Contra Costa Clean Water Program

Pollutants of Concern Report: Accomplishments in Water Year 2016 and Allocation of Effort for Water Year 2017

Submitted to:

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October 2016

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Acronyms and Abbreviations

BART	Bay Area Rapid Transit
BASMAA	Bay Area Stormwater Management Agencies Association
Bay Area	San Francisco Bay Area
BMP	best management practices
CCCWP	Contra Costa Clean Water Program
EPA	United States Environmental Protection Agency
g/yr	grams per year
kg	kilogram
LID	low impact development
MRP	municipal regional stormwater permit
MS4	municipal separate storm sewer system
NPDES	National Pollutant Discharge Elimination System
PCBs	polychlorinated biphenyl congeners
POC	pollutants of concern
ppb	parts per billion
PSD	particle size distribution
RMP	regional monitoring program
RWQCB	Regional Water Quality Control Board
SRP	stormwater resource plan
SSC	suspended sediment concentration
TMDL	total maximum daily loads
TOC	total organic carbon
WY	water year

1.0 BACKGROUND

This report summarizes Pollutants of Concern (POC) monitoring conducted by the Contra Costa Clean Water Program (CCCWP) during water year (WY) 2016 (October 1, 2015 through September 30, 2016), and describes POC monitoring to be completed in the coming water year, WY 2017 (October 1, 2016 through September 30, 2017). This report fulfills provision C.8.h.iv of Municipal Regional Stormwater Permit (MRP) 2.0, Order No. R2-2015-0049. The following subsections describe monitoring goals (Section 1.1), CCCWP's dual jurisdiction between the San Francisco Bay and Central Valley Regional Water Quality Control Boards (Section 1.2), lessons learned from the past five years of permit implementation (Section 1.3), and POC load estimates from currently identified source areas (Section 1.4) to put the monitoring goals in context. Section 2.0 describes monitoring completed in WY 2016. Section 3.0 describes monitoring to be completed in WY 2017. The report concludes with Section 4.0, a summary of monitoring performed by third parties reported elsewhere.

1.1 Monitoring Goals

The CCCWP Permittees monitor POCs with the goal of identifying reasonable and foreseeable means of achieving load reductions required by total maximum daily loads (TMDLs). TMDLs are watershed plans to attain water quality goals developed and adopted by the San Francisco Bay Regional Water Quality Control Board (RWQCB). The two most prominent TMDLs driving stormwater monitoring, source control and treatment projects are the mercury TMDL and the polychlorinated biphenyl congeners (PCBs) TMDLs. These regulatory plans are intended to reduce concentrations of mercury and PCBs in fish within San Francisco Bay, in the interest of protecting people and wildlife that depend on San Francisco Bay for food.

Mercury and PCBs tend to bind to sediments. The principal means of transport from watersheds is via sediments washed into the Municipal Separate Storm Sewer System (MS4). An important focus of POC monitoring is, therefore, identifying the most significant sources of contaminated sediments to the MS4. An additional focus is quantifying the effectiveness of control measures. The highest POC monitoring priorities for Permittees is answering these two basic TMDL implementation questions: where are the most significant POC sources and what can be done to control them?

The San Francisco Bay RWQCB framed those two priorities as management questions, along with three others, in MRP 2.0 as follows:

1. ***Source Identification*** Identify which sources or watershed source areas provide the greatest opportunities for reductions of POCs in urban stormwater runoff.
2. ***Contributions to Bay Impairment*** Identify 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***	Provide support for planning future management actions or evaluating the effectiveness or impacts of existing management actions.
4.	***Loads and Status***	Provide information on POC loads, concentrations, and presence in local tributaries or urban stormwater discharges.
5.	***Trends***	Evaluate trends in POC loading to San Francisco Bay and POC concentrations in urban stormwater discharges or local tributaries over time.

Provision C.8.f of MRP 2.0 does not specify monitoring details; rather, it requires a total number of samples for different pollutant types to be monitored over the permit term, along with yearly minimum numbers of samples for each POC. The effort is to be applied to the five management questions listed above.

MRP 2.0 requires all stormwater programs to collectively reduce PCBs from stormwater by 3 kilograms (kg) per year. This makes questions 1 (Sources) and 3 (Effectiveness) the highest priorities for Permittees to maintain compliance. Part of question 2 (watershed areas that contribute most to impairment) is also directly related to achieving load reductions. In order to prioritize management actions, Permittees need to know which specific watersheds or sub-catchments are the greatest densities of source areas or average sediment pollutant concentrations.

Other aspects of the five management questions are not as much directly related to complying with the PCBs load reduction requirement of 3 kg. Knowing which areas of San Francisco Bay are most sensitive (second part of question 2) is interesting from a planning perspective, but nothing in the language of MRP 2.0 indicates that extra credit would be given for reducing loads to sensitive areas. Likewise, long-term trends of POC concentrations in urban stormwater may be interesting to follow, but short term actions are a higher priority to comply with the numeric requirements of this permit, and to make progress towards improving long-term trends. For this reason, the “sensitive areas” aspect of question 2 and the trends analysis in question 5 is mostly addressed by funding pilot and special studies that are implemented by the Regional Monitoring Program for Water Quality in San Francisco Bay. In addition to the annual contribution to the regional monitoring program (RMP) made by CCCWP and other members of the Bay Area Stormwater Management Agencies Association (BASMAA), CCCWP and BASMAA work directly with RMP technical work groups to plan studies that fulfill the management questions set forth by MRP 2.0, and to review results and conclusions.

The loads and status aspect (question 4 above) involves watershed modeling using monitoring data to estimate current loads of POCs and potential long-term load reductions that may be achieved through source control and stormwater treatment. This addresses long-term planning to understand how

implementation of stormwater treatment through green infrastructure[1] leads to attainment of POC load reduction goals. Modeling to forecast attainment of load reduction goals will be performed as part of developing a Reasonable Assurance Analysis in fulfillment of Provisions C.11.d.i and C.12.d.i. A Reasonable Assurance Analysis establishes the relationship between areal extent of green infrastructure implementation and POC reductions, estimates the amount and characteristics of land area that will be treated through green infrastructure in future years, and estimates the amount of POC reductions that will result from green infrastructure implementation by specific future years. CCCWP will be developing a Stormwater Resources Plan (SRP) during the next two years that will include some of the preliminary analysis and reporting required for the Reasonable Assurance Analysis.

In addition to sediment-associated TMDL pollutants such as mercury and PCBs, provision C.8.f also requires monitoring of copper, nutrients, and emerging contaminants (perfluorooctane sulfonates, and perfluoroalkyl sulfonates, alternative flame retardants). Copper and nutrients are directly monitored by CCCWP as described in Sections 2.0 and 3.0 below. Emerging contaminants are assessed through a regional collaboration with BASMAA and the RMP and are therefore not discussed at length in this report.

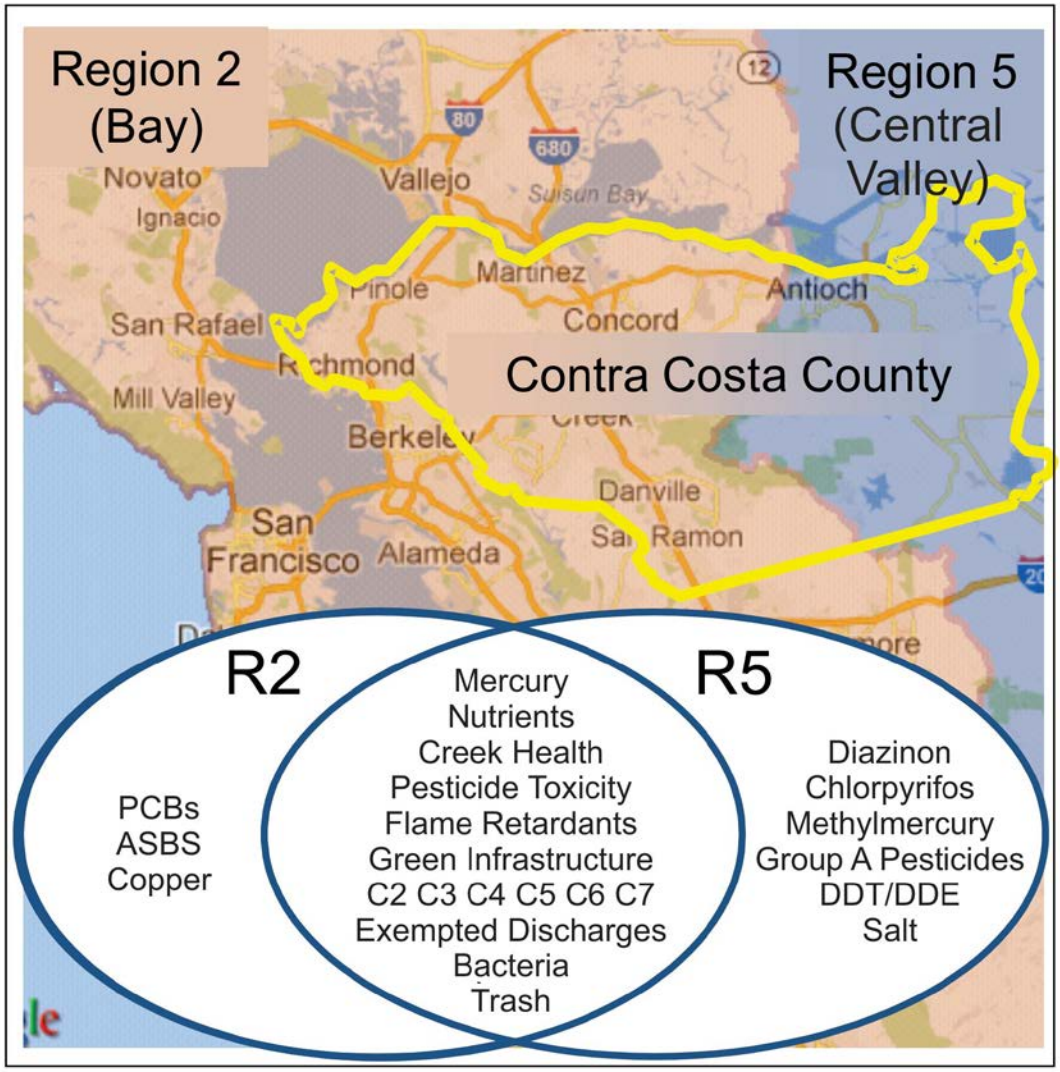
To summarize, of the five monitoring goals: source identification, contribution to impairment, effectiveness assessment, loads and status, and trends, the most urgent compliance-driven priorities for CCCWP Permittees are source identification and effectiveness assessment for mercury and PCBs. Analysis and modeling to forecast long-term trends will commence within the next two years through development of a SRP. Stormwater Resources Plan. Assessments of long-term trends and contribution to impairment are regional projects carried out in collaboration with BASMAA and the RMP.

1.2 Dual Regional Water Quality Control Board Jurisdictions

The CCCWP is in a unique position among Bay Area stormwater programs, as the County is split between the jurisdiction of the San Francisco Bay and the Central Valley RWQCBs (Figure 1). In addition to meeting monitoring requirements in MRP 2.0, CCCWP must also meet monitoring requirements established in the East Contra Costa County NPDES Permit (East County Permit). As noted in Figure 1, there are more issues common to both permits than there are issues unique to either one. CCCWP works collaboratively with both RWQCBs to promote coordinated monitoring which, to the extent possible, satisfies both permits with a single monitoring program plan.

[1] American Rivers defines “green infrastructure” as approach to water management that protects, restores, or mimics the natural water cycle. Green infrastructure is effective, economical, and enhances community safety and quality of life. It means planting trees and restoring wetlands, rather than building a costly new water treatment plant. Practically, in terms of stormwater management in Contra Costa County, this means requiring that all new development and redevelopment projects include stormwater treatment via approved low impact development (LID) designs. These include rain gardens, bioswales, infiltration galleries, etc.

Figure 1. Jurisdictions of San Francisco Bay (red) and Central Valley (blue) Regional Water Quality Control Boards in Contra Costa County (yellow)



Venn Diagram Shows Overlapping and Unique Issues and Permit Provisions

Coordinated monitoring for MRP 1.0 and the East County Permit during the 2010-2015 time frame of both permits was highly successful. A single Bay Area regional collaboration to monitor creek health was extended into Eastern Contra Costa County, allowing evaluation of creek status data in the context of the entire Bay Area. Evaluations of the sources and causes of pesticide toxicity were conducted by the CCCWP in both jurisdictions, resulting in a single stressor source identification study being submitted to both RWQCBs. A methylmercury control study required by the Central Valley RWQCB benefitted by having access to a stormwater treatment pilot project being conducted as a Bay Area regional collaboration. Pollutant loads monitoring in Marsh Creek, in Eastern Contra Costa County, benefitted San Francisco Bay regional planning efforts by quantifying pollutants in a tributary that discharges to the Delta just upstream of San Francisco Bay.

The Central Valley RWQCB is developing a Delta RMP to monitor water quality in receiving waters affected by dischargers to the Delta. In May 2015, CCCWP staff and Permittees sat down with the Central Valley RWQCB to explain that participation by East County Permittees in the existing San Francisco Bay RMP provides equivalent value to participation in a Delta RMP, and that any additional Delta receiving water monitoring expected of East County Permittees would be best accomplished as special studies of the San Francisco Bay RMP. This approach again promotes efficient use of countywide resources in a coordinated manner. Going forward, CCCWP will explore regulatory options that can lead to more unified permit reissuance and implementation.

The summaries of monitoring completed (Section 2.0) and monitoring to be completed (Section 3.0) make note, where appropriate, of monitoring information addressing East County permit needs in addition to requirements of MRP 2.0.

1.3 Lessons Learned from MRP 1.0 (Order No. R2-2009-0074)

At the advent of MRP 1.0 in 2009, CCCWP and other BASMAA member agencies had some working knowledge of the distribution of PCBs and mercury loads across the urban landscape. Monitoring studies conducted in the 2000-2002 time frame showed that concentrations of PCBs are highest in older industrial areas where PCBs were used and released in the past. Mercury is somewhat more evenly distributed across urban land use types, with exceptions where known legacy mining sources (e.g., New Almaden) exist upstream. Still, mercury concentrations also tend to be higher in older industrial urban areas. These early assessments turned up evidence that, in some places, PCBs in sediments collected from catch basins, curbs and gutters may be elevated because of release from nearby contaminated properties. Follow up assessments solidified the evidence of specific source properties in the City of Richmond (within Contra Costa County). Other programs had similar findings of specific source properties. The early studies performed by CCCWP and other BASMAA member agencies were used, along with other information, to develop the mercury TMDL and PCBs TMDL for San Francisco Bay.

CCCWP monitoring for PCBs and mercury during MRP 1.0 focused on:

- Identification and confirmation of suspected source properties
- Evaluation of the effectiveness of stormwater treatment via green infrastructure
- Measurement of tributary loads of mercury and PCBs from the Marsh Creek watershed
- Evaluation of a pilot diversion of stormwater from a pump station into a sanitary sewer as a potential PCBs control measure

The source identification and effectiveness evaluations were performed as a regional collaboration funded by a grant from the EPA's San Francisco Bay Water Quality Improvement Fund. Results are expected to be published in 2017. Preliminary findings were summarized in the Integrated Monitoring Report submitted to the San Francisco Bay RWQCB in 2014. Briefly, the source identification work confirmed two private properties in the City of Richmond with consistently high concentrations of PCBs

in sediments collected from adjacent curbs, gutters and catch basins. One of the properties is a metal recycler that in the past accepted and recycled used transformers; the other property is a forklift repair shop where hydraulic oil is prevalent[2]. The evidence that these properties may be sources of PCBs contaminated sediments to the MS4 is sufficiently strong to make referrals to the San Francisco Bay RWQCB. The potential load reductions that may be achieved from abating these potential source properties are discussed in Section 1.4 below.

The stormwater treatment pilot tests involved installation of bioretention cells along Cutting Boulevard in the City of Richmond. The location was near, but not adjacent to, the above-mentioned source suspected properties. The concept was to evaluate area-wide treatment alternatives that could capture sediments, which are moderately contaminated with PCBs and are typical of older industrial areas at some distance away from known or suspected source properties. Although load reduction calculations for that particular project have not been reported yet, the 2014 Integrated Monitoring Report presented estimates of the potential load reductions achievable by low impact development (LID) projects discussed in Section 1.4 below.

Marsh Creek was selected for tributary monitoring because it has an old mercury mine near its headwaters. The Mount Diablo mercury mine site is currently being investigated by the U.S. Army Corps of Engineers (USACE) for possible remedial actions. Because the mouth of Marsh Creek discharges to the Sacramento-San Joaquin River Delta just upstream of the boundary of the San Francisco Bay RWQCB's jurisdiction, this tributary monitoring project satisfied permit provisions in both MRP 1.0 and the East County permit.

The lesson learned about PCBs in Marsh Creek is the surrounding (and relatively new) suburban communities appear to have some of the lowest concentrations of PCBs in storm-borne sediments found anywhere in the Bay Area. With respect to mercury, the Marsh Creek reservoir appears to function as a highly efficient trap for potentially contaminated sediments coming from the mercury mine in the upper watershed. The primary spillway of the reservoir rarely overtopped during the time Marsh Creek was monitored, and therefore nearly all storm events monitored were entirely urban discharges from the lower watershed, with very little influence from the mercury mine in the upper watershed. Consequently, mercury concentrations in suspended sediments from the lower Marsh Creek watershed are comparable to background concentrations typical of the San Francisco Bay Area.

After reviewing Marsh Creek monitoring data and discussing findings with staff of the Central Valley and the San Francisco Bay RWQCBs, CCCWP obtained concurrence that monitoring small storms at Marsh Creek was no longer necessary. Rather, the new approach at Marsh Creek is to wait for extremely wet years with successive late season storms which can cause upper watershed flow to reach the Delta. The

[2] Transformer oil and hydraulic oil are known historic products containing PCBs.

intention is to inform the USACE remedial investigation as to whether mercury-contaminated sediments from the Mount Diablo mercury mine site are able to reach the lower reaches of Marsh Creek.

The pilot stormwater diversion to a nearby wastewater treatment plant was a success from an infrastructure rehabilitation standpoint. The new diversion system offers operational flexibility, including the ability to discharge to onsite or alternative treatment in the future. The receiving treatment plant, West County Wastewater District, has expressed an interest in exploring options for more full-scale use now that the pilot project is completed. The pump station serves the North Richmond area, which includes the City of Richmond, unincorporated Contra Costa County, and a small section of the City of San Pablo. As an older urban area with a watershed of approximately 400 acres, North Richmond will continue to be a high priority for project development in the Contra Costa SRP, and therefore a likely area for future monitoring. The PCBs loads reduced by the pilot diversion and the potential PCBs loads reduced through full-scale diversion are discussed in Section 1.4 below.

One important lesson learned about monitoring LID is that we need to devote more monitoring effort to quantifying the benefits of complete infiltration. Much of the LID monitoring in MRP 1.0 was focused on effectiveness from the pollutant removal standpoint (i.e., comparison of pollutant concentrations in stormwater flowing into a bioretention cell with concentrations in treated water flowing out of the bioretention underdrain). This inflow-outflow monitoring focus overlooks the benefit of infiltration, which essentially provides 100 percent reduction until infiltration capacity is exceeded. Monitoring during WY 2017 and in the future will include water level logging using piezometers deployed across a variety of LID designs to provide better countywide information on infiltration rates. This will help improve our ability to model the load reduction benefits of existing and future LID.

1.4 Monitoring Context: Load Reduction Requirements for PCBs

As noted above, source identification monitoring is a significant priority for CCCWP during implementation of MRP 2.0. The context for this priority is the load reductions performance criteria for PCBs established in Table 12.1 of MRP 2.0. Throughout the region, stormwater permittees are expected to achieve load reductions of 3,000 grams per year (g/yr) by June 2020. The CCCWP Permittees' share of this reduction is 560 grams, with 90 grams to be achieved by June 2018. Two-thirds of the required load reductions may be credited if a regional policy is adopted for abating the release of PCBs during building demolition. Therefore, CCCWP Permittees are expected to show 30 g/yr load reductions for PCBs by the year 2018, and 187 g/yr by June 2020. Load reductions achieved by current and potential future best management practices (BMPs) help put the required load reductions into context. A few of the existing and potential future BMPs, and their estimated load reductions are listed below:

- 2015 pilot diversion to sanitary: **< 0.1 grams PCBs**
- Potential future full-scale diversion to sanitary: **~ 1 g/yr**
- Pilot installation of LID along one block in an old industrial area: **<0.2 g/yr**
- Source control at a 14-acre metal recycling property: **57 g/yr**

A quick glance at the list above makes it clear source control offers the largest potential mass reduction for an action in a defined area. The language of MRP 2.0 provides 50 percent credit for referring a source property to the San Francisco Bay RWQCB for enforcement, as long as the affected municipality implements interim control measures around the affected property. So a referral at the metal recycler, combined with control measures around that property, could achieve credit that provides most of the 30 grams needed to be achieved by 2018, outside of the demolition program credit.

Going forward, if there are other source properties needing to be addressed, CCCWP Permittees want to know where they are so they can be abated and credited. A significant amount of the monitoring effort in WY 2017 will focus on the following three-tiered source assessment approach:

- Tier 1: Are elevated concentrations of PCBs found in curbs and gutter sediments (street dirt) proximate to, or discharged /tracked out from, suspected source properties?
  - If the answer is yes, this could lead to further investigation and possibly referral.
  - If the answer is no, Tier 2 evaluations are used to further demonstrate no significant sources.
- Tier 2: Are elevated concentrations of PCBs found in sediments within the MS4 system?
  - If the answer is yes, this could lead to further investigation and possibly referral.
  - If the answer is no, Tier 3 evaluations are used to further demonstrate no significant sources.
- Tier 3: Are elevated concentrations of PCBs found in stormwater entering the MS4 system?
  - If the answer is yes, this could lead to further investigation and possibly referral.
  - If the answer is no, additional investigation may not be warranted.

CCCWP Permittees do not necessarily expect PCB load reduction performance criteria established in MRP 2.0 can be met by source control alone. This is why infiltration rate studies are included in the monitoring plan. CCCWP Permittees have embraced LID as the preferred method of treatment. Monitoring the infiltration performance of existing LID facilities will further development of the Contra Costa SRP, which will support future funding of LID and other stormwater improvement projects.

Again, for context, the amount of acres treated to achieve a load reduction of 100 g/yr varies by land use:

- Old industrial: 1,200 acres
- Old urban: 3,700 acres

2.0 MONITORING ACCOMPLISHED IN WATER YEAR 2016

During WY 2016, the following monitoring activities were completed to increase CCCWP's understanding of the geographic distribution of PCBs and mercury (management question 1).

- Street dirt sampling countywide (Tier 1 approach) in urban landscape targeted for historic land uses and halo extent not previously sampled.
- Sediment sampling within MS4 drop inlets (Tier 2 approach) within Rumrill Boulevard and Giant Highway areas to characterize spatial distribution of PCBs and mercury within these halos of interest due to historic land uses.
- Stormwater sampling (Tier 3 approach) on West Gertrude Avenue in the City of Richmond adjacent to suspected source property for PCBs and mercury to confirm if elevated concentrations are present in runoff.

Additionally, BMP effectiveness monitoring for mercury, methylmercury and suspended sediment concentration (SSC) was performed at the aforementioned bioretention cells on Cutting Boulevard in the City of Richmond. This work was done for a two-fold purpose: 1) to inform treatment BMP effectiveness (management question 3); and, 2) to provide continued monitoring data for a methylmercury control study investigation, per Central Valley RWQCB permit requirements. All monitoring activities were performed in accordance with CCCWP's POC Sampling and Analysis Plan and Quality Assurance Project Plan, draft guidance documents (ADH and AMS, 2016a; ADH and AMS, 2016b). Each of these monitoring efforts is described in subsections below.

2.1 Street Dirt Sampling and Analysis (Tier 1 Screening for Source ID)

In WY 2016, eight street dirt locations throughout the county were sampled and analyzed for PCBs, mercury, total organic carbon (TOC) and particle size distribution (PSD). Street dirt is surface material within the public right-of-way available for stormwater entrainment into the MS4. It is found in street gutters, on sidewalks and driveway aprons, or accumulated near an MS4 entry point (e.g., adjacent to a drop inlet grate). WY 2016 sampling took place at sites known to have, or suspected of having, elevated levels of PCBs, or were sites requested for survey by CCCWP Permittees.

Table 1 provides site IDs, position coordinates and site descriptions (rationale for selection) for each location. Refer to Table 2 for analytical test methods, reporting limits and holding times. Refer to Figures 2 and 3 for the general locations of street dirt sampling.

For context from recent sampling prior to WY 2016, see the *Contra Costa Clean Water Program Pollutants of Concern Sediment Screening 2015 Annual Sampling and Analysis Report* (ADH, 2016) for a summary of WY 2015 sampling efforts and locations.

Table 1. Street Dirt Sampling Locations and Selection Rationale (WY 2016)

Site ID[1]	Latitude (decimal degrees)	Longitude (decimal degrees)	General Description and Selection Rational
CC-ANT-901-R	37.99699	-121.84398	EnviroStor site. Antioch PG&E substation
CC-ANT-921-DI	38.01235	-121.77752	Sampled low point where contribution from two known hot sites flow into drop inlet
CC-OAK-922-R	38.00763	-121.75099	Recently identified, high potential, recommended for testing by CCCWP
CC-OAK-923-R	38.00502	-121.74364	Recently identified, high potential, recommended for testing by CCCWP
CC-PTZ-915-R	38.01571	-121.86083	Site was recommended for sampling in WY 2015, but was not sampled due to access issues. Requires a key from the county Flood Control and Water Conservation District to access the levee at 1600 Loveridge Road.
CC-RCH-912-R	37.95408	-122.37690	Site doesn't exist in Geotracker. Site was a drum recycling facility pre-1961-1983. Received casting sand from Atlas Foundry, may have been involved in burning hazardous chemical drums, along with Atlas. Chevron removed some contaminated soil at least by 1987. Adjacent to Fass Metals, which is known to have very high levels of PCBs. The information above could not be confirmed in EnviroStor or Geotracker. Tier 1 category was designated as a conservative measure due to reported use and proximity to PCBs-impacted FASS Metals site at 818 W. Gertrude Avenue.
CC-RCH-924-R	37.92583	-122.36911	Known hot spot at PG&E property along 1st Street and Cutting; recommended for testing by CCCWP.
CC-RCH-924-R-D	37.92583	-122.36911	Field duplicate sample of CC-RCH-924-R
CC-RCH-926-DI	37.92406	-122.36285	Sampled at low point where known hot site appears to flow into drop inlet; recommended for testing by CCCWP.

1 Site ID Key:

ANT	Antioch	D	field duplicate	OAK	Oakley	R	right-of-way
CC	Contra Costa	DI	drop inlet	PTZ	Pittsburgh	RCH	Richmond

Table 2. Sediment Analytical Tests, Methods, Reporting Limits and Holding Times

Sediment Analytical Test	Method	Reporting Limit	Holding Time
Total PCBs (RMP 40 congeners)[1]	EPA 8082A	0.5 µg/kg	1 year
Total Mercury	EPA 7471B	5 µg/kg	1 year
Total Organic Carbon (TOC)	ASTM D4129-05M	0.05%	28 days
Particle Size Distribution (PSD)[2]	ASTM D422M	0.01%	28 days

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

2 Particle size distribution by the Wentworth scale; percent fines (slit and clay) are less than 62.5 microns.

Figure 2. Street Dirt Sampling Locations – West County (WY 2016)

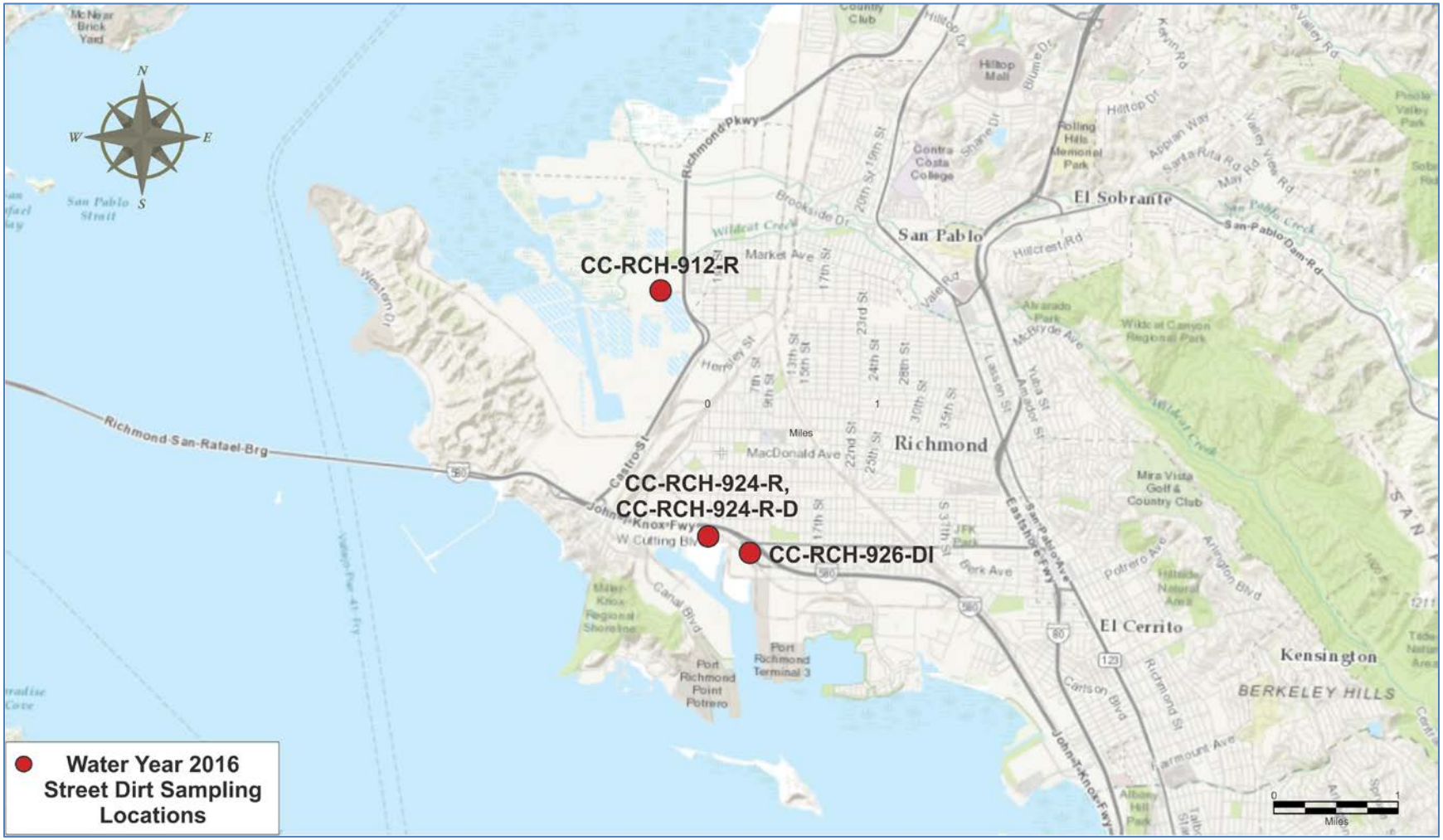
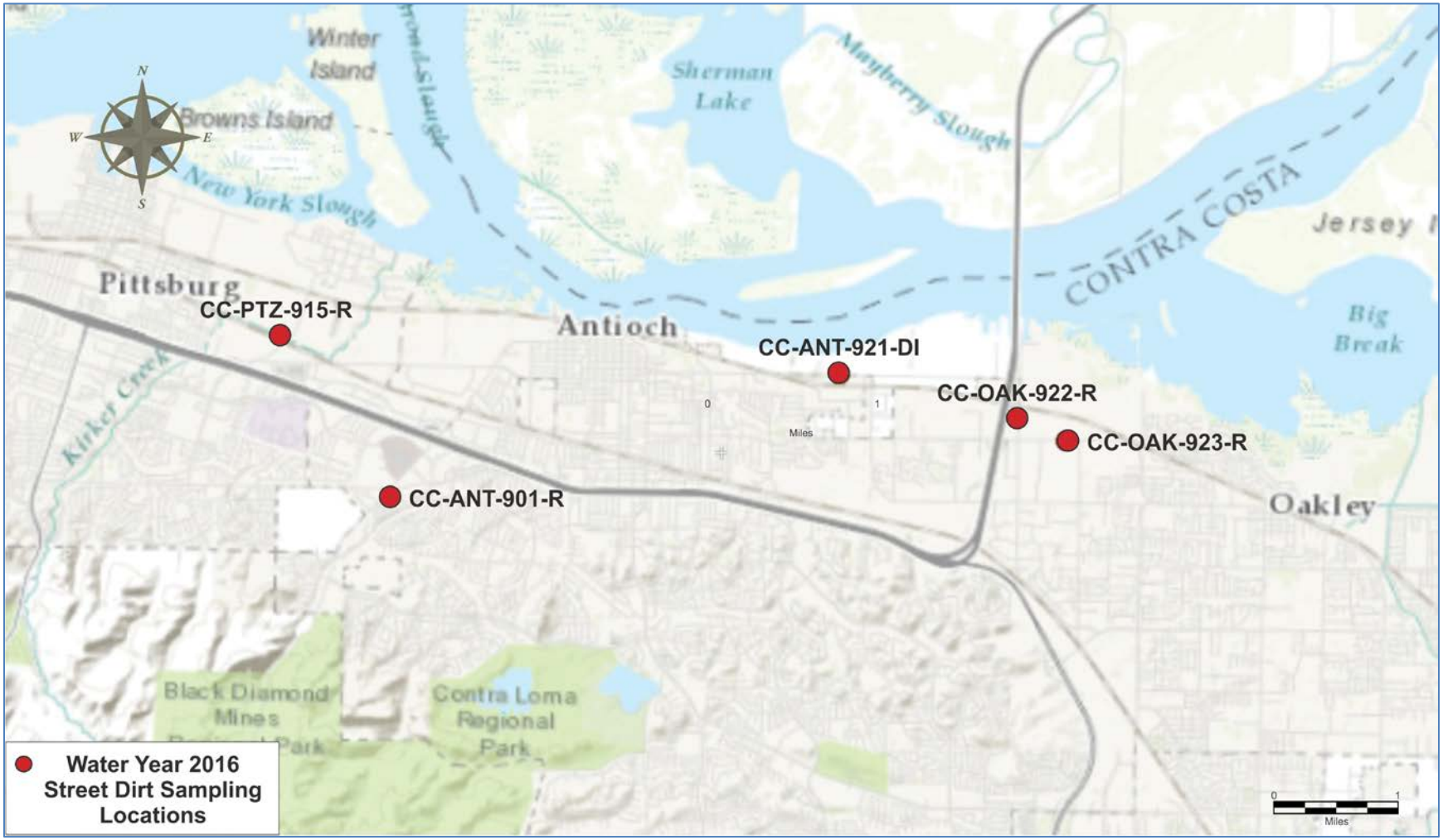


Figure 3. Street Dirt Sampling Locations – East County (WY 2016)



2.2 MS4 Drop Inlet Sediment Sampling and Analysis (Tier 2 Screening for Source ID)

During WY 2016, seven drop inlet locations were sampled in the Rumrill Boulevard area (Table 3 and Figure 4), and seven drop inlet locations were sampled in the Giant Highway area (Table 4 and Figure 5).

The Rumrill Boulevard area is in the City of San Pablo and starts at the Bay Area Rapid Transit (BART) station to the south and runs north to Folsom Avenue. This area has three prominent sections of source PCBs that may continue to migrate outward and contaminate the surrounding areas. The lower section is near the BART station off Rumrill Boulevard; the middle section is around a soccer field and a vacant lot; and the northern section is around an automobile dismantler near Market Street and Rumrill Boulevard. MS4 drop inlets serving runoff from these areas were identified as sampling locations. Based on field conditions, sites were sampled where sufficient sediment accumulated within drop inlets vaults and sites were safely accessible.

The Giant Highway area is in the City of San Pablo and runs north from Parr Boulevard to John Avenue. The monitoring approach for this area is to sample 6 to 8 drop inlets along Giant Highway that have sediment present within the drop inlet and are safely accessible. The intention of sampling is to characterize PCBs and mercury levels within the MS4 in a somewhat uniform spatial distribution along Giant Highway. Recent research shows that large amounts of sediment migrate along Giant Highway and, even if concentrations of PCBs and mercury are not highly elevated, the large mass of mobile sediment available may point toward this area as having a high opportunity for source control measures.

MS4 drop inlet sediment samples were tested for PCBs, mercury, TOC and PSD. Refer to Table 2 for test methods, reporting limits and holding times.

Table 3. Rumrill Boulevard Sampling Locations and Selection Rationale (WY 2016)

Site ID[1]	Latitude (decimal degrees)	Longitude (decimal degrees)	General Description and Selection Rational[2]
CC-RUM-947-DI	37.96002	-122.36148	Drop inlet contained sufficient sediment for sampling, moderate amount of plant material, no trash
CC-RUM-948-DI	37.95870	-122.36045	Drop inlet contained sufficient sediment for sampling, moderate amount of plant material, no trash
CC-RUM-949-DI	37.95855	-122.35922	Drop inlet contained sufficient sediment for sampling, no plant material, no trash
CC-RUM-950-DI	37.95807	-122.35686	Drop inlet contained sufficient sediment for sampling, moderate amount of plant material, no trash
CC-RUM-951-DI	37.95611	-122.35697	Drop inlet contained sufficient sediment for sampling, great amount of plant material, trash present
CC-RUM-952-DIC	37.95336[3]	-122.35774[3]	Three adjacent drop inlets were sampled in this composite, all contained sufficient sediment, no plant material, no trash
CC-RUM-953-C	37.95208	-122.35853	Location sampled is within target area, but is a composite from an outfall pipe

1 Site ID Key:
C composite CC Contra Costa DI drop inlet DIC drop inlet composite RUM Rumrill Boulevard

2 Site sampled due to availability of sufficient sediment, safety, and proximity to target area as provided by geo spatial distribution.

3 This location is the approximate midpoint of the composite sampling locations.

Table 4. Giant Highway Sampling Locations and Selection Rationale (WY 2016)

Site ID[1]	Latitude (decimal degrees)	Longitude (decimal degrees)	General Description and Selection Rational[2]
CC-GNT-940-DI	37.97876	-122.35315	Drop inlet at northern boundary of Giant Highway, contained sufficient sediment for sampling, no plant material, no trash
CC-GNT-941-DI	37.97719	-122.35355	Drop inlet contained sufficient sediment for sampling, minor plant material, no trash, flows directly into Wildcat Creek
CC-GNT-942-DI	37.97634	-122.35379	Drop inlet in front of industrial complex noted for elevated levels of PCBs in past testing, sufficient sediment present to sample
CC-GNT-943-DI	37.97319	-122.35464	Drop inlet contained great amounts of plant material but had sufficient amount of sediment for sampling
CC-GNT-944-DI	37.97096	-122.35522	Drop inlet sampled contained sufficient sediment for sampling and located in area known to have elevated PCBs
CC-GNT-945-DI	37.96910	-122.35573	Drop inlet at southern boundary of Giant Highway, contained sufficient sediment for sampling, small amounts of plant material and trash, soil was moist
CC-GNT-946-C	37.97396[3]	-122.35486[3]	Composite sample collected from open channel that runs along southbound lane of Giant Highway

1 Site ID Key:
C composite CC Contra Costa DI drop inlet GNT Giant Highway

2 Site sampled due to availability of sufficient sediment, safety, and proximity to target area as provided by geo spatial distribution.

3 This location is the approximate midpoint of the composite sampling locations.

Figure 4. MS4 Drop Inlet Sediment Sampling Locations – Rumrill Boulevard Area, San Pablo (WY 2016)

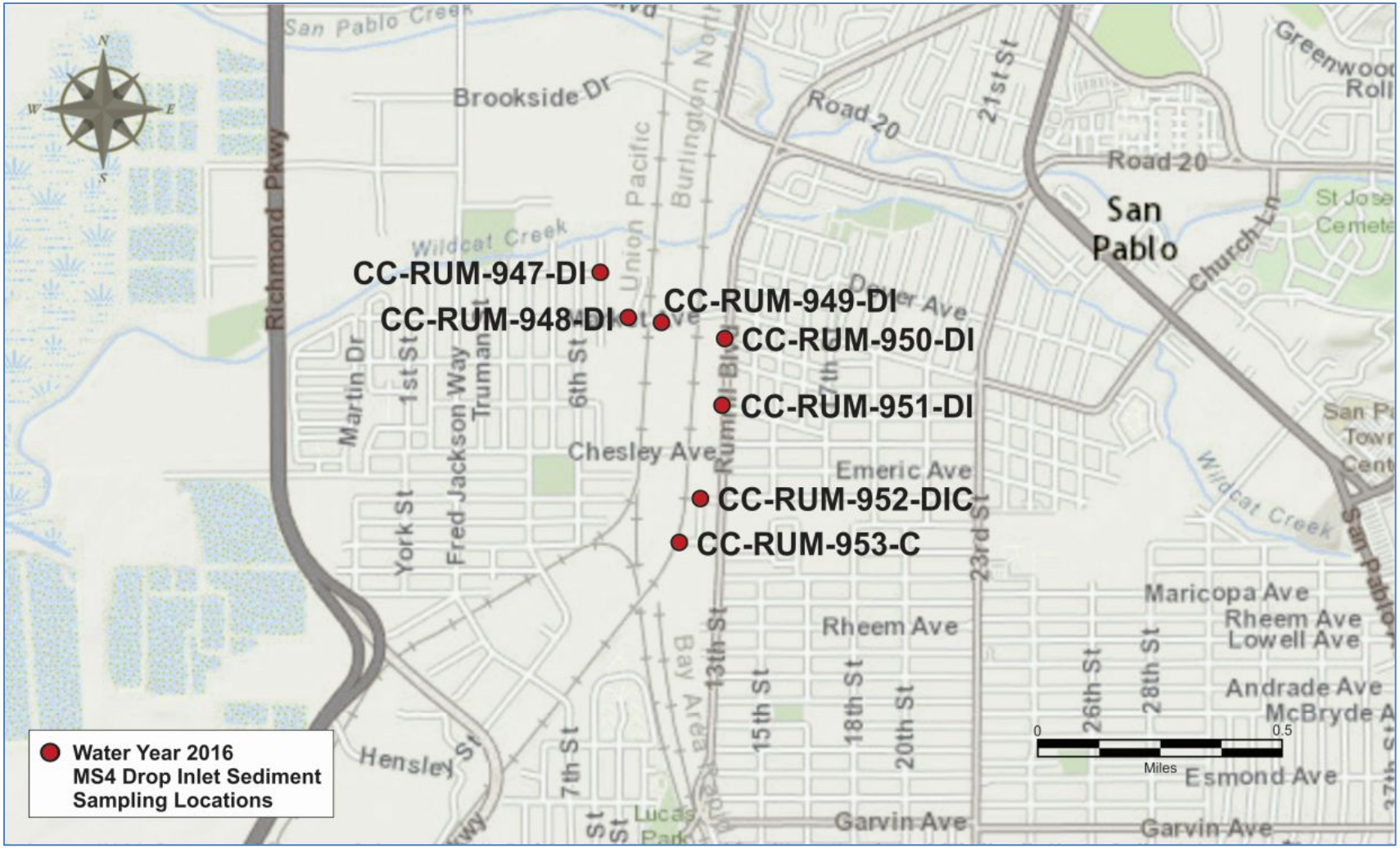
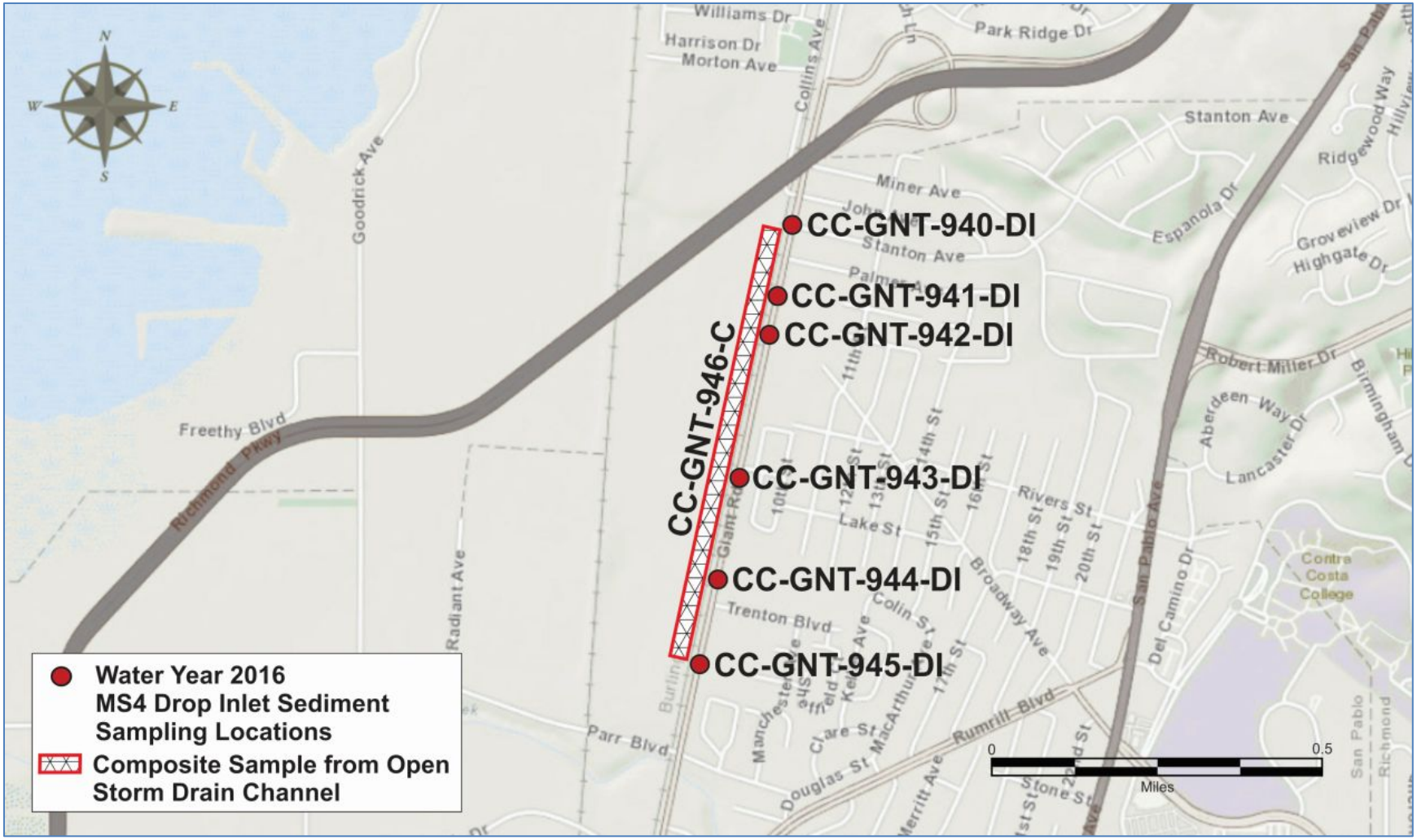


Figure 5. MS4 Drop Inlet Sediment Sampling Locations – Giant Highway Area, San Pablo (WY 2016)



2.3 Stormwater Sampling and Analysis (Tier 3 Screening for Source ID)

WY 2016 stormwater samples were collected along West Gertrude Avenue in the City of Richmond as a follow up to the determination of high PCBs and mercury concentrations found in street dirt samples collected in WY 2015. Stormwater sampling point WGA-SF1-01 (Table 3 and Figure 6) was in the same general location as street dirt sample CC-RCH-401-U, which had the highest concentration of PCBs and mercury of all sites tested in WY 2015 (ADH, 2016).

Stormwater sampling results corroborated street dirt sampling results and indicated runoff to the MS4 is high in PCBs and mercury along West Gertrude Avenue, especially at the farthest west drop inlet (site WGA-DI1-01) which is adjacent to the suspected source property. Particle ratios in suspended sediment for PCBs were 473 parts per billion (ppb) at WGA-DI1-01 and were 700 ppb at WGA-SF1-01 (runoff coming directly off the suspected source property).

Table 5. Stormwater Sampling Results – West Gertrude Avenue, Richmond (WY 2016)

Site ID[1]	WGA-DI1-01	WGA-DI2-01	WGA-DI3-01	WGA-DI4-01	WGA-DI5-01	WGA-SF1-01
Date Sampled	1/19/2016	1/19/2016	1/19/2016	1/19/2016	1/19/2016	1/19/2016
Latitude	37˚ 57.246'	37˚ 57.246'	37˚ 57.246'	37˚ 57.246'	37˚ 57.246'	37˚ 57.248'
Longitude	-122˚ 22.655'	-122˚ 22.634'	-122˚ 22.603'	-122˚ 22.551'	-122˚ 22.488'	-122˚ 22.655'
Total PCBs[2] (ng/L)	69.5	13.2	3.88	40.6	71.1	35.9
Total Hg (µg/L)	3.75	1.11	2.01	3.37	0.97	16.9
Total MeHg (ng/L)	0.32	0.39	0.49	0.41	0.39	0.22
MeHg/Hg Ratio (%)	8.5	35	24	12	40	1.3
SSC (mg/L)	147	44.4	262	113	226	51.3
TOC (mg/L)	2.12	1.31	6.68	6.31	4.28	3.80
PCBs/SSC Ratio (ppb)[3]	***473***	297	15	359	315	***700***
THg/SSC Ratio (ppb)	25.5	25.0	7.67	29.8	4.29	329

1 Site ID Key:
DI drop inlet SF sheet flow WGA West Gertrude Avenue

2 PCBs in water analyzed by method EPA 1668

3 Values in bold italics indicate a likely high source area for PCBs

Figure 6. Stormwater Sampling Locations – West Gertrude Avenue, Richmond (WY 2016)

2.4 BMP Effectiveness Evaluation

BMP effectiveness monitoring for mercury and methylmercury was conducted at two adjacent pilot biofiltration BMPs (LAU3 and LAU4) on Cutting Boulevard in the City of Richmond (Figure 7). These BMPs were selected for monitoring in part because monitoring costs were shared with a concurrent EPA-funded water quality study implemented at the same location. Influent and effluent stormwater samples were collected from each biofiltration BMP at three time points per storm.

Results from this BMP effectiveness evaluation for mercury, methylmercury and SSC will be reported in a forthcoming update to the *Contra Costa Clean Water Program Methylmercury Control Study Progress Report* (ADH and AMEC, 2015).

2.5 Summary of Monitoring Completed in Water Year 2016

As a whole, WY 2016 monitoring is summarized in Table 4. The table lists the total number of tests completed for each pollutant class, and the corresponding targets outlined in MRP 2.0.

Sediment sampling of street dirt and drop inlets was completed late in the water year, and analytical results are not available at the time of this writing. These results will be reported in the Urban Creeks Monitoring Report due on March 31, 2017, and will help inform water year 2017 sampling efforts.

Table 6. Monitoring Completed in Water Year 2016 by Pollutant Class and MRP 2.0 Targets

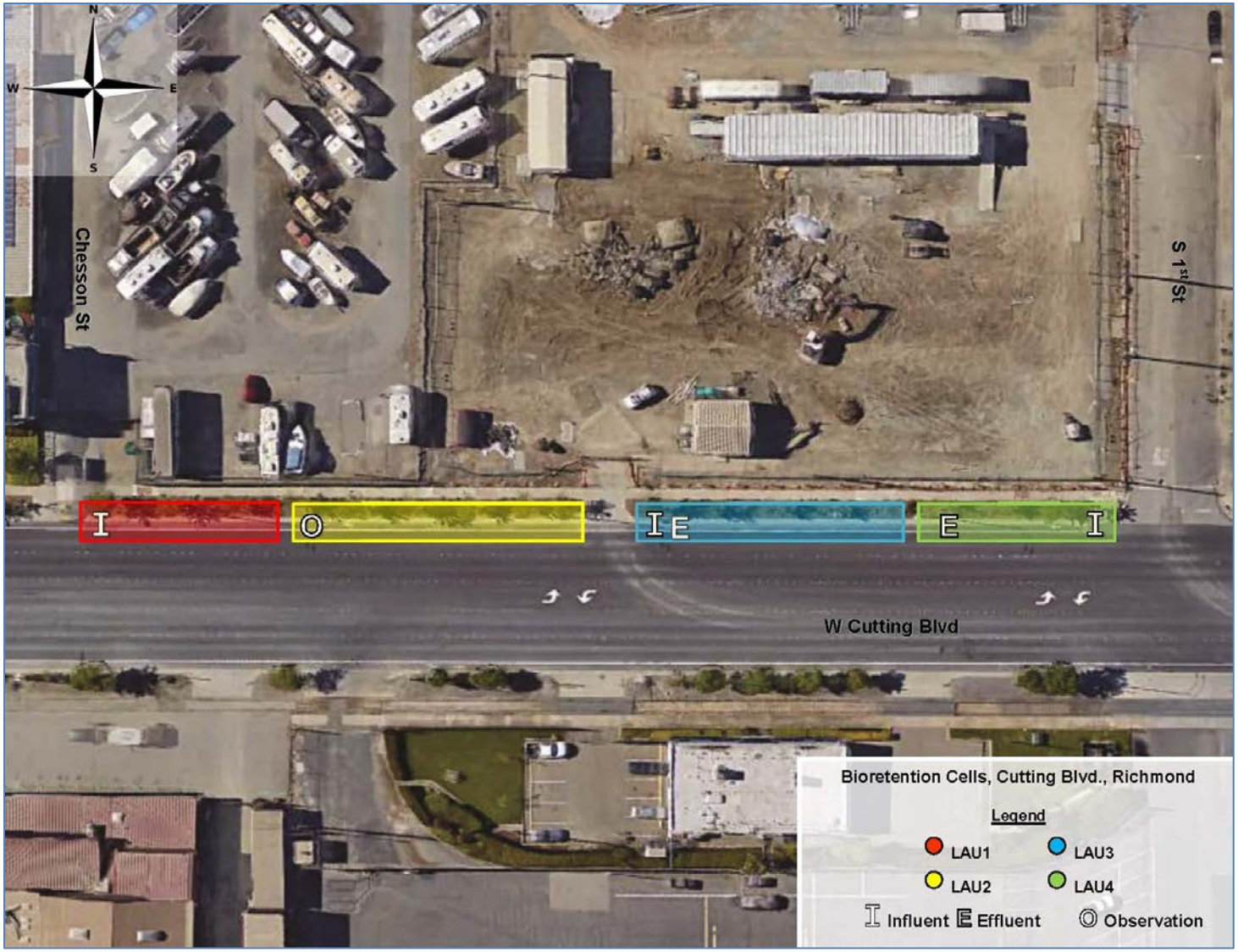
Pollutant Class	Number of Samples Collected and Analyzed in WY 2016	Annual Minimum Samples Required by MRP 2.0	Total Samples Required By MRP 2.0 Over 5-Year Term
PCBs - water	6	8	80
PCBs - sediment	22	8	80
Mercury - water	24	8	80
Mercury - sediment	22	8	80
Copper[1] - water	0	2	20
Emerging Contaminants[2]	0	3	3
Nutrients[3] – water	0	2	20

1 Total and dissolved copper

2 Emerging contaminants (alternative flame retardants) need only be tested during one special study over the 5-year term of the permit

3 Ammonium, nitrate, nitrite, total Kjeldahl nitrogen, orthophosphate and total phosphorus

Figure 7. BMP Effectiveness Monitoring Locations LAU3 and LAU4 on Cutting Boulevard in the City of Richmond



3.0 MONITORING PLAN FOR WATER YEAR 2017

Sampling planned for WY 2017 includes:

- Ongoing street dirt and drop inlet sediment monitoring for PCBs and mercury
- Stormwater runoff sampling for PCBs and mercury (Rumrill Boulevard and Giant Highway)
- Watershed characterization monitoring for copper and nutrients (Walnut Creek and Marsh Creek)
- Upper watershed characterization for mercury (Marsh Creek downstream of reservoir during overflow)
- LID effectiveness – infiltration rates studies (countywide as sites become available)

The subsections below provide background information on monitoring and descriptions of activities as well as overall numeric goals (number of samples to be collected) during the water year.

3.1 Ongoing Street Dirt and Drop Inlet Sediment Sampling and Analysis

Continuation of street dirt sampling will take place at locations that are identified through ongoing desktop research, field surveys, and at locations identified by CCCWP Permittees. Sites that are being added to the potential sampling list include locations of interest due to historic or present day land use, lack of adequate source control by nearby property owners, reoccurring accumulation of sediment, etc.

Based on lessons learned during WYs 2015 and 2016 monitoring, it is apparent that high opportunity areas for PCBs and mercury controls do not always co-locate with known or suspected contaminated source properties. High concentrations of PCBs do not always occur where expected, and in some cases are found in relatively high concentrations in areas of only moderate interest. For this reason, monitoring efforts have been expanded to include halo zones around locations of interest to account for presence of PCBs in areas that might have otherwise been overlooked. Additionally, feedback from the San Francisco Bay RWQCB helped direct efforts toward increased MS4 drop inlet monitoring and stormwater runoff monitoring with the hope of reducing false negatives based on street dirt sampling alone.

Continuation of MS4 drop inlet sediment sampling will take place at locations of interest as identified during street dirt sampling surveys, and that are suitable for sample collection (i.e., sufficient sediment is available, and sites are safely accessible).

Sampling and analysis methods will be the same as those proposed for WYs 2015 and 2016 monitoring. Approximately 15 sediment samples from street dirt and MS4 drop inlet monitoring combined will be targeted for WY 2017.

3.2 Stormwater Sampling and Analysis

Following up on drop inlet sampling in the Rumrill Boulevard and Giant Highway areas, stormwater samples will be collected to better understand where and how PCBs and mercury are transported to the MS4. Samples will be collected where runoff enters drop inlets or other stormwater conveyance structures. The number and location of sampling sites, and frequency of collection, will be informed from Tier 1 and 2 results (street dirt and drop inlet sediment analysis) and from availability of monitoring funds.

Sampling and analysis methods will be the same as those conducted in WYs 2015 and 2016. Approximately 20 stormwater runoff samples countywide will be targeted for WY 2017.

3.3 Watershed Characterization for Copper and Nutrients

Sampling for copper and nutrients is planned for Walnut Creek and Marsh Creek for WY 2017. One site in the lower reach of each creek will be selected for monitoring during two storms, for a total of four samples. For Marsh Creek, the site will be the same location where WY 2012 through 2014 sampling took place (Lower Marsh Creek in the City of Brentwood). This location is immediately upstream of the City of Brentwood's waste water treatment plant discharge. Analyses will consist of total copper, dissolved copper, nutrients, SSC and hardness. Refer to Table 5 for test methods and reporting limits.

Table 7. Watershed Characterization Analytical Tests, Methods and Reporting Limits

Analytical Test	Method	Reporting Limit
Suspended Sediment Concentration (SSC)	ASTM D 3977-97B	3 mg/L
Copper, total recoverable and dissolved	EPA 200.8	0.5 µg/L
Hardness	SM 2340C (titration)	5 mg/L
Ammonium	SM 4500 NH3-C	0.02 mg/L
Nitrate	EPA 300.0	0.05 mg/L
Nitrite	EPA 300.0	0.05 mg/L
Total Kjeldahl Nitrogen	SM 4500 NH3-C	0.1 mg/L
Dissolved Orthophosphate	SM 4500P-E	0.01 mg/L
Total Phosphorus	SM 4500P-E	0.01 mg/L

3.4 Marsh Creek Upper Watershed Characterization

To fill a data gap in the Marsh Creek watershed monitoring effort, upper watershed discharge will be targeted for sampling during WY 2017. The sampling point on Lower Marsh Creek is immediately upstream of discharge from the City of Brentwood's waste water treatment plant. Approximately six miles upstream of the sampling point lies the Marsh Creek Reservoir, which captures runoff from the upper watershed, including the former Mount Diablo Mercury Mine. The reservoir discharges through the primary spillway only during periods of extreme runoff; otherwise, the reservoir is successful at impounding water from most rain events. If sampling opportunities become available (i.e., sustained

discharge from the reservoir to Lower Marsh Creek), runoff at the Lower Marsh Creek sampling point will be collected and analyzed for SSC, mercury and methylmercury.

3.5 LID Effectiveness – Infiltration Rates Monitoring

CCCWP has targeted an approach to infiltration monitoring of LID projects to help inform management decisions regarding the efficacy of infiltration as a means of reducing or eliminating discharge of contaminants. This approach involves ongoing dialogue with Permittees who are implementing new LID infiltration systems within their jurisdiction with the goal of incorporating design features (e.g., monitoring wells) to facilitate field testing. Currently, the Cities of Walnut Creek, San Pablo and the Town of Danville are in communication with CCCWP regarding new LID infrastructure that may be suitable for monitoring.

Research into existing infiltration systems countywide has not yet yielded suitable monitoring locations. For an infiltration system to be suitable, it should incorporate the following features according to hydromodification specialist Dan Cloak (personal communication, October 27, 2015 and August 8, 2016):

- Location on public land and/or site owner's permission to install and operate monitoring equipment
- No influence from tide water or high ground water
- Surface of the native soil at the bottom of the excavation ripped to promote infiltration
- If fitted with underdrain pipe, must not be located at bottom of gravel layer
- Standpipe (monitoring well) extending from the native soil to above the overflow elevation, slotted within the gavel layer
- Accurate as-built plans showing elevation of bottom of excavation, top of gravel layer, top of soil layer, top of overflow grate, and underdrain discharge point.

3.6 Summary of Monitoring Planned for WY 2017

As a whole, sampling planned for WY 2017 is summarized in Table 6.

Table 8. Monitoring Planned for WY 2017 by Pollutant Class and MRP 2.0 Targets

Pollutant Class	Number of Samples Planned for WY 2017	Annual Minimum Samples Required by MRP 2.0	Total Samples Required by MRP 2.0 Over 5-Year Term
PCBs - water	20	8	80
PCBs - sediment	15	8	80
Mercury - water	20	8	80
Mercury - sediment	15	8	80
Copper[1] - water	4	2	20
Emerging Contaminants	0	[2]	[2]
Nutrients – water[3]	4	2	20

1 Total and dissolved copper

2 Emerging contaminants (alternative flame retardants) need only be tested during one special study over the 5-year term of the permit

3 Ammonium, nitrate, nitrite, total Kjeldahl nitrogen, orthophosphate and total phosphorus

4.0 SUMMARY OF POLLUTANT MONITORING REPORTED ELSEWHERE

In addition to directly managing monitoring programs, CCCWP also participates in the RMP by direct financial contributions and by participation in RMP subcommittees responsible for planning and directing monitoring projects. The RMP Sources, Pathways and Loadings Workgroup and the associated Small Tributaries Loading Strategy subgroup, are the chief mechanisms for monitoring projects that directly inform CCCWP's POC implementation program.

In the 2010-2011 time frame, at the outset of the previously issued MRP 1.0 implementation, the RMP reported on the results of a special reconnaissance study to identify drainages that potentially had elevated concentrations of PCBs. The intention was to guide upstream source investigations. During MRP 1.0 implementation, another RMP special study monitored POC concentrations and loads at the mouths of tributaries draining to San Francisco Bay. Findings from those studies were reported in the 2014 Integrated Monitoring Report.

During water years 2015 and 2016, the RMP conducted a second reconnaissance study. With input from CCCWP, locations were selected to provide coverage in areas where data gaps existed. Data from that reconnaissance study will be available in fiscal year 2016-2017 time frame and will be used to plan monitoring activities in water years 2017 and 2018.

5.0 REFERENCES

ADH and AMEC. 2015. *Contra Costa Clean Water Program Methylmercury Control Study Progress Report.* ADH Environmental and Amec Foster Wheeler. October 2015.

ADH and AMS. 2016a. *Contra Cost County Clean Water Program Sampling and Analysis Plan DRAFT Pollutants of Concern Monitoring; Pesticides and Toxicity Monitoring.* ADH Environmental and Applied Marine Sciences. January 21, 2016.

ADH and AMS. 2016b. *Contra Cost County Clean Water Program Quality Assurance Project Plan DRAFT Pollutants of Concern Monitoring; Pesticides and Toxicity Monitoring.* ADH Environmental and Applied Marine Sciences. January 26, 2016.

ADH. 2016. *Contra Costa Clean Water Program Pollutants of Concern Sediment Screening 2015 Annual Sampling and Analysis Report.* ADH Environmental. March 4, 2016.