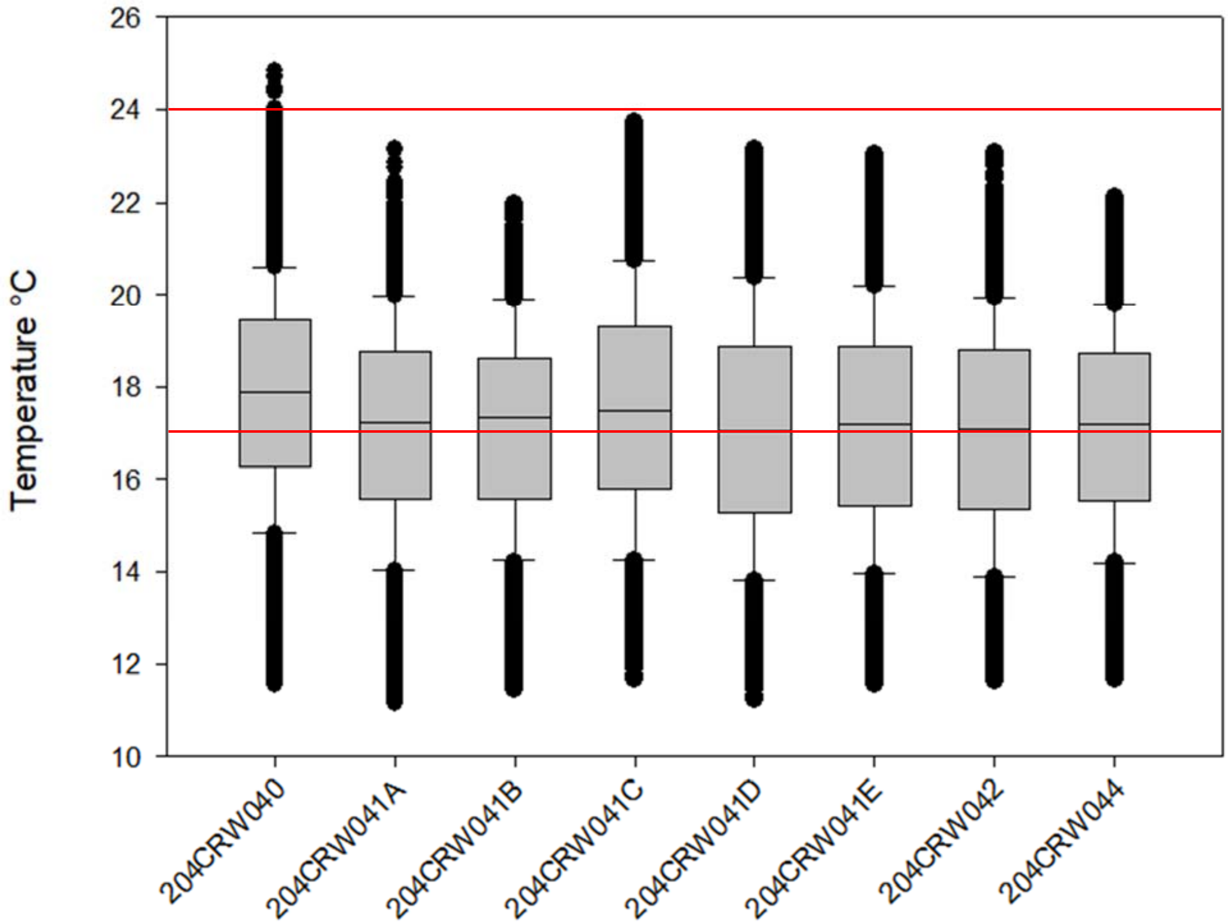

Figure 4-2. Temperature Box Plot at Sites, April 28 through October 10, 2017. 17°C & 24°C thresholds are illustrated with red lines.

Summary 2017 statistics are presented for temperature monitoring data from Crow Creek in

Table 4-1. The highest temperature was recorded at 204CRW040 on June 22. The lowest temperature was recorded at site 204CRW041A on May 13. Average temperatures ranged from 17.0°C to 17.8°C.

Table 4-1. Summary of Continuous Temperature Data Statistics from WY 2017 at Crow Creek Sampling Locations.

Station	Mean	St. Dev	Min	Max	Range
204CRW040	17.8	2.2	11.6	24.8	13.3
204CRW041A	17.1	2.2	11.2	23.2	12.0
204CRW041B	17.1	2.1	11.4	22.0	10.5
204CRW041C	17.5	2.4	11.7	23.7	12.1
204CRW041D	17.1	2.4	11.2	23.2	11.9
204CRW041E	17.2	2.3	11.5	23.0	11.5
204CRW042	17.0	2.2	11.6	23.1	11.5
204CRW044	17.1	2.1	11.7	22.1	10.5

Table 4-2 shows the number of exceedances of Maximum Weekly Average Temperatures (MWATs) compared to the threshold of 17°C. All sites had at least 2 MWATs greater than 17°C. Table 4-3 shows percent exceedance of the 24°C temperature threshold for each continuous monitoring site. The trigger of 20% exceedance of this threshold was not met at any of the sites.

Sullivan et al. (2000) is referenced in C.8.d.iii (4) of the MRP as a potential source for applicable thresholds to use for evaluating water temperature data for creeks that have salmonid fish communities, and illustrates the risk-based approach to evaluating temperature effects on salmonid communities in terms of relative reductions in growth at temperatures other than optimum. However, that study established its MWAT thresholds using data from salmonid populations in the Pacific Northwest and is likely overly conservative for steelhead in central California. Since fish growth is a function of both temperature and available food, optimum temperature and the incremental effect of temperature shifts on growth are ration-dependent and affected by other ecosystem factors, (for example see reviews in Myrick and Cech, 2001 and Atkinson et al., 2011). Streams in the Bay Area and Central California in general tend to be higher-nutrient systems than the glacially-derived geology of the Pacific Northwest, and can thus deliver the larger food supplies to support salmonid growth at warmer temperatures.

Table 4-2. Comparison of 2017 Continuous Temperature Maximum Weekly Average Temperature Measurements with 17°C Temperature Threshold at Crow Creek Sampling Locations in WY 2017. Bold values indicate two or more MWATs above the temperature trigger criterion.

Station	Site Description	# Weeks Deployed[1]	MWAT > 17º C	
			# Weeks	% Weeks
204CRW040	Crow Creek, concrete channel segment below confluence with Cull	24	**14**	58%
204CRW041A	Crow Creek, above outfall in eastern side of box culvert	24	**14**	58%
204CRW041B	Crow Creek, downstream end of box culvert under Cull Canyon Rd.	24	**12**	50%
204CRW041C	Crow Creek, upstream end of box culvert under Cull Canyon Rd., downstream of 48" outfall	24	**14**	58%
204CRW041D	Crow Creek, upstream end of box culvert under Cull Canyon Rd., upstream of 48" outfall	24	**13**	54%
204CRW041E	Crow Creek, upstream of box culvert	24	**13**	54%
204CRW042	Crow Creek at Crow Creek HOA property	24	**13**	54%
204CRW044	Crow Creek East of culvert under Crow Canyon Rd.	24	**14**	58%

[1]Full or partial weeks

Table 4-3. Comparison of 2017 Continuous Temperature Records with 24°C Temperature Threshold at Crow Creek Sampling Locations.

Station	Number of Hourly Records	Mean Temp (˚C)	Number of readings > 24°C	% of readings > 24°C
204CRW040	3969	17.8	9	0.2%
204CRW041A	3969	17.1	0	0%
204CRW041B	3969	17.1	0	0%
204CRW041C	3969	17.5	0	0%
204CRW041D	3969	17.1	0	0%
204CRW041E	3969	17.2	0	0%
204CRW042	3969	17.0	0	0%
204CRW044	3969	17.1	0	0%

4.3 General Water Quality Measurement

General water quality measurements of temperature, DO, pH and specific conductivity were taken at locations during three periods: spring (April/May), midsummer (June/July), and late summer to fall (August/September). In WY 2017, these data were collected from 3 sites (see Table 3-3):

- 204CRW040 – Crow Creek, concrete channel segment below confluence with Cull; and
- 204CRW041E – Crow Creek, upstream of box culvert.
- 204CRW042 – Crow Creek, upstream bridge.

Table 4-4 summarizes WY 2017 spring, midsummer, and summer-fall data in relation to the temperature, pH, and dissolved oxygen thresholds at each site; Figure 4-3, Figure 4-4 and

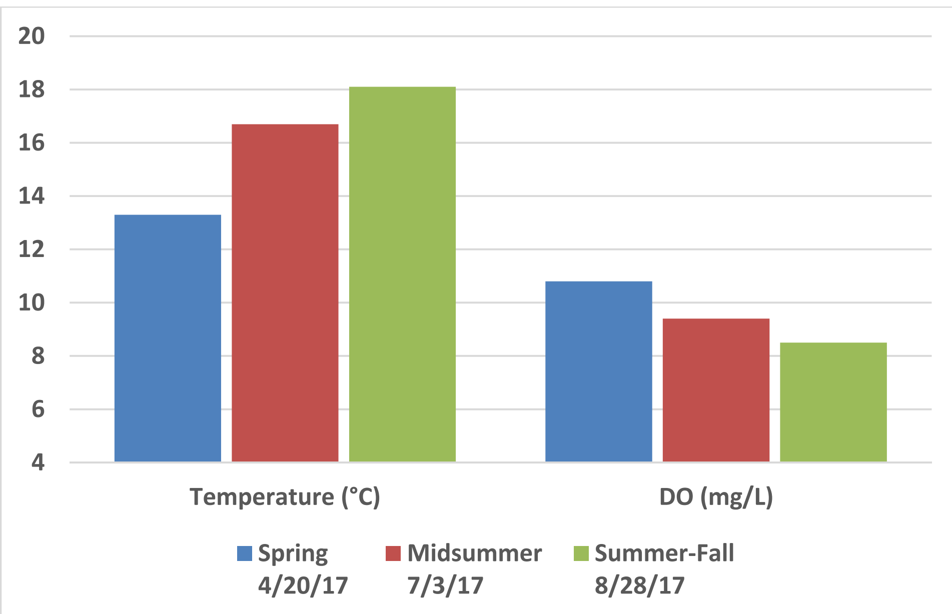

Figure 4-5 show graphical plots of temperature and DO for these sites (only the first week of each deployment are graphed). Midsummer and summer-fall discrete 7-day averages or MWATs for full or partial weeks of deployment were typically between 17°C and 20°C; otherwise the temperature thresholds were not exceeded. The water quality thresholds for conductivity, DO, and low pH were not exceeded more than 20% of the time at any of the General Water Quality monitoring sites, while the threshold for high pH was exceeded more than 20% of the time at multiple sites.

Table 4-4. Comparison of General Water Quality Observations to Trigger Thresholds at Sites 204CRW040, 204CRW041E, 204CRW042 in WY 2017.

Station	Monitoring Season (No of MWATs)	Applicable threshold or water quality standard					
		Temperature MWATs > 17˚C (> 19°C)	Temp % > 24˚C	Specific Cond. >2000 µS/cm	pH < 6.5	pH > 8.5	DO < 7 mg/L (COLD)
204CRW040	Spring (2)	0(0)	0%	0%	0%	82%	0%
	Summer-Fall (2)	2(1)	0%	0%	0%	12%	2%
204CRW041E	Spring (2)	0(0)	0%	0%	0%	49%	0%
	Midsummer (2)	1(0)	0%	0%	0%	0%	0%
	Summer-Fall (2)	2(1)	0%	0%	0%	1%	7%
204CRW042	Spring (2)	0(0)	0%	0%	0%	19%	0%
	Midsummer (2)	1(0)	0%	0%	0%	50%	0%
	Summer-Fall (2)	2(1)	0%	0%	0%	0%	12%

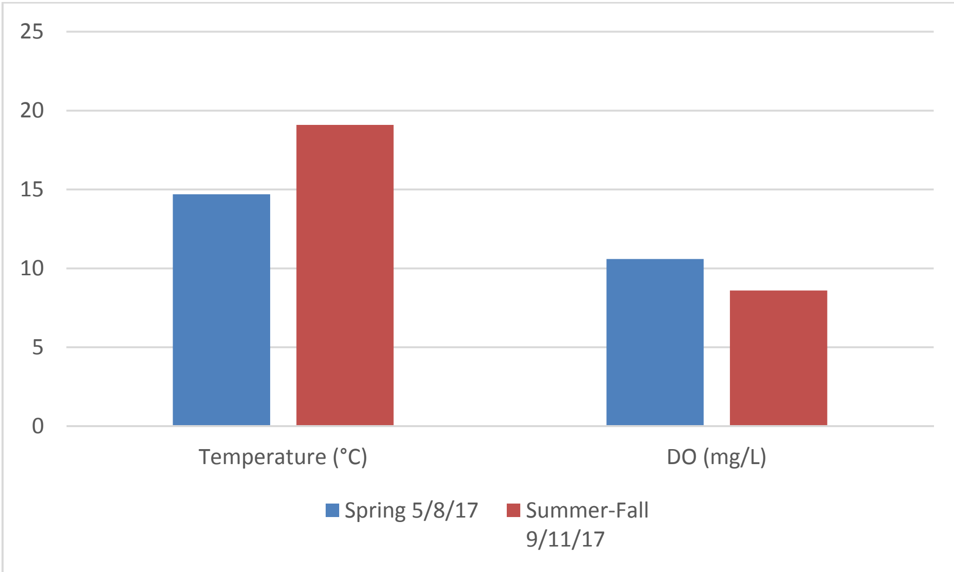

Figure 4-3. General Water Quality Monitoring Discrete 7-day Averages for Temperature and Dissolved Oxygen at 204CRW040 in Spring, Midsummer, and Summer-Fall, WY 2017

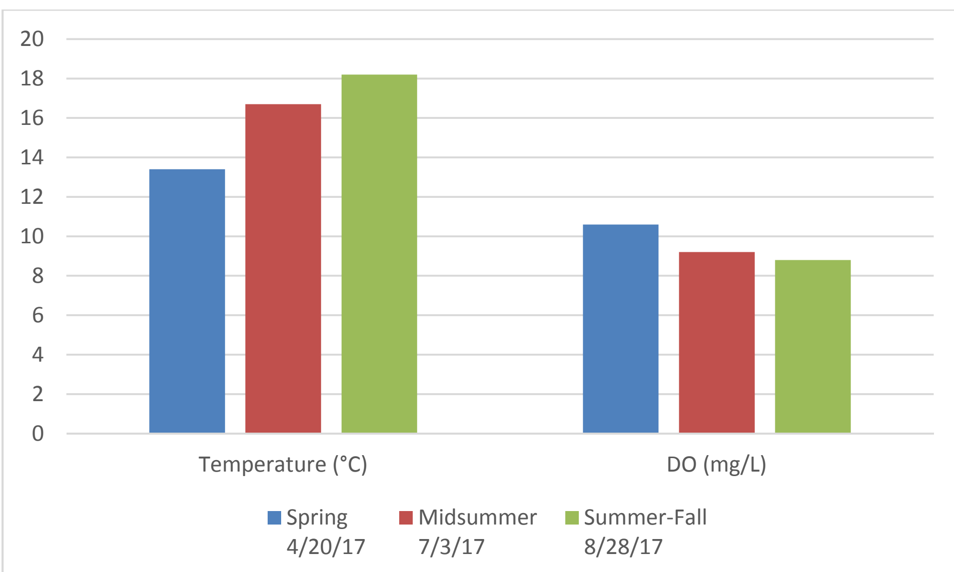

Figure 4-4.General Water Quality Monitoring Discrete 7-day Averages for Temperature and Dissolved Oxygen at 204CRW041E in Spring, Midsummer, and Summer-Fall, WY 2017.

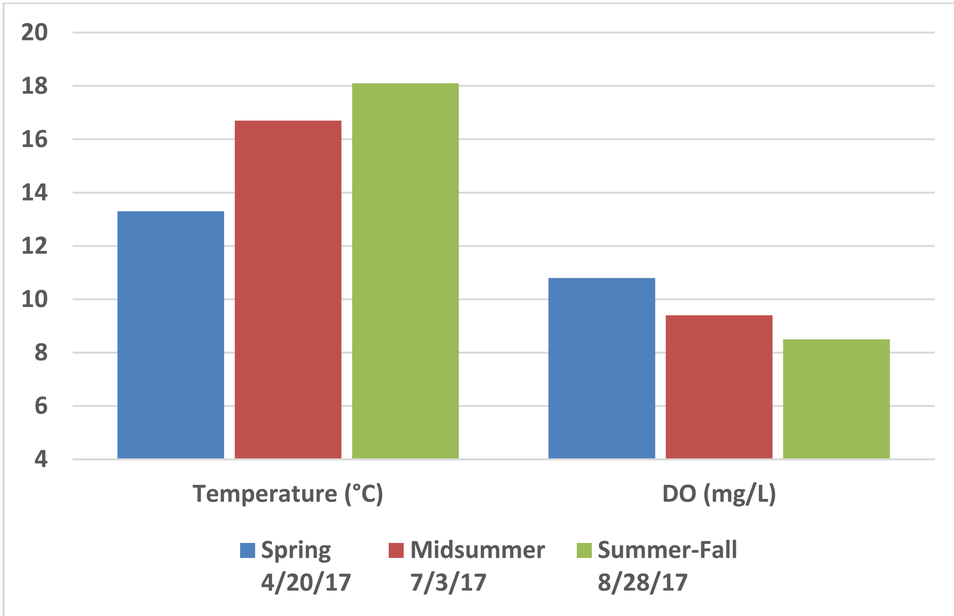

Figure 4-5. General Water Quality Monitoring Discrete 7-day Averages for Temperature and Dissolved Oxygen at 204CRW042 in Spring and Summer-Fall, WY 2017.

4.4 Pathogen Indicators

Single grab water samples for pathogen indicators were collected at five locations in the greater Sausal Creek watershed on July 24, 2017. *E. coli* and Enterococci were enumerated as individual grab samples as presented in

Table 4-5.

The highest counts were measured in the sample from 204SAU110, which had Enterococci at 172.5 MPN and *E. coli* at 220 MPN.

Table 4-5. Enterococci and *E. coli* enumerations at Castro Valley Creek Monitoring Sites - July 24, 2017 FIB Monitoring.

Site ID	Site Description	Creek Name	Enterococci (MPN*/100mL)	*E. coli* (MPN*/100 mL)
204SAU055	Sausal above Whipple Creek outfall	Sausal Creek	53.7	90
204SAU090	Sausal at Leimert Ave.	Sausal Creek	107.1	170
204SAU110	Palo Seco above Sausal	Palo Seco Creek	**172.5**	220
204SAU130	Palo Seco approx 70 m east of Mountain Blvd	Palo Seco Creek	57.1	50
204SAU200	Sausal above Palo Seco	Sausal Creek	68.1	220

*Most Probable Number per 100mL

BOLD font indicates result meets trigger conditions.

5 Stressor Assessment

This section is a preliminary review of targeted monitoring data to identify samples with results that meet the "trigger" conditions for potential further investigation via a SSID project, or other actions to reduce the stressor effect of urban runoff. Stressor assessment was conducted according to the trigger criteria in MRP Provisions C.8.d.iii through C.8.d.v, as listed in the following subsections).

5.1 Temperature

The reissued MRP (SFRWQCB 2015) defines the temperature trigger as when two or more weekly average temperatures exceed the Maximum Weekly Average Temperature of 17.0°C for a Steelhead stream, or when 20% of the results at one sampling station exceed the instantaneous maximum of 24°C[13].

All WY 2017 temperature monitoring sites were in streams with COLD Beneficial Use, and experienced at least two MWATs above both 17.0°C and 19°C during the summer (Table 4-2 and Figure 4-1). No sites exceeded the 24°C instantaneous maximum for 20% or more of the records.

5.2 Continuous Monitoring of Dissolved Oxygen, Temperature, and pH

MRP trigger criteria occur when results at one sampling station exceed the applicable temperature or dissolved oxygen trigger or demonstrate a spike in temperature or drop in dissolved oxygen with no obvious natural explanation. The temperature trigger is defined as any of the following: Maximum Weekly Average Temperature exceeds 17.0°C for a Steelhead stream, or 20 percent of the instantaneous results exceed 24°C.

These trigger criteria were compared against the results obtained during General Water Quality monitoring. No MWAT triggers were observed during spring deployments; during the midsummer and summer-fall deployments multiple sites had one or more MWATs above 17.0°C and some above 19°C (Table 4-4). Comparisons with other threshold values identified in the MRP indicate that thresholds for conductivity, DO, and low pH were not exceeded more than 20% of the time at any of the General Water Quality monitoring sites, while the threshold for high pH was exceeded more than 20% of the time at multiple sites.

[13] Permittees shall calculate the weekly average temperature by breaking the measurements into non-overlapping, 7-day periods.

5.3 Pathogen Indicators

The pathogen trigger criteria consist of the following[14]:

- Enterococci (marine and freshwater):
  - o Geometric mean of 35 colony forming units (cfu) per 100 milliliters (mL)
  - o Statistical threshold value of 130 cfu per 100 mL
- E. coli (freshwater)
  - o Geometric mean of 126 colony forming units (cfu) per 100 milliliters (mL)
  - o Statistical threshold value of 410 cfu per 100 mL

Table 5-1 presents the results of the pathogen indicator enumeration with comparison against the trigger criteria identified above. ACCWP conducted fecal indicator bacteria monitoring at five sites within the Sausal Creek watershed of Oakland on July 24, 2017. Sausal Creek is designated for both contact (REC-1) and non-contact (REC-2) recreation, and the three of the five sampling sites are located in areas with easy access along public trails adjacent to the creek (Bridgeview Trail and Palos Colorados Trail). Of the 10 datapoints generated through ACCWP monitoring, only one, a reported enterococcus concentration of 173 MPN/100 mL at site 204SAU110, exceeded the relevant STV; this site is not located on a public trail, however, and access is much more limited relative to sites along trails.

Table 5-1. Comparison of WY 2016 Pathogen Indicator Concentrations to Water Quality Objectives and Triggers – ACCWP July 24, 2017 FIB Monitoring.

Site ID	Site Description	Creek Name	Enterococci (MPN/100mL)*	*E. coli* (MPN/100 mL)*
204SAU055	Sausal above Whipple Creek outfall	Sausal Creek	53.7	90
204SAU090	Sausal at Leimert Ave.	Sausal Creek	107.1	170
204SAU110	Palo Seco above Sausal	Palo Seco Creek	**172.5**	220
204SAU130	Palo Seco approx 70 m east of Mountain Blvd	Palo Seco Creek	57.1	50
204SAU200	Sausal above Palo Seco	Sausal Creek	68.1	220

*Most Probable Number per 100mL

BOLD font indicates result meets trigger conditions.

[14] Water Board staff have confirmed to the RMC Work Group that for the purposes of trigger assessment, units of cfu/100ML can be considered equivalent to the units of MPN/100ML reported in laboratory analysis results.

6 Next Steps

All sites identified in Section 5 as meeting trigger criteria as candidates for new SSID projects will be reviewed by the Program in conjunction with relevant Permittees and RMC programs to determine potential follow-up actions pursuant to MRP Provision C.8.e. ACCWP initiated three SSID projects developed through the RMC selection process in the previous permit term, and together with other RMC participants will initiate new SSID projects as stipulated in MRP Provision C.8.e.ii (1). Where triggers or potential trigger conditions have been identified in WY 2017 results, ACCWP will also work with local stormwater managers to identify appropriate follow-up activities, which may be either incorporated in WY 2018 Creek Status Monitoring or conducted outside the scope of MRP Provision C.8.d.

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BASMAA. 2012b. Creek Status Monitoring Program Standard Operating Procedures. Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program. 196 pp.

BASMAA Regional Monitoring Coalition. 2014a. Creek Status Monitoring Program Quality Assurance Project Plan, Final Draft Version 1.0. Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program. 80 pp plus appendices.

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Alameda County Flood Control and Water Conservation District

Zone 7 Water Agency

ALAMEDA COUNTYWIDE CLEAN WATER PROGRAM

POLLUTANTS OF CONCERN MONITORING 2017 SEDIMENT SAMPLING REPORT

APPENDIX A.3

URBAN CREEKS MONITORING REPORT

OCTOBER 2016 THROUGH SEPTEMBER 2017

Report prepared by

Alameda Countywide Clean Water Program

399 Elmhurst Street,
Hayward, California 94544

Submitted to:

California Regional Water Quality Control Board, San Francisco Bay Region

FINAL

March 31, 2018

Protecting Alameda County Creeks, Wetlands & the Bay

Acknowledgement

Applied Marine Sciences, Inc. contributed substantially to the site reconnaissance, implementation of monitoring and preparation of the data analysis in this report.

Preface

The Bay Area Stormwater Management Agencies Association (BASMAA) Regional Monitoring Coalition (RMC) collaboratively developed an outline for preparation of the first Urban Creeks Monitoring Report (UCMR) that was submitted in March 2013 in compliance with the Municipal Regional Stormwater Permit (MRP)[1] Reporting Provision C.8.g.v regarding all monitoring conducted during the MRP permit term.

The following participants make up the RMC and are responsible for preparing IMR documents on behalf of their respective member agencies:

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

This report was prepared by ACCWP to fulfill reporting requirements for a portion of the Pollutants of Concern Loads Monitoring data collected in Water Year 2017 (October 1, 2016 through September 30, 2017). This report is an Appendix to the full UCMR submitted by ACCWP on behalf of the following Permittees:

- The 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 of the Alameda County Flood Control and Water Conservation District.

[1] Unless otherwise noted references to the MRP are to the reissued "MRP2" (SFBRWQCB, 2015), which became effective January 1, 2016. Most of the monitoring requirements addressed in this Appendix have not changed substantially from the original "MRP1" (SFBRWQCB, 2009)

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1. Introduction

This report fulfills a portion of the reporting requirements of Provision C.8.h.iii of the Bay Area Municipal Regional Stormwater Permit (MRP[2]) for Pollutants of Concern (POC) Monitoring data collected pursuant to MRP Provision C.8.f during Water Year (WY) 2017 (October 1, 2016 - September 30, 2017). Additional data required by Provision C.8 are reported in other appendices and portions of ACCWP's Urban Creeks Monitoring Report (UCMR), of which this is Appendix A.3.

Provision C.8.f of the MRP lists five priority POC management information needs 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.

As required in provision C.8.h.iv, ACCWP's Pollutants of Concern (POC) Monitoring Report (ACCWP 2017) described accomplishments during Water Year 2017 and the allocation of POC monitoring sampling effort planned for WY 2018 to address these information needs. This report covers monitoring for Polychlorinated Biphenyls (PCBs) and total mercury primarily to address information need #1, to assist in PCB source identification studies as part of a process outlined in ACCWP (2016). The main objective of this monitoring is to identify individual properties (parcels) with elevated concentrations of PCBs that may be abated as a means of attaining pollutant load reduction targets.

This report covers data collected by sampling bedded sediment in public rights-of-way (ROWs) within the cities of Berkeley and Emeryville. All sampling was performed in October 2016 by personnel of Applied Marine Sciences, Inc. (AMS) and ADH Environmental under the direction of AMS.

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[2] The San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) issued the first five-year MRP to 76 cities, counties and flood control districts (i.e., Permittees) in the Bay Area on October 14, 2009 (SFRWQCB 2009) and reissued the permit on November 19, 2015 (MRP2, SFBRWQCB 2015) with an effective date of January 1, 2016. Unless otherwise noted references in this report to the MRP are to the reissued "MRP2"

2. Methods

The Program prepared a draft Quality Assurance Project Plan (QAPP) and Sampling and Analysis Plan (SAP) describing methods based on those used for Task 3 of Clean Watersheds for a Clean Bay (CW4CB), a regional program of pilot PCB implementation projects under the coordination of the Bay Area Stormwater Management Agencies Association (BASMAA 2012).

Surface soil/sediment samples were collected using the general procedures described in the RMC SOP FS-6, Collection of Bedded Sediment Samples for Chemical Analysis & Toxicity (BASMAA 2016).

Prior characterization efforts conducted on behalf of BASMAA member agencies have regularly used laboratory analyses with target Reporting Limits (RLs) consistent with California Surface Water Ambient Monitoring Program (SWAMP) Quality Assurance Project Plan (SWAMP 2017); this project, however, as more of a screening level monitoring project, is not restricted to use of lowest obtainable RLs. Instead, the project selected laboratory methods that provide data at concentrations required to inform management actions, but at lower cost in order to allow a greater number of samples to be analyzed. Target Minimum RLs for this study are listed in Table 2-1 and Table 2-2.

Table 2-1. Target MRLs for Sediment Quality Parameters.

Analyte	MRL
Sediment Total Organic Carbon	0.01% OC
%Moisture	n/a
%Lipids	n/a
Mercury	30 µg/kg

Table 2-2. Target MRLs for Analyte PCB Congeners in Soils/Sediment.

Congener	Soils MRL (µg/kg)	Congener	Soils MRL (µg/kg)
PCB 8	10	PCB 118	10
PCB 18	10	PCB 128	10
PCB 28	10	PCB 132	10
PCB 31	10	PCB 138	10
PCB 33	10	PCB 141	10
PCB 44	10	PCB 149	10
PCB 49	10	PCB 151	10
PCB 52	10	PCB 153	10
PCB 56	10	PCB 156	10
PCB 60	10	PCB 158	10
PCB 66	10	PCB 170	10
PCB 70	10	PCB 174	10
PCB 74	10	PCB 177	10
PCB 87	10	PCB 180	10
PCB 95	10	PCB 183	10
PCB 97	10	PCB 187	10
PCB 99	10	PCB 194	10
PCB 101	10	PCB 195	10
PCB 105	10	PCB 201	10
PCB 110	10	PCB 203	10

3. Field Sampling

3.1. Objectives

The objectives of the sampling effort were to analyze the following:

- Sediment / soil samples collected from up to 12 sites in west Berkeley for analysis of PCB congeners, Hg, Total Organic Carbon (TOC), and particle size analysis (analyzed as % fines, < 63 µm) by ALS Group (ALS).

- Archived sediment samples collected at 2 sites collected by CDM Smith in 2014 as part of an investigation of a Union Pacific Railroad (UPRR) property at 73rd Ave in Oakland (CDM 2014).

3.2. Sampling Locations

A list of sites that were successfully sampled in WY 2017, is summarized in Table 3-1. Figure 3-1 shows the locations of the polygons sampled, from which composites were generated.

Table 3-1. Sampling Activities for POCs Sediment Sampling WY 2017.

SiteID	Major Streets	Date	# Samp Pts.	Lat, Centroid	Long, Centroid
BER-A	Codornices Cr south to Gilman, mainly 2nd St	10/26/16	7	37.87988	-122.30607
BER-B	3rd, 4th, 5th, Gilman, Camelia, Cedar	10/26/16	5	37.87734	-122.30222
BER-C	7th, 8th, 9th streets, Gilman, Camelia, Page	10/26/16	5	37.87881	-122.29827
BER-D	2nd St between Gilman and Hearst	10/26/16	6	37.87412	-122.30424
BER-E	4th, 5th, 6th, parts of 7th, 8th. Keep RR samples separate	10/26/16	8	37.86782	-122.29873
BER-F	4th through 8th, Bancroft to 67th	10/26/16	7	37.85683	-122.29264
RR-ROW	Corridor around RR tracks, 1 composite	10/26/16	4	37.87262	-122.30258
EME-B	Hollis, Doyle, Vallejo, Marshall, 63rd - 67th	10/26/16	5	37.84686	-122.28925

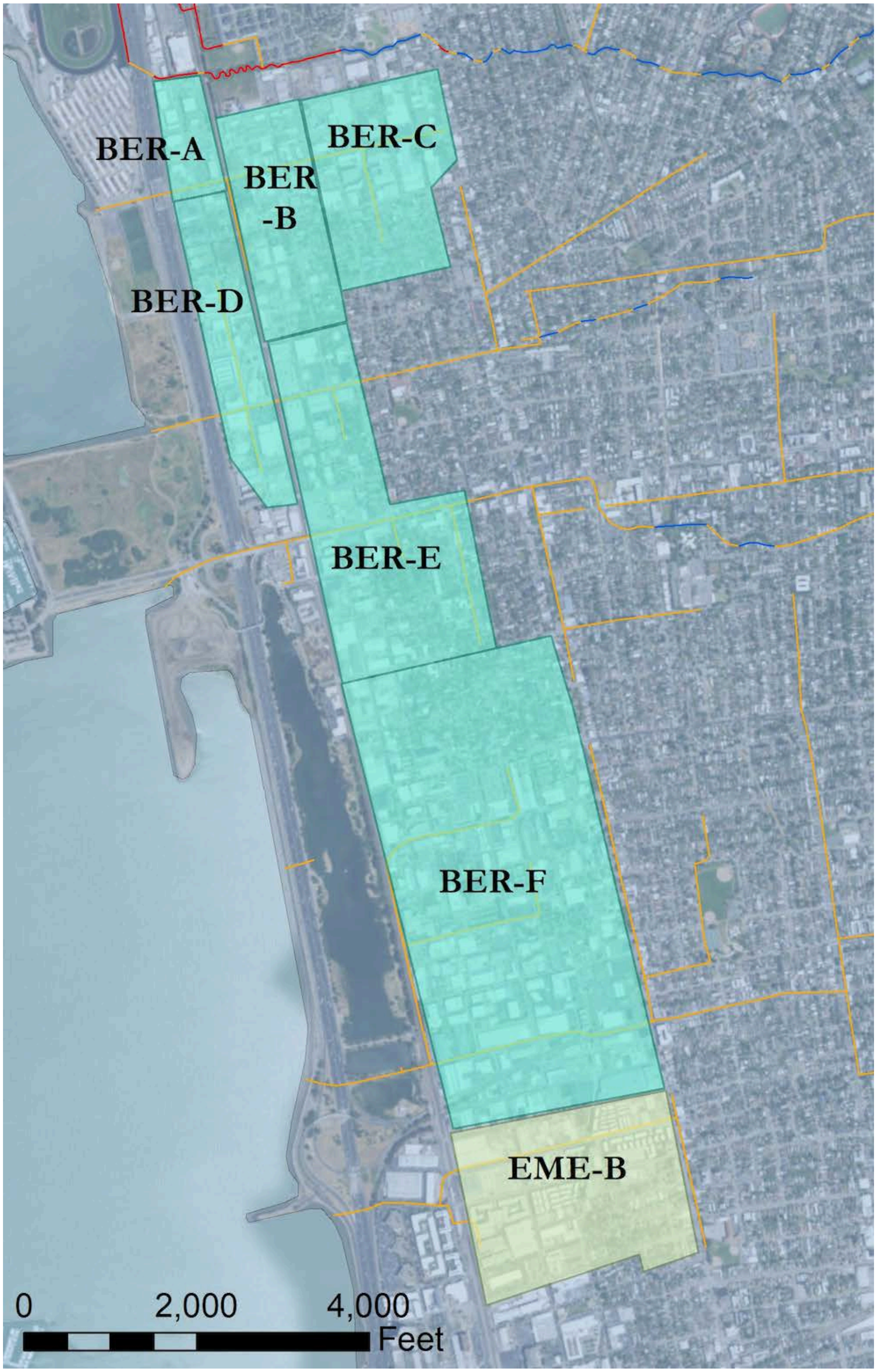

Figure 3-1. Overview of ROW Areas Successfully Sampled WY2017. Berkeley zones shaded in blue, Emeryville zone shown in beige.

4. Results and Discussion

4.1. Quality Assurance

AMS performed validation and verification on laboratory data consistent with SWAMP Measurement Quality Objectives (MQOs). QA review indicated that data quality was generally good, with the following observations:

- For analysis of conventional parameters, ALS failed to report replicate data for analysis of particle size distribution (PSD) that would allow assessment of precision. For this reason, affected data was flagged with the "VQCP" qualifier, indicating "QA/QC protocols were not met for precision, flagged by QAO." Analysis of conventional parameters Total Organic Carbon, density, and total solids achieved all MQOs.

- For analysis of inorganics, analyses met all MQOs and no additional qualification was required.

- For analysis of PCBs, laboratory analyses achieved MQOs with the exception of those assessing precision. Due to a relative lack of fine material present in composite samples, ALS was unable to run their typical MS/MSD analyses with the submitted batch. Therefore, precision was assessed solely through LC/LCSD pairs, with all results falling within control limits (CLs). Affected data were therefore flagged with a "VBS" qualifier, indicating that there was "insufficient sample available to follow standard QC procedures, flagged by QAO."

4.2. Results

The summary results associated with all WY 2017 POC soil / sediment monitoring are presented in Table 4-1. As a practice, ALS does not report sum of PCBs associated with analysis by EPA method 8082M. AMS calculated total PCBs as reported in Table 4-1 with substitution of 1⁄2 of the MDL for any non-detects, consistent with methodology employed for sum of various organic constituents for the RMC Creek Status Monitoring Program reporting.

Table 4-1. Summary Results for WY 2017 POC Sediment Monitoring.

Site	Sample Type	Total PCBs (µg/kg)	Total Hg (mg/kg dw)	TOC (%dw)	Density (g/cm^3)	Silt+Clay (%)
BER-A	ROW	184.8	0.27	8.18	0.63	19.82
BER-B	ROW	29.8	0.15	3.99	0.81	14.37
BER-C	ROW	37.1	0.12	3.68	0.84	9.29
BER-D	ROW	11.9	0.16	1.62	1.21	5.75
BER-E	ROW	85.8	0.24	6.59	0.64	15.16
BER-F	ROW	187.4	0.26	5.43	0.83	10.81
EME-B	ROW	18.6	0.13	4.04	0.75	7.52
RR-ROW	ROW	35.3	0.17	3.20	0.88	19.49
SM-11	Archive	407.2	0.17	0.41	NA	NA
SM-13	Archive	2539.8	0.21	0.94	NA	NA

Table 4-1 includes analytical data for both the ROW soil samples and the previously-mentioned archived sediment samples collected in 2014 (SM-11 and SM-13) associated with an investigation at a UPRR facility. It should be noted that the two archived sediment samples were not analyzed for PSD.

Of the eight ROW samples analyzed, PCB concentrations at BER-A and BER-F were slightly elevated compared to the remaining six samples, each of which fell below 100 µg/kg dw. It should be noted that the area covered by the BER-F polygon contains the BER-002 property sampled in WY 2016, which exhibited the highest PCB concentration of the WY 2016 sites (780 µg/kg dw).

The two Arroyo Viejo Creek samples archived as part of the 2014 CDM Smith investigation exhibited the greatest PCB concentrations (407 and 2540 µg/kg dw, respectively) of all those analyzed WY 2017. These two samples were collected from within intertidal areas of Arroyo Viejo Creek near the Oakland Coliseum that are currently under review for potential referral for regulatory action.

Mercury concentrations for all WY 2017 sites ranged from 0.12 mg/kg to 0.27 mg/kg. Unlike the case for PCBs, the two archived Arroyo Viejo samples were not elevated compared to the ROW samples. In comparison, the ROW samples analyzed in WY 2016 associated with individual targeted properties exhibited a much wider range of concentrations (0.01 mg/kg to 0.9 mg/kg dw).

It should be noted that the two archived samples will not be reported to CEDEN. Neither of these samples was delivered to AMS with coordinate information, thereby precluding their ability to be located accurately and limiting their usefulness. All remaining WY 2017 data will be submitted to the CEDEN node at SFEI.

4.3. Next Steps

Pursuant to Provision C.8.h in MRP2, in October of each year the Program submits a separate POC Monitoring Report describing accomplishments during the preceding Water Year and the allocation of POC monitoring sampling effort for the forthcoming Water Year, i.e. for WY 2018 in the October 2017 report (ACCWP 2017). The POC Monitoring Report also considers other data sources; for example, prior monitoring through by the RMP at an outfall in West Berkeley provided an alternative line of evidence indicating possible sources or reservoirs of sediment with elevated concentrations of both PCBs and mercury.

ACCWP’s sediment sampling in WY 2018 is targeting three distinct areas for which prior evidence suggests potential important sources of PCBs and mercury: (1) southwest Berkeley near Heinz and Grayson Streets; (2) East Oakland near the Zone 12 Line H watershed; and (3) Alameda Point redevelopment area. POC sediment data will be used to support identification of priority watersheds and management areas for Permittee actions to reduce PCBs and for Annual Reporting pursuant to MRP provisions C.11 and C.12.

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ALAMEDA COUNTYWIDE CLEAN WATER PROGRAM

STRESSOR / SOURCE IDENTIFICATION PROJECT:

DUBLIN CREEK BIOLOGICAL COMMUNITY AND SEDIMENT QUALITY

FINAL REPORT

WATER YEAR 2017

URBAN CREEKS MONITORING REPORT,

APPENDIX A.4A

Report prepared by

Alameda Countywide Clean Water Program
399 Elmhurst Street,
Hayward, California 94544

Submitted to:

California Regional Water Quality Control Board, San Francisco Bay Region

FINAL

March 31, 2018

MEMBER AGENCIES:

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Union City

County of Alameda

Alameda County Flood Control and Water Conservation District

Zone 7 Water Agency

Protecting Alameda County Creeks, Wetlands & the Bay

List of Acronyms

Acronym	Definition
ACCWP	Alameda Countywide Clean Water Program
BASMAA	Bay Area Stormwater Management Agencies Association
BMP	Best Management Practice
CSCI	California Stream Condition Index
CSM	Creek Status Monitoring
I-	Interstate Highway
IBI	Index of Biotic Integrity
LUCMP	Local Urban Creek Monitoring Program
MRP, MRP 2.0	Municipal Regional Stormwater Permit (reissuance from previous “MRP 1.0”)
NPDES	National Pollutant Discharge Elimination System
PAH	Polycyclic Aromatic Hydrocarbon
PEC	Probable Effects Concentration
QAPP	Quality Assurance Project Plan
RMC	Regional Monitoring Coalition
RWQCB	Regional Water Quality Control Board
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board(California Regional Water Quality Control Board, San Francisco Bay Region)
SSID	Stressor/Source Identification
SOP	Standard Operating Procedure
SPoT	Stream Pollutant Trends
SWAMP	Surface Water Ambient Monitoring Program
TEC	Threshold Effect Concentration
TOC	Total Organic Carbon
USEPA	United States Environmental Protection Agency
WY	Water Year

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1 Introduction

The Alameda Countywide Clean Water Program (ACCWP) conducts Creek Status Monitoring as required by Provision C.8.c of the Municipal Regional Stormwater Permit (MRP, SFBRWQCB 2015)[1]. ACCWP's 17 member agencies have joined with 56 other MRP Permittees to form the BASMAA Regional Monitoring Coalition (RMC), a regional collaborative to coordinate monitoring conducted pursuant to MRP Provision C.8, Water Quality Monitoring. The RMC prepared a Quality Assurance Project Plan (QAPP, BASMAA 2014a and 2016a) and Standard Operating Procedures (SOPs, BASMAA 2012b, 2014b and 2016b) to standardize monitoring methods and ensure comparability of monitoring data with the state's Surface Water Ambient Monitoring Program (SWAMP) (see Table 1-1).

Table 1-1. Standard Operating Procedures Pertaining to BASMAA RMC Creek Status Monitoring.

SOP #	SOP Title
FS-1	BMI and Algae Bioassessments, and Physical Habitat Measurements
FS-2	Water Quality Sampling for Chemical Analysis, Pathogen Indicators, and Toxicity
FS-3	Field Measurements, Manual
FS-4	Field Measurements, Continuous General Water Quality
FS-7	Field Equipment Cleaning Procedures
FS-8	Field Equipment Decontamination Procedures
FS-9	Sample Container, Handling, and Chain of Custody Procedures
FS-10	Completion and Processing of Field Datasheets
FS-11	Site and Sample Naming Convention
FS-12	Ambient Creek Status Monitoring Site Evaluation
FS-13	QA/QC Data Review

The RMC's Creek Status and Long-Term Trends Monitoring Plan (BASMAA 2011) assigns each of the Creek Status Monitoring (CSM) parameters listed in MRP Table 8.1 to one of two sub-design components:

- Regional: ambient monitoring to assess the condition of aquatic life in creeks across the San Francisco Bay Area. Candidate monitoring sites were drawn from a probabilistically generated master list that included all perennial and non-perennial creeks and rivers

[1]The MRP was initially issued as SFBRWQCB 2009 (MRP 1.0) and reissued on November 19, 2015 with minor revisions in monitoring provisions regarding Stressor/Source Identification. Unless otherwise noted, references to trigger values and other permit requirements in this report refer to the original MRP 1.0 unless identified as referring to the reissued MRP 2.0.

within the applicable portions of the five participating counties. Sites from the RMC master list are identified by an alphanumeric code in which the last 6 characters are "Rnnnnn" with "R" designating the RMC probabilistic design and "nnnnn" the site's numeric sequence number generated through the RMC master draw[2]. RMC sites can also be assigned an alternative ID using the SWAMP naming procedure described in RMC SOP FS-11.

- Targeted: monitoring design and site selection address local watershed management questions. The last 6 characters of each Site ID reflect the watershed and numbering from the base of the watershed per the RMC SOP FS-11.

Creek Status Monitoring (CSM) was initiated in WY2012 (October 2011 through September 2012) and reported in the first Urban Creeks Monitoring Report (UCMR, BASMAA 2013) submitted to the Regional Water Quality Control Board (RWQCB) in March 2013. The UCMR evaluated all data against "trigger criteria" listed for each parameter in MRP Table 8.1, which identified potential follow-up actions including Stressor/Source Identification (SSID) projects as required by Provision C.8.d.i of the Municipal Regional Stormwater Permit (MRP), subject to several conditions:

1. Creek Status Monitoring results meet one or more trigger criteria in MRP Table 8.1
2. When conducting monitoring through a regional collaborative, Permittees were collectively required to initiate no more than ten SSID projects during the MRP 1 Permit term, and ACCWP's proportionate share was assumed to be three projects out of the 10.
3. If results indicated toxicity, at least 2 of the 10 SSID projects must be for toxicity
4. No need to repeat for continuing or recurring occurrences of the trigger in later results from the same receiving water limitations, unless directed to do so by the Water Board
5. No need to follow up on trigger results that are caused by Pollutants of Concern, which are already being addressed by other portions of the MRP (e.g. pesticides).

The RMC programs developed a collaborative decision-making process for selecting sites for SSID follow-up. Program representatives reviewed the previous year's CSM results that reached "trigger" criteria, and prioritized sites for SSID follow-up based on several criteria including environmental significance of the trigger results and the feasibility of completing the project steps outlined in the MRP (see below). After consultation with affected Permittee(s), the RMC confirmed the candidate SSID project list with Water Board staff in April 2012 and individual programs planned initiation of SSID studies in their areas for FY 2013-14.

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[2]As recommended for SWAMP data compatibility per RMC SOP FS-11, all site ID codes begin with a 3 digit Hydrologic Unit Code.

MRP 1.0 listed four steps[3] for a SSID project, with ACCWP and other Countywide Programs leading the technically oriented steps 1 and 4 and collaborating with relevant Permittees on step 2. Permittee(s) will be the lead on step 3 to the extent that effective stormwater BMPs are within their power and jurisdiction. The four steps are:

(1) Conduct a site-specific study (or non-site specific if the problem is widespread) to identify and isolate the cause(s) of the trigger stressor/source. If the trigger stressor or source is already known (e.g. toxicity), proceed directly to step 2.
(2) Identify and evaluate the effectiveness of options for controlling the cause(s) of the trigger stressor/source.
(3) Implement one or more controls.
(4) Confirm the reduction of the cause(s) of trigger stressor/source.

Previous progress reports (ACCWP 2014, 2016) describe the first three years of an SSID study of sediment quality in the Dublin Creek watershed. This report documents further project activities through September 2017, and additional analyses that were performed to place the data collected to-date into context.

[3] The reissued MRP modifies details and reporting requirements of these steps.

2 Background

2.1 Study Area

2.1.1 Dublin Creek

Site 204R00084 is located on Dublin Creek just west of the junction of Interstate Highways (I-) 580 and 680 in Dublin. At this location, Dublin Creek is within an area of mixed land use and contains a variety of channel structures, both natural and artificial.

To the west (upstream) of Donlon Way, near the junction of Interstate Highway I-580 and San Ramon Road the channel is predominantly natural, with some engineered channels interspersed within some residential housing developments. This upper portion of the creek includes two main branches that drain low density residential and rural land uses in portions of Dublin, Pleasanton, and unincorporated Alameda County; it also crosses under I-580 twice and thus receives considerable runoff from the freeway. East of Donlon Way the creek is an engineered channel designated as the Zone 7 flood control channel “Line T”.

2.1.2 Beneficial Uses

Beneficial uses (SFRWQCB, 2015) assigned to Dublin Creek include:

- Warm freshwater habitat (WARM);
- Wildlife habitat (WILD); and
- Water Contact and Non-contact Recreation (REC-1 and REC-2). Public parks or other facilities allow access or approaches to sections of Dublin Creek.

2.2 Problem Statement

The Dublin Creek watershed was originally identified for a SSID project based largely upon bioassessment and sediment chemistry monitoring results associated with Year 1 implementation of the CSM program. The results that triggered the investigation are summarized below.

2.2.1 Water Quality Triggers

Comparison of WY2012 sampling results at site 204R00084 with MRP 1.0 trigger criteria are presented in Table 2-1. Triggers for sediment quality were based on calculation of Threshold Effects Concentration (TEC) and Probable Effects Concentration (PEC) for each analyte as determined following MacDonald et al. (2000). It should be noted that there are some limitations in the MacDonald method, which are discussed below.

Table 2-1. Water Year 2012 MRP Triggers and Significance at Dublin Creek Site 204R00084

Trigger type	Trigger status at site	Comment
"Triad" - bioassessment indication of alteration	**IBI score Very Poor**	Widespread in region, generally driven by habitat alteration
"Triad" - sediment chemistry	**10 chemicals > Threshold Effects Concentration**	TEC and PEC contributions by chemical groups: • PAHs - not elevated, • Pesticides (organochlorine) - all somewhat elevated • Metals - slightly elevated for nickel
	Probable Effects Concentration: average Quotient < 0.5	
	Pyrethroids calculated 1.06 >1 Toxic Unit Equivalent	
"Triad" - sediment toxicity	Not present or triggered	Pyrethroids likely not significant
Chlorine in water column	**Low: 0.10 mg/l >0.08 on one of 2 occasions**	Widespread in region; result is near limit of method detection
Toxicity in water column	Not present or triggered	Pyrethroids likely not significant
General Water Quality - DO	Not sampled	
General WQ - other	Not sampled	
Temperature	Not sampled	
Pathogen Indicators	Not sampled	

Re-evaluation of the WY2012 data reported in the UCMR (BASMAA 2013) revealed relatively large differences in some cases between using one-half of the MDL vs. one-half of the MRL to estimate ND results for statistical purposes. Calculated TEC quotients for individual and total PAHs were lower across-the-board using the MDL due to the relatively large proportion of non-detects and the difference between MDLs and MRLs reported. It should be noted that WY 2012 analyses are predominantly non-detects, and therefore that the TEC quotients calculated are driven by the RL rather than quantified laboratory results.

While MacDonald (2000) generated PECs for multiple trace elements, PAHs, and organochlorine (OC) pesticides, there was insufficient data at time of its publication to evaluate the consensus PECs generated as to their predictive ability for associated sediment toxicity for each of the analytes reported. Analytes for which predictive ability is particularly uncertain include various PAH (anthracene, fluorine, and fluoranthene) and OC pesticide (dieldrin, DDDs, DDTs, endrin, heptachlor epoxide, and lindane) parameters (MacDonald, 2000).

When examining pyrethroid concentrations, a similar degree of uncertainty exists. Weston (2005) reported that predictions of sediment toxicity to *H. azteca* were supported by observed results for sites with TU ratios below one (little or no mortality) and above four (high or full mortality). For TUs between one and four, however, the predictive ability of the TU is less certain (Weston 2005). The Toxicity Unit calculation for pyrethroids was eliminated as a trigger criterion in MRP 2.0, as was the complex linkage of sediment chemistry, toxicity, and bioassessment.

2.2.2 Potential Sources and Activities Contributing to Triggers

The Causal Analysis/Diagnosis Decision Information System (CADDIS) was developed by the US EPA as an online guidance tool for conducting causal assessments of impacts to aquatic ecosystems (US EPA 2010). The online tool provides a framework and resource base for Stressor Identification (SI) using a five-step process for conducting a causal assessment:

Step 1: Define the Case
Step 2: List Candidate Causes
Step 3: Evaluate Data from the Case
Step 4: Evaluate Data from Elsewhere
Step 5: Identify Probable Causes

The Stressor Identification process may be iterative, and if the stressor cannot be adequately identified in the first attempt, the process may continue with collection of additional data or testing other suspected stressors. It should be noted that CADDIS is designed to be initiated following observations of a biological effect; however, in this case the sediment quality concerns were triggered by chemical concentrations that were not accompanied by significant toxicity.

For the engineered channel section found at site 204R00084, physical habitat alteration is the most likely cause of biological community degradation. Figure 2-1 shows a simple conceptual diagram from CADDIS, illustrating causal pathways related to physical habitat change as a candidate cause of biological impairment. CADDIS also notes that “urbanization” comprises several types of causal activities that together result in an “urban stream syndrome” of co-occurring, interacting changes in five general stressor categories:

- Water/Sediment Quality
- Temperature
- Hydrology
- Physical Habitat
- Energy Sources

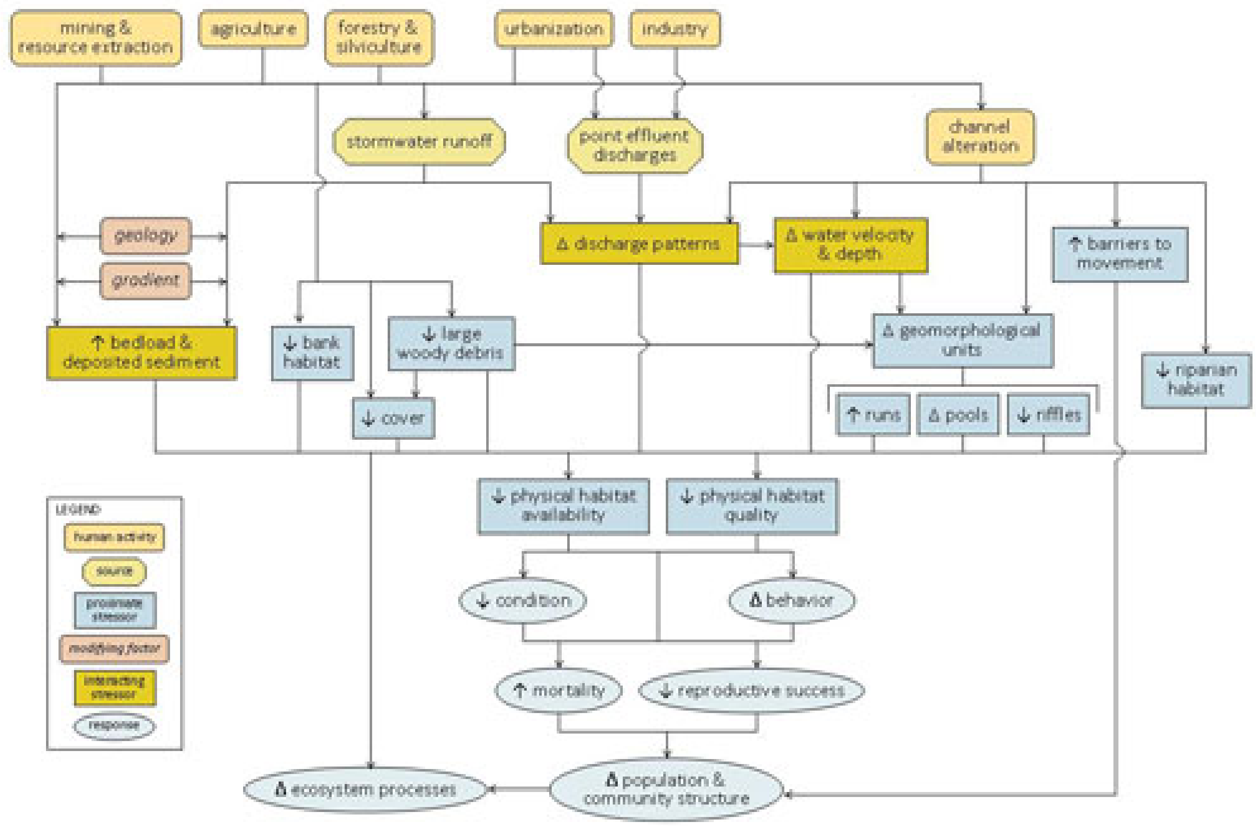

Figure 2-1. Conceptual diagram illustrating causal pathways, from sources to impairments, related to physical habitat (USEPA 2010).

3 Previous SSID Monitoring

3.1 Sediment Chemistry Monitoring

ACCWP (2014) described a study design for WY2013 sampling along an urbanization gradient in Dublin Creek. Figure 3-1 presents a schematic of the creek system with illustration of channelization and hydromodification, as well as general watershed land uses.

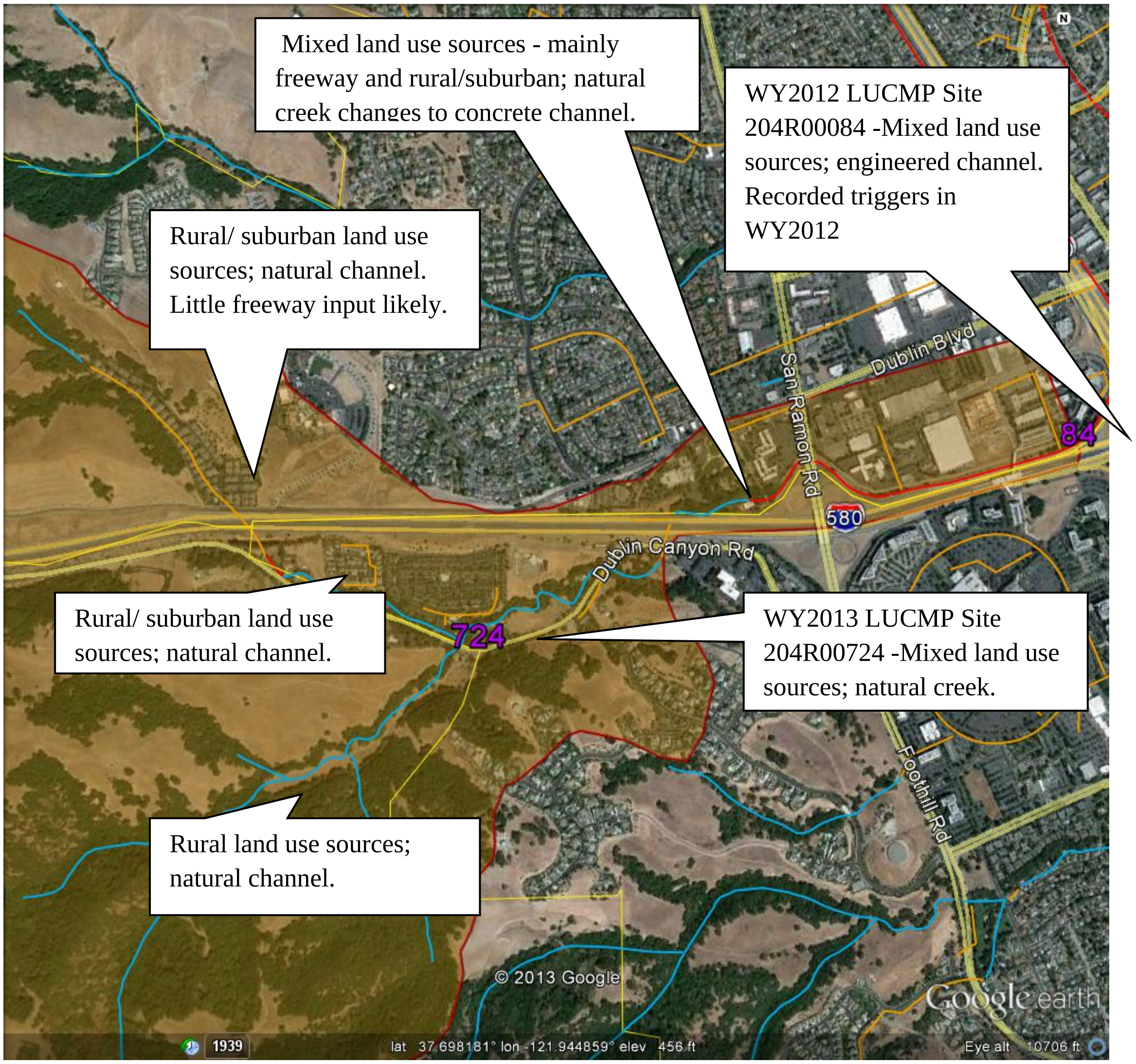

Figure 3-1. Conceptual Model of Candidate Causal Stressors in the Dublin Creek Watershed

The sampling locations and sampling strategies for SSID monitoring in the Dublin Creek Watershed in WY2013 are presented in Table 3-1 and Table 3-2, and shown in Figure 3-2 and Figure 3-3.

Table 3-1. WY2013 Monitoring Locations and Sampling for Dublin Creek SSID.

Site	Site Description
204DUB005 (aka 204R00084)	Original RMC sampling location: also known as 204R00084. Mixed commercial and industrial land use (downtown area) adjacent to engineered channel at base of watershed
204DUB030	Slightly upstream of, but similar conditions to, 204DUB005. Mixed land use adjacent to concrete channel
204DUB040	Uppermost main stem site downstream of the lower culverted segment under freeway. Limited adjacent area of commercial, industrial and park land uses; mixed rural and suburban sources to culvert from upper watershed; natural channel.
204DUB055	Natural channel section on main stem just downstream of confluence with Devaney Canyon branch; integrates land use sources from the branches at 204DUB060 and 204DUB080.
204DUB060	Devaney Canyon branch above its confluence with main stem; unincorporated agricultural and former agricultural land use. Mostly natural channel (sediment sample composited from culvert under Dublin Canyon Rd. and pool downstream of culvert).
204DUB080	Main stem Dublin Creek above confluence with Devaney Canyon. Mixed rural and medium density residential land use, and freeway runoff sources
204DUB090	Main stem Dublin Creek downstream of upper culvert under freeway-- sources from upper watershed include mixed residential and open land use. For comparison with 204DUB040. Only to be analyzed if downstream sites show variability.

Table 3-2.WY2013 Monitoring Locations and Sampling for Dublin Creek SSID Study.

Site Code	Latitude	Longitude	Available sampling and notes for 2013 sampling	Pyrethroids	Total metals + mercury	Organochlorine pesticides	Polycyclic Aromatic Hydrocarbons (PAHs)	% fines	Total Organic Carbon (TOC)	Bioassessment
204DUB005 (aka 204R00084)	37.70100	-121.92537	RMC data WY12 for sediments and bio-assessment + WY13 sediment		X		X	X		
204DUB030	37.69932	-121.93290	WY13 sediment	X	X	X	X	X	X	
204DUB040	37.69921	-121.93824	WY13 sediment	X	X	X	X	X	X	X
204DUB055	37.69496	-121.94837	WY13 sediment	X	X	X	X	X		
204DUB060	37.69473	-121.94862	WY13 sediment		X	X	X	X		
204DUB080	37.69522	-121.94890	WY13 sediment		X	X	X	X	X	
204DUB090	37.69655	-121.9530	WY13 sediment (archived sample)		X	X	X	X		

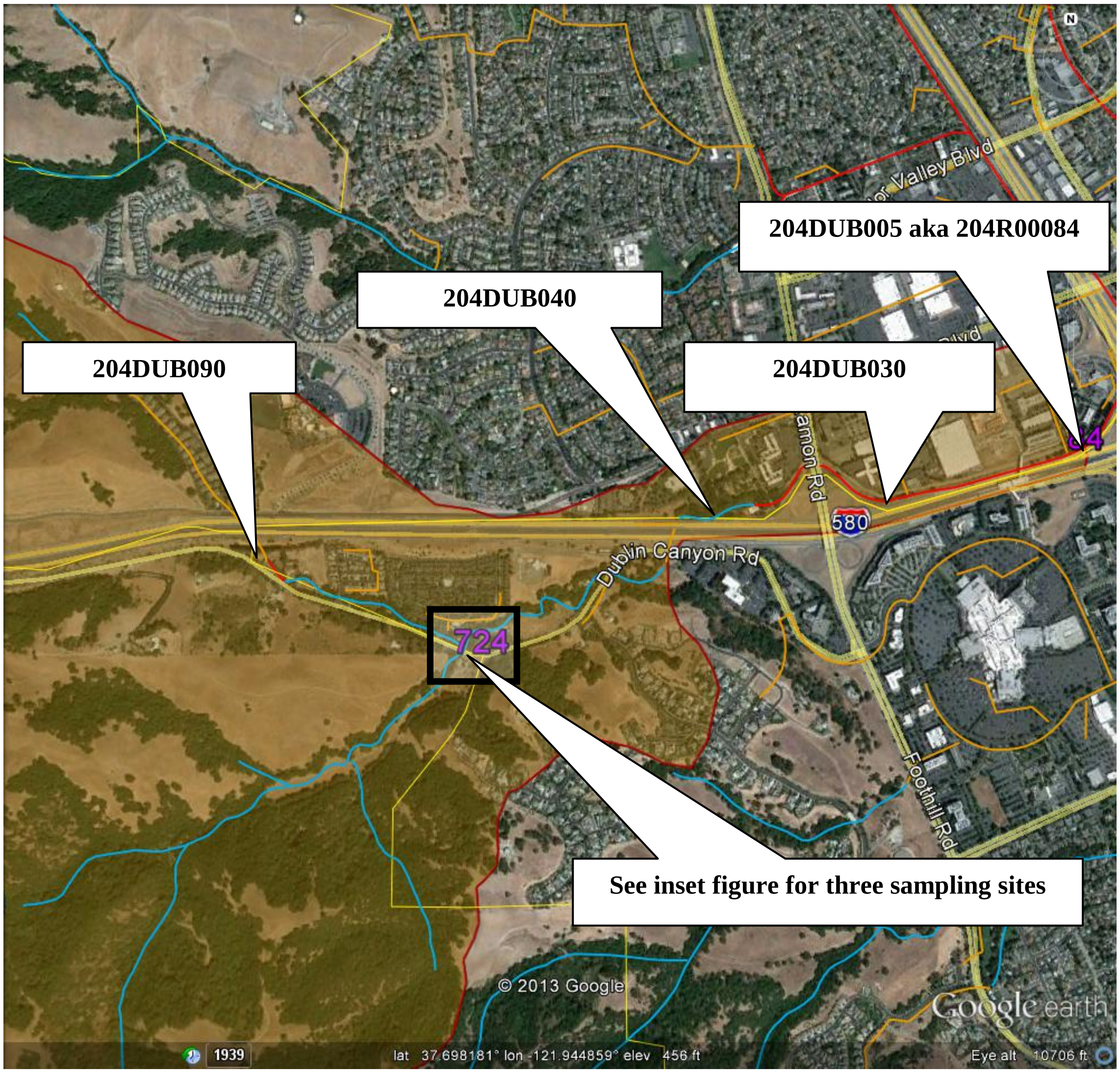

Figure 3-2. WY2013 Monitoring Locations in the Dublin Creek Watershed

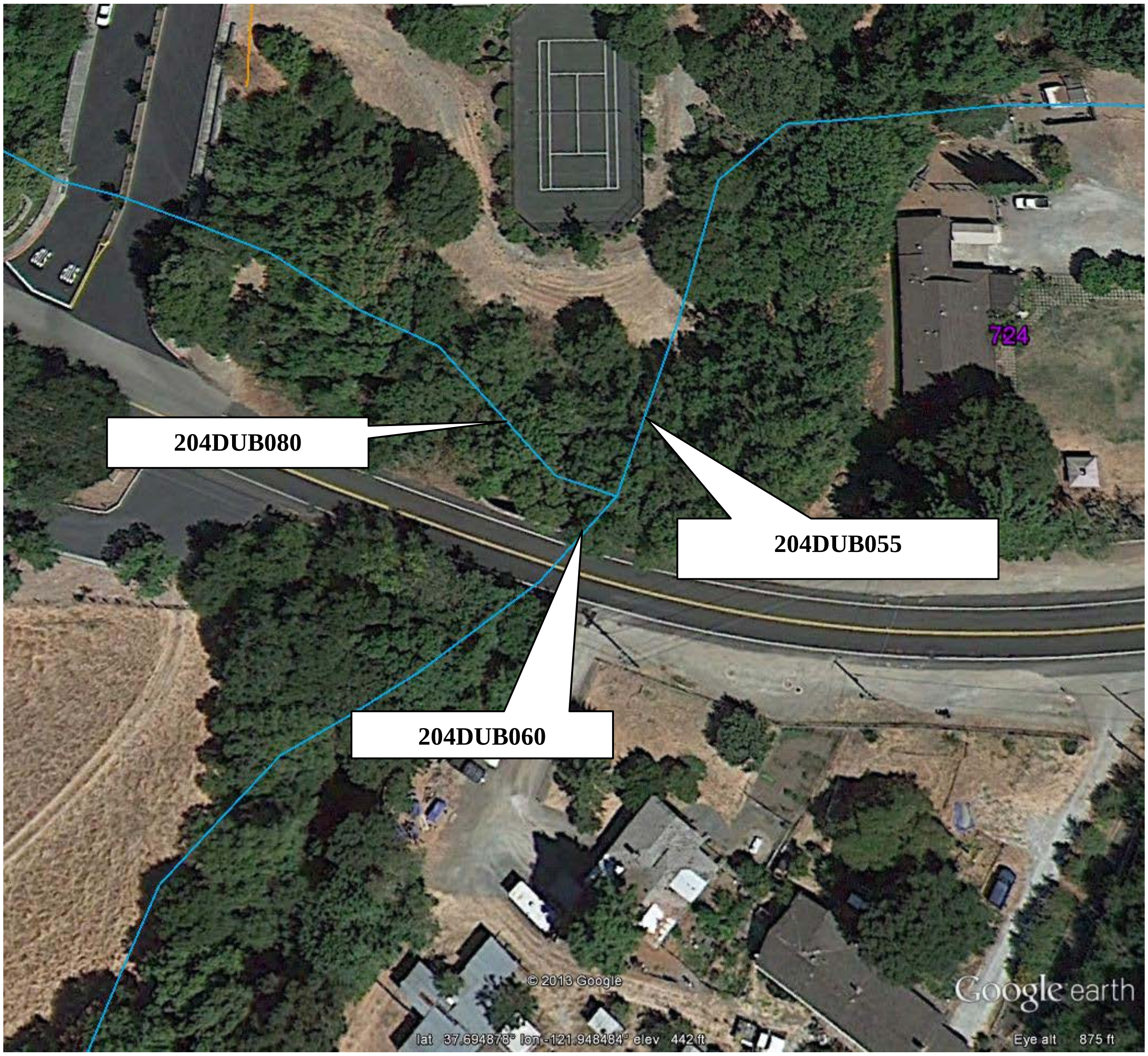

Figure 3-3. Monitoring Locations for 204DUB055, 204DUB060 and 204DUB080

3.2 Bioassessment Monitoring

In WY2017, ACCWP conducted bioassessment monitoring at site 204R01748, a probabilistic site in a natural channel segment of Dublin Creek. The calculated CSCI score for this site was reported as 0.88, which places it in the possibly intact category.

3.3 Monitoring Findings

The following general trends and overall findings are based on the results of this monitoring:

3.3.1 Sediment Chemistry

Results from the special study sampling are discussed below by analysis:

- Pyrethroids: Bifenthrin was the only pyrethroid recorded at concentrations above detection limits in this study. This is consistent with published literature, which finds bifenthrin to be the most common pyrethroid in sediments (Anderson *et al*, 2012). Compared with DPR investigations, the results presented here are very much lower than average concentrations found in other Californian sediments (Zhang, 2010). There was no observed difference between concentrations of pyrethroids at the three special study sites monitored.
- Organochlorine pesticides: In comparison with sediment results published in the literature, the results from the Dublin special study suggest low concentrations of organochlorine pesticide presence (Kinnetic Laboratories and EOA, 2002 and Anderson *et al*, 2012). Of the Dublin sites investigated, Site 204DUB060 recorded the highest organochlorine pesticide concentrations.
- Metals: In general metal concentrations were similar to average concentrations found in the SPoT program (Anderson *et al*, 2012). Mercury concentrations were much lower than averages recorded in the joint Agency Program from 2002. Compared with the other sites investigated in this study, 204DUB005 and 204DUB080 had generally higher concentrations of metals compared with other sites monitored in WY2013.
- PAHs: PAH concentrations were lower than those averages reported in the SPoT program (Anderson *et* al, 2012) and the Alameda County Sediment sampling program results from 2002 (ACCWP, 2002). In comparison to the other sites investigated in this study, site 204DUB080 had higher concentrations of PAHs.

3.3.2 Bioassessment

Sites in different zones of the watershed all showed relatively low condition scores compared to undeveloped reference conditions. Habitat modification due to urbanization is the main source of biological community alteration, especially for highly modified channels but also where natural channels have experienced changes due to increased watershed imperviousness and nearby roads (e.g. Schuler, 2004, SFBRWQCB, 2012).

4 Discussion and Planned Activities

As described in the WY2016 progress report, the information collected to-date is inconclusive in terms of identifying potential stressors. City of Dublin staff reported no inspection sites in the relatively small catchment area that would be highlighted as potential sources of the contaminants found in the sediments, which were found at concentrations similar to, or less than, those in other urbanized areas in California based on comparison with published literature.

It should be noted that the initial identification of Dublin Creek as a SSID study site was based upon one sampling point collected in the first year of the CSM implementation. Having completed six years of CSM monitoring, we now have data to place the site in greater context than was available during year 1. This brings into question whether this site would have been a priority site for SSID work; information supporting this finding is provided in the sections below.

4.1 Sediment Quality

As part of step 4 of the CADDIS process discussed briefly, we compiled data for the 16 sites within Alameda County that have been sampled for sediment quality parameters through CSM monitoring (Table 4-1). The sites are spread throughout the County and encompass a variety of regions of the County and conditions.

As part of the original 2012 Urban Creeks Monitoring Report (UCMR), ACCWP identified 10 of the 27 sediment chemistry parameters with relevant TEC / PEC thresholds at site 204R00084 that generated a TEC quotient[4] above 1.0; it should be noted that 9 of the 12 quotients above 1.0 were associated with analyses of pesticides (Chlordane, Dieldrin, Endrin, Heptachlor Epoxide, Lindane, Sum DDD, Sum DDE, Sum DDT, and Total DDTs) that are no longer specified for monitoring through MRP 2.0. None of the 2012 data for any analyte generated a PEC quotient greater than or equal to the MRP 1.0 trigger threshold of 0.5.

Excluding pesticides no longer analyzed through MRP 2.0, the only data for probabilistic site 204R00084 that generated a TEC quotient above 1.0 was associated with analysis of nickel. In order to place this into context, we compared results for nickel across the 16 sites within Alameda County where MRP sediment chemistry monitoring has been conducted (Figure 4-2). As can be seen, concentrations of nickel at site 204R00084 were among the lower observed across the Alameda County sites.

[4] Calculated prior to change in technique used to estimate contribution of non-detects.

Figure 4-1. ACCWP CSM Sediment Sampling Sites, 2012-17

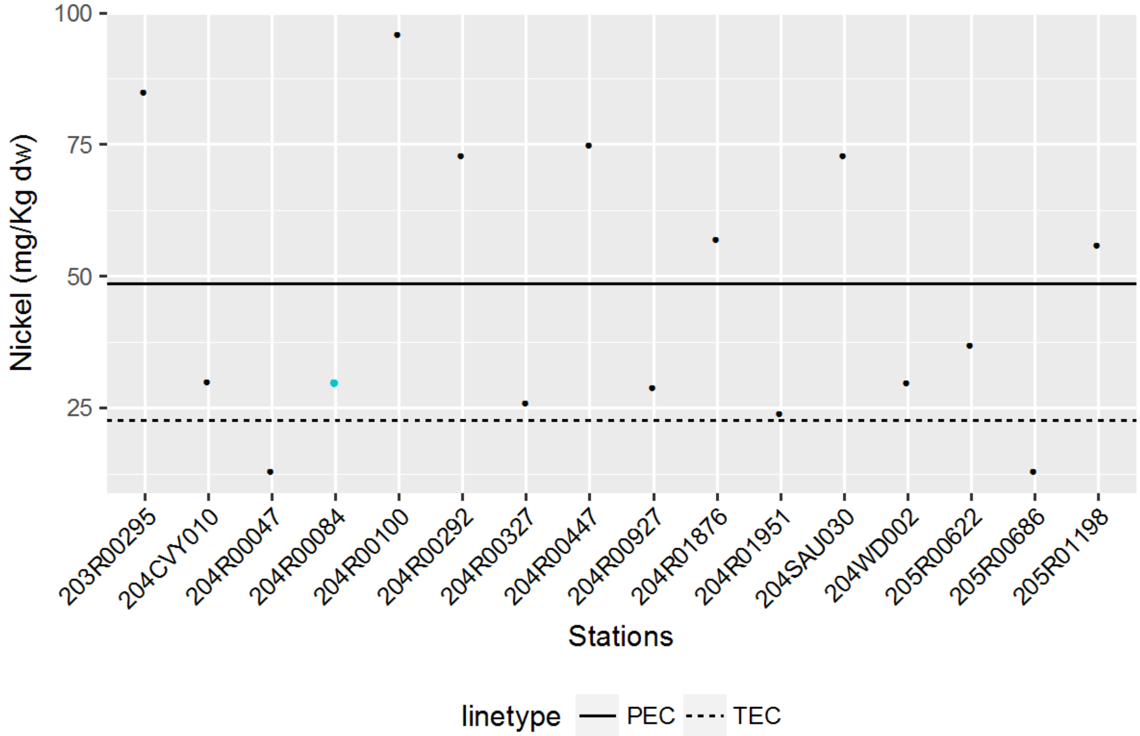

Figure 4-2. Relative Concentration of Nickel within ACCWP Sediment Chemistry Monitoring Sites 2012-17. Dublin Creek Sampling Station Shown in Blue.

In summary, there are multiple factors that argue against the concerns with sediment chemistry in the Dublin Creek watershed based upon data collected to-date. First, as previously discussed, the original identification of multiple TEC and PEC quotients above thresholds was largely driven by estimation techniques for dealing with laboratory non-detects in calculation of total PAHs and pesticides, which have been adjusted in successive years of the CSM program. Additionally, with removal of MRP 1.0 requirement for analysis of organochlorine pesticides in sediment, the number of analyses exceeding identified TEC / PEC thresholds dropped to 3 of 18 analytes for which site 204R00084 fell above relevant TEC quotients (and 0 of 18 relative to PEC quotients). These combined with the comparison of laboratory results for the analytes in question across all sites sampled within Alameda County suggests that concentrations in Dublin Creek are not outliers for sediment chemistry, and that this watershed would likely not have been selected for follow-on work based upon sediment chemistry results.

4.2 MRP Usage of TEC and PEC Metrics

MRP 2.0 permit language in Section C.8.g.iv indicates follow-up SSID project may be indicated when:

- *For pollutants without WQOs, results exceed Probable Effects Concentrations or Threshold Effects Concentrations*

This language tends to use the TECs and PECs calculated by MacDonald (2000) somewhat interchangeably when in fact they are quite different types of indicators. Per MacDonald (2000), the two terms are defined as "*threshold effect concentration (TEC; below which adverse effects are not expected to occur) and a probable effect concentration (PEC; above which adverse effects are expected to occur more often than not)*". As it relates to the MRP usage, the use of PEC as indicating a potential SSID project does have merit as a potential indicator of effects. However, the use of the TEC as an equivalent indicator does seem problematic, as concentrations between the calculated TEC and PEC values are difficult to interpret as to their likelihood of causing adverse effects.

With six years of concurrent sediment chemistry and sediment toxicity monitoring data compiled from 16 locations, we now have the capacity in a small way to evaluate the predictive ability of the PEC threshold against measured sediment toxicity results at these sites. Table 4-1 compiles ACCWP sites for which significant toxicity was exhibited along with the number of individual PEC quotients measured above 0.5 at those sites.

Table 4-1. ACCWP Samples Identified with Statistically Significant Sediment Toxicity and Associated Number of Trace Metals and PAHs PEC Quotients ≥ 0.5.

StationCode	Year	Species	Statistically Significant?	% effect	No. TEC Quotients ≥ 1.0	No. PEC Quotients ≥ 0.5	Analytes with PEC quotients ≥ 0.5
204R00047	2012	*H. azteca*	Y	7.8%	2	0	
205R00686	2013	*H. azteca*	Y	14.3%	1	0	
204R00447	2014	*H. azteca*	Y	46.4%	4	2	Nickel, Zinc
203R00295	2014	*H. azteca*	Y	15.4%	13	2	Mercury, Nickel
205R01198	2017	*H. azteca*	Y	33.7%	4	1	Nickel
205R01198	2017	*C. dilutus*	Y	66.7%	4	1	Nickel
204WRD002	2017	*C. dilutus*	Y	24.1%	6	0	

Only one of the samples collected to-date by ACCWP exhibited statistically significant toxicity to a sediment test species at a percent effect above 50%, the MRP 2.0 criterion used to indicate that follow-up monitoring is required (site 205R01198 for *C. dubia*). Of the six sites identified in Table 4-1 above that exhibited statistically significant toxicity regardless of percent effect, half were associated with sites with at least one PEC quotient above 0.5.

4.3 Biological Community

A total of 127 probabilistic sites have been sampled within Alameda County since the beginning of the CSM program in 2012; 118 of these sites are classified as urban land use. In order to understand where the two monitored sites in the Dublin Creek watershed (Figure 4-3) fall in comparison to remaining sites sampled, we compared CSCI scores compiled throughout CSM implementation.

Percentiles generated for CSCI scores at Alameda County urban sites are shown in

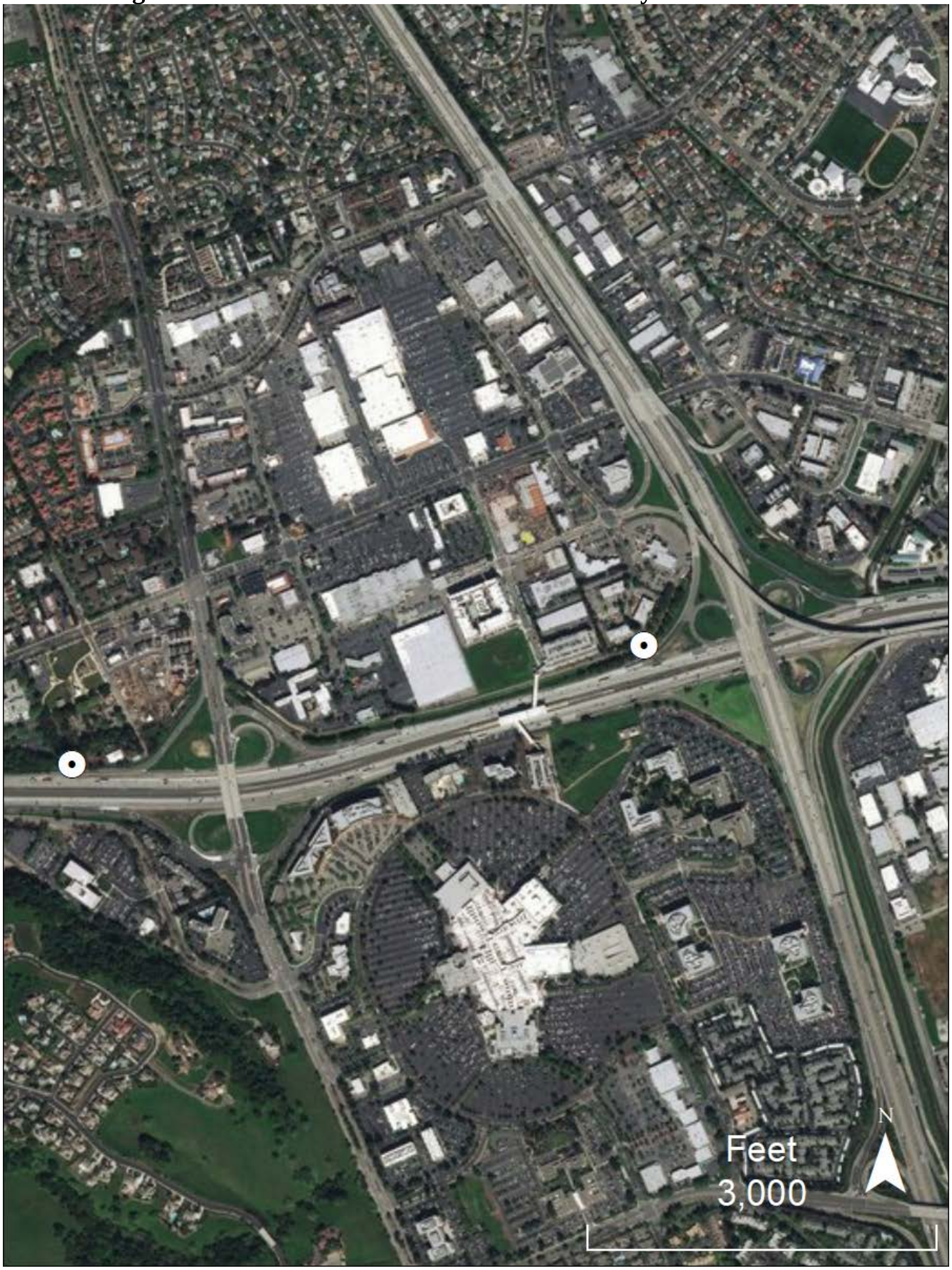

Figure 4-3. Location of Two Dublin Creek Bioassessment Monitoring Sites.

Table 4-2. A cumulative distribution function (CDF) of CSCI scores was developed from all urban creeks (N = 96) sampled in Alameda County during WY 2012-2016 (Figure 4-4), the period being assessed as part of an overall BASMAA review. The CDF was calculated using version 3.4.3 of the ‘spsurvey’ statistical library, using the R system (Stevens and Olsen 2004). The adjusted weights were generated from all RMC site assessments during the five-year period (BASMAA RMC Five Year Bioassessment Report, in prep). Each relevant SSID CSCI score was subsequently plotted on the CDF to determine the percentile represented by each observed score relative to the ambient condition in the County.

Figure 4-3. Location of Two Dublin Creek Bioassessment Monitoring Sites.

Table 4-2. CSCI Percentiles Calculated from Urban Probabilistic Monitoring Sites in Alameda County, 2012-16

Statistic	N	Estimate	Lower 95% Confidence Interval	Upper 95% Confidence Interval
5Pct	1	0.16	0.15	0.16
10Pct	9	0.18	0.16	0.21
25Pct	23	0.26	0.23	0.31
50Pct	47	0.39	0.35	0.42
75Pct	72	0.54	0.50	0.59
90Pct	86	0.73	0.69	0.76
95Pct	89	0.76	0.74	0.97
Mean	96	0.43	0.40	0.45
Variance	96	0.04	0.03	0.05
Std. Deviation	96	0.19	0.17	0.21

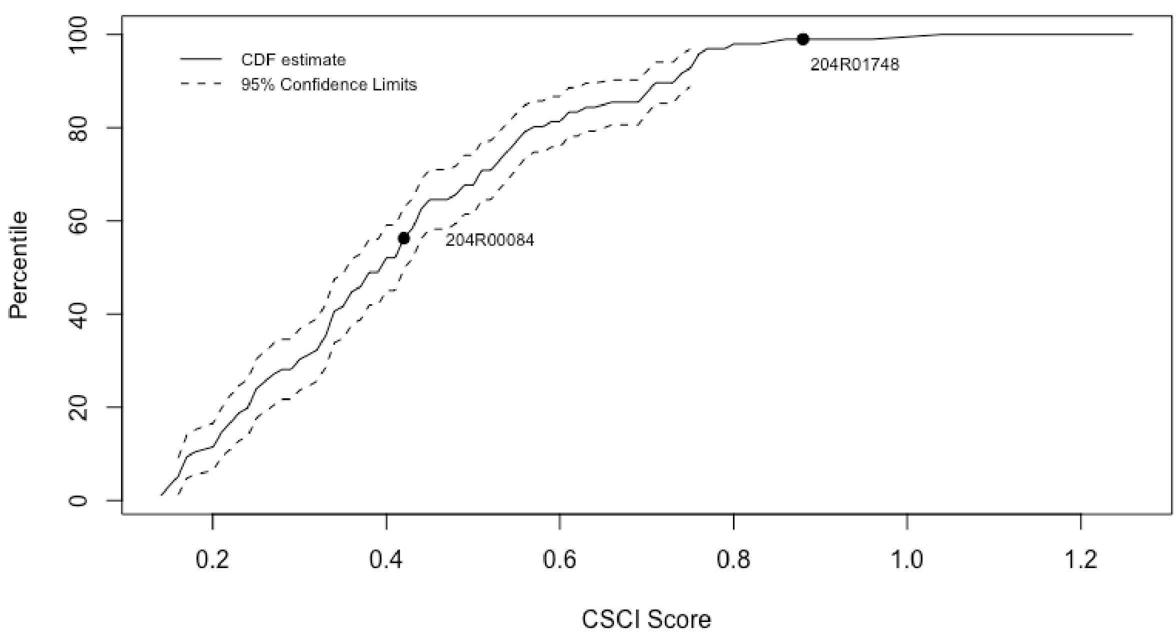

Figure 4-4. CDF of Urban Alameda County Sites 2012-16 with Dublin Creek Sites Highlighted.

The two SSID sites in Dublin Creek correspond to 50th (site 204R00084) and 99th percentile (204R01748) of urban creek monitoring CSCI data distribution generated from 2012-2016 monitoring. The CSCI scores at 204R00084 and 204R01748 correspond to the very likely altered (<=0.62) and possibly intact (0.79-0.92) CSCI categories, respectively. Based on CSCI metric, neither of the Dublin Creek sites appears to be outliers relative to remaining urban sites in Alameda County.

5 Future Direction

As discussed previously, additional knowledge gained through the last six years of CSM monitoring has furthered our understanding of how the Dublin Creek sediment chemistry and bioassessment data compare relative to that obtained from other watersheds within Alameda County. Our understanding is that the study area sites are typical of urban creek conditions throughout the County. Further, we also better understand that the MRP SSID triggers for sediment chemistry were overly conservative and not actually associated with toxicity at these sites. On this basis, in accordance with provision C.8.e.iii(3)(b), we request that the Executive Officer consider this SSID project complete. No additional follow-up is indicated. Future resources are proposed to be put toward SSID efforts following up on other management priorities or indicators of potential water quality concern generated through other ACCWP monitoring efforts.

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Zone 7 Water Agency

ALAMEDA COUNTYWIDE CLEAN WATER PROGRAM

STRESSOR SOURCE IDENTIFICATION PROJECT:

CASTRO VALLEY CREEK SEDIMENT QUALITY

WATER YEAR 2017 PROGRESS REPORT

URBAN CREEKS MONITORING REPORT, APPENDIX A.4B

Report prepared by

Alameda Countywide Clean Water Program

399 Elmhurst Street,
Hayward, California 94544

Submitted to:

California Regional Water Quality Control Board, San Francisco Bay Region

FINAL

MARCH 31, 2018

Protecting Alameda County Creeks, Wetlands & the Bay

List of Acronyms

Acronym	**Definition**
ACCWP	Alameda Countywide Clean Water Program
ACFCWCD	Alameda County Flood Control and Water Conservation District
BASMAA	Bay Area Stormwater Management Agencies Association
BMP	Best Management Practice
DPR	Department of Pesticide Regulation
I-	Interstate Highway
IBI	Index of Biotic Integrity
MRP, MRP 2.0	Municipal Regional Stormwater Permit (reissuance from previous "MRP 1.0")
PAH	Polycyclic Aromatic Hydrocarbon
PEC	Probable Effects Concentration
QAPP	Quality Assurance Project Plan
RMC	Regional Monitoring Coalition
RWQCB	Regional Water Quality Control Board
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board (California Regional Water Quality Control Board, San Francisco Bay Region)
SSID	Stressor/Source Identification
SOP	Standard Operating Procedure
SPoT	Stream Pollutant Trends
SWAMP	Surface Water Ambient Monitoring Program
TEC	Threshold Effect Concentration
UCMR	Urban Creeks Monitoring Report
UCMR	Urban Creeks Monitoring Report
WY	Water Year

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1 Introduction

The Alameda Countywide Clean Water Program (ACCWP) conducts Creek Status Monitoring as required by Provision C.8.c of the Municipal Regional Stormwater Permit (MRP, SFRWQCB 2015)[1]. ACCWP's 17 member agencies have joined with 56 other MRP Permittees to form the BASMAA Regional Monitoring Coalition (RMC), a regional collaborative to coordinate monitoring conducted pursuant to MRP Provision C.8, Water Quality Monitoring. The RMC prepared a Quality Assurance Project Plan (QAPP, BASMAA 2014a and 2016a) and Standard Operating Procedures (SOPs, BASMAA 2012b, 2014b and 2016b) to standardize monitoring methods and ensure comparability of monitoring data with the state's Surface Water Ambient Monitoring Program (SWAMP) see Table 1-1.

Table 1-1. Standard Operating Procedures Pertaining to BASMAA RMC Creek Status Monitoring

SOP #	SOP Title
FS-1	BMI and Algae Bioassessments, and Physical Habitat Measurements
FS-2	Water Quality Sampling for Chemical Analysis, Pathogen Indicators, and Toxicity
FS-3	Field Measurements, Manual
FS-4	Field Measurements, Continuous General Water Quality
FS-7	Field Equipment Cleaning Procedures
FS-8	Field Equipment Decontamination Procedures
FS-9	Sample Container, Handling, and Chain of Custody Procedures
FS-10	Completion and Processing of Field Datasheets
FS-11	Site and Sample Naming Convention
FS-12	Ambient Creek Status Monitoring Site Evaluation
FS-13	QA/QC Data Review

The RMC's Creek Status and Long-Term Trends Monitoring Plan (BASMAA 2011) assigns each of the Creek Status monitoring parameters listed in MRP Table 8.1 to one of two sub-design components:

- Regional: ambient monitoring to assess the condition of aquatic life in creeks across the San Francisco Bay Area. Candidate monitoring sites were drawn from a probabilistically generated master list that included all perennial and non-perennial creeks and rivers within the applicable portions of the five participating counties. Sites from the RMC

[1]The MRP was initially issued as SFBRWQCB 2009 (MRP 1.0) and reissued on November 19, 2015 with minor revisions in monitoring provisions regarding Stressor/Source Identification, which was renumbered as provision C.8.e in the reissued MRP 2.0. Unless otherwise noted, references to trigger values and other permit requirements in this report refer to the original MRP (SFBRWQCB 2009)

master list are identified by an alphanumeric code in which the last 6 characters are "Rnnnnn" with "R" designating the RMC probabilistic design and "nnnnn" the site's numeric sequence number generated through the RMC master draw[2]. RMC sites can also be assigned an alternative ID using the SWAMP naming procedure described in RMC SOP FS-11.

- Targeted: monitoring design and site selection address local watershed management questions. The last 6 characters of each Site ID reflect the watershed and numbering from the base of the watershed per the RMC SOP FS-11.

Creek Status Monitoring was initiated in WY2012 (October 2011 through September 2012) and reported in the first Urban Creeks Monitoring Report (UCMR, BASMAA 2013) submitted to the Regional Water Quality Control Board (RWQCB) in March 2013. The UCMR evaluated all data against "trigger criteria" listed for each parameter in MRP Table 8.1, which identified potential follow-up actions including Stressor/Source Identification (SSID) projects as required by Provision C.8.d.i of the Municipal Regional Stormwater Permit (MRP), subject to several conditions:

1. Creek Status Monitoring results meet one or more trigger criteria in MRP Table 8.1
2. When conducting monitoring through a regional collaborative, Permittees were collectively required to initiate no more than ten SSID projects during the MRP Permit term, and ACCWP's proportionate share were assumed to be three projects out of the 10.
3. If results indicated toxicity, at least 2 of the 10 SSID projects must be for toxicity
4. No need to repeat for continuing or recurring occurrences of the trigger in later results from the same receiving water limitations, unless directed to do so by the Water Board
5. No need to follow up on trigger results that are caused by Pollutants of Concern that are already being addressed by other portions of the MRP (e.g. pesticides).

The RMC programs developed a collaborative decision-making process for selecting sites for SSID follow-up. Program representatives reviewed the previous year's creek status monitoring results that reached "trigger" criteria, and prioritized sites for SSID follow-up based on several criteria including environmental significance of the trigger results and the feasibility of completing the project steps outlined in the MRP (see below). After consultation with affected Permittee(s), the RMC confirmed the candidate SSID project list with Water Board staff in April 2012 and individual programs planned initiation of SSID studies in their areas for FY 2013-14.

[2] As recommended for SWAMP data compatibility per RMC SOP FS-11, all site ID codes begin with a 3 digit Hydrologic Unit Code.

MRP 1.0 listed four steps[3] for a SSID project, with ACCWP and other Countywide Programs leading the technically oriented steps 1 and 4 and collaborating with relevant Permittees on step 2. Permittee(s) will be the lead on step 3 to the extent that effective stormwater BMPs are within their power and jurisdiction. The steps are:

(1) Conduct a site specific study (or non-site specific if the problem is widespread) to identify and isolate the cause(s) of the trigger stressor/source. If the trigger stressor or source is already known (e.g. toxicity), proceed directly to step 2.

(2) Identify and evaluate the effectiveness of options for controlling the cause(s) of the trigger stressor/source.

(3) Implement one or more controls.

(4) Confirm the reduction of the cause(s) of trigger stressor/source.

Previous progress reports (ACCWP 2014, 2016) describe the first three years of an SSID study of sediment quality in the Castro Valley Creek watershed. This report documents further project activities through January 2018, and identifies planned follow-on activities.

[3] The reissued MRP modifies details and reporting requirements of these steps.

2 Background

2.1 Study Area

2.1.1 Castro Valley Creek

Castro Valley Creek is a tributary to San Lorenzo Creek, which covers an area of 5.5 square miles in an unincorporated area of Alameda County. It is located to the southeast of San Leandro in the western portion of the County known as Castro Valley. The subwatersheds of interest in this study are presented in Figure 2-1. The land use estimates for the targeted subwatersheds directly upstream of the area of interest are presented in Table 2-1 (Scanlin and Feng 1997).

Table 2-1. Estimated Land Use Percentages of Selected Subwatersheds of the Castro Valley Creek

SubwatershedCode (per Map)	Area (acres)	Commercial	Open	Residential	Pervious Area
1	908	4%	52%	44%	80%
2	391	37%	3%	60%	41%

The site within Castro Valley for which monitoring results triggered the SSID project (Site 204R00047) is in an engineered channel that receives flows from mixed commercial and residential land uses along with some non-urban areas in the upper watershed. There is also the potential for freeway impacts where Interstate-Highway (I-) 580 crosses the creek system a few hundred meters upstream of Site 204R00047.

At the site of interest, the creek is designated as a flood control channel of the Alameda County Flood Control and Water Conservation District (ACFCWCD), i.e. Zone 2 Line I.

2.1.2 Beneficial Uses

Beneficial uses (SFRWQCB, 2015b) assigned to Castro Valley Creek include:

- Cold Freshwater Habitat (COLD);
- Preservation of rare or endangered species (RARE);
- Warm freshwater habitat (WARM);
- Wildlife habitat (WILD); and
- Water Contact and Non-contact Recreation (REC-1 and REC-2). Public parks or other facilities allow access or approaches to sections of Castro Valley.

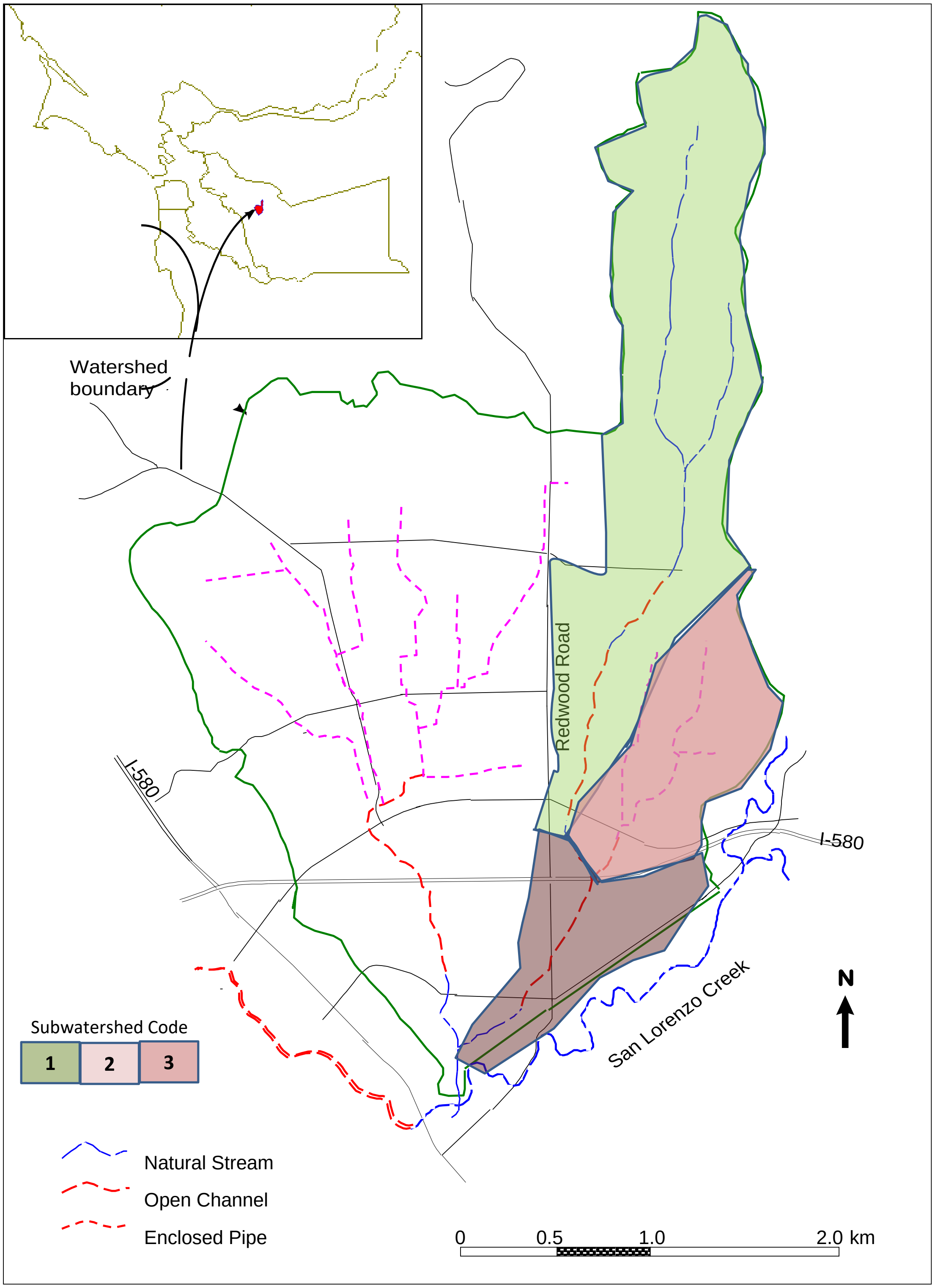

Figure 2-1. Site 204R00047 Relative to Castro Valley Creek Watershed

2.2 Problem Statement

2.2.1 Water Quality Triggers

Comparison of WY 2012 sampling results at site 204R00047 with MRP 1.0 trigger criteria are presented in Table 2-2.Triggers for sediment quality were based on calculation of Threshold Effects Concentration (TEC) and Probable Effects Concentration (PEC) for each analyte as determined following MacDonald et al. (2000). It should be noted that there are some limitations in the MacDonald method, which are discussed below.

Table 2-2. WY 2012 MRP Triggers and Significance at Castro Valley Creek Site 204R00047

Trigger type	Trigger status at site	Comment
"Triad" - bioassessment indication of alteration	**IBI score Poor** (Poor chosen as trigger)	Widespread in region, generally driven by habitat alteration
"Triad" - sediment chemistry	**16 chemicals > Threshold Effects Concentration**	TEC and PEC contributions by chemical groups: • PAHs - somewhat elevated • Pesticides (organochlorine) all significantly elevated • Metals - slightly elevated zinc
	Probable Effects Concentration: average Quotient > 0.5	
	Pyrethroids calculated 2.38 >1 TU Equivalent	
"Triad" - sediment toxicity	Not present or triggered	
Chlorine in water column	**Low: 0.12 mg/l >0.08 on one of 2 occasions**	Widespread in region; result is near limit of method detection
Toxicity in water column	Present but not triggered	*Hyalella* initial sample 48% of control, retest did not confirm
General Water Quality - DO	Not sampled	
General WQ - other	Not sampled	
Temperature	Not sampled	
Pathogen Indicators	Not sampled	

Re-evaluation of the WY 2012 data reported in the UCMR (BASMAA 2013) revealed relatively large differences in some cases between using one-half of the MDL vs. one-half of the MRL to estimate ND results for statistical purposes. Calculated TEC quotients for individual and total PAHs were lower across-the-board using the MDL due to the relatively large proportion of non-detects and the difference between MDLs and MRLs reported. It should be noted that WY 2012 analyses were predominantly non-detects, and therefore, the TEC quotients calculated are driven by the RL rather than quantified laboratory results.

While MacDonald (2000) generated PECs for multiple trace elements, PAHs, OC pesticides, and pyrethroid pesticides, there was insufficient data at the time of its publication to evaluate the consensus PECs generated as to their predictive ability for associated sediment toxicity for each of the analytes reported. Analytes for which predictive ability is particularly uncertain include various PAH (anthracene, fluorine, and fluoranthene) and OC pesticide (dieldrin, DDDs, DDTs, endrin, heptachlor epoxide, and lindane) parameters (MacDonald, 2000).

When examining pyrethroids concentrations, a similar degree of uncertainty exists. Weston (2005) reported that predictions of sediment toxicity to *H. azteca* were supported by observed results for sites with TU ratios below one (little or no mortality) and above four (high or full mortality). However, for TUs between one and four, the predictive ability of the TU was less certain (Weston 2005). The Toxicity Unit calculation for pyrethroids was eliminated as a trigger criterion in MRP 2.0, as was the complex linkage of sediment chemistry, toxicity, and bioassessment used for interpreting results of the various monitoring components.

2.2.2 Potential Sources and Activities Contributing to Poor Sediment Quality

The Causal Analysis/Diagnosis Decision Information System (CADDIS) was developed by the US EPA as an online guidance tool for conducting causal assessments of impacts to aquatic ecosystems (US EPA 2010). The online tool provides a framework and resource base for Stressor Identification (SI) using a five-step process for conducting a causal assessment:

Step 1: Define the Case
Step 2: List Candidate Causes
Step 3: Evaluate Data from the Case
Step 4: Evaluate Data from Elsewhere
Step 5: Identify Probable Causes

The Stressor Identification process may be iterative, and if the stressor cannot be adequately identified in the first attempt, the process may continue with collection of additional data or testing other suspected stressors. It should be noted that the CADDIS is designed to be initiated following observations of a biological effect; however in this case the sediment quality concerns were triggered by chemical concentrations that were not accompanied by significant toxicity.

Figure 2-2 shows a simple conceptual diagram from CADDIS, illustrating causal pathways related to unspecified toxic chemicals as a candidate cause of biological impairment. However CADDIS also notes that “urbanization” comprising several types of causal activities that together result in an “urban stream syndrome” of co-occurring, interacting changes in five general stressor categories:

- Water/Sediment Quality
- Temperature
- Hydrology
- Physical Habitat

- Energy Sources

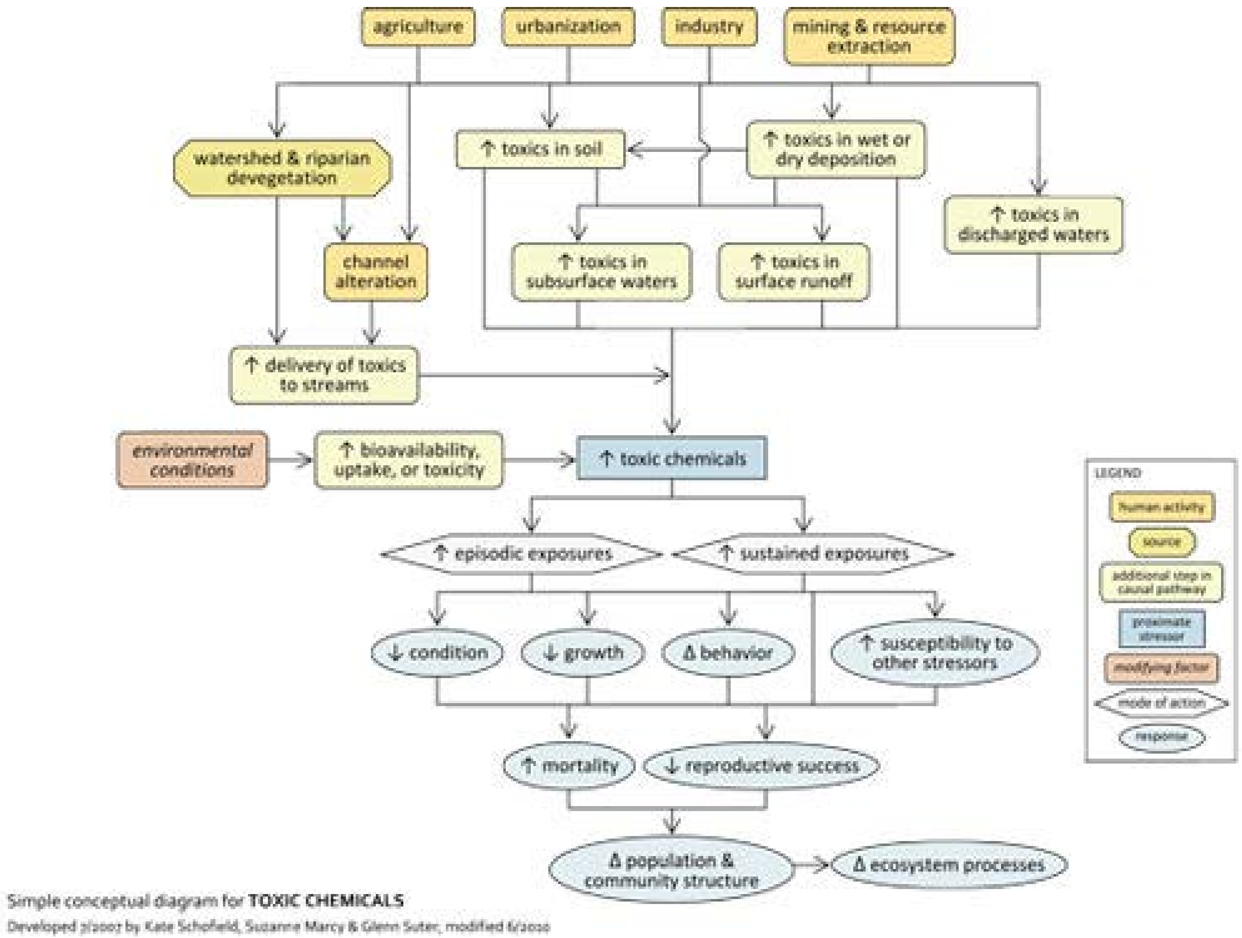

Figure 2-2. Conceptual Diagram Illustrating Causal Pathways, From Sources To Impairments, Related to Unspecified Toxic Chemicals (USEPA 2010)

Potential sources of poor sediment quality relevant to Castro Valley Creek included:

- Commercial land use discharges,
- Residential land use sources,
- Freeway runoff,
- Legacy pollutants
- Hydromodification of the channel.

3 Previous SSID Monitoring

ACCWP (2014) described a study design for WY 2013 sediment sampling in target subwatersheds of Castro Valley Creek, to try to characterize these potential source types. A literature review was also conducted. Sediment sampling was conducted in July 2013 at 5 sites shown in Figure 3-1, in conjunction with sediment sampling for Creek Status Monitoring.

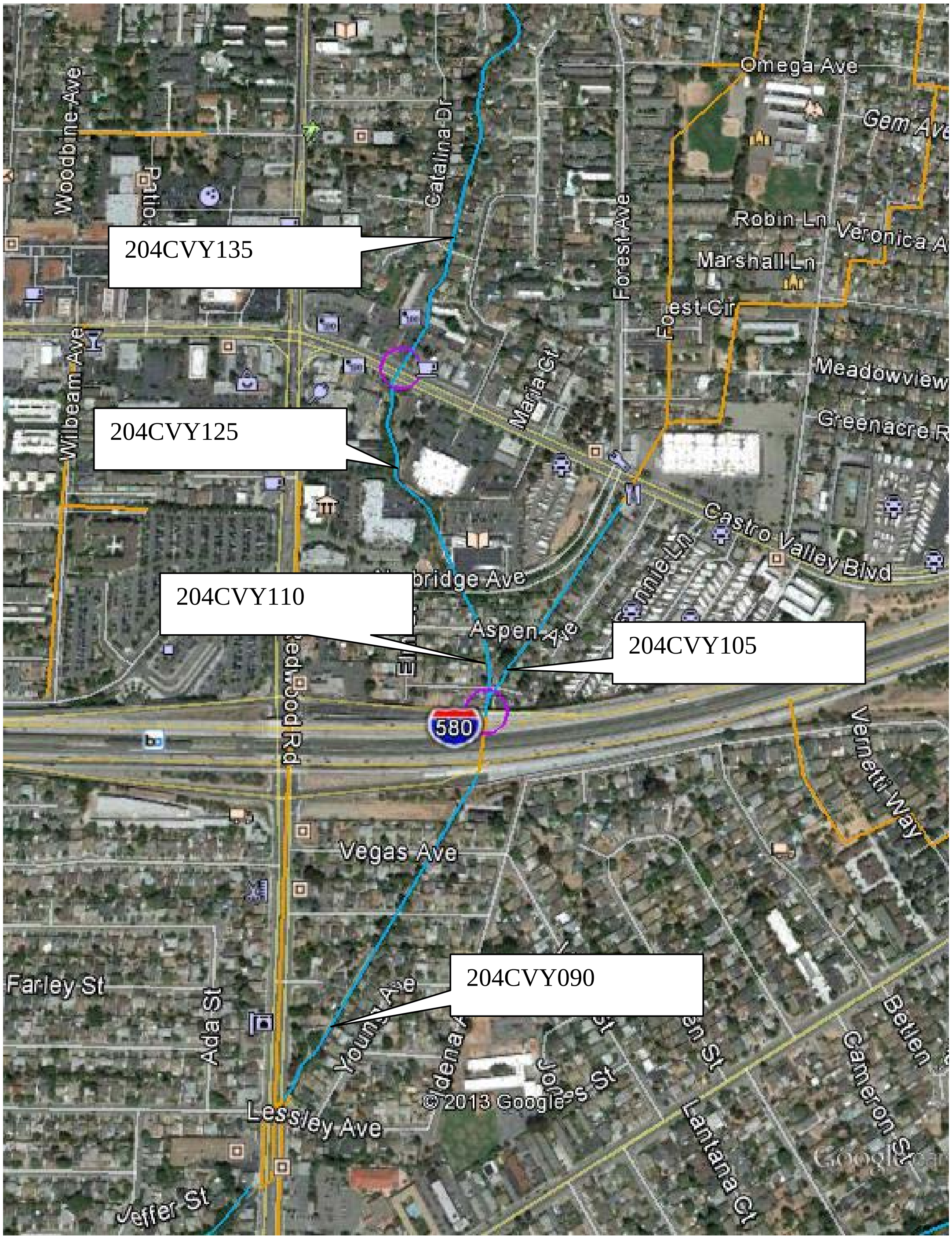

Figure 3-1. WY 2013 Monitoring Locations for Source Identification in the Castro Valley Creek Watershed

At each of the five monitoring locations, sediment samples were collected and analyzed for:

- Pyrethroid pesticides;
- Total metals;
- Organochlorine pesticides;
- Polycyclic aromatic hydrocarbons;
- Percent fines;
- Total organic carbon.

Results of this monitoring were generally similar to sediment chemistry concentrations observed in other urban areas in California:

- Pyrethroids were slightly higher in the eastern (mostly culverted) branch of Castro Valley Creek suggesting sources from the urbanized areas upstream. These results are consistent with published findings that pyrethroid concentrations increase with degree of urbanization (Anderson *et al*, 2012, TDC, 2010a and 2010b). Bifenthrin was the most commonly found pyrethroid in the watershed. This result is consistent with other state and regional findings. Bifenthrin is stable in aquatic environments and is more commonly used in urbanized areas. However, pyrethroid concentrations in this study were lower than those reported as average concentrations in the SPoT program (Anderson *et al*, 2010) and by DPR (Zhang, 2010).

- PAH concentrations were lower than the averages found in other parts of the Alameda County (ACCWP, 2002) but generally higher than those found in Castro Valley sediment samples in 1989-1991. In this study the highest PAH concentrations were found in the most downstream site (Site 204CVY090), below I-580.

- Metal concentrations were generally comparable to concentrations previously found in Castro Valley Creek sediments in 1989-1991. Mercury concentrations were lower than those found in creek and channel sediments from western Alameda County (ACCWP 2002). The upper western branch of the Castro Valley Creek, above the commercial land use area, had higher metal concentrations compared with the eastern branch.

- Organochlorine pesticide concentrations were lower than those found in Castro Valley sediments in 1989-1991 and lower than averages found in the joint Agency sediment sampling program around the MRP region (Kinnetic Laboratories and EOA, 2002). Organochlorine pesticide concentrations were found to be slightly higher in the upper reaches of the western branch.

In WY 2016, ACCWP selected the site 204CVY010 at the base of the watershed (at USGS gaging station 11181008) for Pesticides and Toxicity Monitoring per provision C.8.g of MRP 2.0. This provision combines all pesticide and toxicity monitoring that was formerly distributed between Creek Status and Pollutants of Concern Monitoring provisions and requires Permittees to select monitoring sites where toxicity could be likely. No water or sediment toxicity was observed in dry season samples from this lower Castro Valley Creek site. Out of the MRP 2.0 analyte list, 7 constituents had Threshold Effect Concentration (TEC) exceeding 1.0 and one had a Probable Effect Concentration (PEC) quotient exceeding 1.0.

In WY 2018, ACCWP again selected the site 204CVY010 at the base of the watershed for wet season Pesticides and Toxicity Monitoring per provision C.8.g of MRP 2.0. Monitoring was completed on January 11, 2018. This monitoring included assessment of aquatic toxicity and analysis of select pesticides in water (Pyrethroids, Imadacloprid, and Fipronil).

The aquatic toxicity sample for the Castro Valley location exhibited significant toxicity to *Chironomus dilutus* relative to the laboratory control, with a 95% effect. Combined with the lack of toxic response exhibited by the remaining test species (*Selenastrum capriconutum*, *Ceriodaphnia dubia*, *Hyalella azteca*, and *Pimephales promelas*) our initial focus centered on the non-pyrethroid pesticides as possible causative agents.

Results for analytical chemistry were received on February 22, 2018. Analyses of all pyrethroid pesticides were reported as non-detects with acceptable reporting limits consistent with QAPP (0.2 to 0.4 ng/L per analyte). Results at this site for both Fipronil (382 ng/L) and Imidacloprid, (237 ng/L), however, were both an order of magnitude higher than any samples collected at the other ACCWP sites monitored.

Consistent with provision C.8.g of MRP 2.0, ACCWP conducted follow-up toxicity monitoring for the failed test (*C. dilutus* survival) from January 2018. ACCWP also incorporated additional analysis of Fipronil and Imidacloprid to help assess variability of these constituents among Castro Valley Creek rain events. Monitoring was completed on March 1, 2018, and results of these toxicity and chemistry analyses are expected to be available in mid-April.

4 Discussion and Planned Activities

As described in the WY 2016 progress report, the data collected to-date are inconclusive in terms of identifying potential stressors. Program staff reviewed the initial monitoring results with stormwater program staff for the unincorporated Alameda County, who conducted a review of over 4 years of inspection reports in the vicinity and determined that no major illicit discharges had been reported that could be singled out as causing the observed sediment chemistry concerns.

Moreover, it should be noted that the initial identification of Castro Valley Creek as a SSID study site was based upon one sampling point collected in the first year of Creek Status Monitoring. Having completed six years of CSM monitoring (though not all data was available for this report), we now have data to place the site in greater context, which brings into question whether this site would have been a priority site for SSID work. Information supporting this finding is provided in the sections below.

4.1 Sediment Quality

As part of step 4 of the CADDIS process briefly discussed above, we compiled data for the 16 sites within Alameda County that have been sampled for sediment quality parameters through CSM monitoring to-date (Figure 4-1). The sites are spread throughout the County and encompass a variety of creek conditions.

As part of the original 2012 UCMR, ACCWP identified 16 of the 27 sediment chemistry parameters with relevant TEC / PEC thresholds at site 204R00047 that generated a TEC quotient[4] above 1.0. It should be noted that 9 of the 16 quotients above 1.0 were associated with analyses of pesticides (Chlordane, Dieldrin, Endrin, Heptachlor Epoxide, Lindane, Sum DDD, Sum DDE, Sum DDT, and Total DDTs) that are no longer specified for monitoring through MRP 2.0. For 2015 monitoring at a second probabilistic site in Castro Valley Creek, 204R01951, eight of the analytes generated TEC quotients above 1.0, with four of these associated with constituents that are no longer analyzed. None of the sediments collected for either site generated a PEC quotient greater than or equal to the MRP 1.0 trigger threshold of 0.5.

Using current substitution techniques for estimating contribution of non-detects and excluding pesticides no longer analyzed through MRP 2.0, the only data for the two Castro Valley Creek probabilistic sites 204R00047 and 204R01951 that generated a TEC quotient above 1.0 were associated with analysis of three metals (Lead, Mercury, and Zinc) and two PAHs (Chrysene and Pyrene). In order to place this data into context, we compared results for these five analytes (Figure 4-2 through Figure 4-6) across the 16 sites within Alameda County where MRP sediment chemistry monitoring has been conducted. It should be noted that not all parameters were analyzed in each year (Table 4-1). For the two PAHs, Castro Valley Creek sediment samples represent fairly typical concentrations relative to other watersheds sampled. For the three metals, sediment samples from the upper watershed site at 204R01951 are in the upper quartile of all Alameda County sampling sites, while they represent generally lower concentrations at site 204R00047.

[4] Calculated prior to change in technique used to estimate contribution of non-detects.

Figure 4-1. ACCWP CSM Sediment Sampling Sites, 2012-17

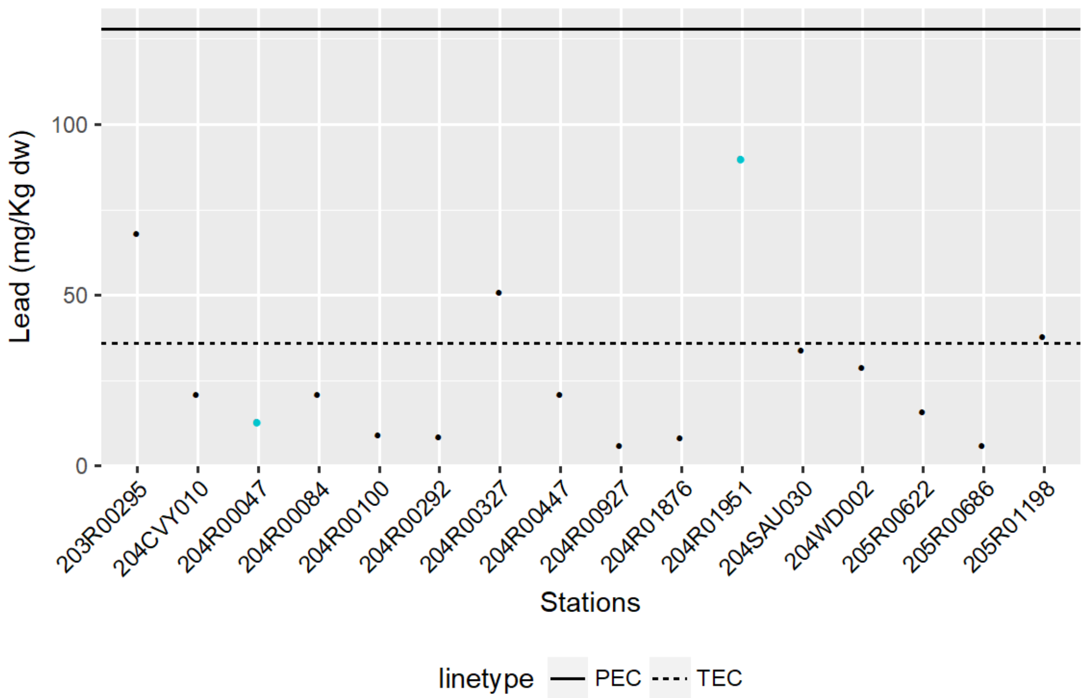

Figure 4-2. Relative Concentration of Lead within ACCWP Sediment Chemistry Monitoring Sites 2012-17. Castro Valley Creek Sampling Stations Shown in Blue

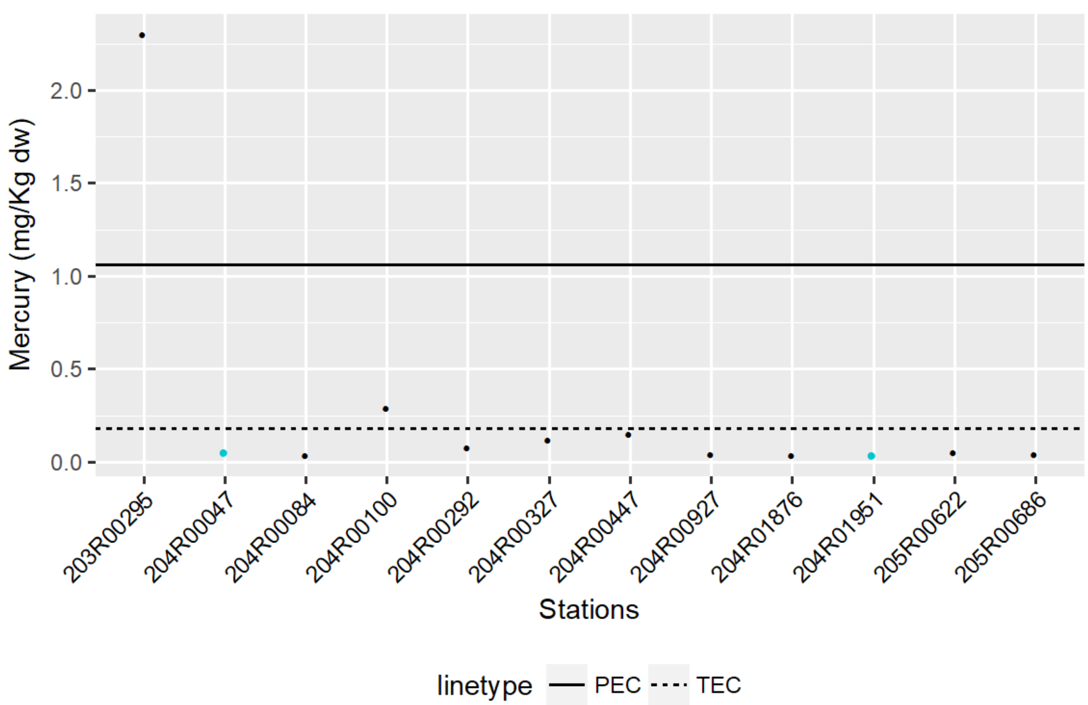

Figure 4-3. Relative Concentration of Mercury within ACCWP Sediment Chemistry Monitoring Sites 2012-17. Castro Valley Creek Sampling Stations Shown in Blue. Note that Analysis of Mercury Discontinued under MRP 2.0

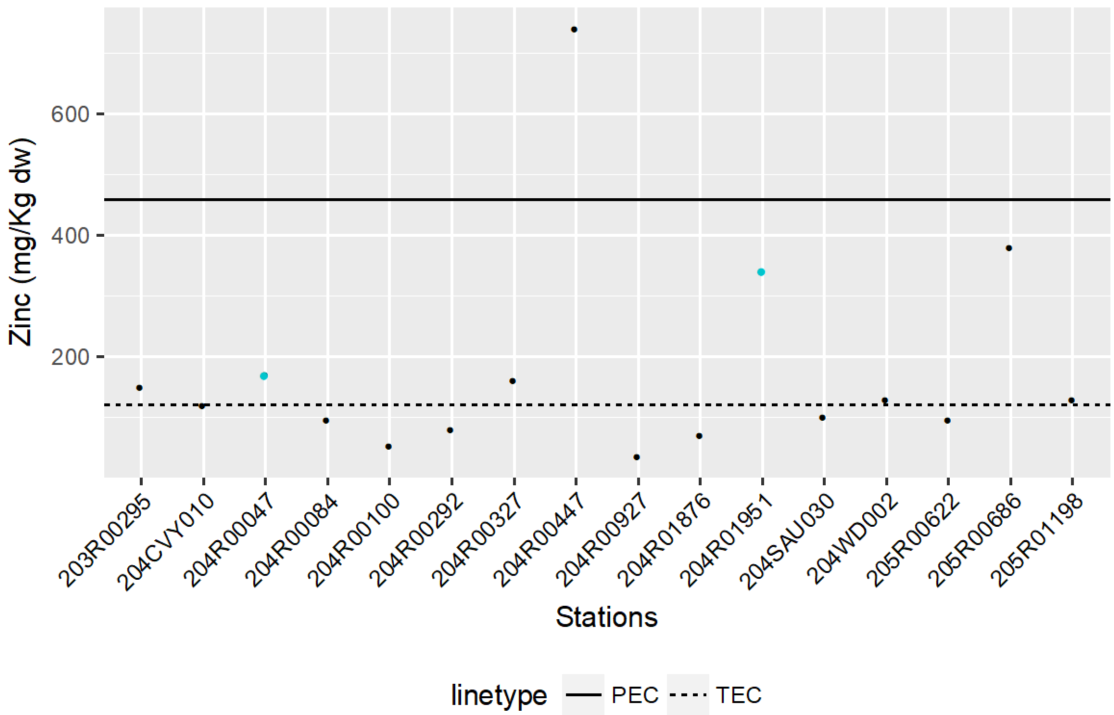

Figure 4-4. Relative Concentration of Zinc within ACCWP Sediment Chemistry Monitoring Sites 2012-17. Castro Valley Creek Sampling Stations Shown in Blue

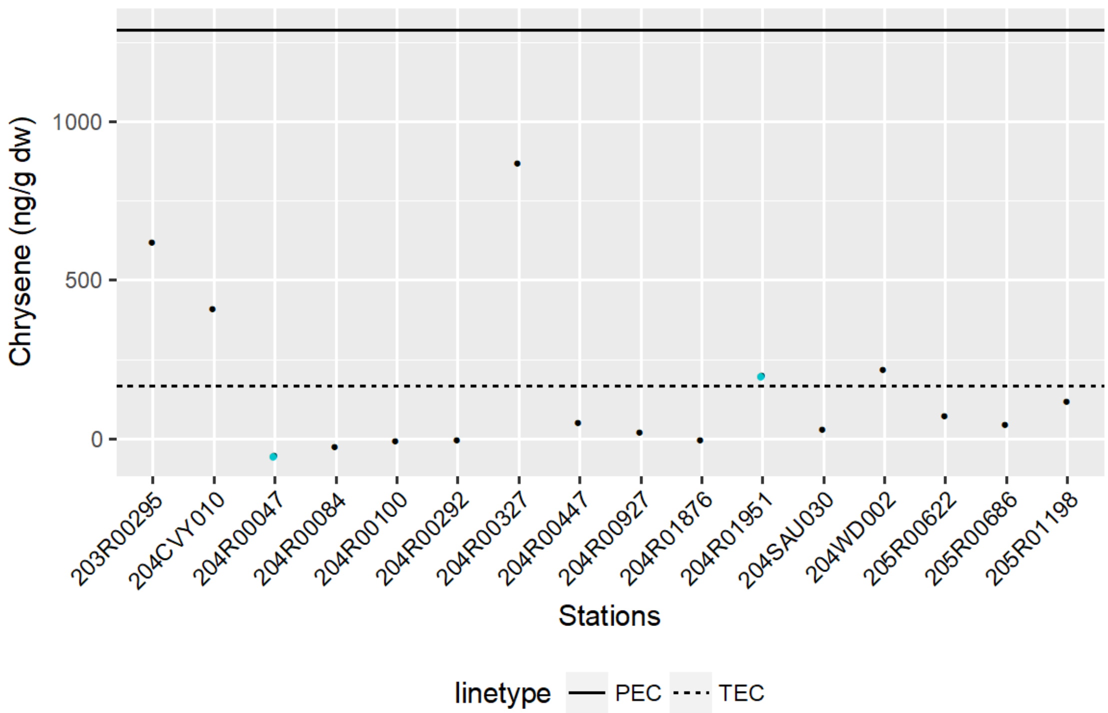

Figure 4-5. Relative Concentration of Chrysene within ACCWP Sediment Chemistry Monitoring Sites 2012-17. Castro Valley Creek Sampling Stations Shown in Blue

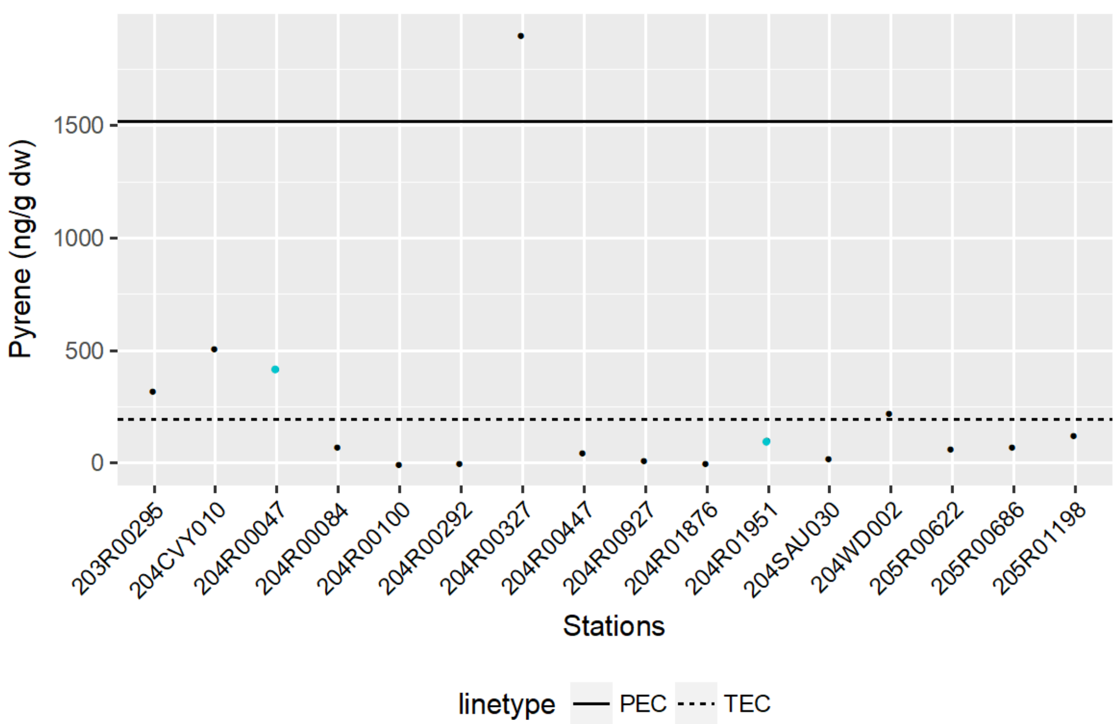

Figure 4-6. Relative Concentration of Pyrene within ACCWP Sediment Chemistry Monitoring Sites 2012-17. Castro Valley Creek Sampling Stations Shown in Blue

Table 4-1. Parameters Monitored through ACCWP CSM Sediment Chemistry Monitoring 2012-17

Site	WY	Analyte						
		Metals	Hg	PAHs	OC Pesticides	Pyrethroid Pesticides	Fipronil, Carbaryl	Particle Size, TOC
204R00047	2012	X	x	x	x	x		x
204R00084	2012	X	x	x	x	x		x
204R00100	2012	X	x	x	x	x		x
204R00327	2013	X	x	x	x	x		x
204R00447	2013	X	x	x	x	x		x
205R00686	2013	X	x	x	x	x		x
203R00295	2014	X	x	x	x	x		x
204R00292	2014	X	x	x	x	x		x
204R00927	2014	X	x	x	x	x		x
204R01876	2015	X	x	x	x	x		x
204R01951	2015	X	x	x	x	x		x
205R00622	2015	X	x	x	x	x		x
204CVY010	2016	X		x		x	x	x
204SAU030	2016	X		x		x	x	x
205R01198	2017	X		x		x	x	x
204WRD010	2017	X		x		x	x	x

In summary, there are multiple factors that argue against previously-identified concerns with sediment chemistry in the Castro Valley Creek watershed based upon data collected to-date. First, as previously discussed, the original identification of multiple TEC and PEC quotients above thresholds was largely driven by estimation techniques for dealing with laboratory non-detects in calculation of total PAHs and pesticides, which have been adjusted in successive years of the CSM program to eliminate this previous bias. Additionally, with removal of MRP 1.0 requirement for analysis of organochlorine pesticides in sediment, the number of analyses exceeding identified TEC / PEC thresholds dropped to 4 of 18 analytes for which site 204R00047 fell above relevant TEC quotients (and 0 of 18 relative to relevant PEC quotients) and 4 of 18 for upstream site 204R01951 (again, with 0 of 18 relative to PEC quotients). These combined with the comparison of results for the analytes in question across all sites sampled within Alameda County suggest that concentrations of priority pollutants in Castro Valley Creek are not outliers for sediment chemistry, and indicates that this watershed would likely not have been selected for follow-on work based upon sediment chemistry results.

4.2 MRP Usage of TEC and PEC Metrics

MRP 2.0 permit language in Section C.8.g.iv indicates follow-up SSID project may be indicated when:

- *For pollutants without WQOs, results exceed Probable Effects Concentrations or*

Threshold Effects Concentrations

This language tends to use the TECs and PECs calculated by MacDonald (2000) somewhat interchangeably when in fact they are quite different types of indicators. Per MacDonald (2000), the two terms are defined as "*threshold effect concentration (TEC; below which adverse effects are not expected to occur) and a probable effect concentration (PEC; above which adverse effects are expected to occur more often than not)*". As it relates to the MRP usage, the use of PEC as indicating a potential SSID project does have merit as a potential indicator of effects. However, the use of the TEC as an equivalent indicator does seem problematic, as concentrations between the calculated TEC and PEC values are difficult to interpret as to their likelihood of causing adverse effects.

With six years of concurrent sediment chemistry and sediment toxicity monitoring data compiled from 16 locations, we now have some ability to evaluate the predictive ability of the PEC threshold against measured sediment toxicity results at these sites. Table 4-2 compiles ACCWP sites for which significant toxicity was exhibited along with the number of individual PEC quotients measured above 0.5 at those sites.

Table 4-2. ACCWP Samples Identified with Statistically Significant Sediment Toxicity and Associated Number of Trace Metals and PAHs PEC Quotients ≥ 0.5

Station Code	Year	Species	Statistically Significant?	% Effect	No. TEC Quotients ≥ 1.0	No. PEC Quotients ≥ 0.5	Analytes with PEC quotients ≥ 0.5
204R00047	2012	*H. azteca*	Y	7.8%	2	0	
205R00686	2013	*H. azteca*	Y	14.3%	1	0	
204R00447	2014	*H. azteca*	Y	46.4%	4	2	Nickel, Zinc
203R00295	2014	*H. azteca*	Y	15.4%	13	2	Mercury, Nickel
205R01198	2017	*H. azteca*	Y	33.7%	4	1	Nickel
205R01198	2017	*C. dilutus*	Y	66.7%	4	1	Nickel
204WRD002	2017	*C. dilutus*	Y	24.1%	6	0	

Only one of the samples collected to-date by ACCWP exhibited statistically significant toxicity to a sediment test species at a percent effect above 50%, the MRP 2.0 criterion used to indicate that follow-up monitoring is required (site 205R01198 for *C. dubia*). Of the six sites identified in Table 4-2 above that exhibited statistically significant toxicity regardless of percent effect, half were associated with sites with at least one PEC quotient above 0.5.

4.3 Biological Community

A total of 127 probabilistic sites have been sampled within Alameda County since the beginning of the CSM program in 2012; 118 of these sites are classified as urban land use. In order to understand where the two monitored sites in the Castro Valley Creek watershed (204R00047 and 204R01951) fall in comparison to remaining sites sampled, we compared CSCI scores compiled through CSM implementation.

Percentiles generated for CSCI scores at Alameda County urban sites are shown in Table 4-3. A cumulative distribution function (CDF) of CSCI scores was developed from all urban creeks (N = 96) sampled in Alameda County during WY 2012-2016 (Figure 4-7), the period being assessed as part of an overall BASMAA review. The CDF was calculated using version 3.4.3 of the 'spsurvey' statistical library, using the R system (Stevens and Olsen 2004). The adjusted weights were generated from all RMC site assessments during the five-year period (BASMAA RMC Five Year Bioassessment Report, in prep). Each relevant SSID CSCI score was subsequently plotted on the CDF to determine the percentile represented by each observed score relative to the ambient condition in the County.

Table 4-3. CSCI Percentiles Calculated from Urban Probabilistic Monitoring Sites in Alameda County, 2012-16

Statistic	N	Estimate	Lower 95% Confidence Interval	Upper 95% Confidence Interval
5Pct	1	0.16	0.15	0.16
10Pct	9	0.18	0.16	0.21
25Pct	23	0.26	0.23	0.31
50Pct	47	0.39	0.35	0.42
75Pct	72	0.54	0.50	0.59
90Pct	86	0.73	0.69	0.76
95Pct	89	0.76	0.74	0.97
Mean	96	0.43	0.40	0.45
Variance	96	0.04	0.03	0.05
Std. Deviation	96	0.19	0.17	0.21

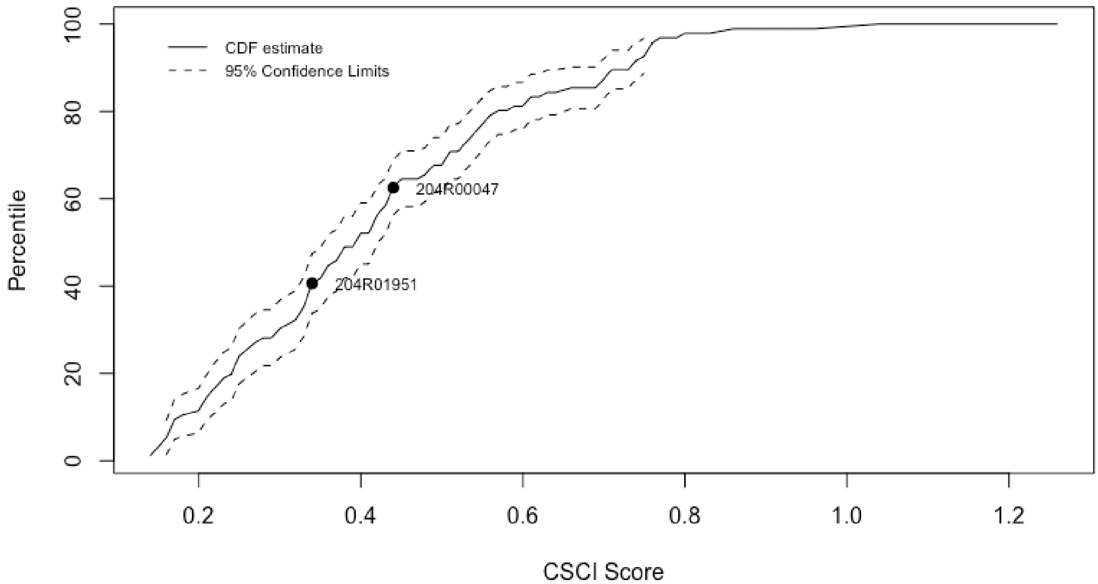

Figure 4-7. CDF of Urban Alameda County Sites 2012-16 with Castro Valley Creek Sites Highlighted

The two SSID sites in Castro Valley Creek correspond to the 40th (204R01951) and 63rd (204R00047) percentiles of urban creek monitoring CSCI data distribution generated from 2012-2016 monitoring. The CSCI scores at both 204R00047 and 204R01951 correspond to the very likely altered CSCI category (<=0.62). Based on CSCI metric, neither of the Castro Valley Creek sites appears to be outliers relative to remaining urban sites in Alameda County.

4.4 Aquatic Toxicity and Chemistry

To-date, a total of three sampling events have been conducted in the Castro Valley Creek watershed under the CSM and Pesticide and Toxicity components of MRP 1.0 and MRP 2.0 implementation at sites shown in Figure 4-8 and described below.

- WY 2015 dry season sampling at probabilistic site 204R01951 exhibited no aquatic toxicity.
- WY 2016 dry season sampling at targeted site 204CVY010 exhibited no aquatic toxicity
- WY 2018 wet season sampling at targeted site 204CVY010 exhibited statistically significant aquatic toxicity to *C. dilutus*.

The wet season 2018 toxicity sampling coincided with pesticide sampling identified under MRP Section C.8.g.iii, for which both the Fipronil and Imidacloprid results in water at the Castro Valley site were an order of magnitude greater than that of samples collected at two other Alameda County sites. Although representing only a snapshot in time, concentrations of measured pesticides were in several cases above benchmarks established by EPA Office of Pesticide Programs (OPP) for freshwater invertebrates (Table 4-4). Follow-up work, discussed previously and below, will be used to help assess temporal variability in both the toxicity and chemistry monitoring data.

Table 4-4. Comparison of Preliminary Results for Fipronil and Imidacloprid Collected at Pesticides and Toxicity Monitoring Site 204CVY010 January 9, 2018 with EPA OPP Freshwater Aquatic Life Benchmarks for Invertebrates

Station	Analyte	Concentration (ng/L)	Aquatic Life Benchmark, Acute (ng/L)	Aquatic Life Benchmark, Chronic (ng/L)
204CVY010	Fipronil	382	110	11
204CVY010	Fipronil Desulfinyl	4.4	100,000	10,310
204CVY010	Fipronil Sulfide	15.5	NA	NA
204CVY010	Fipronil Sulfone	63	360	37
204CVY010	Imidacloprid	237	NA	NA

Note: Aquatic Life Benchmarks from EPA Office of Pesticide Programs (https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/aquatic-life-benchmarks-and-ecological-risk#benchmarks)

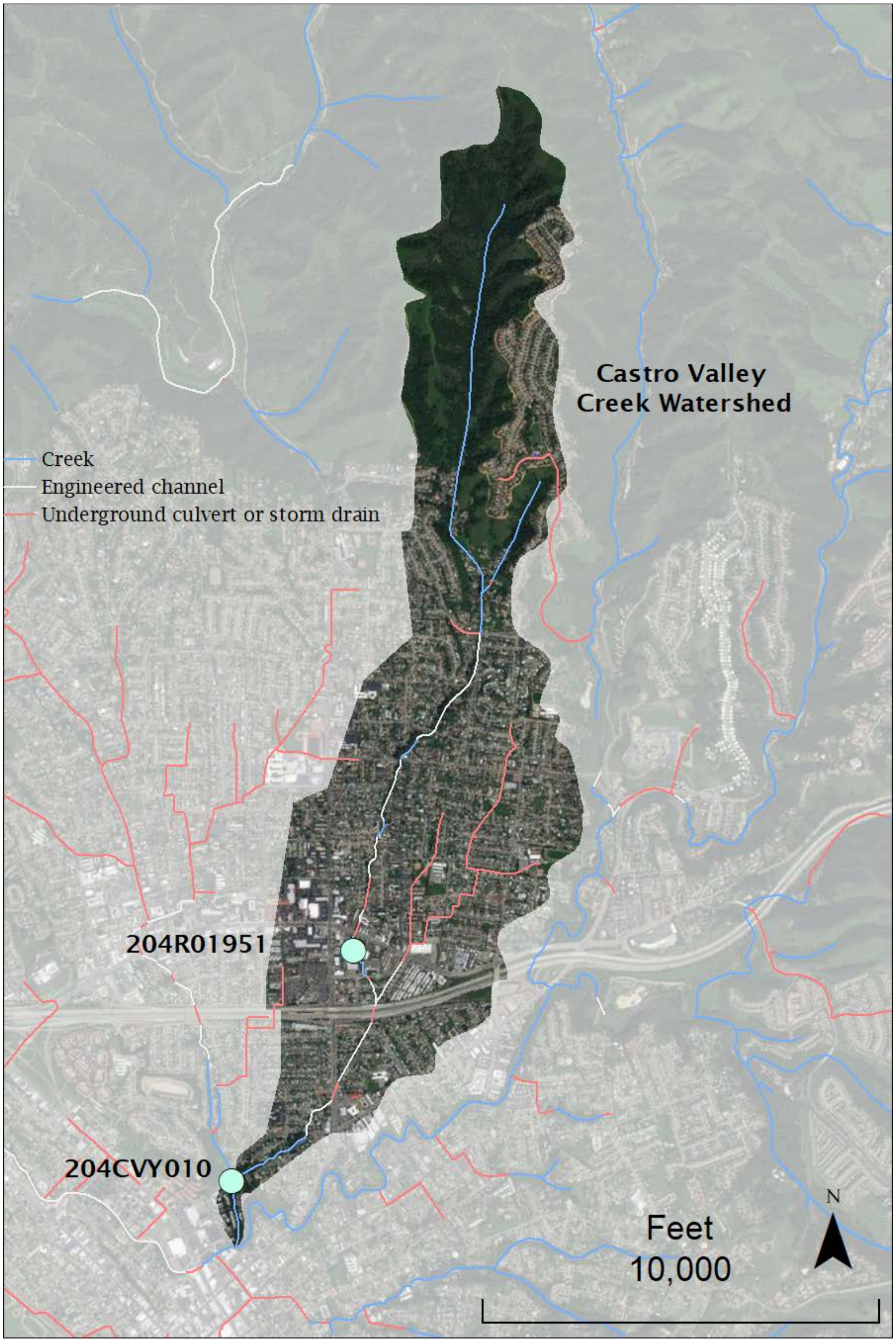

Figure 4-8. Map depicting sites 204CVY010 and 204R01951 in Castro Valley Creek Watershed

5 Future Direction

Literature review and more recent sediment chemistry sampling during the course of Creek Status Monitoring confirm that the pollutant concentrations in Castro Valley Creek sediments are typical of urbanized areas in California. In WY 2015, no aquatic or sediment toxicity was observed in the Castro Valley Creek samples, although the pyrethroid equivalent Toxicity Units in sediment were high enough to potentially cause toxicity according to the thresholds established in MacDonald et al. (2000). In WY 2016 the integrator site 204CVY010 also reached triggers according to MacDonald et al. (2000), with no associated toxicity observed. Thus the trigger criteria seem likely to be overpredictive of potential toxicity in the types of creeks and channels found in Alameda County.

Recent WY 2018 Pesticides and Toxicity monitoring identified a statistically significant aquatic toxicity event, with results of concurrent aquatic chemistry analyses potentially indicative of pesticide-related toxicity. ACCWP performed follow-on pesticide and toxicity monitoring at the same location at the next significant rainfall event on March 1, 2018. Following receipt of associated analytical results, Program staff will review all data collected to-date through CSM work, SSID-associated monitoring, and pesticides and toxicity monitoring within the Castro Valley Creek watershed. Program staff will incorporate results and findings from WY 2018 in a final report by September 2018.

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ALAMEDA COUNTYWIDE CLEAN WATER PROGRAM

MEMBER AGENCIES:

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Albany
Berkeley
Dublin
Emeryville
Fremont
Hayward
Livermore
Newark
Oakland
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Pleasanton
San Leandro
Union City
County of Alameda
Alameda County Flood Control and Water Conservation District
Zone 7 Water Agency

STRESSOR / SOURCE IDENTIFICATION PROJECT: CROW CREEK LOW DISSOLVED OXYGEN

FINAL REPORT

WATER YEAR 2017

URBAN CREEKS MONITORING REPORT, APPENDIX A.4C

Report prepared by
Alameda Countywide Clean Water Program
399 Elmhurst Street,
Hayward, California 94544

Submitted to:
California Regional Water Quality Control Board, San Francisco Bay Region

FINAL
March 31, 2018

Acknowledgements

Applied Marine Sciences, Inc. conducted all monitoring and prepared this review of the Crow Creek continuous monitoring data.

List of Acronyms

Acronym	Definition
AMS	Applied Marine Sciences
ACCWP	Alameda Countywide Clean Water Program
BASMAA	Bay Area Stormwater Management Agencies Association
DO	Dissolved Oxygen
MRP, MRP 2.0	Municipal Regional Stormwater Permit (reissuance from previous “MRP1.0”)
NPDES	National Pollutant Discharge Elimination System
QAPP	Quality Assurance Project Plan
RMC	Regional Monitoring Coalition
RMP	Regional Monitoring Program
RWQCB	Regional Water Quality Control Board
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SSID	Stressor/Source Identification
SOP	Standard Operating Procedure
SWAMP	Surface Water Ambient Monitoring Program
USEPA	United States Environmental Protection Agency
WY	Water Year

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1. Introduction

The Alameda Countywide Clean Water Program (ACCWP) conducts Creek Status Monitoring as required by Provision C.8.c of the Municipal Regional Stormwater Permit (MRP, SFRWQCB 2015)[1]. In 2012, ACCWP's 17 member agencies joined with 56 other MRP Permittees to form the BASMAA Regional Monitoring Coalition (RMC), a regional collaborative to coordinate monitoring conducted pursuant to MRP Provision C.8, Water Quality Monitoring.

The RMC's Creek Status and Long-Term Trends Monitoring Plan (BASMAA 2011) consists of two primary sampling design components: 1) Regional monitoring to assess the ambient condition of aquatic life in creeks across the San Francisco Bay Area, within the applicable areas of the five participating counties; and 2) Targeted monitoring to address local watershed management questions.

Creek Status Monitoring under the BASMAA RMC was initiated in Water Year (WY) 2012 and reported in the initial Urban Creeks Monitoring Report (UCMR, BASMAA 2013) that was submitted to the San Francisco Regional Water Quality Control Board (SFRWQCB). The UCMR evaluated all data against "trigger criteria" listed for each parameter in the MRP, and identified potential follow-up actions including targeted Stressor/Source Identification (SSID) projects as required by Provision C.8.d.i of the Municipal Regional Stormwater Permit (MRP). ACCWP's Creek Status Monitoring during WY 2012 identified low dissolved oxygen (DO) at a site on Crow Creek (204CRW030), with 4 of 7 weekly rolling averages during September below the COLD (cold freshwater habitat) beneficial use criteria of 7 mg/L. As a result, a site-specific SSID Project was initiated to characterize and investigate observations of low DO around the site.

Previous reports submitted to the SFRWQCB have documented the available Crow Creek monitoring data (WY 2012-2016) prior to the WY 2017 SSID monitoring activities. These reports have shown:

- Seasonal differences in dissolved oxygen levels. Low (< 7 mg/L) dissolved oxygen concentrations during the summer and early fall seasons, especially at sites downstream of the confluence with Cull Creek (204CRW040, 204CRW030) during below-average streamflow conditions (i.e., WY 2012-14)
- Episodic inputs to the creek impact upon general water quality parameters. Short-term fluctuations in specific conductivity during the summer and early fall seasons, both at

[1]The MRP was initially issued as SFBRWQCB 2009 (MRP 1.0) and reissued on November 19, 2015 with minor revisions in monitoring provisions regarding Stressor/Source Identification, which was renumbered as provision C.8.e in the reissued MRP 2.0. Unless otherwise noted, references to trigger values and other permit requirements in this report refer to the original MRP (SFBRWQCB 2009)

sites upstream and downstream of the confluence with Cull Creek (204CRW040, 204CRW030).
- Storm drain system and/or small-scale variation in stream channel characteristics may play an important role in dissolved oxygen dynamics. The timing and magnitude of fluctuations in specific conductivity and general water quality parameters (e.g., temperature, pH) at upstream monitoring sites suggest variability in localized discharges.

Based on these findings, ACCWP devised a sampling plan for WY 2017 that closely followed WY 2016 monitoring through the deployment of closely spaced continuous monitoring sensors from below the confluence of Cull and Crow Creeks (204CRW040) to the upstream extent of extensive urban development (204CRW044). The objectives of the WY 2017 monitoring activities were to:
- Investigate whether urban runoff can be linked to the low DO in Crow Creek
- If urban runoff is a contributor to low DO, assess whether the evidence is strong and specific enough to suggest where or how management actions could address that contribution
- Determine if the WY 2017 data fills the remaining gaps in knowledge about the causes of low DO below the confluence of Cull and Crow Creeks

This final report summarizes the WY 2017 monitoring activities and findings over the duration of the SSID study.

2. Background

2.1 Study Area

2.1.1 San Lorenzo Creek Watershed

San Lorenzo Creek Watershed has been the primary focus of recent SSID follow-up monitoring by the ACCWP. The watershed encompasses over 49 square miles (30,000 acres) that extends from the San Francisco Bay shoreline to the East Bay hills (Figure 2-1). The watershed encompasses both urban and non-urban landscape, mostly in unincorporated portions of Alameda County. It consists of more than 81 miles of natural creeks including some segments of Castro Valley and Chabot Creeks within the urbanized area, and Crow Creek spanning both rural and suburban development.

The watershed has undergone extensive landscape alterations, including construction of the flood control channel in the lower portions of the watershed by the US Army Corps of Engineers, and the Cull Canyon and Don Castro Reservoirs by the Alameda County Flood Control and Water Conservation District (SFEI 2001).

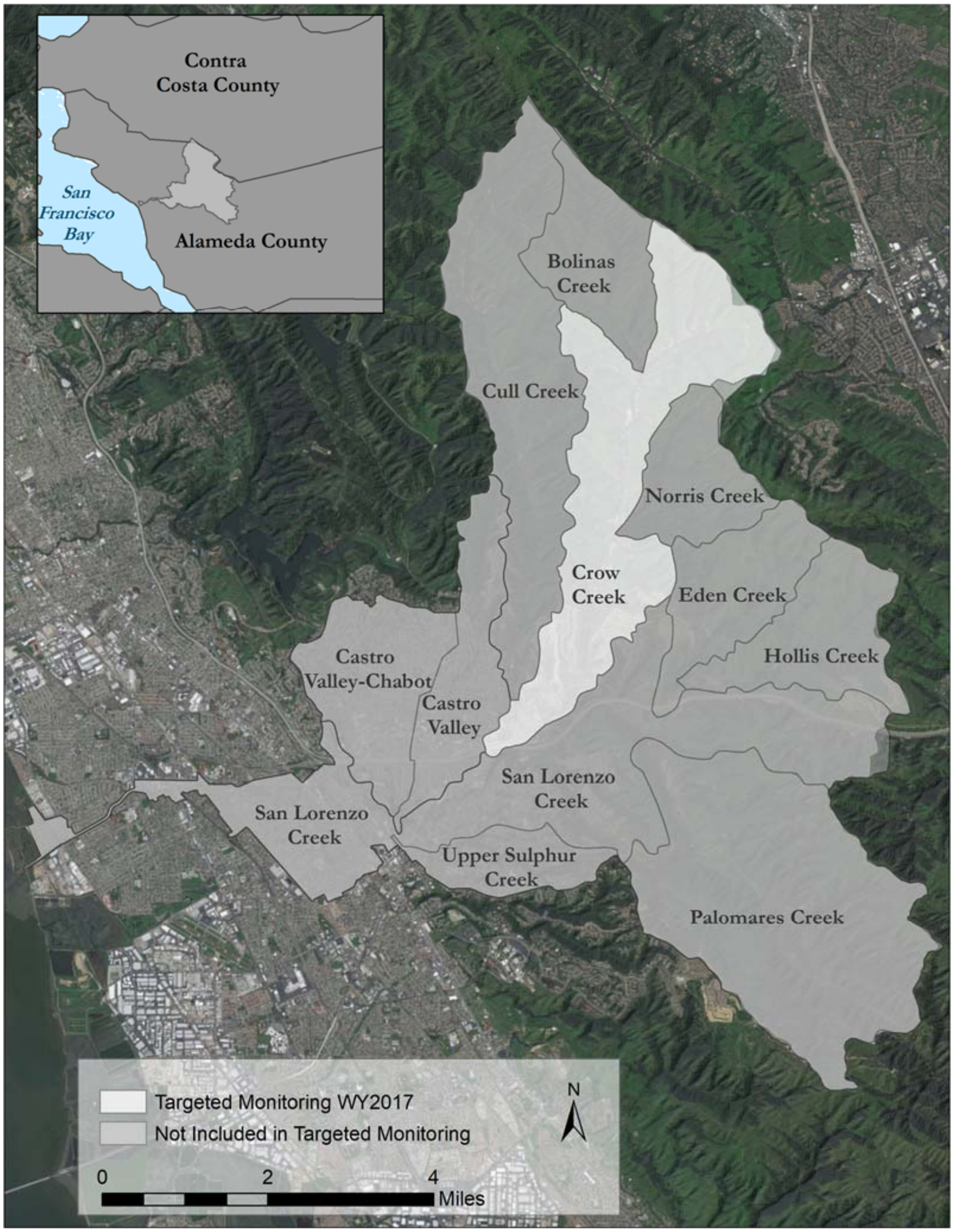

Figure 2-1.Map of the San Lorenzo Creek Watershed and major sub-watersheds. Crow Creek was the focus of the 2017 continuous monitoring.

2.1.2 Crow Creek Watershed

Crow Creek is a tributary to San Lorenzo Creek, with a watershed area of about 5.8 square miles (Figure 2-1). Most of the existing development in the upper watershed is concentrated along Crow Canyon Road, which parallels the creek. Rural land uses include grazing, some single-family homes and also a number of equine facilities. The lower watershed contains some suburban residential tracts and also receives sporadic inputs from Cull Creek, a primarily non-urban watershed whose drainage is mostly impounded in Cull Reservoir just above its confluence with Crow Creek. The East Bay Regional Parks District manages the Cull Canyon Regional Recreation Area around the reservoir. The Crow Creek site where initial low DO triggers were observed (204CRW030) has a tributary watershed comprising only suburban drainage and open space.

2.2 Problem Statement

2.2.1 Beneficial Uses

Beneficial uses (SFRWQCB, 2015b) have been assigned to San Lorenzo Creek and its tributaries by SFBRWQCB as follows:

Table 2-1. Beneficial uses at San Lorenzo Creek and Crow Creek

Site	COLD	MIGR	RARE	SPWN, WARM	WILD, REC-1, REC-2	MUN, FRESH, GWR
San Lorenzo Creek	X	X	--	X	X	X
Crow Creek	X	X	X	X	X	--

2.2.2 Water Quality Triggers

The water quality trigger under investigation in the Crow Creek SSID study is low dissolved oxygen (<7 mg/L; COLD). In WY 2012, DO below 7 mg/L was observed during General Water Quality monitoring at a site directly below the confluence of Cull Creek and Crow Creek in September. Follow-up continuous dry season monitoring during WY 2012-2016 has not substantiated the cause of impaired water quality, although localized discharges are indicated based on the magnitude and timing of general water quality changes. Observations of low dissolved oxygen have continued during certain seasons and WYs during the monitoring period.

lists the potential triggers in MRP Table 8.1 in comparison to available Creek Status monitoring data during WY 2012-2016.

2.2.3 Candidate Causes for Low Dissolved Oxygen in Crow Creek

ACCWP (2016) presented a conceptual model for low dissolved oxygen in the Crow Creek watershed, following a review of Crow Creek data from WY 2012-2015 and employing CADDIS (*Causal Analysis/Diagnosis Decision Information System*), an online tool for assessing

Table 2-2. Review of trigger types and significance at Crow Creek continuous monitoring sites, WY 2012-2016

Trigger type	Strength/magnitude	Comment
Bioassessment	Not sampled	Nearby site 204R00927 (located downstream of 204CRW030) sampled in WY 2014; Nearby site 204R01375 (located upstream of 204CRW044) sampled in WY 2016
Sediment Chemistry	Not sampled	Nearby site 204R00927 in WY 2014
Sediment Toxicity	Not sampled	Nearby site 204R00927 in WY 2014
Chlorine in water column	Sampled	Nearby site 204R00927 in WY 2014; Site 204R01375 in WY 2016
Toxicity in water column	Not sampled	Nearby site 204R00927 in WY 2014
General Water Quality – Dissolved Oxygen	67% <7 mg/L rolling average[1]	7-day rolling averages were below 7 mg/L at 204CRW030 in Fall 2012 (4 of 6), summer 2013 (10 of 10), and fall 2014 (5 of 5), at 204CRW040 in summer 2014 (9 of 9), and at 204CRW041E (2 of 2) and 204CRW045 (1 of 2) in summer 2016
General WQ - other	Not triggered	
Temperature	Not triggered	
Pathogen Indicators	Not sampled	

[1] Based on WY 2012 September deployment data only

impacts to aquatic ecosystems (US EPA 2010). Based on this evaluation three candidate causes of biological impairment that may be associated with changes in dissolved oxygen in Crow Creek have been proposed:

- Agricultural and urban runoff: Three major stormwater lines deliver runoff from surrounding urban land use within the study reach. Prior water quality data has indicated dry season urban runoff discharges as a potential source of variation in water quality conditions between monitoring sites (reference).
- Riparian vegetation: Riparian vegetation, though still present in unmodified segments of the creek channel, has been substantially altered throughout the study reach and to a somewhat lesser extent in the upstream watershed. Urban and rural development has altered the presence and composition of riparian vegetation, likely resulting in reduced shading relative to pre-disturbance conditions.
- Channel alteration: Large portions of the channel network in the study reach have been modified into rectangular concrete channels or underground culverts. Most “natural”

stream channels have been modified with reinforced banks. Additionally, the stream channel in the study reach is substantially incised into the floodplain. Together, these channel alterations have likely had a substantial impact on channel form, stream hydrology, hydrologic pathways, stream channel shading, turbulence and re-aeration, and primary production, with unknown effects on dissolved oxygen conditions.

Of these three factors, agricultural and urban runoff is the most tractable. Therefore continued monitoring and assessment of water quality conditions, including targeted monitoring to identify the influence of specific stormwater outfalls and pollution sources was prioritized.

3. Monitoring Design for WY 2017

3.1 Approach and Methods

Source characterization to investigate dissolved oxygen stressors in Crow Creek continued in WY 2017. Monitoring locations shown in Figure 3-1 and described in Table 3-1 were subject to continuous monitoring activities. As part of the SSID design, deployment locations were selected at approximately the same areas as WY 2016. The close proximity of the selected stations was intended to isolate the possible influences of multiple storm drain lines entering the study reach.

Data loggers for collecting hourly conductivity and temperature measurements (HOBO U24 by Onset Computer Corporation) were deployed at seven locations in a study reach bounded by 204CRW040 and 204CRW044. In addition, a data logger for temperature only (HOBO V2 by Onset Computer Corporation) was deployed at 204CRW041B. All data loggers were deployed on April 28^{th} and retrieved on October 11^{th} and during deployment loggers were checked on June 16^{th} and July 28^{th}.

Monitoring dissolved oxygen and other general water quality parameters (i.e., temperature, conductivity, pH) at 15-minute intervals was also conducted by deploying YSI Sondes between stations 204CRW040 and 204CRW044. The YSI monitoring procedures followed the RMC SOP FS-5 (BASMAA 2016b).

All YSI monitoring was conducted during the spring (April – May), summer (June - July) and fall (August - October) seasons. Spring deployment of YSI Sondes was conducted at sites 204CRW041E and 204CRW042 on April 17-27, 2017, and at 204CRW040 on May 5-15, 2017. Summer deployments occurred at sites 204CRW041E and 204CRW042 on June 30-July 12, 2017. Fall deployments were conducted at sites 204CRW041E and 204CRW042 on August 25-September 8, 2017, and at 204CRW040 on September 8-19, 2017.

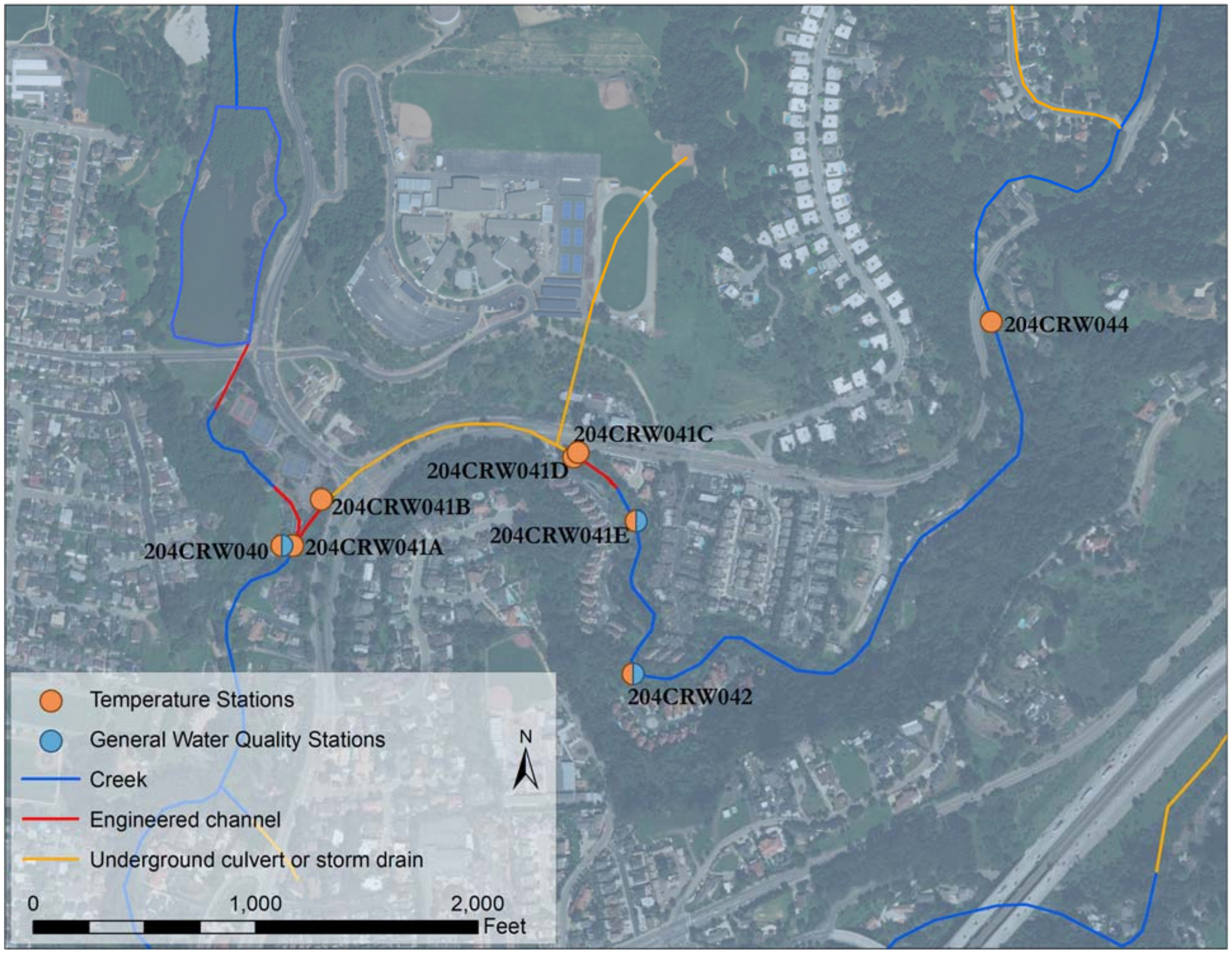

Figure 3-1. Crow Creek SSID monitoring locations for WY 2017

Table 3-1. Monitoring locations and water quality parameters for WY 2017 Crow Creek SSID.

Site Code	Description	Latitude	Longitude	Temp + Cond	Temp Only	Basic WQ
204CRW040	Crow Creek 5 m downstream of Crow Creek/Cull Creek confluence at transition from concrete channel to natural creek	37.70143	-122.05467	X		X
204CRW041A	Inside Crow Creek box culvert approximately 75 m upstream of Crow Creek/Cull Creek confluence	37.70150	-122.05451	X		
204CRW041B	Crow Creek, near downstream end of box culvert under Crow Canyon Rd., above confluence with Cull Creek	37.70204	-122.05398		X*	
204CRW041C	Inside Crow Creek box culvert approx. 30 m below upstream end, downstream of large outfall located under entrance to Crow Creek Rd.	37.70272	-122.0501	X*		
204CRW041D	Crow Creek upstream of box culvert, between 2 large outfalls approximately 30 m upstream of entrance to Crow Creek Rd.	37.70265	-122.0501	X*		
204CRW041E	Crow Creek upstream of box culvert, upstream of second large outfall approximately 100 m upstream of entrance to Crow Creek Rd.	37.70189	-122.04912	X		X
204CRW042	Crow Creek 50 m upstream of first bridge on Crow Creek Road	37.69996	-122.04920	X		X
204CRW044	Crow Creek East of culvert under Crow Canyon Rd.	37.70442	-122.04369	X		

* Hobo loggers were installed with a sandbag weir to maintain water depth

3.2 Quality Control / Deployment Checks

Basic water quality parameters (DO, temperature, conductivity, and pH) measured by YSI Sondes met QA measurement quality objectives.

In general, continuous hourly temperature and conductivity monitoring by HOBO's exhibited fairly smooth, predictable curves, suggesting few quality assurance concerns or perturbations to the system. There were, however, two exceptions:

- The HOBO unit deployed at 204CRW040 became partially buried in sediment sometime between a maintenance check conducted on July 28, 2017 and retrieval on October 11, 2017. Beginning at approximately 12pm on August 26, 2017, the conductivity measurements exhibited a rapid decline to near 0 μ/cm^2, indicating the likely timing for burial. As we were unable to post-correct conductivity data using standard methods prescribed by the instrument manufacturer for the period after July 28, all conductivity data collected after the maintenance visit was rejected. Temperature data, however, did not appear to be affected in the same manner. Temperature measurements remain fairly consistent and follow the same curve as the other sites monitored on Crow Creek. The temperature data collected during the concurrent period was qualified, but not rejected.

- Shortly following a maintenance visit on June 16, 2017, conductivity measurements at site 204CRW041C exhibited a marked decline that extended until approximately 4am on June 28, 2017. These data are not supported by similar changes in measurements at upstream of downstream stations and are therefore believed to be erroneous. AMS qualified affected data within this range with the "FIF" flag, indicating instrument failure. Temperature data appeared unaffected.

4. Results and Discussion

This review of the WY 2017 continuous monitoring data consists of brief evaluation of streamflow conditions, followed by an analysis of the dissolved oxygen and specific conductivity observations from three short-term YSI Sonde deployment periods, as well as temperature and conductivity records from HOBO sensors.

4.1 Streamflow in WY 2017

Streamflow conditions (measured at the USGS Gage 11180900, located approximately 1 km upstream of the study area) during the continuous monitoring period (April to October) were above average relative to the recent years of drought (Figure 4-1). A number of rainfall events in WYs 2012, 2016, and 2017 caused elevated flows during the month of April. In WY 2017, average discharge was also higher than each of the previous monitoring years during May through September. Furthermore, streamflow did not drop below 0.1 cfs until September 2, and fluctuated between < 0.1 cfs and 0.7 cfs throughout the month of September (Figure 4-2).

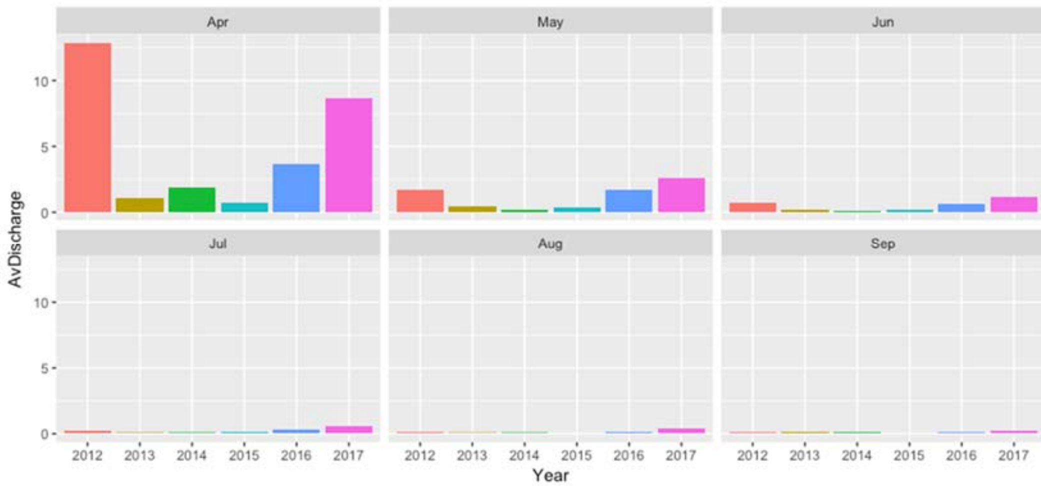

Figure 4-1. Average discharge (cubic ft. per sec) in Crow Creek during April through October in 2012 to 2017, as measured at USGS Gage 11180900.

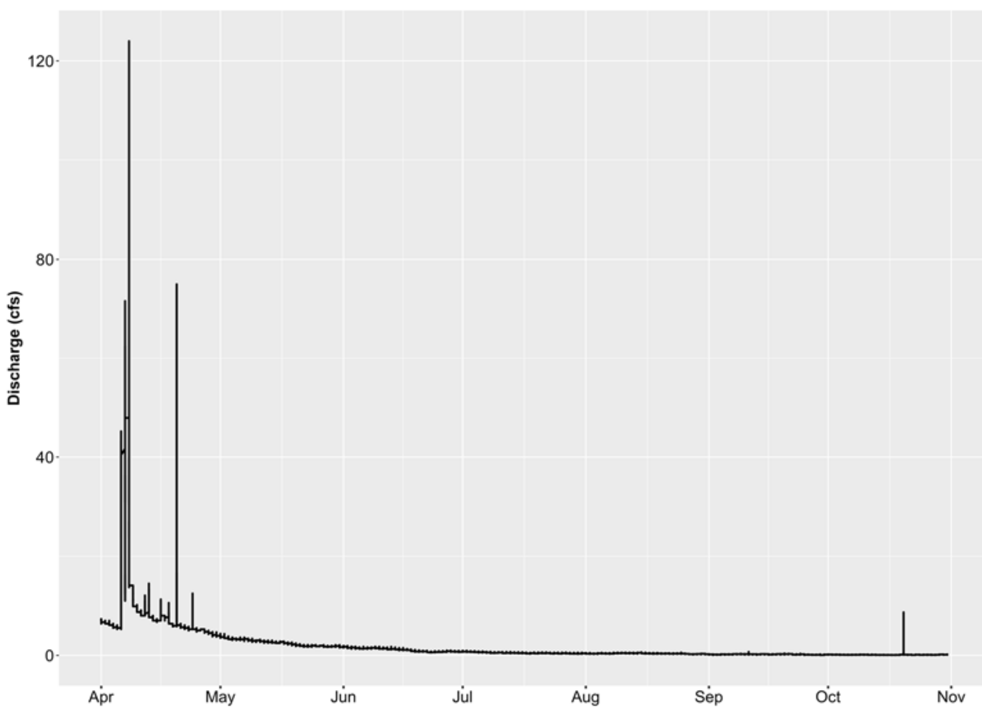

Figure 4-2. Streamflow in Crow Creek from April through September 2017 as measured at USGS Gage 11180900.

4.2 Dissolved Oxygen in WY 2017

In WY 2017, DO was measured as part of general water quality monitoring using YSI Sondes deployed at a downstream site (204CRW040) and up to two upstream sites (204CRW041E and 204CRW042) during 10-14 day periods in the spring (April – May), summer (June – July), and fall (August – October).

Dissolved oxygen data were reviewed as a 7-day rolling average for purposes of comparison to trigger criteria in provision C.8.c and Table 8.1 of the MRP. Each of the 8 deployments (3 deployments at 2 sites and 2 deployments at 1 site) produced two weekly rolling averages for comparison. None of the weekly averages were observed at a concentration below the 7 mg/L cold-water benchmark. Overall, 265 of 8924 (3%) 15-minute DO records were below 7 mg/L in WY 2017. All of these instances occurred during September 2017.

Spring

DO concentrations were consistently greater than 7 mg/L during the spring deployment (Figure 4-3). Both upstream sites exhibited normal diel patterns (Figure 4-4), with a steady rise in DO saturation beginning around 7am and continuing until around 2pm, when the daily maximum of 104-107% was reached. DO then gradually dropped until 8-9pm, and remained relatively constant at around 100% until 7am. DO patterns were similar at the downstream site, except that daily maxima were much higher (often 106-120%), daily minima were lower (98-100%), and nighttime values were less stable and tended to increase during the period of monitoring. The lowest observed concentration was 9.8 mg/L, recorded at 204CRW040 at 8pm on 5/9/17.

Summer

DO concentrations at the two summer deployment sites were very similar to each other, followed diel patterns similar to the spring conditions, and were consistently above 7 mg/L. Notably, the DO saturation maxima and minima corresponded to a much wider range than at the same sites during the spring deployment. Nighttime DO minima at both sites were around 85-90%, while daytime maxima ranged from 105-115%.

Fall

Dissolved oxygen exhibited similar diel patterns during the fall deployment to previous deployments, but had the widest range of the three deployment periods. DO concentrations at both the downstream site and two upstream sites dropped below 7 mg/L during the nighttime during the deployment period, but daytime concentrations were typically >8 mg/L and 7-day rolling averages were all >7 mg/L. DO percent saturation typically reached a minimum at 6am,

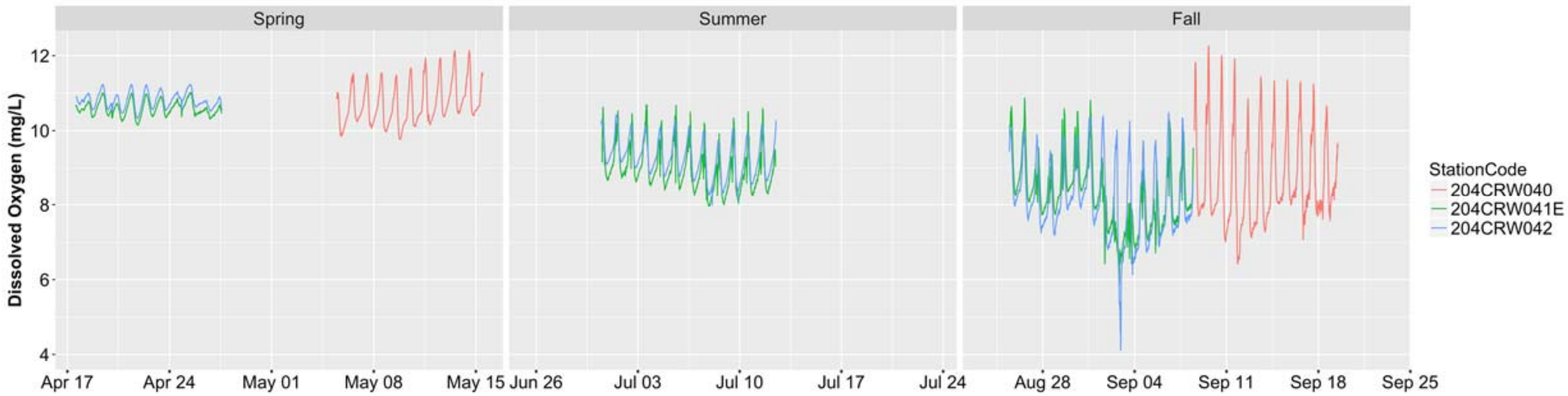

Figure 4-3. Dissolved oxygen concentration (mg/L) during the spring, summer, and fall deployment periods measured by YSI Sonde

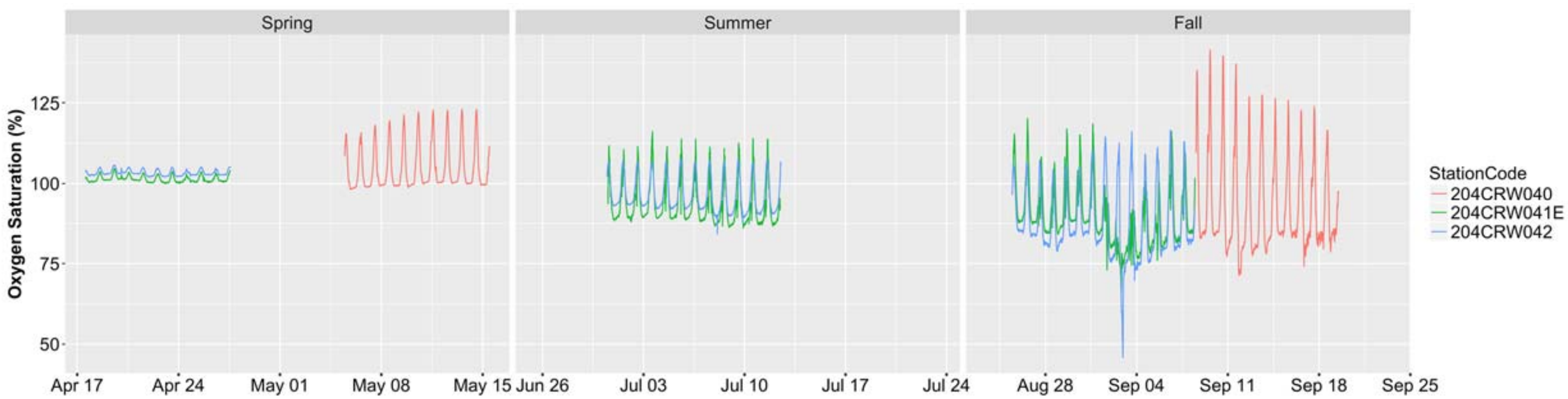

Figure 4-4. Dissolved oxygen percent saturation (% sat) during the spring, summer, and fall deployment periods measured by YSI Sonde

then increased during the day and reached a maximum around 6pm. DO saturation ranged between 45-120% for the upstream sites and 70-140% for the downstream site.

4.3 Conductivity in WY 2017

In WY 2017, conductivity was measured both as part of general water quality monitoring using YSI Sondes, and at stations monitored by HOBO sensors. Both sets of data are discussed below.

Spring

The YSI Sondes conductivity measurements indicated several anomalies during the spring deployments (Figure 4-5). Three short-term dips in conductivity were observed at the upstream locations, 204CRW041E and 204CRW042. These anomalies were observed at 12am on 4/18/17 (lasting for 14 hrs), 12:30am on 4/20/17 (15 hrs), and 7:30pm on 4/24/17 (2.5 hrs). The major drop in conductivity after 4/20/17 was traced to a rainfall event that coincided with this period. Subsequent to the rain event, conductivity at 204CRW041E and 204CRW042 was relatively stable at 565 uS/cm and 735 uS/cm, respectively, other than the brief unexplained drop in conductivity on 4/24/17. In contrast, the downstream location at 204CRW040 did not exhibit obvious spikes or dips in conductivity, consistent with the deployment period being further into the dry season. Conductivity was relatively stable around 900 uS/cm. However, there were more regular daily changes than observed upstream, likely reflecting the diel pattern in ambient flow.

Consistent with the conductivity observations by YSI Sonde, the HOBO deployments during the spring period indicated several short-term fluctuations during the course of the monitoring (Figure 4-6). Furthermore, many of the fluctuations occurred concurrently at several stations indicating realistic changes to the environmental conditions throughout the study reach. In addition to the dips and spikes in conductivity, a phase shift is evident at two stations 204CRW041A and 204CRW041D that can likely be attributed to the location near the box culvert upstream of the confluence, where sufficient flow has been an issue in the past.

Summer

Summer deployment of the YSI Sondes was conducted at 204CRW041E and 204CRW042. Conductivity at both locations were the most stable of three deployment periods, with diel patterns most similar to the spring conditions at 204CRW040. Site 204CRW041E consistently exhibited conductivity around 945 uS/cm, while 204CRW042 was higher around 975 uS/cm. Most notable in this deployment series was the presence of many short-term fluctuations in conductivity, lasting for just a few minutes to hours. The largest change at either station was observed on 7/3/17, when the conductivity dipped by 20 uS/cm between 15-minute observations before returning to ambient levels. At least 15 obvious fluctuations in conductivity were apparent in the time series, and coincided with both locations.

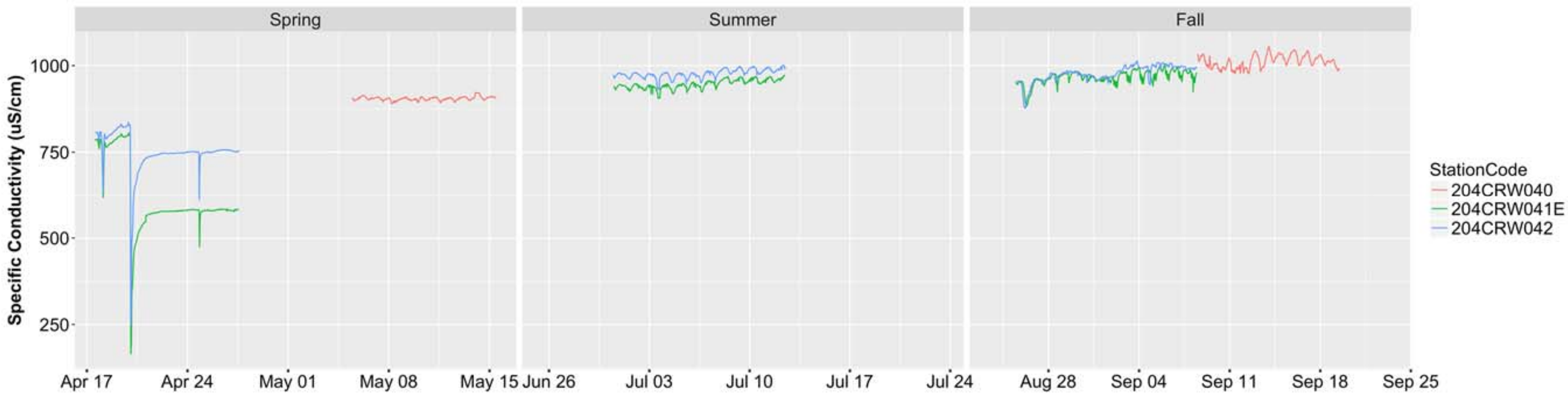

Figure 4-5. Specific conductivity during the spring, summer, and fall deployment periods measured by YSI Sonde.

Conductivity measurements by the HOBO sensors were highly variable during the summer deployment period. The general pattern among stations reflected a diurnal pattern. However, frequent shifts in the daily curves were apparent, both at upstream and downstream sites. The largest change occurred at the downstream site 204CRW040, where an unexplained spike in conductivity occurred on 7/25/17, followed by an unexplained dip the following day.

Fall

Deployment of YSI Sondes was conducted both at downstream (204CRW040) and at upstream locations (204CRW041E and 204CRW042). All three sites indicated the most variable daily fluctuations during the course of the monitoring period. At the upstream sites, the largest of these anomalies occurred on 8/26/17, when the conductivity dropped from 960 uS/cm to 880 uS/cm during the course of several hours before returning to ambient levels. Both stations mirrored the same pattern, indicating brief inputs of lower conductivity water into the creek. More than 10 other instances of depressed conductivity followed by rapid return to ambient levels were noted in the time series. These short-term changes are most likely a feature of changing urban runoff into the creek from the surrounding watershed.

The downstream location was monitored later into the fall deployment period, but indicated many instances of fluctuating conductivity during brief periods. This was most obvious during the earlier portion of the time series, with the apparent sensitivity to these fluctuations dampened later into the deployment period. This observation may be attributable to the increase in freshwater flows as flow conditions increased during the season.

Conductivity measured by the HOBO sensors during the fall deployment period was highly variable, particularly at the upstream stations. Several large spikes in conductivity occurred during the deployments at 204CRW041A and 204CRW041C. In each case, the spikes were episodic, returning to ambient levels within a few hours. The largest spikes corresponded to between 200 and 500 uS/cm increases. For example, at 204CRW041A on 9/17/17 conductivity increased from approximately 1300 uS/cm to 1900 uS/cm during a few hours timeframe, before returning back to ambient levels.

Overall, each conductivity data set contained a number of anomalous, sudden, short-lived changes in conductivity. The synchronous occurrence of these events at multiple sites indicates that these fluctuations reflect actual environmental changes, such as dry weather runoff discharges. These events were detected both at the upstream sites 204CRW041D, 204CRW041E and 204CRW042, indicating that the source of the changes may originate upstream of the urbanized area, or at the downstream site 204CRW040, indicating potential impacts along contiguous stretches of the creek.

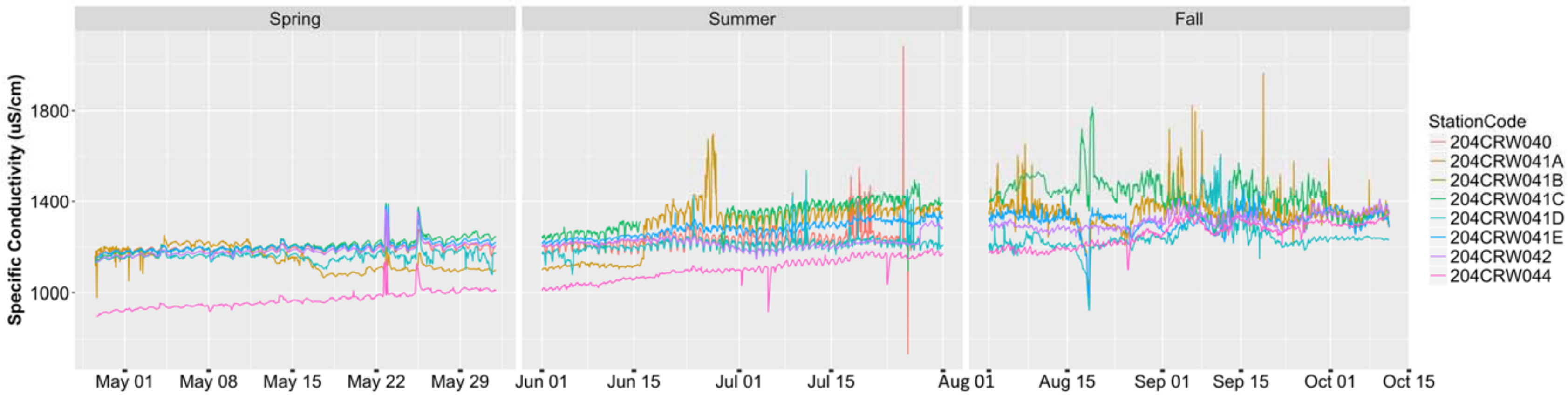

Figure 4-6. Specific conductivity during the spring, summer, and fall deployment periods measured by HOBO sensors.

4.4 Temperature in WY 2017

HOBO sensors were deployed at eight stations during the continuous monitoring period. Temperature measurements at upstream stations tracked each other very closely owing to the proximity of the stations over the deployment periods (Figure 4-7). Temperatures were slightly higher at the downstream site 204CRW040, likely owing to some combination of additional flow from Cull Creek and outfalls upstream of the station.

Spring

During the spring deployment period, temperatures showed typical diel patterns at each of the stations. The most noticeable pattern was the higher daily maximum temperatures at the 204CRW040 relative to the other sites. No major fluctuations in water temperature were evident.

Summer

A similar pattern to the water temperature at stations monitored during the summer deployment months was evident. During the majority of the monitoring period, stations exhibited daily maxima in temperature of 17-25 C. Notably, the downstream station 204CRW040 again obtained the highest maxima during each daily cycle. Also of note is the observation of higher temperatures at all but one of the stations during the period of 6/16/17 – 6/22/17. The reason for the lower temperatures at 20CRW041B may be attributable to the location of the station in the box culvert.

Fall

Temperatures recorded from HOBO sensors during the fall deployment period were fairly consistent up till approximately 9/5/17. After this period, a clear phase shift was apparent, when the temperatures dropped from 20-23˚C to 12-17 ˚C. The trend towards declining temperatures was most apparent at the upstream stations.

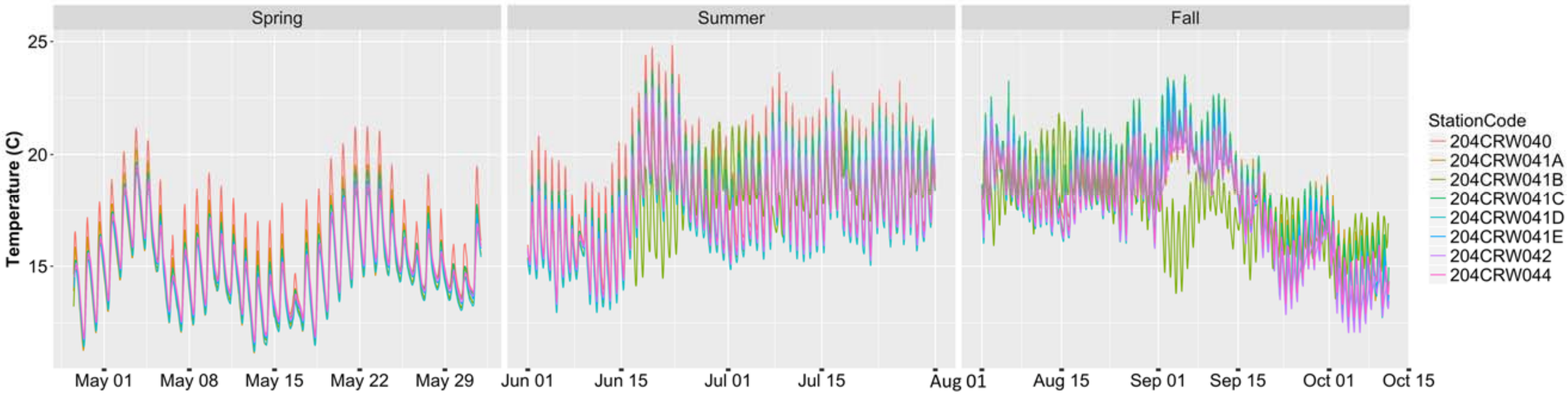

Figure 4-7. Temperature during the spring, summer, and fall deployment periods measured by HOBO.

4.5 Discussion

The Crow Creek SSID project was initiated in WYs 2012 and 2013 (ACCWP 2014b), which focused on the area immediately around the confluence of Crow and Cull Creeks. Continuous monitoring sites were established upstream and downstream of the confluence of Cull Creek and Crow Creek where YSI Sondes and HOBO sensors were deployed. In 2014 and 2015, general water quality monitoring was extended further from the confluence area to assess the potential contributions from upstream sources to the low DO conditions. In 2016 and 2017, the water quality monitoring continued with more intensive sampling along Crow Creek.

From 2012 to 2017, 100 7-day rolling averages of dissolved oxygen data have been calculated and reported from data collected along Crow Creek[2]. Of these, 31 averages were below the 7 mg/L cold-water benchmark criteria (Table 4-1). Low DO concentrations were observed downstream of the confluence of Cull Creek and Crow Creek (204CRW030 and 204CRW040) where mean concentrations in the summer/ fall were usually lower than in the spring (

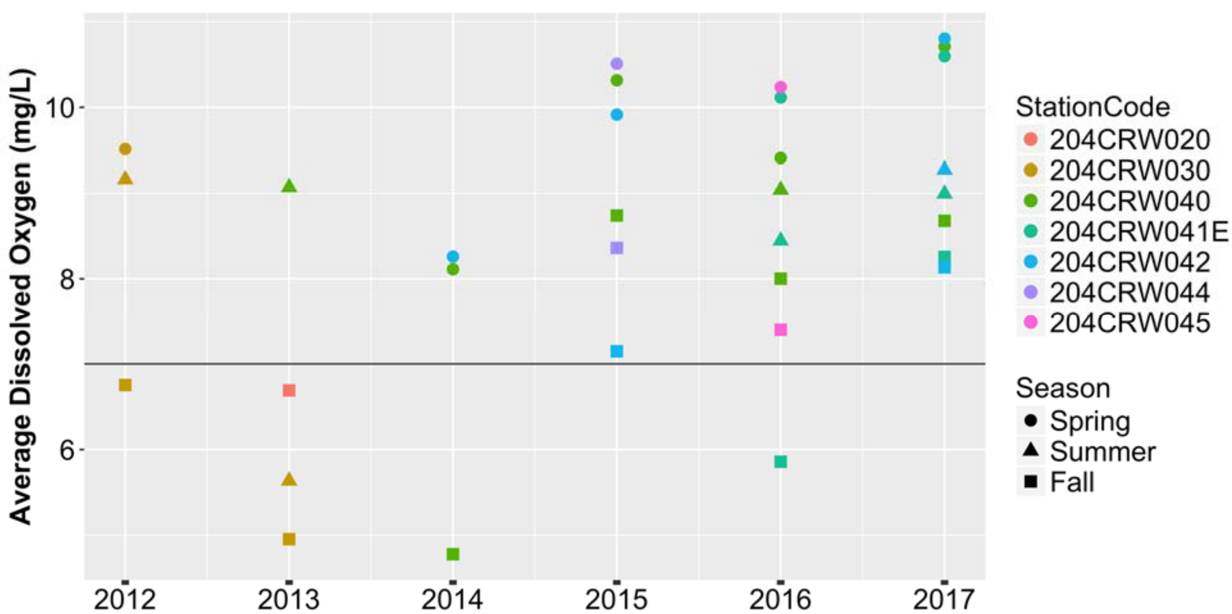

Figure 4-8). Twenty-two of the 31 occurrences of 7-day rolling average below the cold-water benchmark occurred during summer of WYs 2013, 2014 and 2016. No rolling averages were observed below 7 mg/L at Crow Creek stations in the summer of 2012 or 2017; two water years with above average precipitation and streamflow conditions.

[2] It should be noted that the method of calculating the rolling averages was changed beginning in 2014 to reflect the Water Board's request that these be calculated as non-overlapping vs. overlapping averages.

Consistent throughout the 6-year dataset is a pattern of high fluctuations in specific conductivity in the section of Crow Creek below the confluence with Cull Creek (i.e., 204CRW030, 204CRW040), which suggests regular, localized discharges into the creek. Furthermore, the duration and timing suggests that urban sources are likely contributing factors to the observed patterns. Fluctuations in conductivity at these sites generally do not align with patterns observed at reference sites, which typically have smooth, low amplitude (<5 uS) diel curves in conductivity. Additionally, elevated conductivity at 204CRW030 relative to 204CRW040 (located only 150m upstream) during summer/early fall season suggests localized inputs of high conductivity water occurring downstream of the Cull Creek / Crow Creek confluence. While the continuous monitoring recorded multiple events of short-term conductivity spikes, they were not associated with periods of low dissolved oxygen.

In WY 2017, low DO (7-day average < 7 mg/L) was not observed at 204CRW040, the downstream reach where DO problems were especially apparent in past years. Neither were there any obvious episodic patterns of low DO evident at other stations monitored along the creek. Consistent with previous monitoring, the site farthest downstream in the study reach

Table 4-1. Percentage (and number) of weekly (7-day average) rolling average DO less than the 7 mg/ benchmark for COLD beneficial use during all previous General Water Quality deployment periods on Crow Creek.

Study Site	Spring (April-May)	Summer (June-July)	Fall (August-October)
	2012		
204CRW030	0% (0 of 8)	**67% (4 of 6)**	Not Sampled
	2013		
204CRW020	Not Sampled	Not Sampled	0% (0 of 5)
204CRW030	Not Sampled	**100% (5 of 5)**	**100% (10 of 10)**
204CRW040	Not Sampled	0% (0 of 5)	Not Sampled
	2014		
204CRW040	0% (0 of 4)	**100% (9 of 9)**	Not Sampled
204CRW042	0% (0 of 4)	*	Not Sampled
	2015		
204CRW040	0% (0 of 2)	Not Sampled	0% (0 of 2)
204CRW042	0% (0 of 2)	Not Sampled	0% (0 of 2)
204CRW044	0% (0 of 2)	Not Sampled	0% (0 of 2)
	2016		
204CRW040	0% (0 of 2)	0% (0 of 2)	0% (0 of 2)
204CRW041E	0% (0 of 2)	**100% (2 of 2)**	Not Sampled
204CRW042	Not Sampled	Not Sampled	0% (0 of 2)
204CRW045	0% (0 of 2)	**50% (1 of 2)**	Not Sampled
	2017		
204CRW040	0% (0 of 2)	0% (0 of 2)	0% (0 of 2)
204CRW041E	0% (0 of 2)	0% (0 of 2)	0% (0 of 2)
204CRW042	0% (0 of 2)	0% (0 of 2)	0% (0 of 2)

* DO data did not pass data quality objectives

(204CRW040) exhibited much greater daily swings in dissolved oxygen than the upstream sites (204CRW041E and 204CRW042) in the spring and early summer deployments. These observations suggest the increased freshwater inputs that occurred in WY 2016/17 (in contrast to previous years of drought) have contributed to improved water quality conditions in the reach downstream of the confluence with Cull Creek, i.e. 204CRW040. It also seems likely that low DO concentrations may recur in years that experience below-average precipitation.

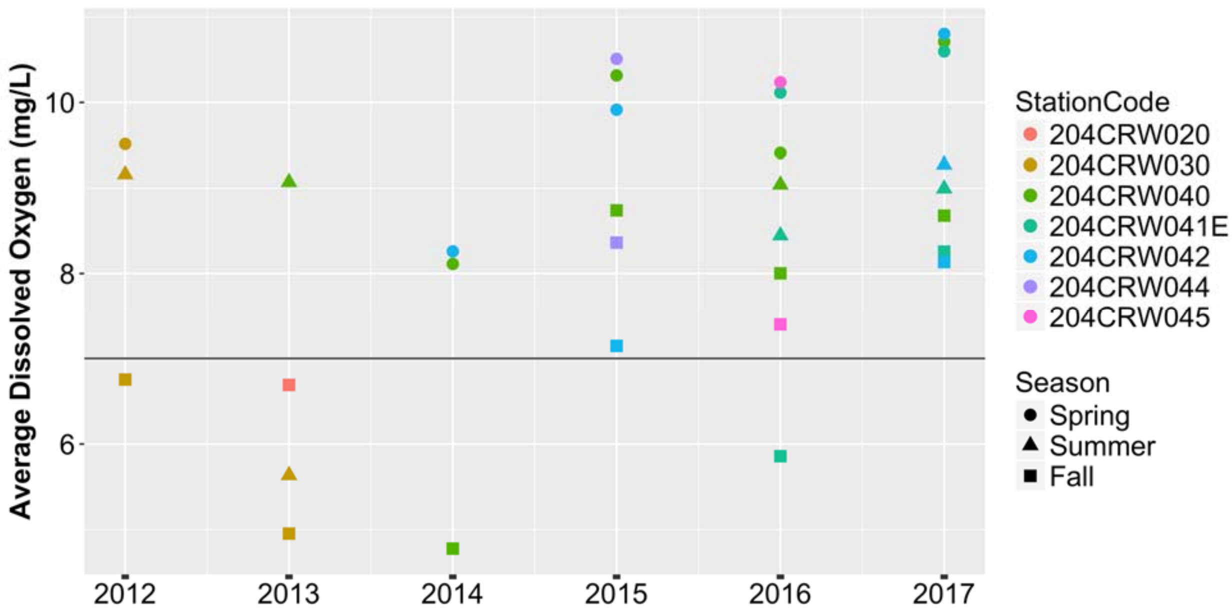

Figure 4-8. Average dissolved oxygen (mg/L) at the locations subject to continuous monitoring by YSI Sondes during the spring (Apr-May), summer (Jun-Jul), and fall (Aug-Oct) deployment periods in each year of the Crow Creek SSID study.

5. Project Completion Rationale & Future Directions

The above-average precipitation and high summer base flows during the past two WYs appear to have limited the potential for low DO occurrence in the reach of Crow Creek downstream of the confluence with Cull Creek. Continuous monitoring data has indicated multiple events when conductivity fluctuated in unexplained ways that were likely caused by urban runoff; however, these fluctuations were not associated with periods of low dissolved oxygen or other indicators of water quality concern.

As multiple years of intensive monitoring at the study site have not been able to replicate the 2012 findings of multiple instances where DO concentrations fell below objectives, the trigger threshold exceedance was found to be episodic, and reasonable methods have not revealed a stressor/source. Based on these inconclusive findings, in accordance with provision C.8.e.iii(3)(b), it is requested that the Executive Officer consider this SSID project complete. No additional follow-up indicated. Future resources are proposed to be put toward SSID efforts following up on other indicators of potential water quality concern generated through other ACCWP monitoring efforts.

6. References

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BASMAA.2012b. Creek Status Monitoring Program Standard Operating Procedures. Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program.196 pp.

BASMAA.2014a. Creek Status Monitoring Program Quality Assurance Project Plan, Final Version 2. Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program.81 pp plus appendices.

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BASMAA. 2016b. Creek Status Monitoring Program Standard Operating Procedures. Version 3, March 2016. Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program.http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/SWAMP/BASMAA_RMC_SOP_V3_Final%20March%202016.pdf

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Protecting Alameda County Creeks, Wetlands & the Bay

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March 31, 2018

Bruce Wolfe
Executive Officer
San Francisco Bay Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

SUBJECT: Electronic Data Submittal - ACCWP Creek Status Monitoring from October 2016 through September 2017 Pursuant to Provision C.8.h

Dear Bruce:

The member agency Permittees of the Alameda Countywide Clean Water Program (Program) through their Management Committee, and in conformance with the Memorandum of Agreement signed by their governing bodies, have authorized and directed me to prepare and submit certain reports as part of their compliance with Monitoring requirements of the Municipal Regional Stormwater NPDES Permit CAS612008 (MRP, reissued on November 19, 2015 as Order No. R2015-0049).

With this letter I am submitting a CD-ROM containing the Program's Monitoring data collected between October 1, 2016 and September 30, 2017 pursuant to the following provisions of Order No. R2015-0049:

- C.8.d Creek Status Monitoring
- C.8.e Stressor/Source Identification Projects
- C.8.f Pollutants Of Concern Monitoring
- C.8.g Pesticides And Toxicity Monitoring

These data are provided in Microsoft Excel files listed in Attachment A, which are formatted according to templates compatible with data management requirements of the Surface Water Ambient Monitoring Program (SWAMP). The Program is submitting these data to the Regional Water Board by March 31, 2018 and also to the Regional Data Center for upload into the California Environmental Data Exchange Network (CEDEN) as specified in Provision C.8.h.ii of Order No. R2015-0049, with the exception of the non-surface water data collected pursuant to C8.f.[1]

[1] As stated in a letter sent on March 20, 2017, by the Bay Area Stormwater Management Agencies Association to Jarma Bennett, manager of the CEDEN at the State Water Resources Control Board regarding changes to CEDEN's scope that were previously announced, the SWRCB's decision for CEDEN to include and display non-surface water data (previously explicitly excluded) is insufficiently supported by guidance and documentation to clarify whether MRP Permittees should now submit non-surface water data to CEDEN for compliance with MRP Provision C.3.h.ii, which was written on the basis of CEDEN's original scope.

Other data addressing the requirements of Provision C.8.f, which are fulfilled in part or in whole through the efforts of third parties other than the Program, will be submitted through the entities responsible for Quality Assurance in a time schedule determined by their respective programs.[2]

By signing this letter on behalf of the program, I certify under penalty of law that this document and all attachments are prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who managed the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. [40CFR 122.22(d)].

The quality of all monitoring data was evaluated through data collection and evaluation methods consistent with the 2016 updates of the Standard Operating Procedures and Quality Assurance Project Plan developed through the BASMAA Regional Monitoring Coalition (RMC), a regional collaborative that includes all ACCWP member Permittees. These documents have been reviewed by Region 2 SWAMP staff for SWAMP-comparability where applicable, as provided in Provision C.8.b of Order No. R2015-0049.

Please contact me if you have any questions or comments.

Sincerely,

James Scanlin
Program Manager

Attachment: CD ROM
Attachment A: list of data files on CD-ROM (2 pp)

Copy via email: Alameda Countywide Clean Water Program Management Committee Representatives

[2] As described in the ACCWP Pollutants of Concern Monitoring Report submitted October 2017, this will include electronic submittal of Regional Monitoring Program monitoring results by the San Francisco Estuary Institute and of data collected by the SWAMP Sediment Pollution Trends (SPoT) program.

Attachment A

Data files for ACCWP Creek Status, Stressor-Source Identification, Pesticides and Toxicity and Pollutants of Concern Monitoring
October 1, 2016-September 30, 2017

Sources of templates for data files (see Contents file ACCWP-CSM_ToC_2018-0304.xlsx for details):

SWAMP v2.5 Database references currently available through http://www.waterboards.ca.gov/water_issues/programs/swamp/data_management_resources/index.shtml
Kevin Lunde, SFRWQCB SWAMP Program (Continuous Monitoring)

Filename	Comment
AC_2017_BA_PHAB_BIOTA_Export_1of5.xls	File 1 of 5, compiles data for stations 204R01748, 204R03327, 204R01310, 204R01497, and 204R03033
AC_2017_BA_PHAB_BIOTA_Export_2of5.xls	File 2 of 5, compiles data for stations 204R03135, 204R01199, 204R01375, 204R00831, and 204R01343
AC_2017_BA_PHAB_BIOTA_Export_3of5.xls	File 1 of 5, compiles data for stations 204R02367, 204R03481, 204R00711, 204R03399, and 204R03183
AC_2017_BA_PHAB_BIOTA_Export_4of5.xls	File 1 of 5, compiles data for stations 204R03199, 204R03391, 204R02975, 205R02782, and 204R02759
AC_2017_BA_PHAB_BIOTA_Export_5of5.xls	File 5 of 5, compiles data for stations 205R02862 and 204R03295
AC_BIOASSMT_WQ_EXPORT_22SITES_2017.xls	Compiles data for all 22 stations (2 additional stations sampled due to difficulty in obtaining permits and atypically wet conditions that caused creeks to flow longer)
AC_205R01198_WQ_Export_081717_18-02-06-08-24-41.xls	Dry season, compiles data for sites 204WRD002, 205R01198, and a follow-up tox test at site 205R01198
AC_204SAU200_WQ_Export_072417_18-02-06-08-28-27.xls	Compiles data for sites 204SAU200, 204SAU130, 204SAU110, 204SAU090, and 204SAU055
CM_ACCWP_YSI_204CRW040_2017_Spring.xls	
CM_ACCWP_YSI_204CRW041E_2017_Spring.xls	
CM_ACCWP_YSI_204CRW042_2017_Spring.xls	
CM_ACCWP_YSI_204CRW041E_2017_Summer.xls	SSID study
CM_ACCWP_YSI_204CRW042_2017_Summer.xls	SSID study
CM_ACCWP_YSI_204CRW040_2017_Fall.xls	
CM_ACCWP_YSI_204CRW041E_2017_Fall.xls	
CM_ACCWP_YSI_204CRW042_2017_Fall.xls	
CM_ACCWP_HOBO_204CRW040_2017.xls	Conductivity probe failure (excessive drift) beginning July 28, 2017

Filename	Comment
CM_ACCWP_HOBO_204CRW041A_2017.xls	
CM_ACCWP_HOBO_204CRW041B_2017.xls	
CM_ACCWP_HOBO_204CRW041C_2017.xls	Short-term bias in conductivity data following maintenance visit, June 16-28, 2017 data qualified
CM_ACCWP_HOBO_204CRW041D_2017.xls	
CM_ACCWP_HOBO_204CRW041E_2017.xls	
CM_ACCWP_HOBO_204CRW042_2017.xls	
CM_ACCWP_HOBO_204CRW044_2017.xls	
AC_205R01198_POC_Export_071317_17-12-08-13-39-47.xls	204WRD002 and 205R01198

Attachment B, Alameda Countywide Clean Water Program, Urban Creeks Monitoring Report
BASMAA Regional Monitoring Coalition
Regional Stressor/Source Identification (SSID) Report, prepared in compliance with Municipal Regional Stormwater NPDES Permit (MRP; Order No. R2-2015-0049) Provision C.8.e.ii(1)
MRP 2.0 SSID Project Locations, Rationales, Status
Updated March 2018

SSID Project ID	Date Updated	County/ Program	Creek/ Channel Name	Site Code(s) or Other Site ID	Project Title	Primary Indicator(s) Triggering Stressor/Source ID Project									Indicator Result Summary	Rationale for Proposing/Selecting Project	Current Status of SSID Project or Date Completed	EO Concurrence of project completion (per C.8.e.iii.(b))
						Bioassess	General WQ	Chlorine	Temp	Water Tox	Sed Tox	Sed Chem	Pathogen Indicators	Other				
AL-1	2/23/18	ACCWP	Palo Seco Creek		Exploring Unexpected CSCI Results and the Impacts of Restoration Activities	X									Sites where there is a substantial difference in CSCI score observed at a location relative to upstream or downstream sites, including sites on Palo Seco Creek upstream of the Sausal Creek restoration-related sites, that had substantial and unexpected differences in CSCI scores.	The project will provide additional data to aid consideration of unexpected and unexplained CSCI results from previous water year sampling on Palo Seco Creek, enable a more focused study of monitoring data collected over many years in a single watershed, and allow analysis of before and after data at sites upstream and downstream of previously completed restoration activities.	The work plan is under development. Completion planned June 2018.	
AL-2		ACCWP																
CC-1	2/1/18	CCCWP	Lower Marsh Creek		Stressor Source Identification Study of Marsh Creek Fish Kills					X					9 fish kills have been documented in Marsh Creek between September 2005 and October 2017. A conclusive cause has not been identified.	Fish kills are clear indicators that aquatic habitat beneficial uses are not attained in this reach of Marsh Creek. These events are of interest to the public as well as regulatory and resource agencies in SF Bay and Central Valley regions. Past monitoring data from CCCWP and other parties are being used to develop a phased work plan investigating multiple potential causes, including low dissolved oxygen, warm temperatures, daily pH swings, fluctuating flows, physical stranding, and pesticide exposure.	The work plan is under development. Completion planned June 2018.	
SC-1	1/22/18	SCVURPPP	Coyote Creek		Coyote Creek Toxicity SSID Project						X				The SWRCB recently added Coyote Creek to the 303(d) list for toxicity.	This SSID study will investigate sources of toxicity to Coyote Creek.	The work plan will be submitted with SCVURPPP's WY 2017 UCMR.	
SC-2		SCVURPPP																
SM-1	1/31/18	SMCWPPP	Pillar Point / Deer Creek / Denniston Creek		Pillar Point Harbor Bacteria SSID Project								X		FIB samples from 2008, 2011-2012 exceeded WQOs.	The Pillar Point Harbor MST study conducted in 2008, 2011-2012 pointed to urban runoff as a primary contributor to bacteria at Capistrano Beach and Pillar Point Harbor. However, the specific urban locations were not identified nor were the contributing organisms established. This SSID project will investigate bacteria contributions from the urban areas within the watershed.	The work plan will be submitted with SMCWPPP's WY 2017 UCMR.	

MRP 2.0 SSID Project Locations, Rationales, Status
Updated March 2018

SSID Project ID	Date Updated	County/ Program	Creek/ Channel Name	Site Code(s) or Other Site ID	Project Title	Primary Indicator(s) Triggering Stressor/Source ID Project									Indicator Result Summary	Rationale for Proposing/Selecting Project	Current Status of SSID Project or Date Completed	EO Concurrence of project completion (per C.8.e.iii.(b))
						Bioassess	General WQ	Chlorine	Temp	Water Tox	Sed Tox	Sed Chem	Pathogen Indicators	Other				
FS-1		FSURMP																
TBD		RMC/TBD																