POLLUTANTS OF CONCERN MONITORING DATA REPORT

Water Year 2018

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

SAN MATEO COUNTYWIDE
Water Pollution Prevention Program

A Program of the City/County Association of Governments

March 31, 2019

CREDITS

This report is submitted by the participating agencies in the

SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program
Clean Water. Healthy Community.
www.flowstobay.org

Town of Atherton
City of Belmont
City of Brisbane
City of Burlingame
Town of Colma
City of Daly City
City of East Palo Alto
City of Foster City
City of Half Moon Bay
Town of Hillsborough
City of Menlo Park
City of Millbrae
City of Pacifica
Town of Portola Valley
City of Redwood City
City of San Bruno
City of San Carlos
City of San Mateo
City of South San Francisco
Town of Woodside
County of San Mateo
SM County Flood Control District

Prepared for:

San Mateo Countywide Water Pollution Prevention Program (SMCWPPP)
555 County Center, Redwood City, CA 94063
A Program of the City/County Association of Governments (C/CAG)

Prepared by:

EOA, Inc.
1410 Jackson St., Oakland, CA 94610

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

LIST OF ABBREVIATIONS

BASMAA	Bay Area Stormwater Management Agency Association
BMP	Best Management Practice
CEC	Contaminants of Emerging Concern
CEDEN	California Environmental Data Exchange Network
CSCI	California Stream Condition Index
CW4CB	Clean Watersheds for Clean Bay
DTSC	California Department of Toxic Substances Control
ECWG	Emerging Contaminants Work Group of the RMP
MRP	Municipal Regional Permit
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollution Discharge Elimination System
PBDEs	Polybrominated Diphenyl Ethers
PCBs	Polychlorinated Biphenyls
PFAS	Perfluoroalkyl Sulfonates
PFOS	Perfluorooctane Sulfonates
POC	Pollutant of Concern
RMC	Regional Monitoring Coalition
RMP	San Francisco Bay Regional Monitoring Program
RWSM	Regional Watershed Spreadsheet Model
SAP	Sampling and Analysis Plan
SMCWPPP	San Mateo Countywide Water Pollution Prevention Program (Countywide Program)
SFEI	San Francisco Estuary Institute
SPoT	Statewide Stream Pollutant Trend Monitoring
SSC	Suspended Sediment Concentration
STLS	Small Tributary Loading Strategy
TOC	Total Organic Carbon
UCMR	Urban Creeks Monitoring Report
USEPA	US Environmental Protection Agency
WQO	Water Quality Objective
WY	Water Year

1.0 INTRODUCTION

This Pollutants of Concern (POC) Monitoring Data Report (POC Data Report) was prepared by the San Mateo Countywide Water Pollution Prevention Program (SMCWPPP or Countywide Program), a program of the San Mateo County City/County Association of Governments (C/CAG). SMCWPPP prepared this report on behalf of San Mateo County local agencies subject to the National Pollutant Discharge Elimination System (NPDES) regional stormwater permit for Bay Area municipalities, referred to as the Municipal Regional Permit (MRP). The MRP was reissued by the San Francisco Regional Water Quality Control Board (Regional Water Board) on November 19, 2015 (Regional Water Board 2015). This report fulfills the requirements of MRP Provision C.8.h.iii for reporting a summary of Provision C.8.f POC Monitoring conducted during Water Year (WY) 2018[1].

This POC Data Report builds on SMCWPPP's POC Monitoring Report dated October 15, 2018 (SMCWPPP 2018c). In accordance with MRP Provision C.8.h.iv, the POC Monitoring Report included POC monitoring locations, number and types of samples collected, purpose of sampling (i.e., Management Questions addressed), and analytes measured. The October 15, 2018 POC Monitoring Report also described the POC monitoring allocation of sampling effort planned for WY 2019.

This POC Data Report is included as an appendix to the Countywide Program's WY 2018 Urban Creeks Monitoring Report (UCMR). In addition, consistent with MRP Provision C.8.h.ii, POC monitoring data generated from sampling of receiving waters (e.g., creeks) were submitted to the San Francisco Bay Area Regional Data Center for upload to the California Environmental Data Exchange Network (CEDEN)[2].

1.1. POC Monitoring Requirements

Provision C.8.f of the MRP requires monitoring of several POCs including polychlorinated biphenyls (PCBs), mercury, copper, emerging contaminants[3], and nutrients. Provision C.8.f specifies yearly (i.e., WY) and total (i.e., permit term) minimum numbers of samples for each POC. In addition, POC monitoring must address the five priority management information needs (i.e., Management Questions) identified in C.8.f:

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);

[1] The water quality monitoring described in this report was conducted on a Water Year basis. A Water Year begins on October 1 and ends on September 30 of the named year. For example, Water Year 2018 (WY 2018) began on October 1, 2017 and concluded on September 30, 2018.

[2] CEDEN has historically only accepted and shared data collected in streams, lakes, rivers, and the ocean (i.e., receiving waters). In late-2016, we were notified that there were changes to the types of data that CEDEN would accept and share. However, pending further clarification, SMCWPPP will continue to submit only receiving water data to CEDEN.

[3] Emerging contaminant monitoring requirements will be met through participation in the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP) special studies. The special studies will account for relevant contaminants of emerging concern (CECs) in stormwater and will address at least PFOS, PFAS, and alternative flame retardants being used to replace PBDEs.

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 or presence in local tributaries or urban stormwater discharges; and
5. **Trends** – providing information on trends in POC loading to the Bay and POC concentrations in urban stormwater discharges or local tributaries over time.

The MRP specifies the minimum number of samples for each POC that must address each Management Question. For example, over the first five years of the permit, a minimum total of 80 PCBs samples must be collected and analyzed. At least eight PCB samples must be collected each year. By the end of year four[4] of the permit term, each of the five Management Questions must be addressed with at least eight PCB samples. It is possible that a single sample can address more than one information need. The MRP's POC Monitoring requirements are summarized in Table 1.

SMCWPPP participated in a Bay Area Stormwater Management Agencies Association (BASMAA) regional project that was developed to satisfy provision C.8.f requirements for SMCWPPP and other Bay Area stormwater programs to each collect at least eight PCBs and mercury samples that address Management Question No. 3 (Management Action Effectiveness). The study investigated the effectiveness of hydrodynamic separator (HDS) units and various types of biochar-amended bioretention soil media (BSM) at removing PCBs and mercury from stormwater runoff. The study is summarized in the main body of the Countywide Program's WY 2018 UCMR and further details are provided in the project reports (BASMAA 2019a and b).

Data gathering needed to comply with MRP provisions C.11 (Mercury Controls) and C.12 (PCBs controls) is partly addressed through Provision C.8.f (i.e., POC Monitoring). Similarly, certain samples collected per C.11 and C.12 count towards C.8.f POC monitoring requirements. The specific provisions and their associated timelines are:

- Provisions C.11.a.iii and C.12.a.iii require that Permittees provide a list of management areas in which new PCBs and mercury control measures will be implemented during the permit term. These management areas are designated "Watershed Management Areas" (WMAs). Progress toward developing the list was initially submitted in a report dated April 1, 2016 (SMCWPPP 2016a). Beginning with a report submitted with the Countywide Program's September 2016 Annual Report, the initial list was expanded upon by designating all catchments with high interest parcels (i.e., with land uses associated with PCBs such as old industrial, electrical and recycling) and/or with existing or planned PCBs and mercury controls as WMAs (SMCWPPP 2016b). The WMA list was further updated in reports (SMCWPPP 2017b and 2018b) submitted with the Countywide Program's September 2017 and September 2018 Annual Reports and will continue to be updated with each subsequent Annual Report, per MRP Provision C.11.a.iii(3). MRP Provision C.8.f (POC Monitoring) supports C.11/12.a requirements by requiring monitoring directed toward source identification (i.e., identifying WMAs and source properties within WMAs that provide the greatest opportunities for implementing cost-effective controls that reduce loads of PCBs in urban stormwater runoff).

[4] Note that the minimum sampling requirements addressing information needs must be completed by the end of year four of the permit (i.e., WY 2019); however, the minimum number of total samples does not need to be met until the end of year five of the permit (i.e., WY 2020).

- Provision C.12.e requires that Permittees collect at least 20 composite samples (region-wide) of caulks and sealants used in storm drains or roadway infrastructure in public rights-of-way. The Countywide Program participated in a BASMAA regional project to address this requirement. Results of the investigation were documented by BASMAA (2018), a report submitted with the Countywide Program's 2018 Annual Report.

1.2. Third-Party Data

The Countywide Program strives to work collaboratively with water quality monitoring partners to develop mutually beneficial monitoring approaches. Provision C.8.a.iii of the MRP allows Permittees to use data collected by third-party organizations to fulfill monitoring requirements, provided the data are demonstrated to meet the required data quality objectives. As such, samples collected in San Mateo County through two ongoing programs, (1) the Small Tributary Loading Strategy (STLS) of the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP) and (2) the State's Stream Pollution Trends (SPoT) Monitoring Program, supplement the Countywide Program's efforts towards achieving Provision C.8.f monitoring requirements. In addition, Clean Watersheds for a Clean Bay (CW4CB), a BASMAA project that was funded by a grant from USEPA and ended in 2017, provided WY 2016 data. Third party monitoring conducted by the RMP, SPoT, and CW4CB also provides context for reviewing and interpreting Countywide Program monitoring results. As in past years, this POC Data Report evaluates PCBs and mercury data from third-party POC monitoring efforts, along with data collected by the Countywide Program.

1.2.1. RMP STLS

The RMP's Small Tributary Loading Strategy (STLS) Team typically conducts annual monitoring for POCs on a region-wide basis. SMCWPPP is an active participant in the STLS and works with other Bay Area municipal stormwater programs to identify opportunities to direct RMP funds and monitoring activities towards addressing both short- and long-term municipal stormwater permit management questions. POC monitoring activities conducted by the STLS in recent years focused on pollutant loading monitoring at six region-wide stations (WY 2012 – WY 2014), including the Pulgas Creek Pump Station drainage station in San Mateo County, and wet weather characterization monitoring in catchments of interest (WY 2015 – WY 2018). The wet weather characterization sampling uses a similar approach to the PCBs and mercury sampling that has been implemented by SMCWPPP, and Countywide Program staff has assisted the STLS to select all of its PCBs and mercury monitoring stations in San Mateo County.

RMP STLS monitoring in WY 2019 will continue to focus on wet weather characterization. The number of stations in San Mateo County that will be targeted by the STLS will likely be limited to two or less and, similar to WY 2018, the STLS will likely monitor stations that were previously sampled but had relatively low PCBs concentrations.

In future years, RMP STLS monitoring is expected to shift towards Management Question No. 5 (Trends). A STLS Trends Strategy Team was initiated in WY 2015, with SMCWPPP participation in the Team since it convened. The Team is currently developing a regional monitoring program to assess trends in POC loading to San Francisco Bay from small tributaries. The STLS Trends Strategy will initially focus on PCBs and mercury, but will not be limited to those POCs. Analysis of recent and historical data collected at region-wide loadings stations suggests that PCBs concentrations are highly variable. Therefore, a monitoring design to detect trends with statistical confidence may require more samples than is feasible given budget constraints. The STLS Trends Strategy Team is continuing to evaluate available data to help

inform developing feasible monitoring strategies. The preliminary design concept included additional monitoring at one or two of the region-wide loadings stations to gain a better understanding of the variability in PCBs concentrations/loadings in the existing dataset. However, uncertainties about the utility of developing a trends monitoring program that targets just one or two watersheds coupled with unknowns about how to extrapolate findings to the region has prompted the Trends Strategy Team to delay monitoring and focus instead on identifying practical modeling approaches. The Team is considering modeling options that could be used in concert with monitoring to detect and predict trends in POC loadings. A Trends Strategy Road Map is currently being developed. STLS Trends monitoring is not anticipated to commence before WY 2020.

1.2.2. SPoT Monitoring Program

SPoT conducts annual dry season monitoring (subject to funding constraints) of sediments collected from a statewide network of selected rivers and streams throughout California. The goal of the SPoT monitoring program is to investigate long-term trends in sediment toxicity and sediment contaminant concentrations, and relate contaminant concentrations and toxicity to watershed land uses. Sites are targeted in bottom-of-the-watershed locations with slow water flow and appropriate micromorphology to allow deposition and accumulation of sediments, including a station (204SMA020) near the mouth of San Mateo Creek in the City of San Mateo.

SPoT monitoring staff reported that the San Mateo Creek station was monitored in June 2018. Sediment samples were analyzed for mercury, copper, pesticides, a variety of organic pollutants, and toxicity, but not PCBs. Results of this WY 2018 SPoT monitoring are not yet available (Siegler 2018, personal communication). The most recent technical report prepared by SPoT program staff was published in 2016 and describes seven-year trends from the initiation of the program in 2008 through 2014 (Phillips et al. 2016). An update to the report is anticipated in mid-2019.

Table 1. MRP Provision C.8.f Pollutants of Concern Monitoring Requirements.

Pollutant of Concern	Media	Total Samples by the End of Year Five[d]	Yearly Minimum	Minimum Number of Samples That Must Be Collected for Each Information Need by the End of Year Four				
				Source Identification	Contributions to Bay Impairment	Management Action Effectiveness	Loads and Status	Trends
PCBs	Water or sediment	80	8	8	8	8	8	8
Total Mercury	Water or sediment	80	8	8	8	8	8	8
Total & Dissolved Copper	Water	20	2	--	--	--	4	4
Nutrients[a]	Water	20	2	--	--	--	20	--
Emerging Contaminants[b]	--	--	--	--	--	--	--	--
Ancillary Parameters[c]	--	--	--	--	--	--	--	--

[a.] Ammonium[5], nitrate, nitrite, total Kjeldahl nitrogen, orthophosphate, total phosphorus (analyzed concurrently in each nutrient sample).

[b.] Must include perfluorooctane sulfonates (PFOS, in sediment), perfluoroalkyl sulfonates (PFAS, in sediment), alternative flame retardants. The Permittee shall conduct or cause to be conducted a special study that addresses relevant management information needs for emerging contaminants. The special study must account for relevant Contaminants of Emerging Concern (CECs) in stormwater and would address at least PFOS, PFAS, and alternative flame retardants being used to replace PBDEs.

[c.] Total Organic Carbon (TOC) should be collected concurrently with PCBs data when normalization to TOC is deemed appropriate. Suspended sediment concentration (SSC) should be collected in water samples used to assess loads, loading trends, or BMP effectiveness. Hardness data are used in conjunction with copper concentrations collected in fresh water.

[d.] Total samples that must be collected over the five-year Permit term.

[5] There are several challenges to collecting samples for "ammonium" analysis. Therefore, samples are analyzed for total ammonia which is the sum of un-ionized ammonia (NH_3) and ionized ammonia (ammonium, NH_{4+}). Ammonium concentrations are calculated by subtracting the calculated concentration of un-ionized ammonia from the measured concentration of total ammonia. Un-ionized ammonia concentrations are calculated using a formula provided by the American Fisheries Society that includes field pH, field temperature, and specific conductance. This approach was approved by Regional Water Board staff in an email dated June 21, 2016.

2.0 POC MONITORING RESULTS

In compliance with Provision C.8.f of the MRP, the Countywide Program conducted POC monitoring for PCBs, mercury, copper, and nutrients in WY 2018. General methods employed for POC monitoring and quality assurance/quality control (QA/QC) procedures were similar to previous years (SMCWPPP 2015, 2017a, 2018a). The MRP-required yearly minimum number of samples was met or exceeded for all POCs. The total number of samples collected for each POC, the organization conducting the monitoring, and the Management Questions addressed are summarized in Tables 2 - 5. Specific monitoring stations are shown in Table 6 and mapped in Figure 1. The sections below describe the results of the WY 2018 monitoring. Compliance with applicable water quality objectives (WQOs) is discussed in Section 3.0.

2.1. Statement of Data Quality

A comprehensive QA/QC program was implemented by the Countywide Program covering all aspects of POC monitoring. The QA/QC protocols were similar to previous years and continued to be based upon the Quality Assurance Project Plan (QAPP) developed for the CW4CB project (AMS 2012) and the BASMAA Regional Monitoring Coalition (RMC) QAPP (BASMAA 2016).

Data were assessed for seven data quality attributes: (1) Representativeness, (2) Comparability, (3) Completeness, (4) Sensitivity, (5) Contamination, (6) Accuracy, and (7) Precision. Data Quality Objectives (DQOs) related to these categories were established to ensure that the data collected are of adequate quality for the intended uses. Overall, the results of the QA/QC review suggested that the POC monitoring data generated during WY 2018 were of sufficient quality. Although, some data were flagged in the project database, none was rejected based on comparison to the DOQs. Attachment 1 contains a report summarizing the results of the data validation.

Table 2. SMCWPPP and Third-Party POC Monitoring Accomplishments, PCBs, WYs 2016 - 2018.

Pollutant of Concern/ Organization	Number of PCBs Samples	Management Question Addressed[a]					Sample Type and Comments
		1. Source Identification	2. Contributions to Bay Impairment	3. Management Action Effectiveness	4. Loads and Status	5. Trends	
WY 2018							
SMCWPPP	13	13	13	--	13	1	Stormwater runoff samples to characterize WMAs
SMCWPPP	57	57	--	--	--	--	Upland sediment samples to identify source areas
BASMAA	5	5	--	--	--	--	Regional public infrastructure caulk/sealant samples (1/4 of project total)
BASMAA	8	--	--	8	--	--	Regional HDS unit & biochar effectiveness study (1/4 of project total)
RMP STLS	2	2	2	--	2	2	Stormwater runoff samples to characterize WMAs.
SPoT	--	--	--	--	--	--	Sediment sample to assess trends (mercury only, no PCBs)
WY 2017							
SMCWPPP	17	17	17	--	17	--	Stormwater runoff samples to characterize WMAs
SMCWPPP	67	67	--	--	--	--	Sediment samples to identify source areas
RMP STLS	4	4	4	--	4	--	Stormwater runoff samples to characterize WMAs
SPoT	1	--	--	--	--	1	Sediment sample to assess trends (PCBs only, no mercury)
WY 2016							
SMCWPPP	8	8	8	--	8	--	Stormwater runoff samples to characterize WMAs
RMP STLS	7	7	7	--	7	--	Stormwater runoff samples to characterize WMAs
CW4CB	--	--	--	3	--	--	BMP effectiveness samples at Bransten Road bioretention facilities
Total / MRP Minimum[b]	189 / 80	180 / 8	51 / 8	11 / 8	51 / 8	4 / 8	

NA = Not Applicable. For this pollutant, the MRP does not require sampling to address the management question.

[a] Individual samples can address more than one Management Question simultaneously.

[b] The MRP overall minimum number of samples must be met by the end of the five-year permit term. The MRP minimum number of samples for each Management Question must be met by the end of year four of the permit.

Table 3. SMCWPPP and Third-Party POC Monitoring Accomplishments, Mercury, WYs 2016 - 2018.

Pollutant of Concern/ Organization	Number of Mercury Samples	Management Question Addressed[a]					Sample Type and Comments
		1. Source Identification	2. Contributions to Bay Impairment	3. Management Action Effectiveness	4. Loads and Status	5. Trends	
WY 2018							
SMCWPPP	13	13	13	--	13	1	Stormwater runoff samples to characterize WMAs
SMCWPPP	57	57	--	--	--	--	Upland sediment samples to identify source areas
BASMAA	8	--	--	8	--	--	Regional HDS unit & biochar effectiveness study (1/4 of project total)
RMP STLS	2	2	2	--	2	2	Stormwater runoff samples to characterize WMAs
SPoT	1	--	--	--	--	1	Sediment sample to assess trends (mercury only, no PCBs)
WY 2017							
SMCWPPP	17	17	17	--	17	--	Stormwater runoff samples to characterize WMAs
SMCWPPP	67	67	--	--	--	--	Sediment samples to identify source areas
RMP STLS	4	4	4	--	4	--	Stormwater runoff samples to characterize WMAs
SPoT	--	--	--	--	--	--	Sediment sample to assess trends (PCBs only, no mercury)
WY 2016							
SMCWPPP	8	8	8	--	8	--	Stormwater runoff samples to characterize WMAs
RMP STLS	7	7	7	--	7	--	Stormwater runoff samples to characterize WMAs
CW4CB	--	--	--	3	--	--	BMP effectiveness samples at Bransten Road bioretention facilities
Total / MRP Minimum[b]	184 / 80	175 / 8	51 / 8	11 / 8	51 / 8	4 / 8	

NA = Not Applicable. For this pollutant, the MRP does not require sampling to address the management question.

[a] Individual samples can address more than one Management Question simultaneously.

[b] The MRP overall minimum number of samples must be met by the end of the five-year permit term. The MRP minimum number of samples for each Management Question must be met by the end of year four of the permit.

Table 4. SMCWPPP and Third-Party POC Monitoring Accomplishments, Copper, WYs 2016 - 2018.

Pollutant of Concern/ Organization	Number of Samples	Management Question Addressed[a]					Sample Type and Comments
		1. Source Identification	2. Contributions to Bay Impairment	3. Management Action Effectiveness	4. Loads and Status	5. Trends	
WY 2018							
SMCWPPP	4	--	--	--	4	4	Creek water samples collected during storm event and spring base flows
SPoT	1	--	--	--	--	1	Sediment sample to assess trends at long-term monitoring station
WY 2017							
SMCWPPP	1	--	--	--	1	--	Copper analyzed on a subset of PCBs/Hg stormwater runoff samples
SMCWPPP	5	--	--	--	5	2	Creek water samples collected during storm event and spring base flows[c]
SPoT	1	--	--	--	--	1	Sediment sample to assess trends at long-term monitoring station
WY 2016							
SMCWPPP	3	--	--	--	3	--	Copper analyzed on a subset of PCBs/Hg stormwater runoff samples
Total / MRP Minimum[b]	15 / 20	--	--	--	13 / 4	8 / 4	

NA = Not Applicable. For this pollutant, the MRP does not require sampling to address the management question.

[a] Individual samples can address more than one Management Question simultaneously.

[b] The MRP overall minimum number of samples must be met by the end of the five-year permit term. The MRP minimum number of samples for each Management Question must be met by the end of year four of the permit.

[c] One of these five samples was a PCBs/Hg stormwater runoff sample that was also analyzed for copper.

Table 5. SMCWPPP and Third-Party POC Monitoring Accomplishments, Nutrients, WYs 2016 - 2018.

Pollutant of Concern/ Organization	Number of Samples	Management Question Addressed[a]					Sample Type and Comments
		1. Source Identification	2. Contributions to Bay Impairment	3. Management Action Effectiveness	4. Loads and Status	5. Trends	
WY 2018							
SMCWPPP	4	--	--	--	4	NA	Creek water samples collected during storm event and spring base flows
WY 2017							
SMCWPPP	5	--	--	--	5	NA	Creek water samples collected during storm event and spring base flows
WY 2016							
SMCWPPP	2	--	--	--	2	NA	Creek water samples collected from bottom-of-the-watershed stations
Total / MRP Minimum[b]	11 / 20	--	--	--	11 / 20	NA	

NA = Not Applicable. For this pollutant, the MRP does not require sampling to address the management question.

[a] Individual samples can address more than one Management Question simultaneously.

[b] The MRP overall minimum number of samples must be met by the end of the five-year permit term. The MRP minimum number of samples for each Management Question must be met by the end of year four of the permit.

Figure 1. WY 2018 POC Monitoring Stations in San Mateo County (does not include BASMAA regional project sample locations).

Table 6. POC Monitoring Stations in San Mateo County, WY 2018.

Organization	Station Code	Sample Date	Latitude	Longitude	Matrix	PCBs	Mercury	Suspended Sediment	Total Copper	Dissolved Copper	Hardness as $CaCO_3$	Nutrients[a]
SMCWPPP												
SMCWPPP	SM-BUR-164A	1/8/2018	37.59960	-122.37526	SWR[b]	x	x	x				
SMCWPPP	SM-BUR-85A	1/8/2018	37.60194	-122.37499	SWR	x	x	x				
SMCWPPP	SM-SCS-1011A	1/8/2018	37.51701	-122.25379	SWR	x	x	x				
SMCWPPP	SM-SCS-1011B	1/8/2018	37.51692	-122.25373	SWR	x	x	x				
SMCWPPP	SM-SMO-149A	1/8/2018	37.58710	-122.33222	SWR	x	x	x				
SMCWPPP	SM-SMO-25A	1/8/2018	37.57970	-122.31911	SWR	x	x	x				
SMCWPPP	SM-SSF-366A	1/24/2018	37.64851	-122.40913	SWR	x	x	x				
SMCWPPP	SM-RCY-256A	3/1/2018	37.49483	-122.21869	SWR	x	x	x				
SMCWPPP	SM-RCY-333A	3/1/2018	37.49549	-122.21984	SWR	x	x	x				
SMCWPPP	SM-SCS-1011C	3/1/2018	37.51246	-122.25781	SWR	x	x	x				
SMCWPPP	SM-SCS-1011D	3/1/2018	37.51238	-122.25777	SWR	x	x	x				
SMCWPPP	SM-SSF-1001C	3/1/2018	37.64309	-122.39930	SWR	x	x	x				
SMCWPPP	SM-SSF-306B	4/6/2018	37.65024	-122.41170	SWR	x	x	x				
SMCWPPP	50 samples (see Appendix A)				sediment	x	x					
SMCWPPP	202SPE005	1/8/2018	37.59420	-122.50530	CW[c]				x	x	x	x
SMCWPPP	204COR010	1/8/2018	37.49450	-122.24430	CW				x	x	x	x
SMCWPPP	202SPE005	5/17/2018	37.59420	-122.50530	CW				x	x	x	x
SMCWPPP	204COR010	5/21/2018	37.49450	-122.24430	CW				x	x	x	x
Third Party Organizations												
RMP STLS	SM-SSF-314A	1/9/2018	37.66033	-122.38510	SWR	x	x	x				
RMP STLS	SM-SSF-315A	1/9/2018	37.66033	-122.38502	SWR	x	x	x				
SPoT	204SMA020	June 2018	37.5703	-122.3186	sediment		x		x			

[a] Ammonia (for ammonium), nitrate, nitrite, total Kjeldahl nitrogen, orthophosphate, and total phosphorus are analyzed concurrently in each nutrient sample.

[b] Stormwater Runoff – composite sample.

[c] Creek Water – grab sample.

2.2. PCBs and Mercury

The Countywide Program's PCBs and mercury monitoring focuses on San Mateo County WMAs (see Section 1.1) containing high interest parcels with land uses potentially associated with PCBs such as old industrial, electrical and recycling. During WY 2018, the Countywide Program collected 13 composite samples of stormwater runoff from outfalls at the bottom of WMAs and 50 grab embedded sediment samples within the WMAs. WY 2018 PCBs and mercury monitoring conducted by SMCWPPP primarily focused on addressing Management Question No. 1 (Source Identification), while contributing to the regional dataset being used to address Management Questions No. 2 (Contributions to Bay Impairment) and No. 3 (Loads and Status).

As part of continuing to develop strategies for reducing PCBs and mercury loads in stormwater runoff, the Countywide Program evaluated its WY 2018 PCBs and mercury stormwater runoff and sediment data, additional WY 2018 stormwater runoff sample data collected through the RMP STLS (see Section 1.2.1), and similar data from previous Water Years collected by the Countywide Program and through the STLS. Objectives include attempting to identify source areas and properties within WMAs, identifying which WMAs provide the greatest opportunities for implementing cost-effective PCBs controls, and prioritizing WMAs for potential future investigations.

2.2.1. Stormwater Runoff Monitoring in San Mateo County

During WY 2018, the Countywide Program collected 13 composite samples of stormwater runoff from outfalls at the bottom of WMAs that contain high interest parcels. An additional two stormwater runoff samples were collected in San Mateo County through the RMP's STLS, also from WMAs with high interest parcels. These combined 15 samples primarily help address Management Questions No. 1 (Source Identification). These data will also be used by the RMP STLS to improve calibration of the Regional Watershed Spreadsheet Model (RWSM), which is a land use based planning tool for estimation of overall POC loads from small tributaries to San Francisco Bay at a regional scale (i.e., Management Question No. 4 – Loads and Status).

SMCWPPP identified and prioritized WMAs for the WY 2018 stormwater runoff sampling by evaluating several types of data, including: land use, PCBs and mercury concentrations from prior sediment and stormwater runoff sampling efforts, municipal storm drain maps showing pipelines and access points (e.g., manholes, outfalls, pump stations), and logistical/safety considerations. Composite samples, consisting of four to eight aliquots collected during the rising limb and peak of the storm hydrograph (as determined through field observations), were analyzed for the 40 PCBs congeners used by the RMP for Bay samples[6] (method EPA 1668C), total mercury (method EPA 1631E), and suspended sediment concentration (SSC; method ASTM D3977-97).

Table 7 summarizes PCBs, mercury, and SSC monitoring results for stormwater runoff samples collected in San Mateo County by the Countywide Program and RMP STLS through WY 2018. "Total PCBs" was calculated as the sum of the RMP 40 congeners. Particle ratio is calculated by dividing the total pollutant (PCBs or mercury) concentration by SSC. Assuming all of a pollutant is bound to suspended sediments in the water sample, particle ratios estimate the average concentration of pollutant on the suspended sediment and are sometimes referred to as particle concentration. Since PCBs and mercury are

[6] PCBs congeners 8, 18, 28, 31, 33, 44, 49, 52, 56, 60, 66, 70, 74, 87, 95, 97, 99, 101, l05, 110, 118, 128, 132, 138, 141, 149, l51, 153, 156, 158, 170, 174, 177, 180, 183, 187, 194, 195, 201, 203.

hypothesized to primarily be bound to sediment in aquatic environments, particle ratios are often used to normalize pollutant concentrations in samples with varying levels of suspended sediment.

For sites with more than one sample, total PCBs concentrations were averaged in Table 7. In addition, for sites with multiple samples, particle ratios in Table 7 were calculated by dividing the sum of PCBs concentrations by the sum of suspended sediment concentrations. This averaging is essentially equivalent to compositing all the individual samples that have been collected at a site. This is consistent with the RMP STLS approach to data evaluation (Gilbreath et al. 2019, in preparation).

Both of the WY 2018 RMP STLS catchments (WMAs 314 and 315, located in South San Francisco) had previously been sampled (in WY 2016) using similar methods. PCBs concentrations in the WY 2016 samples (stations SM-SSF-314A and SM-SSF-315A) were relatively low. PCBs concentrations (total PCBs and particle ratio) in samples from these stations were elevated (particle rations greater than 0.5 ppm) and roughly an order of magnitude higher in WY 2018, except that the PCBs particle ratio for sample SM-SSF-314A was at a similar elevated level for both events (Table 7). The PCBs monitoring data from WMAs 314 and 315 are described further in Section 2.2.4. In addition, STLS wet weather characterization data are described in greater detail by Gilbreath et al. (2019, in preparation).

One of the WY 2018 SMCWPPP stations (SM-SSF-306A/B[7]) had also previously been sampled (in WY 2015) by the RMP STLS using similar methods. The total PCBs concentration was about one-third of the concentration measured in WY 2015, but the PCBs particle ratio was not elevated (less than 0.2 ppm) and very similar to the previous sample (Table 7).

It should be noted that low PCBs concentrations in a composite stormwater runoff sample from the bottom of a catchment suggest that either PCBs sources are not prevalent in the catchment or the sample is a "false negative." False negatives could be the result of low rainfall/runoff rates failing to mobilize sediments from source areas, or many other factors. The RMP is currently conducting an "Advanced Data Analysis" that will include attempting to develop a method to normalize results from this type of stormwater runoff composite PCBs sample based upon storm intensity.

2.2.2. Evaluation of Region-wide Water Sampling Data

This section evaluates data collected by the Countywide Program to-date on PCBs concentrations in stormwater runoff and natural waterways in the context of similar data collected throughout the Bay Area. The analysis included data from other countywide stormwater programs and the RMP STLS (Gilbreath et al. 2019, in preparation). The dataset includes stormwater runoff samples collected from 127 municipal separate storm sewer system (MS4) bottom of catchment stations and water samples from 28 natural waterways (usually creeks with generally natural channels) throughout the Bay Area. The MS4 catchment sites included storm drain manholes, outfalls, pump stations, and artificial channels.[8] Many of the sites have been sampled more than once and/or have multiple sample results reported for individual storm events. Twelve of the 127 MS4 sites have multiple sample results (sample counts of 2 to 80) and 15 of the 28 natural waterway sites have multiple sample results (sample counts of 3 to 126).

[7] SM-SSF-306A/B are two nearby sampling locations in the MS4 at the bottom of the watershed that drain the same catchment (WMA 306). Thus for the purposes of this report they are essentially the same station.

[8] Stormwater runoff samples have also been collected from inlets and/or treatment systems (e.g., bioretention) during special studies. However, those are not included in this analysis.

PCBs concentrations in Bay Area stormwater runoff and natural waterway samples (n=155) are shown in Figure 2. PCBs particle ratios are shown in Figure 3. Figures 2 and 3 compare WY 2018 samples collected in San Mateo County to County samples collected in previous Water Years and samples collected outside of the County. In general, PCBs concentrations (total and particle ratio) in WY 2018 San Mateo County samples fell within a similar range compared to earlier County samples and samples collected outside of the County. Two of the three highest PCBs concentrations in the overall water sample dataset were for previous samples collected in San Mateo County, with Pulgas Creek Pump Station South having the highest PCBs concentration (average 448 ng/L) and SM-SCS-75A (Industrial Rd Ditch) having the third highest concentration (160 ng/L). The 33 samples collected at Pulgas Creek Pump Station South station had very elevated PCBs concentrations. The site has had the two highest PCBs concentrations (6,669 ng/L and 4,084 ng/L) measured out of 647 total individual samples and the four highest PCBs particle ratios (37,363 ng/g, 20,733 ng/g, 15,477 ng/g, and 14,744 ng/g).

Table 7. PCB, Mercury, and Suspended Sediment Concentrations in Stormwater Runoff Samples Collected in San Mateo County by SMCWPPP and the RMP STLS through WY 2018.

Station Code	Permittee	Sample Date	SSC (mg/L)	Total PCBs (ng/L)[a]	PCBs Particle Ratio (ng/g)[b]	Hg (ng/L)	Hg Particle Ratio (ng/g)
SMCWPPP Samples							
SM-BEL-60A	Belmont	2/9/2017	34	6.1	178	(c)	(c)
SM-BEL-60B	Belmont	2/9/2017	36	37.2	1,022	(c)	(c)
SM-BUR-1006A	Burlingame	12/15/2016	52	18.9	365	(c)	(c)
SM-BUR-141A	Burlingame	12/15/2016	51	8.5	165	(c)	(c)
SM-BUR-142A	Burlingame	12/15/2016	52	34.5	670	(c)	(c)
SM-BUR-164A	Burlingame	1/8/2018	9.9	4.4	447	5.3	532
SM-BUR-85A	Burlingame	1/8/2018	15	3.7	241	5.6	365
SM-MPK-238A	Menlo Park	3/5/2016	80	3.2	40	13	159
SM-MPK-238B	Menlo Park	3/5/2016	51	6.2	121	9	173
SM-MPK-66A	Menlo Park	3/24/2017	21	8.4	390	(c)	(c)
SM-MPK-71A	Menlo Park	2/17/2016	14	0.6	43	7	496
SM-RCY-254A	Redwood City	3/5/2016	14	1.6	113	10	712
SM-RCY-266A	Redwood City	3/1/2018	22	0.1	4.9	4.1	188
SM-RCY-323A	Redwood City	1/8/2017	8	1.6	191	(c)	(c)
SM-RCY-324A	Redwood City	1/8/2017	44	7.4	169	(c)	(c)
SM-RCY-327A	Redwood City	2/17/2016	44	5.7	130	15	341
SM-RCY-333A	Redwood City	3/1/2018	417	6.3	15	4.4	11
SM-RCY-379A	Redwood City	3/5/2016	123	13.0	106	18	149
SM-RCY-379B	Redwood City	3/5/2016	43	7.9	182	11	252
SM-RCY-388A	Redwood City	2/17/2016	50	2.5	50	15	311
SM-SCS-1011A	San Carlos	1/8/2018	60	10.8	181	3.9	66
SM-SCS-1011B	San Carlos	1/8/2018	15	2.5	167	6.1	408
SM-SCS-1011C	San Carlos	3/1/2018	28	5.8	204	0.7	25.3
SM-SCS-1011D	San Carlos	3/1/2018	25	5.8	230	0.7	26.1
SM-SMO-149A	San Mateo	1/8/2018	17	1.8	105	5.2	308
SM-SMO-156A	San Mateo	2/20/2017	91	18.5	204	(c)	(c)

Station Code	Permittee	Sample Date	SSC (mg/L)	Total PCBs (ng/L)[a]	PCBs Particle Ratio (ng/g)[b]	Hg (ng/L)	Hg Particle Ratio (ng/g)
SM-SMO-25A	San Mateo	1/8/2018	15	2.2	150	3.1	209
SM-SMO-408A	San Mateo	2/20/2017	29	55.3	1,900	(c)	(c)
SM-SMO-89A	San Mateo	1/10/2017	28	4.0	145	(c)	(c)
SM-SSF-1001B	South San Francisco	12/15/2016	32	55.2	1,714	(c)	(c)
SM-SSF-1001C	South San Francisco	3/1/2018	3.2	1.1	353	7.3	2,284
SM-SSF-292A	South San Francisco	12/15/2016	719	7.9	11	(c)	(c)
SM-SSF-294A	South San Francisco	12/15/2016	29	10.5	367	(c)	(c)
SM-SSF-306B	South San Francisco	4/6/2018	14	2.5	173	4.7	323
SM-SSF-316A	South San Francisco	12/10/2016	44	4.3	96	(c)	(c)
SM-SSF-317A	South San Francisco	12/10/2016	6	2.6	450	(c)	(c)
SM-SSF-318A	South San Francisco	12/10/2016	9	2.3	266	(c)	(c)
SM-SSF-356A	South San Francisco	1/24/2018	56	4.9	88	0.4	7.89
RMP Samples							
SM-SCS-210A (Pulgas South)	San Carlos[d]	33 samples[e]	54	448.0	8,222	N/A	N/A
SM-SCS-31A (Pulgas North)	San Carlos[d]	4 samples[e]	68	60.3	893	N/A	N/A
SM-BRI-1004A	Brisbane	3/5/2016	96	10.5	109	71	741
SM-BRI-17A	Brisbane	3/5/2016	96	10.4	109	27	276
SM-EPA-70A	East Palo Alto	2/6/2015	265	28.5	108	52	194
SM-EPA-72A	East Palo Alto	2/6/2015	82	6.5	79	35	427
SM-RCY-267A	Redwood City	12/2/2014	148	9.2	62	55	372
SM-RCY-337A	Redwood City	12/15/2014	29	3.5	121	14	469
SM-SCS-32A	San Carlos	3/11/2016	25	4.2	169	29	1,156
SM-SCS-75A	San Carlos	3/11/2016	26	159.6	6,139	14	535
SM-SSF-291A	South San Francisco	1/8/2017	16	11.8	736	12	775
SM-SSF-293A	South San Francisco	2/6/2015	45	5.2	117	20	436
SM-SSF-296A	South San Francisco	1/8/2017	111	3.4	30	39	350
SM-SSF-306A	South San Francisco	2/6/2015	43	7.8	182	29	679
SM-SSF-314A	South San Francisco	3/5/2016	10	8.6	859	6	562
SM-SSF-314A	South San Francisco	1/9/2018	75	71.0	946	5.1	68.0
SM-SSF-315A	South San Francisco	3/5/2016	33	5.8	175	10	315
SM-SSF-315A	South San Francisco	1/9/2018	91	93.2	1024	4.7	52.1
SM-SSF-319A	South San Francisco	3/5/2016	23	1.8	80	15	639
SM-SSF-359A	South San Francisco	2/7/2017	43	33.9	788	9	210

[a] Total PCBs calculated as sum of RMP 40 congeners.

[b] PCB and Hg Particle Ratios calculated by dividing Total PCBs and Hg concentrations by SSC.

[c] SMCWPPP WY 2017 mercury data were rejected by SMCWPPP's QA/QC Officer (see Section 2.1).

[d] Pulgas Pump Station watershed data were collected during Water Years 2011-2014.

[e] Results are averaged.

Note: stations that were resampled are indicated via shading. SM-SSF-306A/B are two nearby sampling locations in the MS4 at the bottom of the watershed that drain the same catchment (WMA 306). Thus for the purposes of this report they are essentially the same station.

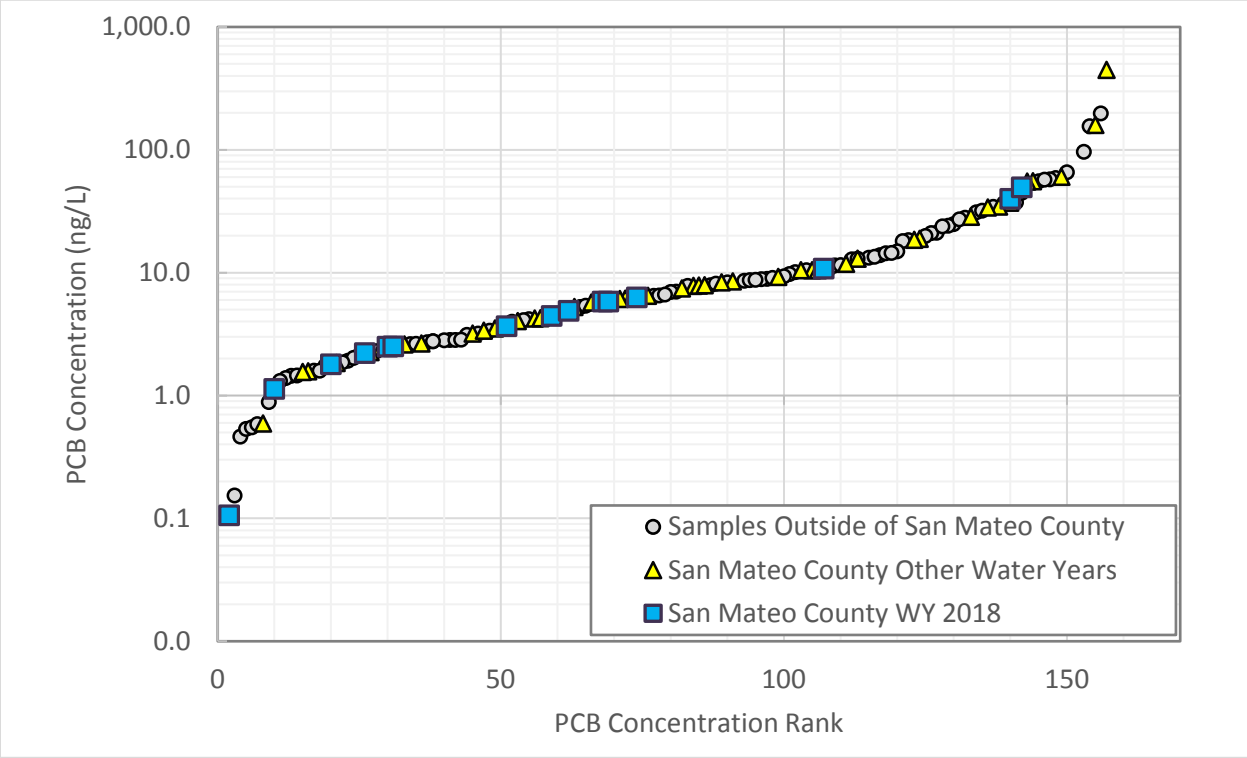

Figure 2. PCBs Concentrations in Stormwater Runoff Samples Collected in MS4s and Natural Waterways in the Bay Area.

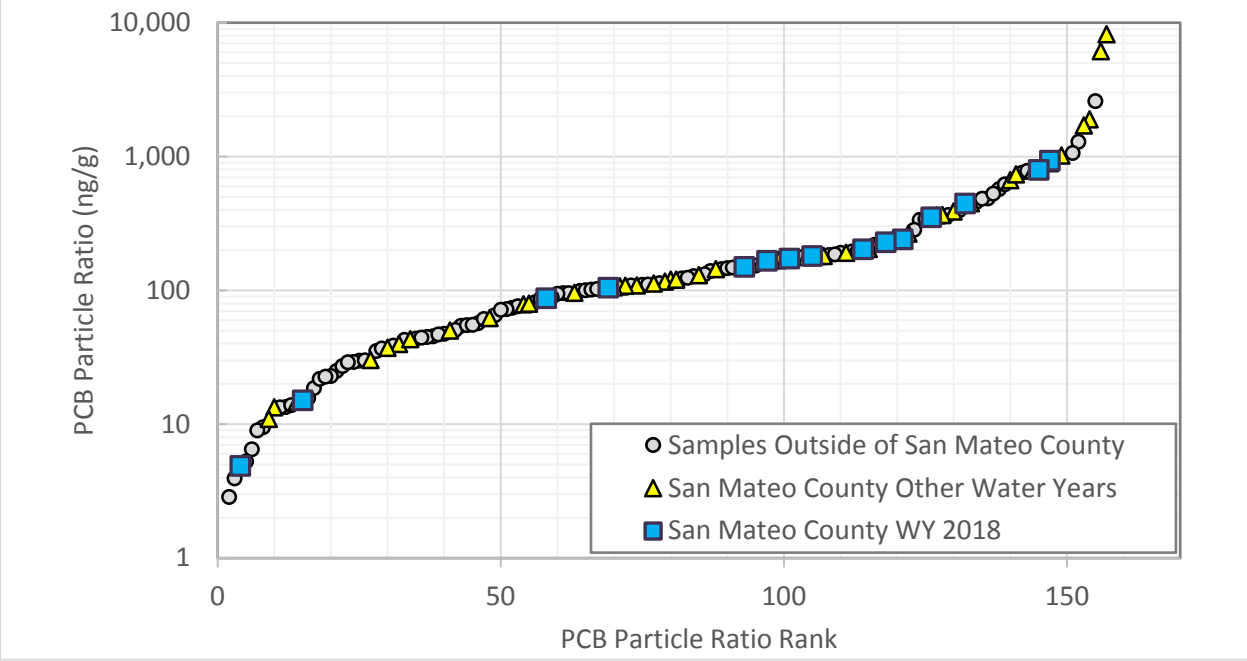

Figure 3. PCBs Particle Ratio in Stormwater Runoff Samples Collected in Large MS4s and Natural Waterways in the Bay Area.

Table 8 provides descriptive statistics for PCBs and mercury concentrations in the Bay Area stormwater runoff and natural waterway dataset (n=155). The median PCB concentration is 6.6 ng/L and the mean is 18.6 ng/L. The median PCB particle ratio is 114 ng/g and the mean is 323 ng/g. As can be seen in Figures 2 and 3, which are plotted on a log scale, there are a few catchments with highly elevated in PCBs (such as the Pulgas Creek Pump Station catchments) that greatly influence the mean concentration relative to the median (i.e., 50th percentile).

Table 8. Descriptive Statistics – PCBs and Mercury Concentrations in Bay Area Stormwater Runoff and Natural Waterway Water Samples through WY 2018[a]

	PCBs (ng/L)[b]	Hg (ng/L)	SSC (mg/L)	PCBs Particle Ratio (ng/g)[c]	Hg Particle Ratio (ng/mg)[c]
Min	ND[d]	0.4	3.2	ND	0.008
10th Percentile	1.56	4.10	16.0	15.5	0.11
25th Percentile	2.76	7.4	31.0	47.1	0.19
50th Percentile	6.6	15.4	55.8	114	0.33
75th Percentile	14.5	36.9	111	230	0.53
90th Percentile	41.7	70.7	266	745	0.77
Max	448	1,053	2,630	8,222	5.29
Mean	18.6	41.7	130	323	0.45

[a] Based upon 155 PCBs samples and 100 mercury samples.
[b] Total PCBs calculated as sum of RMP 40 congeners.
[c] PCBs and Hg Particle Ratios calculated by dividing Total PCBs and Hg concentrations by SSC, respectively.
[d] Not Detected.

2.2.3. Sediment Sampling in San Mateo County

During WY 2018, the Countywide Program collected 50 grab embedded sediment samples as part of the program to attempt to identify source properties within WMAs, potentially for referral to the Regional Water Board for further investigation and potential abatement. These samples were collected in the public right-of-way (ROW), including locations adjacent to high interest parcels with land uses associated with PCBs such as old industrial, electrical and recycling and/or other characteristics potentially associated with pollutant discharge (e.g., poor housekeeping, unpaved areas). Individual and composite sediment samples were collected from manholes, storm drain inlets, driveways, streets, and sidewalks.

Each sample was analyzed for the RMP 40 PCBs congeners and total mercury. Total PCBs was calculated as the sum of the 40 congeners. The laboratory passed all samples through a 2 mm sieve before analysis to remove gravel and cobbles. Table 9 compares the descriptive statistics for POC sediment samples that have been collected in San Mateo County to-date and WY 2018 samples. The mean and median PCBs concentrations were lower in WY 2018 than previous years. For the WY 2018 PCBs samples, one sample was above 1.0 mg/kg, four were between 0.2 and 0.5 mg/kg, and 45 were below 0.2 mg/kg. The median was 0.018 mg/kg and the mean was 0.077 mg/kg. For the WY2018 mercury samples, none was above 1.0 mg/kg, one was between 0.3 and 1.0 mg/kg, and 49 were below 0.3 mg/kg. The median was 0.074 mg/kg and the mean was 0.106 mg/kg.

Table 9. Descriptive Statistics – San Mateo County Embedded Sediment Sample PCBs & Mercury Concentrations

	All Samples To-date		WY 2018 Samples	
Number of Samples	**263**	**216**	**50**	**50**
	PCBs (mg/kg)[a]	**Hg (mg/kg)**	**PCBs (mg/kg)[a]**	**Hg (mg/kg)**
Min	0.001	0.006	0.002	0.019
10th Percentile	0.008	0.044	0.004	0.050
25th Percentile	0.017	0.060	0.009	0.060
50th Percentile	0.044	0.086	0.018	0.074
75th Percentile	0.116	0.158	0.043	0.119
90th Percentile	0.565	0.301	0.244	0.175
Max	193	3.93	1.02	0.831
Mean	1.25	0.208	0.077	0.106

[a] Total PCBs calculated as sum of RMP 40 congeners.

Attachment 2 summarizes WY 2018 embedded sediment monitoring locations and analytical results. The results are discussed by WMA in the following section, along with sediment data from previous Water Years and the stormwater runoff data collected to-date.

2.2.4. Watershed Management Area Prioritization and Descriptions

The Countywide Program evaluated PCBs stormwater runoff and sediment monitoring data to help prioritize WMAs for further investigation and control measure implementation. Based upon the data collected in San Mateo County to-date by the Countywide Program and other parties (e.g., the RMP's STLS), WMAs with one or more sediment and/or stormwater runoff samples with PCBs concentrations (particle ratios for stormwater runoff) greater than 0.5 mg/kg (or 500 ng/g) were provisionally designated high priority. WMAs with samples in the 0.2 – 0.5 mg/kg (200 – 500 ng/g) range were provisionally designated medium priority. WMAs with stormwater runoff sample PCBs particle ratios less than 0.2 mg/kg (200 ng/g) were provisionally designated low priority. It is important to emphasize the provisional nature of these prioritizations, and especially designating a WMA as low priority due to a single stormwater runoff sample having a low PCBs particle ratio. As noted previously, low PCBs results in any single stormwater runoff sample could be a "false negative" in that they result from the storm not being large enough to mobilize sediments with associated PCBs, or other factors. In addition, embedded sediment sample results were not used to designate a WMA lower priority due to the high potential for false negatives. Figure 4 is a map illustrating the current status of WMAs in San Mateo County, based on this provisional prioritization scheme and sediment and stormwater runoff monitoring results to-date.[9] Only WMAs with high interest parcels were included in Figure 4.

[9] Where sediment and stormwater runoff particle ratio analysis results conflict, the higher result was conservatively applied.

Attachment 3 provides a summary of PCBs and mercury monitoring results for San Mateo county WMAs. For each WMA, Attachment 3 includes:

- The WMA area, the area of high interest parcels in the WMA, and the percent of the total WMA area that is comprised of high interest parcels;
- A summary of the number of stormwater runoff and sediment samples collected to-date in the WMA; and
- The median and range of PCBs concentrations in the samples collected to-date in the WMA (median and range of PCBs particle ratio for stormwater runoff samples).

Of the 56 stormwater runoff samples collected in San Mateo County from WY 2015 - 2018 by the Countywide Program and the RMP, ten samples had PCBs particle ratios greater than 0.5 mg/kg, eleven were between 0.2 and 0.5 mg/kg, and the remainder were below 0.2 mg/kg.

Based on the available data to-date (e.g., sediment and stormwater runoff monitoring and land use research through WY 2018), WMAs with PCBs particle ratios over 0.2 mg/kg, elevated concentrations of PCBs in sediment samples, and/or other features relevant to PCBs investigations are described in more detail below.[10] All of the WMAs provisionally designated high or medium priority in Figure 4 are included in the below discussion.

[10] The WMA IDs in San Mateo County are numerical (1 – 1017). Sample names consist of a prefix for the county (SM), followed by a three-letter prefix for the Permittee where the sample was collected (e.g., SSF for South San Francisco, SCS for San Carlos), followed by the WMA ID, and followed by a letter (e.g., A, B, C) to distinguish the sampling site from the WMA in which that sample was collected. Samples collected previously may have a different sample naming convention.

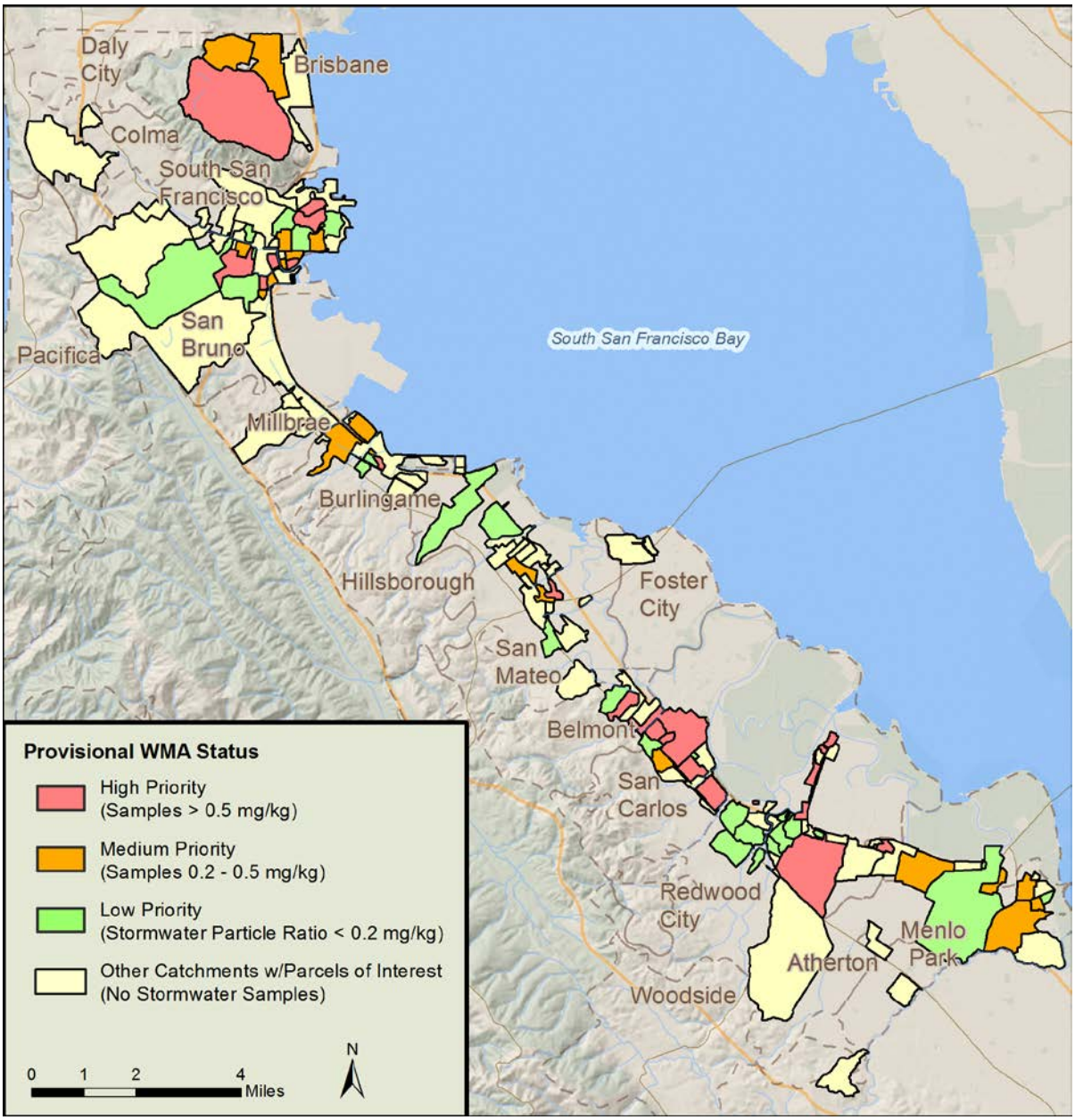

Figure 4. San Mateo County WMA Status Based upon Sediment and Stormwater Runoff Data Collected through WY 2018.

City of Brisbane

WMAs in the City of Brisbane with PCBs particle ratios over 0.2 mg/kg in stormwater runoff samples, elevated concentrations of PCBs in sediment samples, and/or other features relevant to investigating sources of PCBs are shown in Figure 5 and briefly described below. It should be noted that the industrial area in the northeast corner of Figure 5 drains to San Francisco's combined sewer and is therefore considered non-jurisdictional. Table 7 summarizes PCBs, mercury, and SSC monitoring results for stormwater runoff samples collected in San Mateo County by the Countywide Program and RMP STLS through WY 2018. Attachment 2 summarizes WY 2018 embedded sediment monitoring locations and analytical results.

WMA 17

WMA 17 is a large catchment that corresponds to the watershed of the now underground Guadalupe Creek. It contains a large industrial area developed mostly in the 1960s and buildings of the type that would be expected to potentially have PCBs in building materials. Several old railroad lines used to support the industries. A sediment sample collected during WY 2015 in one of the two main lines under Valley Drive had elevated levels of PCBs (1.22 mg/kg) despite potential dilution due to the large size of the watershed. Six additional samples were collected in WY 2018, with one of the samples being high (1.02 mg/kg), and the remaining samples all under 0.2 mg/kg. The high sample was collected from an inlet that drains a portion of one of the old railroad lines. A stormwater runoff sample collected by the RMP in WY 2016 (SM-BRI-17A or Valley Dr SD) had a relatively low PCBs particle ratio of 109 ng/g.

WMA 1004

WMA 1004 is located along Tunnel Avenue in the Brisbane Baylands area. Sample SM-BRI-1004A (Tunnel Avenue Ditch) was collected by the RMP in WY 2016 and (as with the above WMA 17 sample) had a relatively low PCBs particle ratio. The catchment contains all of the Brisbane Baylands old railyard and a large PG&E property on Geneva Avenue. The Baylands area is an active cleanup site (although not for PCBs) and will eventually be redeveloped. Several sediment samples collected in past years in the vicinity of the PG&E property and historical railroad lines had relatively low PCBs concentrations.

WMA 350

WMA 350 is upstream of WMA 1004, and contains a PCBs cleanup site (Bayshore Elementary) that was redeveloped in 2017. The PCBs were associated with the original building materials and it therefore appears unlikely that there is an ongoing source of PCBs to the MS4. One sample collected downstream of the school in WY 2018 had a relatively low concentration of PCBs.

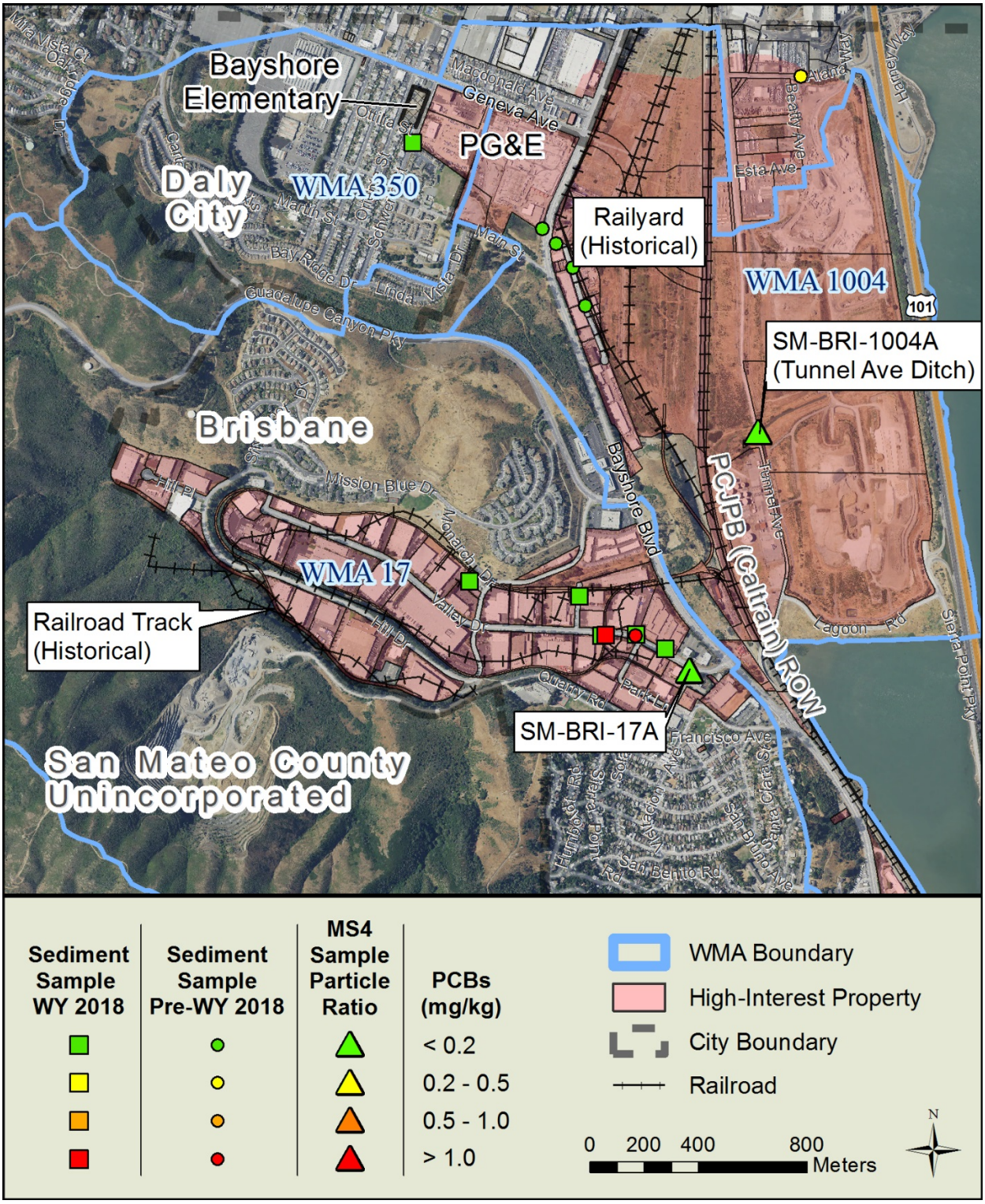

Figure 5. WMAs 17, 350, and 1004.

City of South San Francisco

WMAs in the City of South San Francisco with PCBs particle ratios over 0.2 mg/kg in stormwater runoff samples, elevated concentrations of PCBs in sediment samples, and/or other features relevant to investigating sources of PCBs are shown in Figures 6 through 10 and briefly described below. Table 7 summarizes PCBs, mercury, and SSC monitoring results for stormwater runoff samples collected in San Mateo County by the Countywide Program and RMP STLS through WY 2018. Attachment 2 summarizes WY 2018 embedded sediment monitoring locations and analytical results.

WMA 291

WMA 291 is a relatively large catchment that is comprised almost entirely of old industrial land uses. A stormwater runoff sample collected by the RMP in WY 2017 had an elevated PCB particle ratio (736 ng/g). A 2002 sediment sample at 245 S. Spruce Avenue had an elevated PCBs concentration of 2.72 mg/kg. Samples in WY 2015 and WY 2017 on Linden Avenue near Dollar Avenue were also moderately elevated for PCBs (0.48 and 0.44 mg/kg). Two sediment samples were collected near 245 S. Spruce Avenue in WY 2018, one of which was moderately elevated for PCBs (0.21 mg/kg). The moderately elevated sample was collected from the boundary of the property and a historical railroad, which now is part of the current BART right-of-way.

WMA 294

WMA 294 is a 67 acre catchment that drains into Colma Creek at Mitchell Avenue. Within the WMA is 166 Harbor Way, designated in the Department of Toxic Substances Control (DTSC) Envirostor database as “Caltrans/SSF Maintenance Station.” This property was purchased by Caltrans which tested the soil and found several contaminants including PCBs. The contaminated soil has been capped since at least 2005 and the property is currently mostly vacant with a small portion devoted to k-rail storage. A sediment sample was collected in the driveway of this property in WY 2017 had a moderate PCBs concentration of 0.28 mg/kg. A stormwater runoff sample collected in WY 2017 had a moderately elevated PCBs particle ratio (367 ng/g).

WMA 314

WMA 314 is a 66 acre catchment located near Oyster Point that is comprised of light industrial land uses along with an old railroad right-of-way. Site SM-SSF-314A (Gull Dr. SD) was sampled by the RMP STLS in WYs 2016 and resampled in 2018 and had an elevated PCBs particle ratio in both samples (943 and 946 ng/g). The WY 2018 sample had a total PCBs concentration (71 ng/L) that was about an order of magnitude higher than the WY 2016 sample (8.6 ng/L). Two sediment samples collected in WY 2017 both had relatively low (urban background) concentrations of PCBs, with the highest concentration being 0.15 mg/kg.

WMA 315

WMA 315 is a 108 acre catchment with an outfall very close to the outfall for WMA 314. WMA 315 is comprised almost entirely of light industrial land uses. The RMP STLS collected a stormwater runoff sample at the bottom of this catchment in WY 2016 and then resampled the same station in WY 2018. Total PCBs (5.8 ng/L) and PCBs particle ratio (175 ng/g) were relatively low in the WY 2016 sample, but roughly an order of magnitude higher in the WY 2018 sample (total PCBs = 93.2 ng/L and PCBs particle ratio = 1,024 ng/g). Sediment samples have not been collected in this catchment to-date.

WMA 319

WMA 319 is also located near Oyster Point. Sample SM-SSF-319A (Forbes Blvd Outfall) was collected by the RMP STLS in WY 2016 and had a relatively low PCBs particle ratio of 80 ng/g. Although the catchment was historically industrial, it is now mostly redeveloped and composed of biotechnology corporations. A sediment sample in WY 2017 also had a relatively low (urban background) PCBs concentration.

WMA 358

WMA 358 is a small 32 acre catchment that drains into Colma Creek at Utah Avenue. A sediment sample in WY 2015 had elevated concentrations of PCBs (1.46 mg/kg). Three followup sediment samples in WY 2017 all had relatively low (urban background) levels of PCBs, with the highest concentration being 0.09 mg/kg.

WMA 359

WMA 359 is a small 23 acre catchment that drains into Colma Creek behind 222 Littlefield Avenue. In WY 2017 the RMP STLS collected a storm sample elevated in PCBs that had an elevated PCBs particle ratio of 788 ng/g. The catchment is composed of all old industrial land uses including old railroad tracks. In WY 2018, three follow-up sediment samples collected in the catchment all had relatively low PCBs concentrations (less than 0.2 mg/kg).

WMA 1001

WMA 1001 is a large catchment that is composed of all the non-contiguous small catchments along Colma Creek that have outfall diameters of 18-inches and smaller. In WY 2017, a stormwater runoff sample collected on Shaw Road near the catchment outfall (SM-SSF-1001B) had an elevated PCBs particle ratio (1,710 ng/g). The catchment for this sample is very small and only drains about five light industrial properties along Shaw Road. Six samples were collected in this catchment in WY 2018, with one having a moderately elevated PCBs concentration of 0.35 mg/kg, and the other five all having relatively low concentrations. In WY 2018 a stormwater sample was collected from WMA 1001(c) and had a relatively low PCBs concentration of 1,100 ng/L, but a moderately elevated PCBs particle ratio of 353 ng/g.

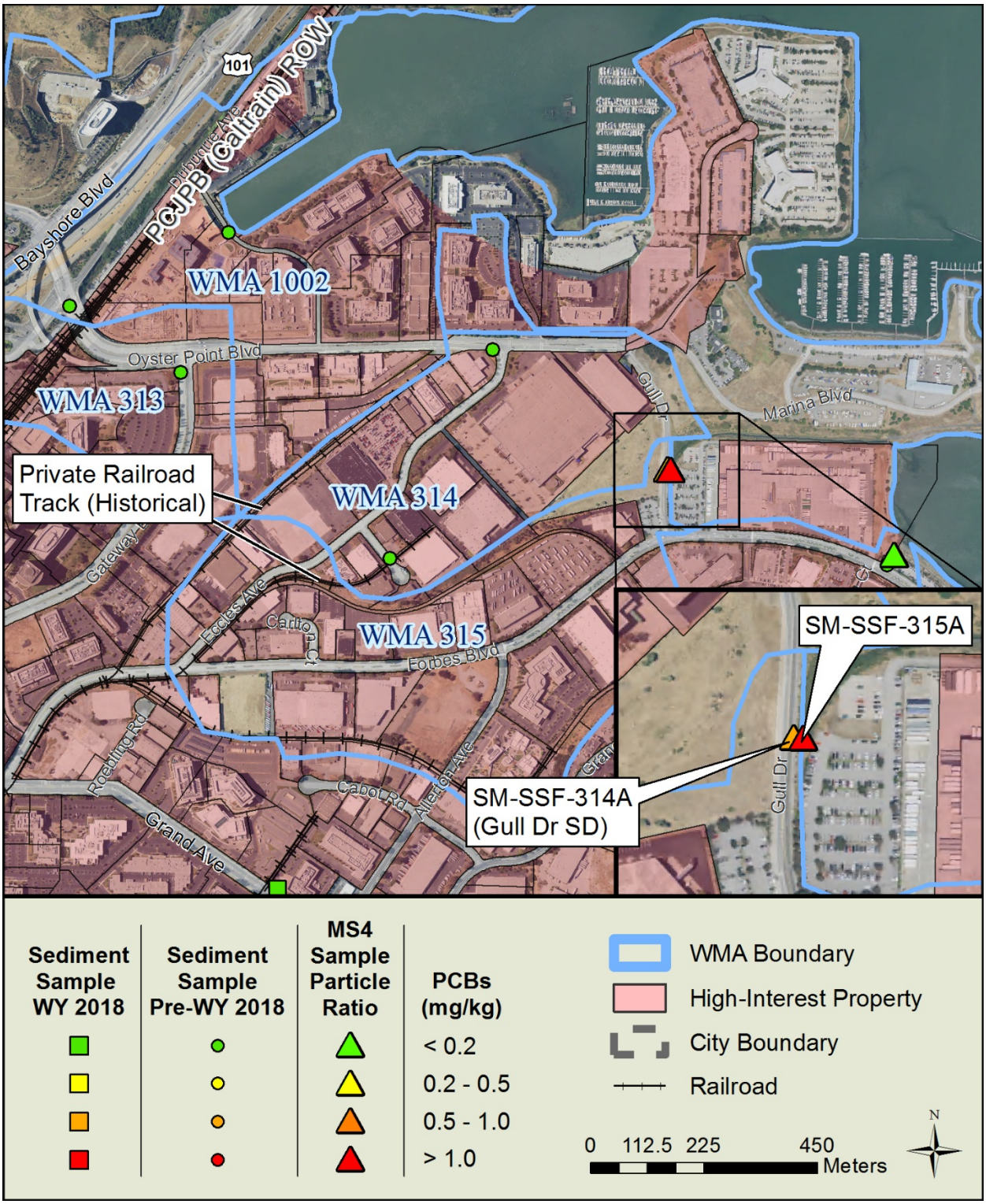

Figure 6. WMAs 313, 314, 315, and 1002

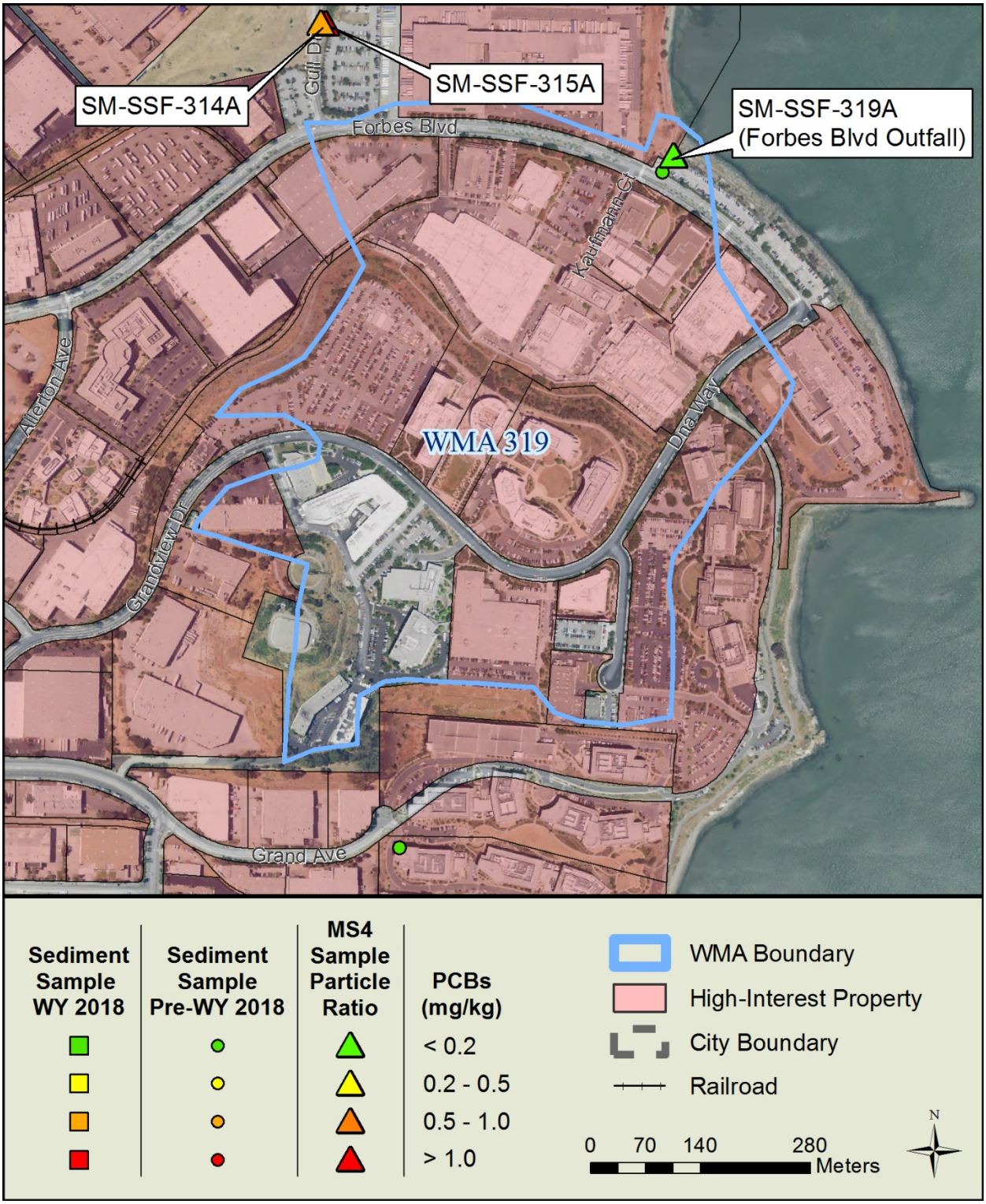

Figure 7. WMA 319

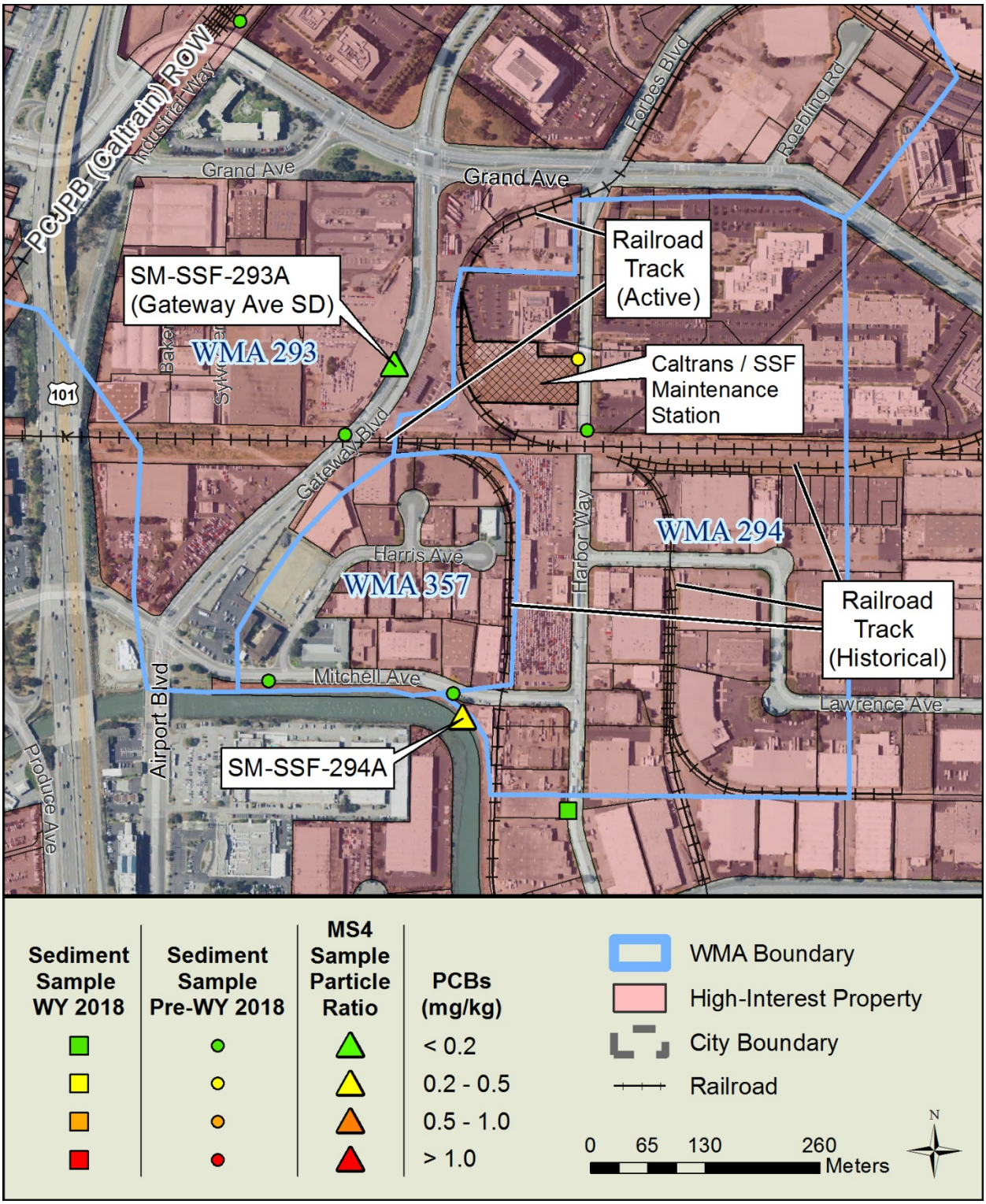

Figure 8. WMAs 293, 294, and 357

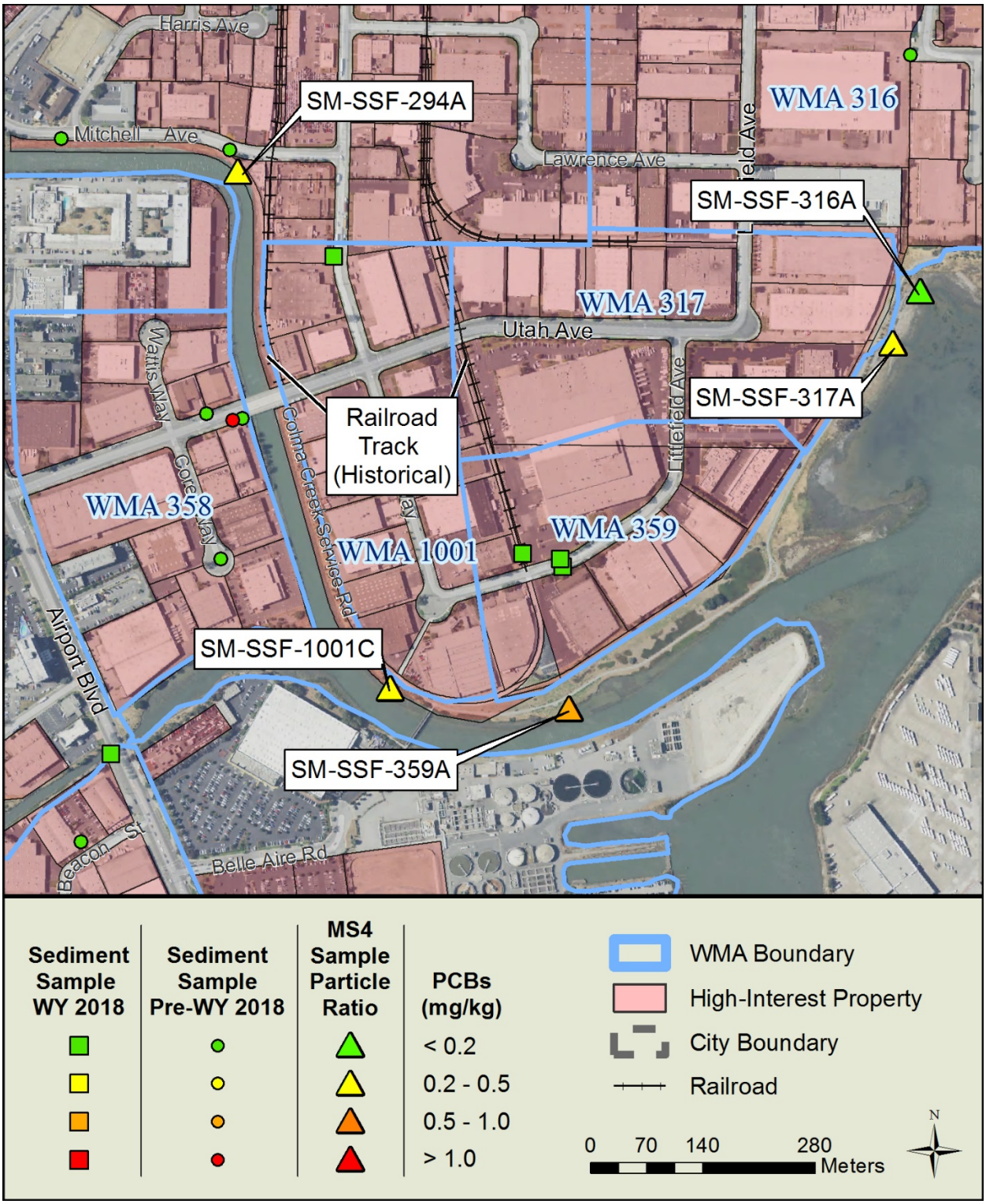

Figure 9. WMAs 316, 317, 358, 359, and 1001

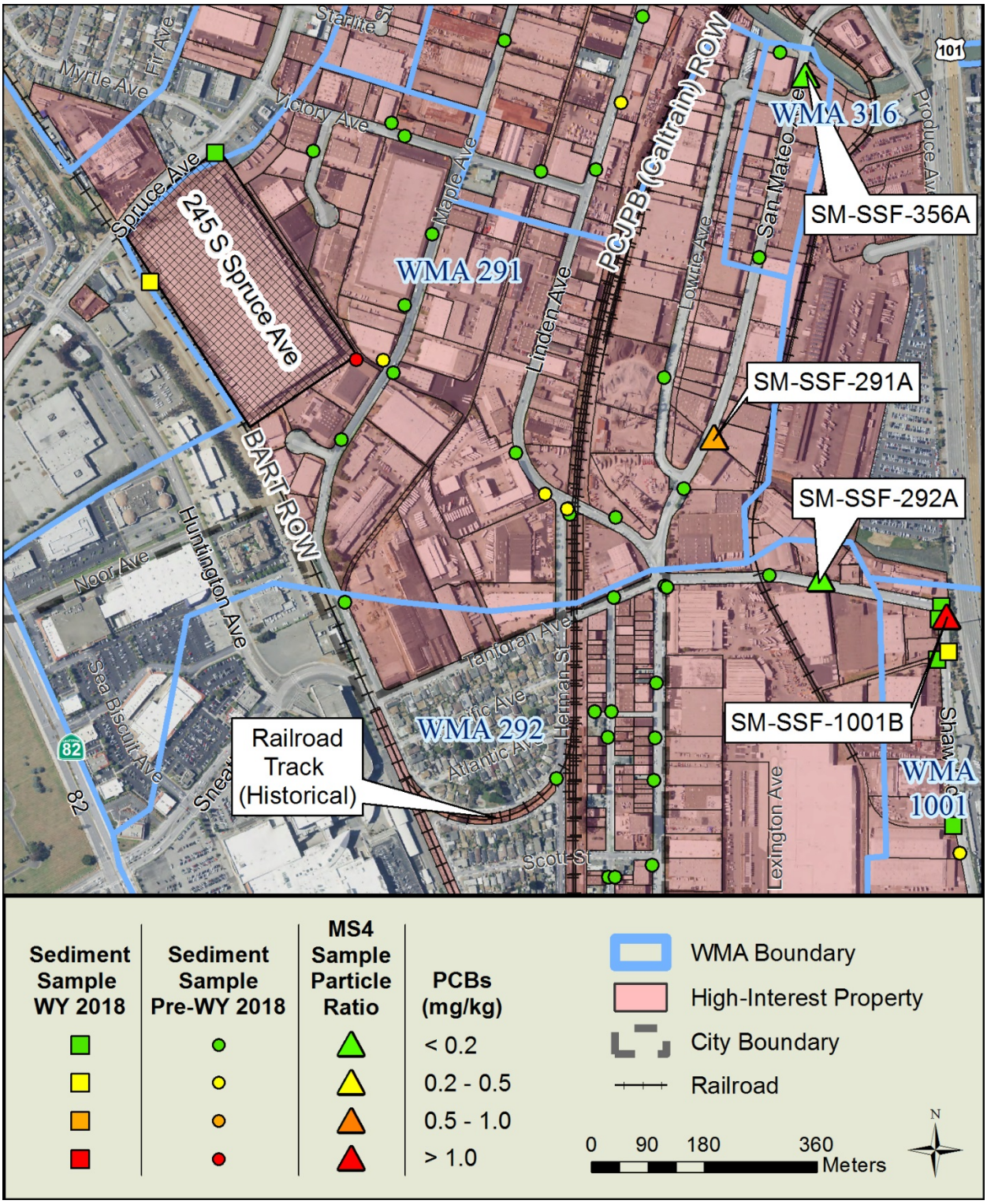

Figure 10. WMAs 291, 292, 316, and 1001

City of Burlingame

WMAs in the City of Burlingame with PCBs particle ratio over 0.2 mg/kg in stormwater runoff samples, elevated concentrations of PCBs in sediment samples, and/or other features relevant to investigating sources of PCBs are shown in Figures 11 and 12 and briefly described below. The PCBs concentrations in fourteen previous sediment samples in the industrial parts of Burlingame have all been relatively low. Table 7 summarizes PCBs, mercury, and SSC monitoring results for stormwater runoff samples collected in San Mateo County by the Countywide Program and RMP STLS through WY 2018. Attachment 2 summarizes WY 2018 embedded sediment monitoring locations and analytical results.

WMA 85

WMA 85 is a 121 acre catchment northwest of Highway 101 in Burlingame that is comprised mostly of light industrial land uses. A stormwater sample collected in WY 2018 had a slightly elevated PCBs particle ratio of 241 ng/g. Two previous sediment samples collected in this WMA had relatively low concentrations (less than 0.2 mg/kg), including one at the pump station.

WMA 142

WMA 142 is a small 20 acre catchment that is comprised mostly of industrial land uses. Sample SM-BUR-142A was part of a trio of stormwater runoff samples collected at the forebay of the Marsten Road pump station. It had a relatively high PCBs particle ratio (670 ng/g). SM-BUR-1006A, which was collected at the same location but drains adjacent WMA 1006, had a moderately elevated PCBs particle ratio (365 ng/g). Seven sediment samples collected in or very close to WMA 142 in WY 2018 all had a low PCBs concentration (less than 0.2 mg/kg).

WMA 164

WMA 164 is a 241 acre catchment. The lower half of this catchment has mostly light industrial land uses and the upper half has mostly residential and commercial land uses. A stormwater runoff sample collected in WY 2018 had a moderately elevated PCBs particle ratio of 447 ng/g. This site is downstream of a pump station where sediments may settle out of the stormwater runoff flows. Four embedded sediment samples collected in this catchment in WYs 2002 and 2015 had relatively low PCBs concentrations (less than 0.2 mg/kg).

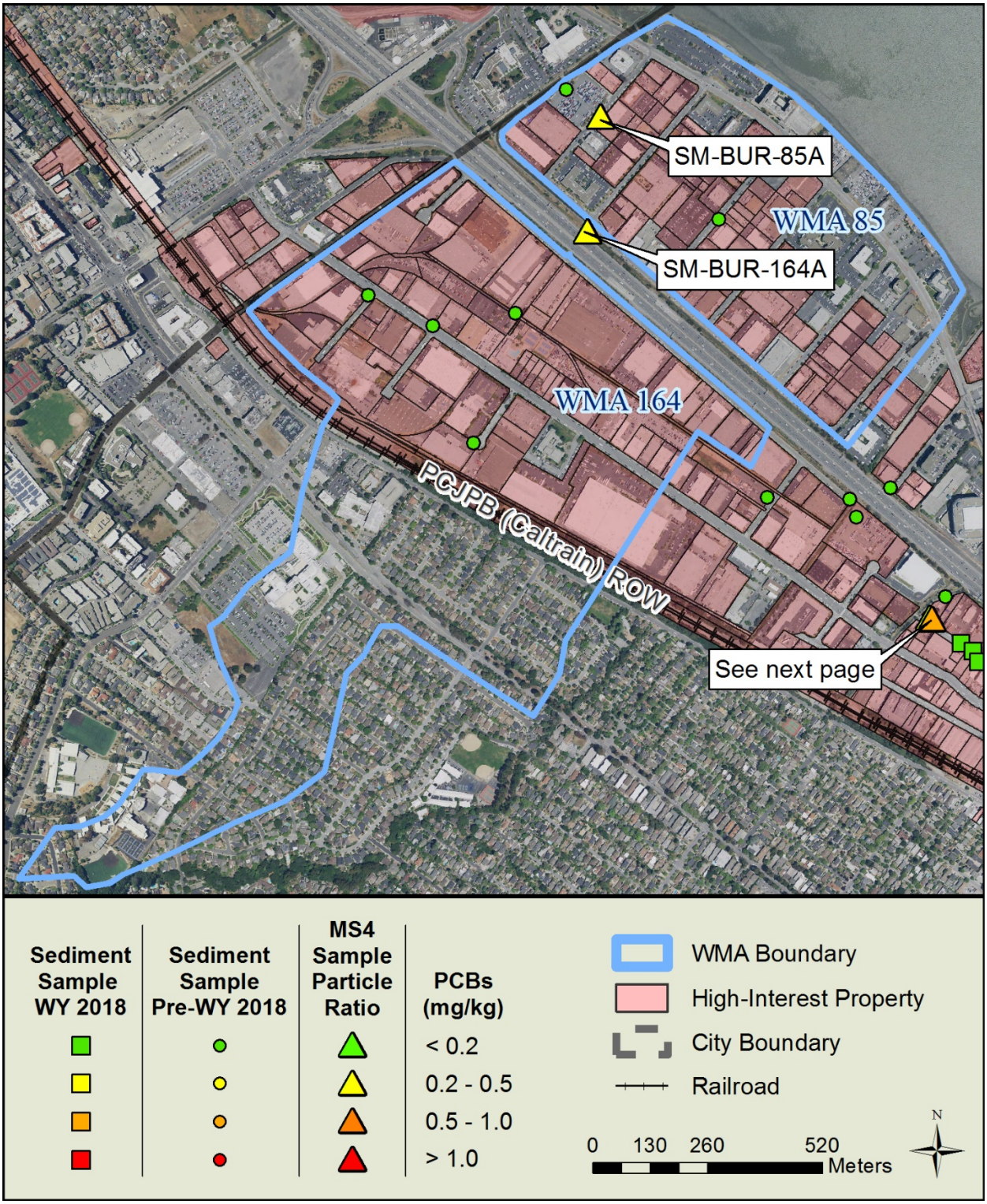

Figure 11. WMAs 85 and 164

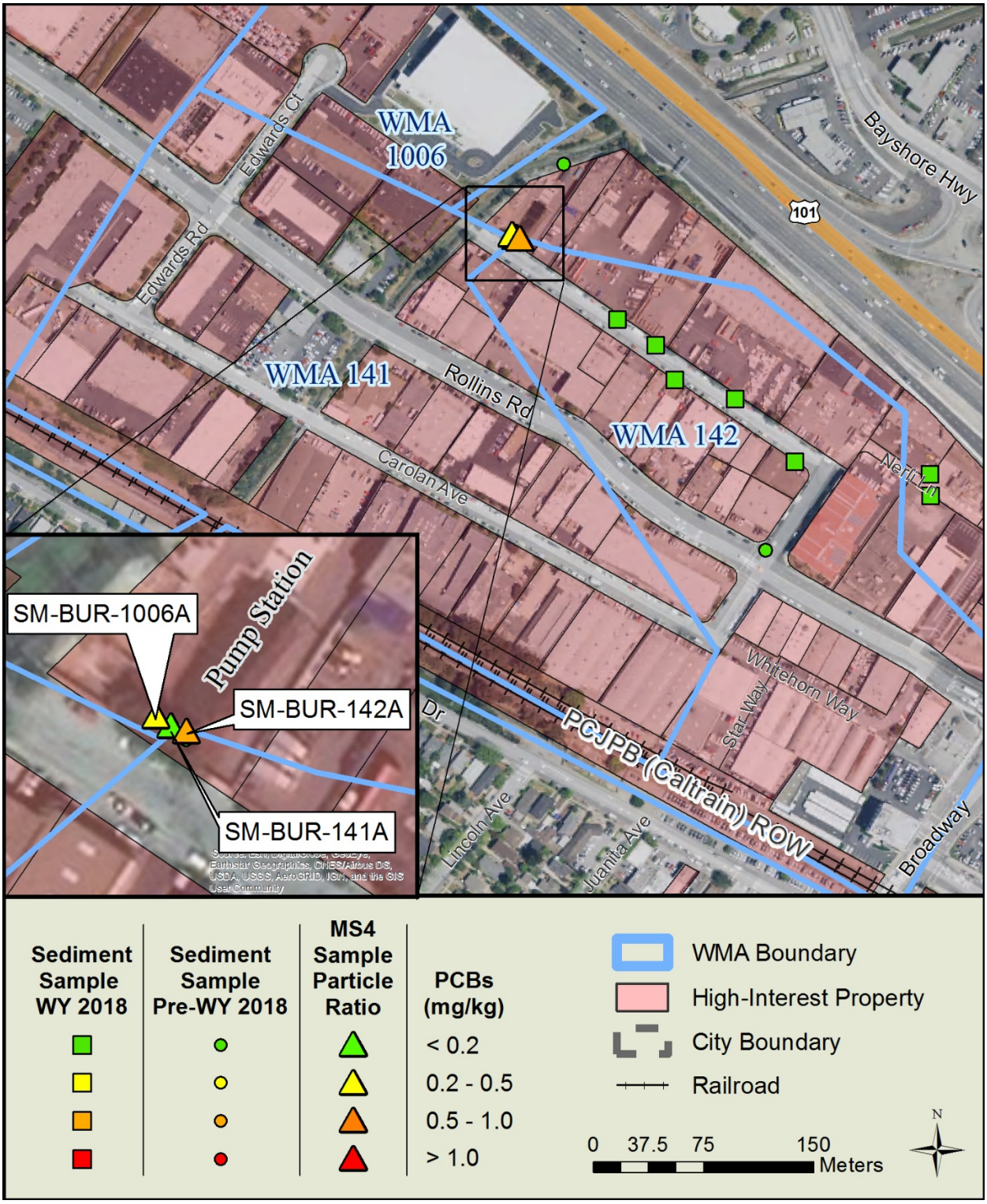

Figure 12. WMAs 141, 142, and 1006

City of San Mateo

WMAs in the City of San Mateo with PCBs particle ratio greater than 0.2 mg/kg in stormwater runoff samples, elevated concentrations of PCBs in sediment samples, and/or other features relevant to investigating sources of PCBs are shown in Figure 13 and briefly described below. Table 7 summarizes PCBs, mercury, and SSC monitoring results for stormwater runoff samples collected in San Mateo County by the Countywide Program and RMP STLS through WY 2018. Attachment 2 summarizes WY 2018 embedded sediment monitoring locations and analytical results.

WMA 156

WMA 156 is a 40 acre catchment that flows north into the 16th Street Channel at Delaware Street. Historically it contained old industrial land uses. It drains Caltrain property including the Hayward Park Station. There is a major retail redevelopment project currently underway in this WMA. A stormwater runoff sample collected in WY 2017 near the catchment outfall had a slightly elevated PCB particle ratio (204 ng/g) but a sediment sample collected upstream did not have an elevated PCBs concentration.

WMA 408

WMA 408 is a 43 acre catchment next to WMA 156. It is comprised of a mix of retail, commercial and residential land uses, with a relatively low proportion (16%) of high interest parcels (see Attachment 3). A stormwater runoff sample collected in WY 2017 had a relatively high PCBs particle ratio (1,900 ng/g). This result is notable given the lack of industrial land uses and low percentage of high interest parcels. Seven embedded sediment samples collected from this WMA in WY 2018 all had relatively low PCBs concentrations (less than 0.2 mg/kg). Given the high previous result and low concentrations in the embedded sediment samples, it may be advisable to resample the stormwater runoff station.

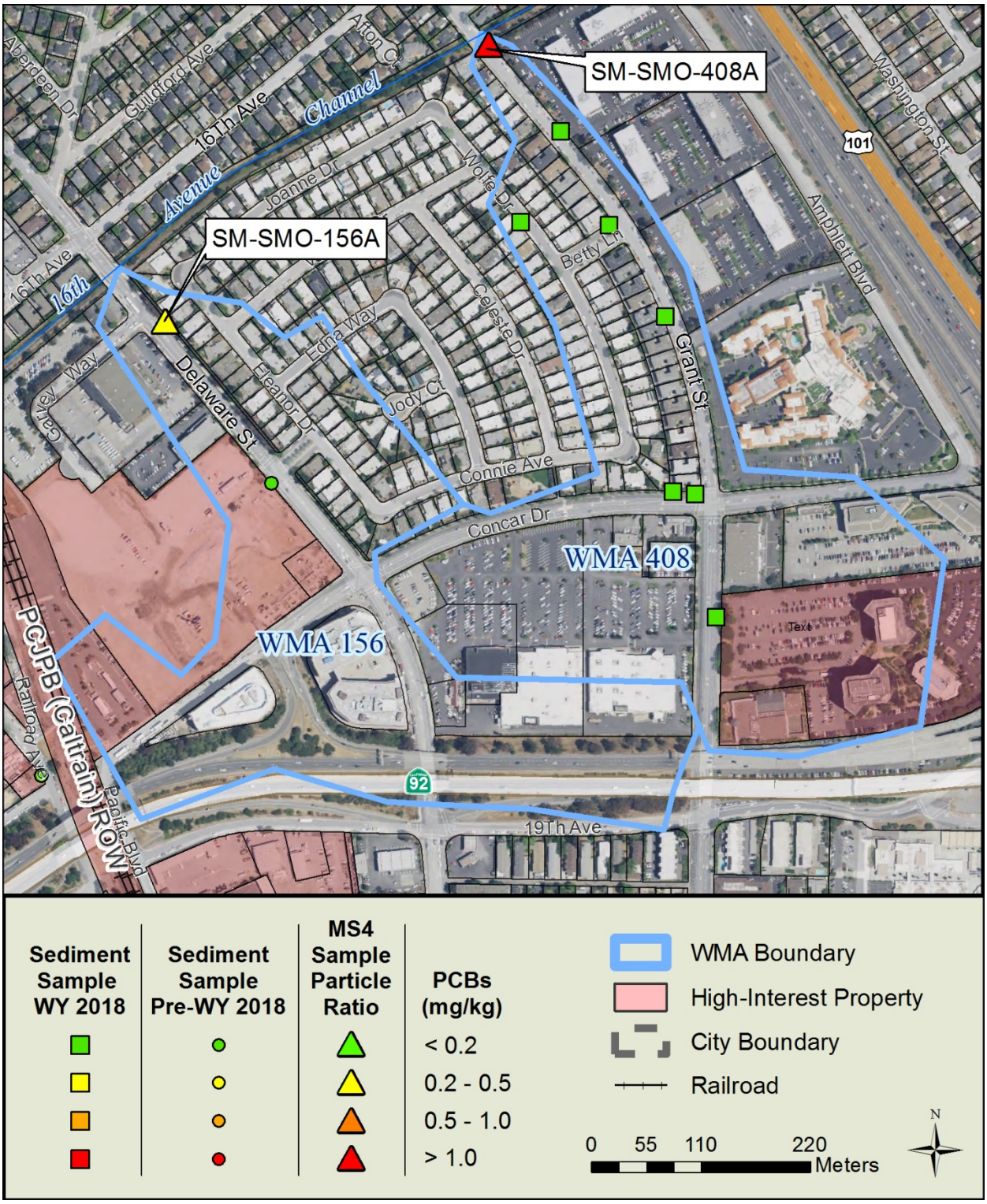

Figure 13. WMAs 156 and 408

City of Belmont

WMAs in the City of Belmont with PCBs particle ratio greater than 0.2 mg/kg in stormwater runoff samples, elevated concentrations of PCBs in sediment samples, and/or other features relevant to investigating sources of PCBs are shown in Figure 14 and briefly described below. Table 7 summarizes PCBs, mercury, and SSC monitoring results for stormwater runoff samples collected in San Mateo County by the Countywide Program and RMP STLS through WY 2018. Attachment 2 summarizes WY 2018 embedded sediment monitoring locations and analytical results.

WMA 60

WMA 60 is a 298 acre catchment that drains north into Laurel Creek. Two stormwater runoff samples were collected in the catchment in WY 2017 (SM-BEL-60A and SM-BEL-60B). Sample SM-BEL-60A was not elevated but SM-BEL-60B had a relatively high PCBs particle ratio (1,022 ng/g). This result was notable since the sample catchment is mostly residential with few high interest parcels. In WY 2018, seven embedded sediment samples were collected in the WMA, all of which had relatively low PCBs concentrations (less than 0.2 mg/kg). Given the high previous result and low concentrations in the embedded sediment samples, it may be advisable to resample the stormwater runoff station.

Figure 14. WMA 60

City of San Carlos

WMAs in the City of San Carlos with PCBs particle ratios greater than 0.2 mg/kg in stormwater runoff samples, elevated concentrations of PCBs in sediment samples, and/or other features relevant to investigating sources of PCBs are shown in Figure 15 – 18 and briefly described below. Table 7 summarizes PCBs, mercury, and SSC monitoring results for stormwater runoff samples collected in San Mateo County by the Countywide Program and RMP STLS through WY 2018. Attachment 2 summarizes WY 2018 embedded sediment monitoring locations and analytical results.

WMA 75

WMA 75 is a 66 acre catchment comprised entirely of old industrial land uses. Sample SM-SCS-75A (Industrial Rd Ditch) was collected by the RMP in WY 2016 and had a PCBs particle ratio of 6,140 ng/g, which is among the highest levels found in Bay Area stormwater samples collected to-date. The sample station is located where the MS4 daylights into a ditch on the east side of Industrial Road downstream of the adjacent Delta Star and Tiegel Manufacturing properties. The Countywide Program collected seven sediment samples in WY 2017 in the area. Two of these samples were collected near the Delta Star and Tiegel properties. One was collected in the storm drain line directly downstream of both properties and had a very elevated PCBs concentration (49.4 mg/kg). The other was also elevated, with a PCBs concentration of 1.20 mg/kg, and was collected from surface sediments at the location where the Tiegel property drains into the public right-of-way. In WY 2018, SMCWPPP collected a sample across the street from Delta Star in front of the PG&E property. The sample had a PCBs concentration of 0.76 mg/kg. It is not believed that the PCBs in this sample originated from the PG&E property given that the sample only drained a portion of the front parking lot, PCBs tend to create a halo effect around polluted areas, and that the entire MS4 in this area consistently contains groundwater and PCBs potentially could have been conveyed up the pipe. The remainder of the PG&E property drains toward the east. The remaining samples were not elevated, suggesting that there are no other sources of PCBs in this WMA other than these two properties (Figure 15).

Delta Star manufactures transformers, including transformers with PCBs historically (from 1961 to 1974). This is a cleanup site with elevated PCBs found in on-site soil and groundwater samples. PCBs migrated to the adjacent Tiegel property at 495 Bragato Road, a roughly three acre site that is largely unpaved. A “Removal Action” under DTSC oversight was implemented between June 1989 and January 1991 to remove soil impacted with PCBs exceeding 25 ppm. The Delta Star and Tiegel properties are currently determined to be in compliance with public health, safety, and the environmental cleanup goals based on exposure at the site. However, based on the PCBs concentrations in the sediment and stormwater runoff samples, the site appears to be a source of PCBs to the MS4 and San Francisco Bay at levels that are a concern from the standpoint of the Bay PCBs TMDL (i.e., contribute to bioaccumulation in Bay fish and other wildlife). The Countywide Program recently worked with the City of San Carlos to refer this property to the Regional Water Board for potential additional investigation and abatement.

WMA 31 (Pulgas Creek Pump Station North)

WMA 31 is a 99 acre catchment that drains to the Pulgas Creek pump station from the north. The RMP collected four stormwater runoff samples from this catchment during two storms in WY 2011. The samples were all elevated, with an average PCBs particle ratio of 893 ng/g. In addition, street dirt and sediment samples with elevated PCBs have been collected in front of and in the vicinity of 977 Bransten Road, a property within WMA 31 (Figure 16). The current occupant of this property is GC Lubricants. 977 Bransten Road is a DTSC cleanup site due to soil and groundwater contamination with PCBs and other

pollutants associated with activities at GC Lubricants and California Oil Recyclers, Inc., a previous tenant at the site. 1007/1011 Bransten Road is the property located adjacent to and immediately north of 977 Bransten Road and designated the "Estate of Robert E. Frank." A DTSC "Site Screening Form" describes PCBs in the subsurface on both sides of border between the two properties and states there may have been a historic source on both sides of the property line. Abatement measures have been implemented to reduce movement of contaminated soils from the properties, including a concrete cap over contaminated areas. However, the available information suggest that soils/sediments with PCBs are migrating from these properties into the public ROW, including the street and the MS4. The Countywide Program recently worked with the City of San Carlos to refer this property to the Regional Water Board for potential additional investigation and abatement.

WMA 210 (Pulgas Creek Pump Station South)

WMA 210 drains to the Pulgas Creek pump station from the south (Figures 17 and 18). The RMP has collected 33 storm samples from this catchment with an average PCBs particle ratio of 8,220 ng/g, the highest of any stormwater runoff sampling location in the Bay Area. There appear to be several sources of PCBs within this WMA.

The best documented of these sites is the property at 1411 Industrial Road. A sediment sample with a very elevated PCBs concentration (193 mg/kg) was previously collected from a storm drain inlet located in the parking lot of this about 1.3 acre property. The property drains to the MS4 at a sidewalk manhole where other elevated sediment samples have been collected. Since 2012 the occupant of this property has been a Habitat for Humanity Re-Store. Before that the property was occupied by an auto body shop and an automotive paint company. Between 1958 and 1994, Adhesive Engineering / Master Builders, Inc. was the occupant and conducted manufacturing, research and development of construction grade epoxy resin and products. Adhesive Engineering / Master Builders, Inc. had a history of violations for leaky wastewater drums and improper storage of hazardous wastes in the late 1980s and early 1990s, and PCBs were reportedly used on the site in the past. An environmental assessment report conducted as part of a business closure in 1994 revealed that 93 mg/kg PCBs was found in a soil sample collected in 1987. The soil sample was collected beneath an aboveground tank that was heated by oil-containing PCBs circulating in coils around the tank. The report also described the removal in 1987 of 44 cubic yards of contaminated soil from the area where the tank was located. As part of the 1994 environmental assessment, a soil sample was collected from the same area and PCBs were not detected at that time, but soil samples from other areas on the property were not collected and tested for PCBs. The above information suggests that the 1411 Industrial Road property is a source of PCBs to the MS4. The Countywide Program is currently working with the City of San Carlos to prepare the documentation to refer this property to the Regional Water Board for potential additional abatement.

In WY 2017, the Countywide Program collected ten sediment samples from the WMA 210 to better delineate the sources of PCBs in this catchment. Three samples were collected in the vicinity of 1411 Industrial Road to help rule out that neighboring properties are PCBs sources. All three of these samples had relatively low PCBs concentrations, with the highest having a PCBs concentration of 0.07 mg/kg, which helps to verify that the properties to the east and south are not also sources. Multiple sediment samples previously collected around the PG&E substation across the street also had relatively low levels of PCBs, suggesting that this property is not a source. PCBs from unknown sources were previously found in inlets and manholes in the vicinity of Center, Washington and Varian Streets and Bayport Avenue (Figure 18). The PCBs in these samples could have originated from any of about 20 small industries on these streets. During WY 2017, seven additional samples were collected in this area. The

results suggest that three small properties may be PCBs sources. Two samples collected from the driveways of 1030 Washington Street, a construction business, had elevated PCBs (1.29 and 3.73 mg/kg). A sample from the driveway of 1029 Washington Street was also elevated with a concentration of 5.64 mg/kg. In addition, samples from the driveway of 1030 Varian Street, an unpaved lot used for storage, had an elevated PCBs concentration of 1.84 mg/kg. It should be noted that all of the buildings in this area appear to be of the type and age that may have PCBs in building materials.

In WY 2018, the Countywide Program collected two sediment samples along Washington Street. The first sample was from the gutter upstream of 1030 Washington Street and had a PCBs concentration of 0.25 mg/kg. The second sample was from the gutter upstream of 1029 Washington Street and had a PCBs concentration of 0.06 mg/kg. These relatively low concentrations suggest that the sources of PCBs are not upstream of the two properties of interest along Washington Street. The Countywide Program is currently working with the City of San Carlos to determine next steps for these properties.

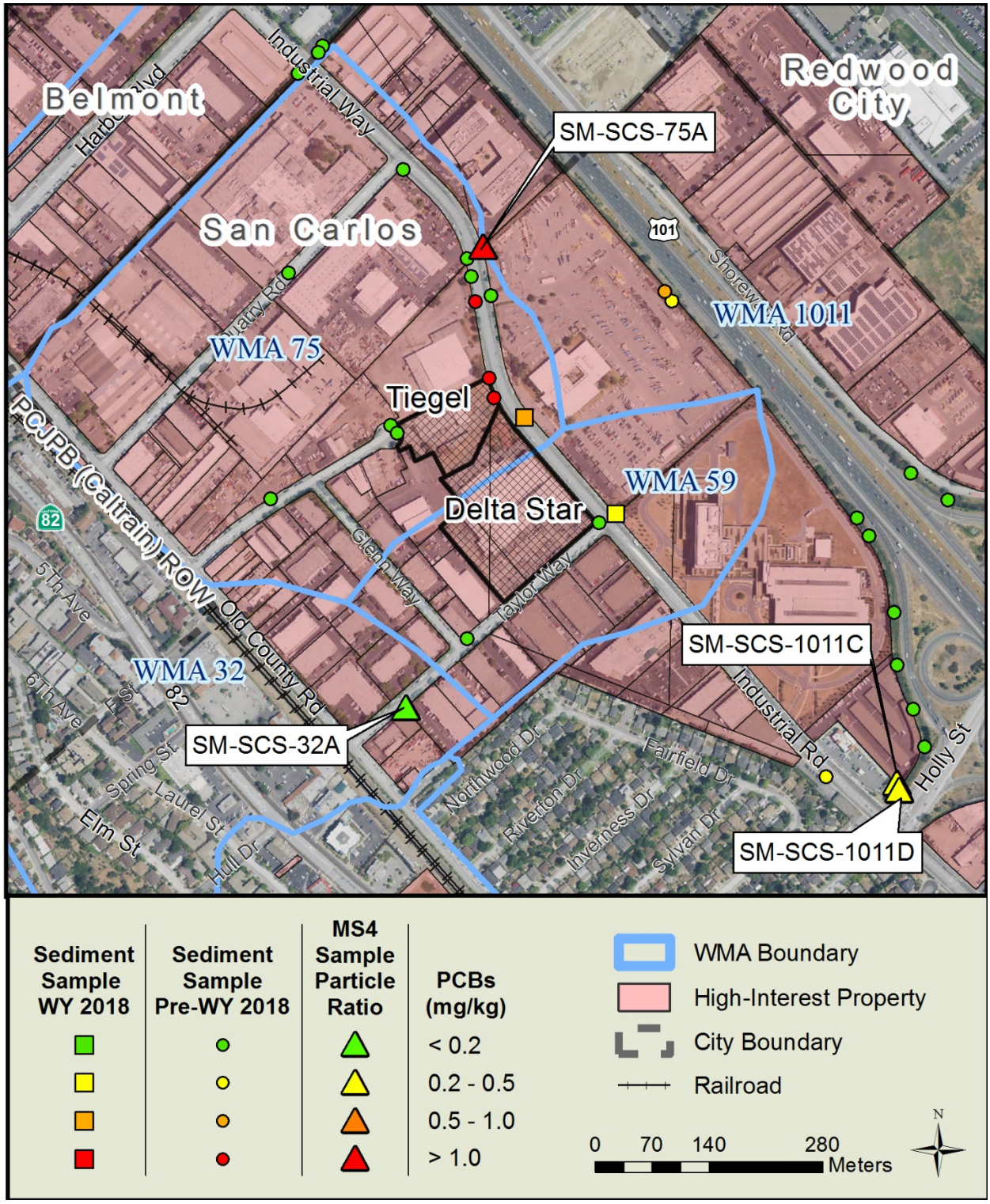

Figure 15. WMAs 59, 75, and 1011

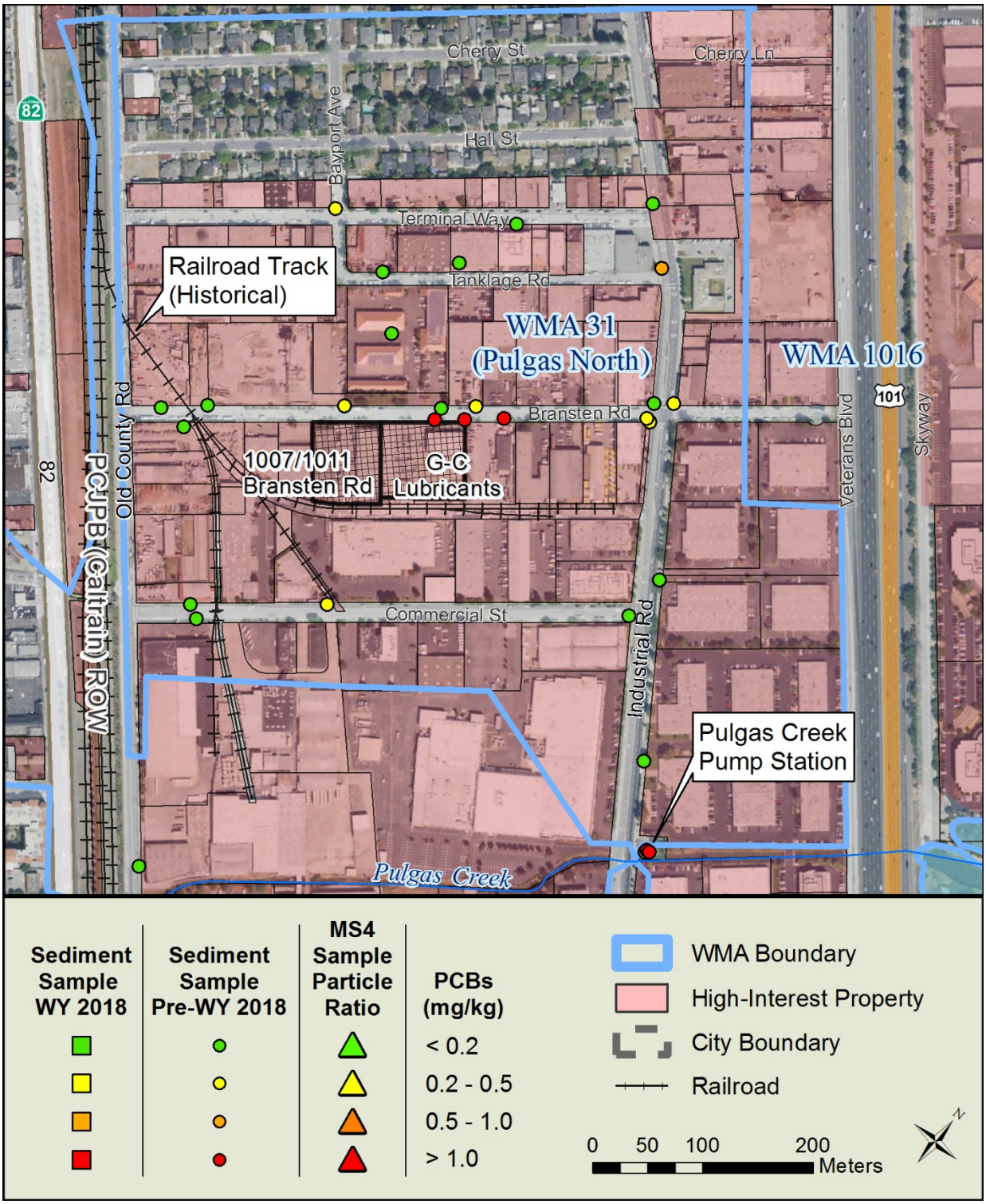

Figure 16. WMA 31

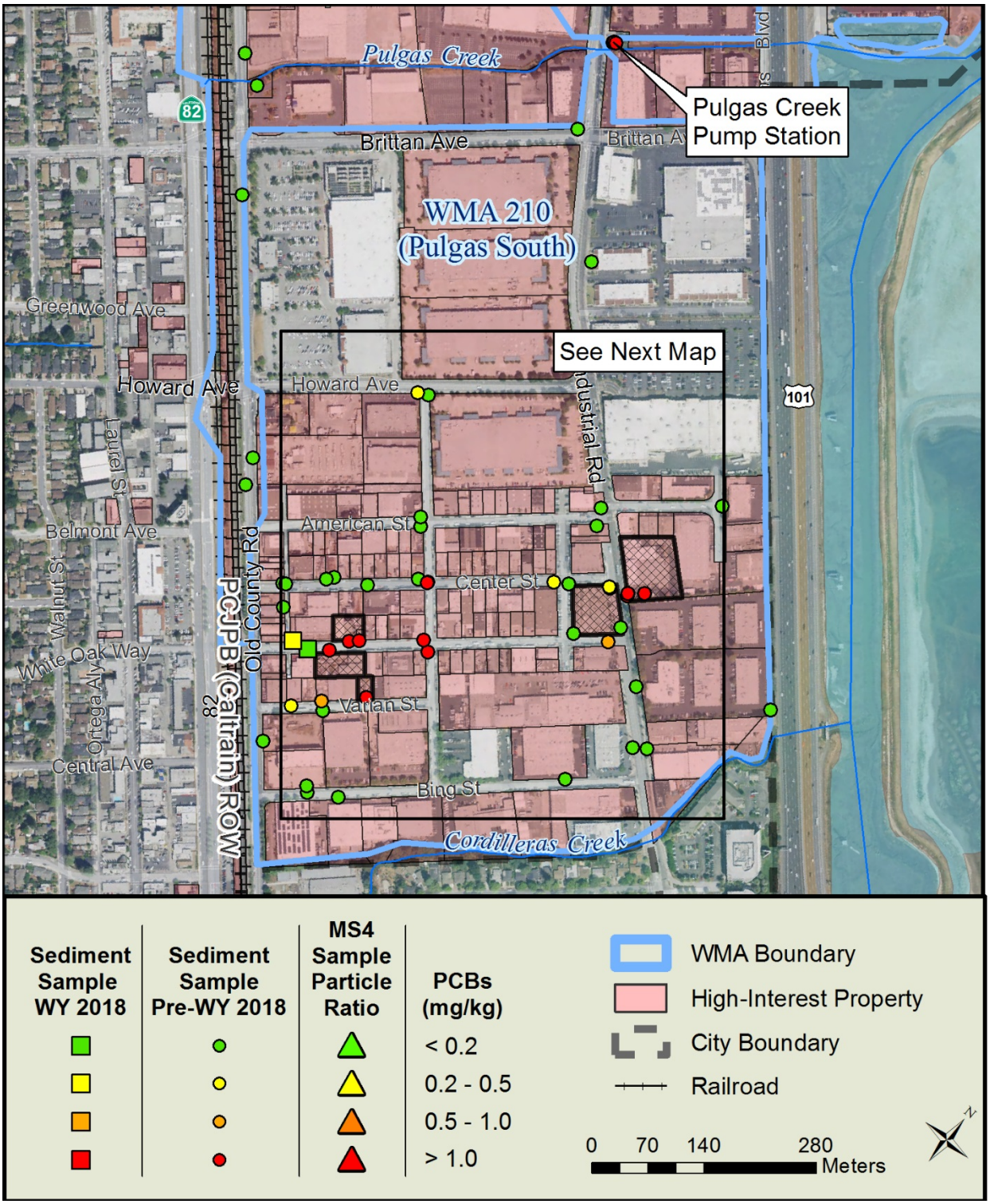

Figure 17. WMA 210

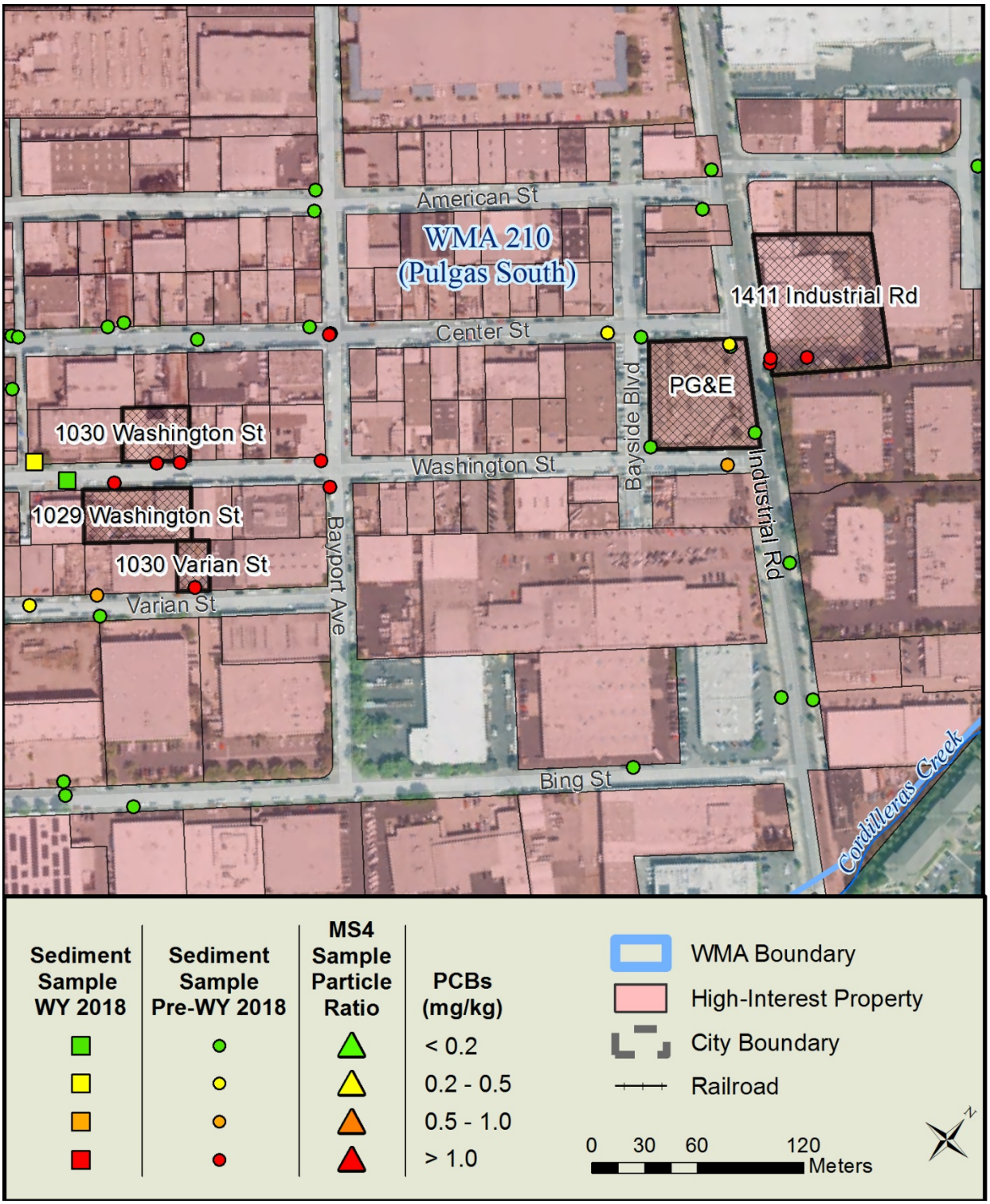

Figure 18. WMA 210 – Enlargement of Sampled Area

City of Redwood City

WMAs in the City of Redwood City with PCBs particle ratio greater than 0.2 mg/kg in stormwater runoff samples, elevated concentrations of PCBs in sediment samples, and/or other features relevant to investigating sources of PCBs are shown in Figure 19 – 22 and briefly described below. Table 7 summarizes PCBs, mercury, and SSC monitoring results for stormwater runoff samples collected in San Mateo County by the Countywide Program and RMP STLS through WY 2018. Attachment 2 summarizes WY 2018 embedded sediment monitoring locations and analytical results.

WMA 239

WMA 239 (Figure 22) is a 36 acre mostly industrial catchment that is half in Redwood City and half in Menlo Park. In WY 2015, SMCWPPP collected a sediment sample in this catchment that had an elevated PCBs concentration of 0.57 mg/kg. Four additional sediment samples were collected in WY 2017, all of which had relatively low (urban background) PCBs concentrations, with the highest concentration being 0.16 mg/kg. Currently in this WMA there is a large housing redevelopment that is almost complete. One of the industries that was redeveloped (Haven Avenue Industrial Condominiums) at 3633 Haven Ave was remediated for PCBs contamination in 2006. Stormwater runoff sampling has not been conducted in this catchment due to a lack of public access to the catchment outfall (which discharges to the Bay).

WMA 379

WMA 379 (Figures 19 and 20) is an 802 acre catchment located in Redwood City and the unincorporated North Fair Oaks census-designated place (CDP). The catchment is divided into a northerly half (A) and a southerly half (B), each with a distinct MS4 outfall. Both were sampled by the Countywide Program in WY 2016. Sample SM-RCY-379A had a relatively low PCBs particle ratio (105 ng/g). Sample SM-RCY-379B also had a relatively low PCBs particle ratio (182 ng/g). In WY 2017, the Countywide Program collected fifteen samples in WMA 379 in an attempt to identify PCBs source along Bay Road and Spring Street, in follow-up to elevated sediment samples collected during previous years. None of nine samples collected in the Bay Road near Hurlingame Avenue area was elevated, with the highest PCBs concentration being 0.14 mg/kg. A single sample collected from an inlet at the back of the sidewalk in front of 2201 Bay Road had a PCBs concentration of 1.97 mg/kg. This site is the location of two properties listed for PCBs on GeoTracker[11]: Tyco Engineering Products and the railroad spur next to the property. The Tyco site was remediated and redeveloped (MRP Provision C.3 compliant) and is currently a parking lot for Stanford Hospital. Four sediment samples were collected on Spring Street in WY 2017. None was elevated, with the highest PCBs concentration being 0.08 mg/kg. In WY 2018, two additional samples were collected to further verify the lower results along Spring Street, and to test for the presence of any PCBs sources along Charter Street on the south side of the old Tyco property. Both samples had low concentrations of PCBs (less than 0.2 mg/kg).

WMA 405

WMA 405 (Figure 21) consists almost entirely of SIMS Metal Management at the Port of Redwood City. Samples from the driveway of SIMS and nearby in WYs 2015 and 2017 had elevated PCBs concentrations of 0.57 and 0.75 mg/kg, respectively. The site has recently made efforts to prevent metal fluff potentially containing a variety of contaminants (including PCBs) from entering the Bay.

[11] GeoTracker is the State Water Resources Control Board's Internet-accessible database system used to track and archive compliance data from authorized or unauthorized discharges of waste to land, or unauthorized releases of hazardous substances from underground storage tanks.

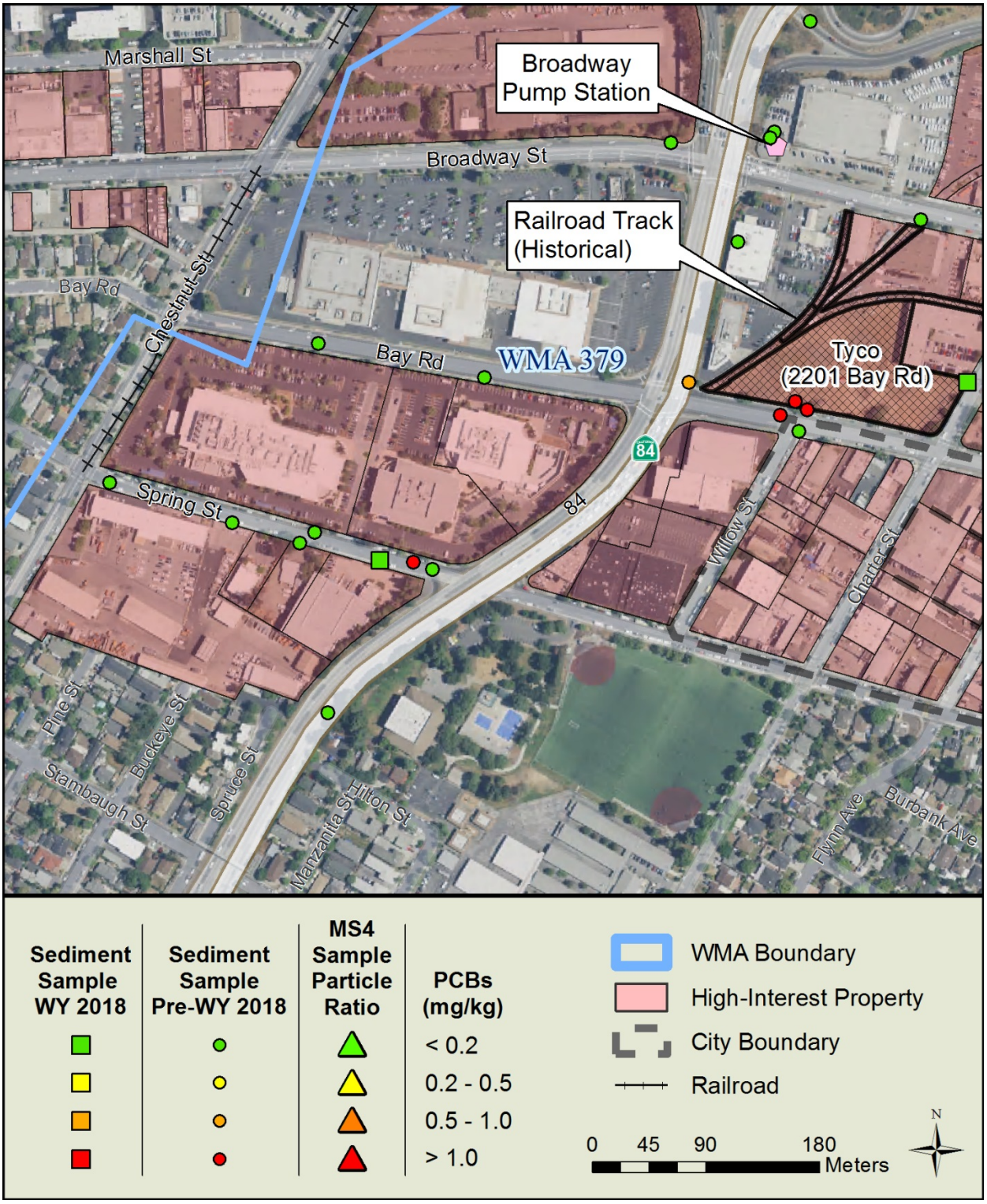

Figure 19. WMA 379 (northwest portion)

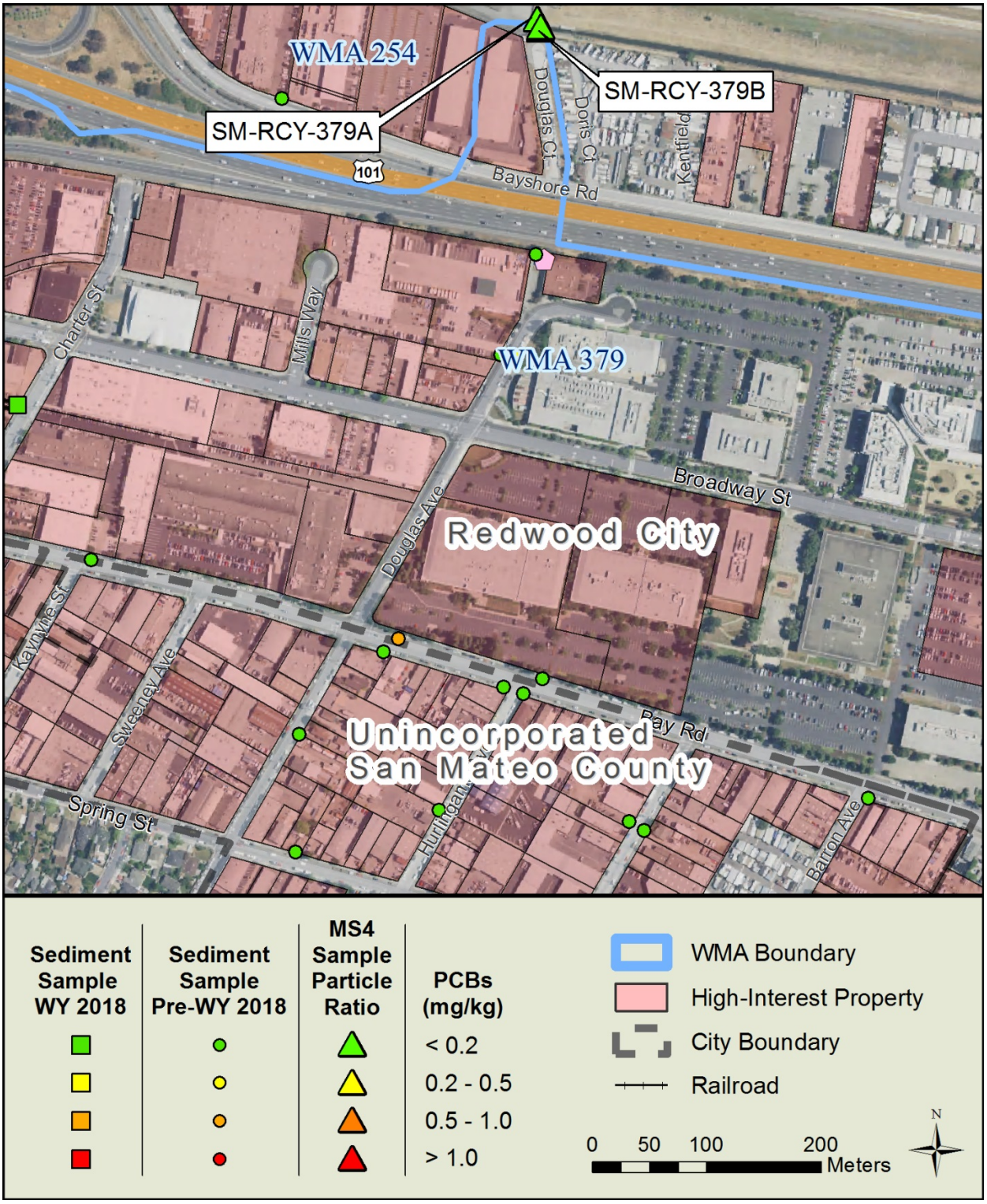

Figure 20. WMAs 254 and 379 (southeast portion)

Figure 21. WMAs 269, 405, 1000

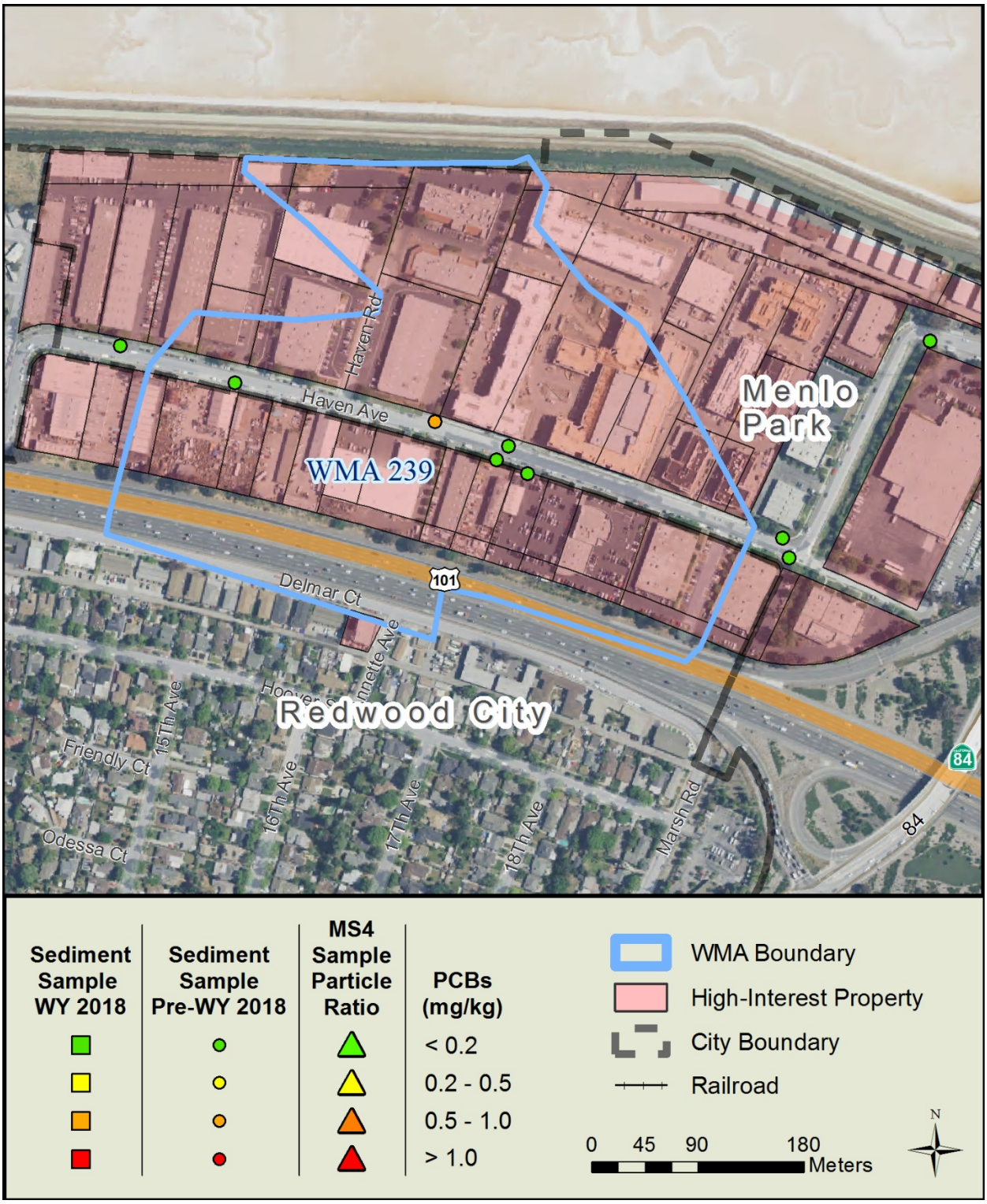

Figure 22. WMA 239

City of East Palo Alto

WMAs in the City of East Palo Alto with PCBs particle ratios greater than 0.2 mg/kg in stormwater runoff samples, elevated concentrations of PCBs in sediment samples, and/or other features relevant to investigating sources of PCBs are shown in Figure 23 and briefly described below. Table 7 summarizes PCBs, mercury, and SSC monitoring results for stormwater runoff samples collected in San Mateo County by the Countywide Program and RMP STLS through WY 2018. Attachment 2 summarizes WY 2018 embedded sediment monitoring locations and analytical results.

WMA 70

WMA 70 is a 490 acre catchment. A stormwater runoff sample collected by the RMP in WY 2015 had an elevated total PCBs concentration (28.5 ng/L) but a relatively low PCBs particle ratio (108 ng/g). Three sediment samples collected by SMCWPPP in the area in WY 2017 had relatively low PCBs concentrations, with the highest having a concentration of 0.03 mg/kg.

WMA 1015

WMA 1015 consists of multiple catchments in the City of East Palo Alto. This WMA contains Romic Environmental Technologies Corporation, a property that is known to be contaminated with PCBs and has been vacant for many years. A stormwater runoff sample and two sediment samples near the driveway to Romic all had relatively low concentrations of PCBs. However, the property drains directly to the Bay and the outfall is inaccessible. The WMA also contains 391 Demeter, a property that formerly was used to stockpile soils with PCBs that were removed from a separate remediation site. The site is expected to be redeveloped in the future. This property also drains directly to the Bay and is not possible to sample since it is all private property and inaccessible. A sediment sample from an inlet at the north end of Demeter Street was moderately elevated in PCBs with a concentration of 0.21 mg/kg.

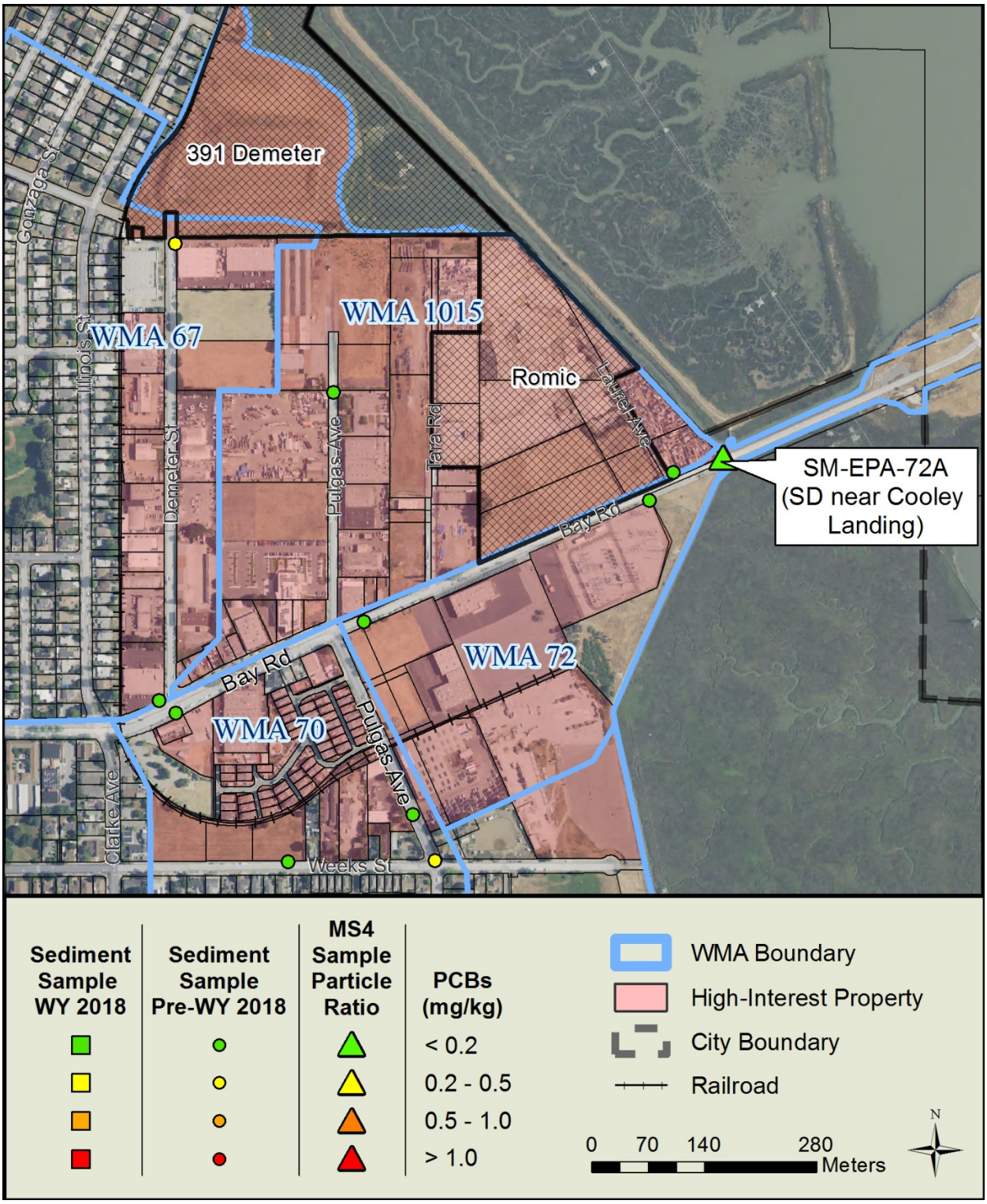

Figure 23. WMAs 70, 72, 1015

2.3. Copper

In WY 2018, the Countywide Program collected a total of four grab creek water samples for copper analysis. Bottom-of-the-watershed stations on San Pedro Creek and Cordilleras Creek were sampled during a storm event on January 8, 2018 (i.e., while stormwater runoff was being discharged to the creeks from the MS4), concurrent with nutrient POC monitoring and MRP Provision C.8.g.iii Wet Weather Pesticides and Toxicity Monitoring. The same two stations were sampled again in May 2018 during dry season base flows. The goal of this approach was to address Management Question No. 5 (Trends) by evaluating seasonal trends in copper concentrations. Management Question No. 4 (Loads and Status) is also addressed by characterizing copper concentrations in mixed-use watersheds. These data are supplemented by the SPoT sample collected in San Mateo Creek and analyzed for copper and other pollutants to assess long-term trends (Management Question No. 5).

All SMCWPPP samples were analyzed for total and dissolved copper[12] (method EPA 200.8) and hardness (method SM 2340C). The results are summarized in Table 10. Comparisons to freshwater WQOs are described in Section 3.0.

Table 10. Total and Dissolved Copper Concentrations in SMCWPPP Water Samples, WY 2018.

Sample Date	Total Copper (µg/L)	Dissolved Copper (µg/L)	Hardness as $CaCO_3$ (mg/L)
San Pedro Creek (202SPE005)			
1/8/2018	9.5	2.7	50
5/17/2018	0.84	0.41 J	190
Cordilleras Creek (204COR010)			
1/8/2018	8.4	4.3	76
5/21/2018	1.7	1.2	380

J-flagged data are above the detection limit but less than the reporting limit and are therefore considered estimated.

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

- As expected, dissolved copper concentrations are lower than total copper concentrations. The dissolved portion of the total copper concentration was higher in the spring base flow samples compared to the storm samples. This finding is consistent with copper's affinity to suspended sediment. Suspended sediment concentration is generally higher during storm events.
- Copper concentrations at both stations were higher during the January storm event compared to the spring base flow event, suggesting an influence by stormwater runoff.
- Copper concentrations were similar (i.e., within the same order of magnitude) in both creeks. This finding is consistent with a lack of local sources of copper.

[12] In order to simplify the field effort and reduce the risk of sample contamination, SMCWPPP requested that the analytical laboratory conduct the sample filtration required for dissolved copper analysis.

2.4. Nutrients

Nutrients were included in the POC monitoring requirements to support Regional Water Board efforts to develop nutrient numeric endpoints (NNE) for the San Francisco Bay Estuary. The "San Francisco Bay Nutrient Management Strategy" (NMS) is part of a statewide initiative to address nutrient over-enrichment in State waters (Regional Water Board 2012). Its goal is to lay out a well-reasoned and cost-effective program to generate the scientific understanding needed to fully support major management decisions such as establishing/revising WQOs for nutrients and dissolved oxygen, developing/implementing a nutrient monitoring program, and specifying nutrient limits in NPDES permits. The NMS monitoring program currently focuses on stations located within San Francisco Bay rather than freshwater tributaries.

MRP Provision C.8.f requires monitoring for a suite of nutrients (i.e., ammonium, nitrate, nitrite, total Kjeldahl nitrogen (TKN), orthophosphate, and total phosphorus). This list is similar to the list of analytes measured by the RMP and BASMAA partners at the six regional loading stations (including a San Mateo County station at the Pulgas Creek Pump Station in the City of San Carlos) monitored in WY 2012 - WY 2014. The prior data collected in freshwater tributaries to San Francisco Bay were used by the Nutrient Strategy Technical Team to develop and calibrate nutrient loading models.

In WY 2018, the Countywide Program collected a total of four samples for nutrient analysis. The analytes and chemical analysis methods were ammonia (SM 4500 C), nitrate (EPA 300.0), nitrite (SM 4500 B), TKN (SM 4500 C), orthophosphate (SM 4500 E), and total phosphorus (SM 4500 E).

Bottom-of-the-watershed stations on San Pedro Creek and Cordilleras Creek were sampled during a storm event on January 8, 2018, concurrent with copper POC monitoring and Provision C.8.g.iii Wet Weather Pesticides and Toxicity Monitoring. The two sites were sampled again in May 2018 during dry season base flows. Nutrient POC monitoring addresses Management Question No. 4 (Loads and Status). Management Question No. 5 (Trends) is also addressed by comparing nutrient concentrations during different flow events. Results are summarized in Table 11. Comparisons to applicable freshwater WQOs are described in Section 3.0.

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

- Concentrations of all nutrients at both stations were higher during the January storm event compared to the spring base flow event, suggesting an influence by stormwater runoff. This finding is consistent with the draft conceptual model developed by the NMS which suggests that nutrient loads to San Francisco Bay from creeks are highest during the wet season, but still considerably less than loads from publicly owned wastewater treatment works (POTWs) (Senn and Novick 2014).
- Organic nitrogen (TKN) made up a greater proportion of the total nitrogen concentration during the January storm event compared to the May event. It is likely that organically-bound nitrogen that washed off surfaces during the January storm had not yet had time to cycle through the ammonification and nitrification processes before samples were collected.

Table 11. Nutrient Concentrations in WY 2018 POC Creek Water Samples Collected by SMCWPPP.

Date	Nitrate as N	Nitrite as N	Total Kjeldahl Nitrogen (TKN)	Ammonia as N	Un-ionized Ammonia as N[1]	Ammonium[2]	Total Nitrogen[3]	Dissolved Orthophosphate as P	Phosphorus as P
San Pedro Creek (202SPE005)									
1/8/2018	0.81	0.009	0.88	0.077 J	0.0008	0.076	1.70	0.062	0.22
5/17/2018	0.47	0.004 J	0.18	0.05	0.0013	0.049	0.65	0.033	0.025
Cordilleras Creek (204COR010)									
1/8/2018	0.54	0.012	0.88	0.077 J	0.001	0.076	1.43	0.13	0.21
5/21/2018	0.11 J	<0.001	0.70	0.055	0.0008	0.054	0.81	0.089	0.11

Notes:
All constituents reported as mg/L.
J-flagged data are above the detection limit but less than the reporting limit and are therefore considered estimated.
[1] Un-ionized ammonia calculated using formula provided by the American Fisheries Society Online Resources. Formula requires field measurements of temperature, pH, and specific conductance, which were not recorded for the January 8, 2018 event. Specific conductance and pH values for Jan. 8 samples were estimated based on laboratory intake measurements reported for the concurrent toxicity samples. Temperature was estimated to be 12°C.
[2] Ammonium = ammonia – un-ionized ammonia.
[3] Total nitrogen = TKN + nitrate + nitrite. Non-detects valued at ½ method detection limit in calculation.

2.5. Emerging Contaminants

Emerging contaminant monitoring is being addressed through the Countywide Program's participation in the RMP. The RMP began investigating Contaminants of Emerging Concern (CECs) in 2001 and established the RMP Emerging Contaminants Work Group (ECWG) in 2006. The purpose of the ECWG is to identify CECs that might impact beneficial uses in the Bay and to develop cost-effective strategies to identify, monitor, and minimize impacts. The RMP published a CEC Strategy "living" document in 2013, completed a full revision in 2017 (Sutton et al. 2013, Sutton and Sedlak 2015, Sutton et al. 2017), and made minor updates in 2018 (Lin et al. 2018). The CEC Strategy document guides RMP special studies on CECs using a tiered risk and management action framework.

Provision C.8.f of the MRP identifies three emerging contaminants that must be addressed through POC monitoring: Perflourooctane Sulfonate Substances (PFOS), Perfluoroalkyl and Polyfluoroalkyl Sulfonate Substances (PFAS), and Alternative Flame Retardants (AFRs). PFAS is a broad class of chemicals used in industrial applications and consumer goods primarily for their ability to repel oil and water. PFOS are a subgroup within the PFAS umbrella and are identified in the CEC Strategy as "moderate" concern due to

Bay occurrence data suggesting a high probability of a low-level effect on Bay wildlife. Other PFAS and AFRs are identified as "possible" concerns due to uncertainties in measured or predicted Bay concentrations or in toxicity thresholds. RMP staff recently published reports summarizing PFOS and PFAS monitoring results (Houtz et al. 2016, Sedlak et al. 2017, Sedlak et al. 2018).[13]

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

In 2018, the RMP's ECWG also developed a special study proposal to analyze stormwater samples collected from urban watersheds for a large suite of CECs. The list of CECs to be analyzed is based on recent work conducted in Puget Sound streams and is intended to target urban runoff constituents rather than those found in wastewater (e.g., pharmaceuticals). The list includes PFOSs, PFASs, and AFRs. Pilot sampling will begin in WY 2019 in close coordination with the STLS.

The above RMP special studies satisfy the POC monitoring requirement for CECs in MRP Provision C.8.f.

[13] The Emerging Contaminants Workgroup is also monitoring a number of other emerging contaminants that are not identified in the MRP. These include microplastics, ethoxylated surfactants, and fipronil.

3.0 COMPLIANCE WITH APPLICABLE WATER QUALITY OBJECTIVES

MRP Provision C.8.h.i requires RMC participants to assess all data collected pursuant to Provision C.8 for compliance with applicable water quality objectives (WQOs). In compliance with this requirement, POC monitoring water sampling data collected in WY 2018 by the Countywide Program were compared to applicable numeric WQOs. There were no exceedances of applicable WQOs.

The comparison to applicable WQOs to into account the following considerations:

- **Discharge vs. Receiving Water** – WQOs apply to receiving waters, not discharges such as stormwater runoff. A WQO generally represents the maximum concentration of a pollutant that can be present in the water column without adversely effecting organisms using the aquatic system as habitat, people consuming those organisms or water, and/or other current or potential beneficial uses. During WY 2018, only nutrient and copper data were collected in receiving waters by SMCWPPP. PCBs and mercury samples were collected within the engineered storm drain network. Dilution is likely to occur when the MS4 discharges urban stormwater (and non-stormwater) runoff into local receiving waters. Therefore, it is unknown whether discharges that exceed WQOs result in exceedances in the receiving water itself, the location where there is the potential for aquatic life to be exposed to a pollutant.
- **Freshwater vs. Saltwater** - POC monitoring samples were collected from freshwater (i.e., above tidal influence in creeks) and therefore comparisons were made to freshwater WQOs.
- **Aquatic Life vs. Human Health** - Comparisons were primarily made to WQOs for the protection of aquatic life, not WQOs for the protection of human health to support the consumption of water or organisms. The rationale is that water and organisms are not likely consumed by humans at the locations of the monitoring stations.
- **Acute vs. Chronic Objectives/Criteria** – All monitoring of stormwater runoff for PCBs and mercury and one of the two copper/nutrient creek sampling events were conducted during episodic storm events. Storm episode monitoring results likely do not represent long-term concentrations of the monitored constituents in receiving waters. Storm monitoring data was compared to acute WQOs for aquatic life that represent the highest concentrations of a pollutant to which an aquatic community can be exposed for a short period of time (e.g., one hour) without resulting in an unacceptable effect. Spring baseflow creek monitoring data were compared to chronic WQOs developed to assess longer-term exposure.

Of the WY 2018 POC monitoring analytes, promulgated WQOs for the protection of aquatic life only exist for total mercury, dissolved copper, and unionized ammonia.

- **Total Mercury**. All water samples collected in San Mateo County watersheds by SMCWPPP and the STLS and analyzed for mercury were stormwater runoff (Table 7). Stormwater runoff results are not directly comparable to WQOs, as described above. However, all of the WY 2018 and previous Water Year mercury concentrations (Table 7) were well below the freshwater acute objective for mercury of 2.4 µg/L (2,400 ng/L).
- **Dissolved Copper.** Acute (1-hour average) and chronic (4-day average) WQOs for copper are expressed in terms of the dissolved fraction of the metal in the water column and are hardness

dependent[14]. The copper WQOs were calculated using the base e exponential functions described in the California Toxics Rule (40 CFR 131.38) which apply hardness values measured at the sample station. Dissolved copper concentrations were compared to the calculated WQOs. Per the above discussion, storm monitoring data was compared to acute WQOs and spring baseflow creek monitoring data were compared to chronic WQOs. All dissolved copper concentrations were below calculated acute and chronic WQOs (Table 12).

- **Nutrients**. The un-ionized ammonia concentrations calculated based on measured concentrations of ammonia in Countywide Program samples (Table 11) were well below the annual median WQO for un-ionized ammonia of 0.025 mg/L.

Table 12. Comparison of WY 2018 Copper Monitoring Data to WQOs.

Station Code	Sample Date	Measured Dissolved Copper (µg/L)	Measured Hardness as $CaCO_3$ (mg/L)	Acute WQO for Dissolved Copper at Measured Hardness (µg/L)	Chronic WQO for Dissolved Copper at Measured Hardness (µg/L)
202SPE005	1/8/2018	2.7	50	7.0	5.0 (NA)
202SPE005	5/17/2018	0.41 J	190	24.6	15.5
204COR010	1/8/2018	4.3	76	10.4	7.1 (NA)
204COR010	5/21/2018	1.2	380	47.3	28.0

J-flagged data are above the detection limit but less than the reporting limit and are therefore considered estimated.
NA = Not applicable. Chronic WQOs are not applicable to storm event grab samples.

[14] The current copper standards for freshwater in California do not account for the effects of pH or natural organic matter and can be overly stringent or under-protective (or both, at different times). Therefore, the California Stormwater Quality Association (CASQA) has asked the USEPA to considering updating the California Toxics Rule standards for copper using the Biotic Ligand Model (BLM) which accounts for the effect of water chemistry in addition to hardness (i.e., temperature, pH, dissolved organic carbon, major cations and anions).

4.0 SUMMARY AND DISCUSSION

In WY 2018, the Countywide Program continued to collect and analyze POC samples in compliance with Provision C.8.f of the MRP. Yearly minimum requirements were met for all monitoring parameters. WY 2018 POC monitoring data collected directly by the Countywide Program were evaluated, along with appropriate data collected by third parties such as the RMP's STLS. Highlights from WY 2018 included the following:

- The Countywide Program's PCBs and mercury monitoring continued to focus on San Mateo County WMAs containing high interest parcels with land uses potentially associated with PCBs, such as old industrial, electrical and recycling. During WY 2018, the Countywide Program collected 13 composite samples of stormwater runoff from the bottom of WMAs to help better characterize these catchments and 50 grab samples of sediment within priority WMAs to help identify source properties.
- The individual and composite grab sediment samples were collected in the public right-of-way (ROW), including locations adjacent to high interest parcels with land uses associated with PCBs and/or other characteristics potentially associated with pollutant discharge (e.g., poor housekeeping, unpaved areas). The samples were collected from a variety of types of locations, including manholes, storm drain inlets, driveways, streets, and sidewalks.
- Using similar methods, the RMP's STLS collected two additional stormwater runoff composite samples for PCBs and mercury analysis from the bottom of WMAs in South San Francisco. The Countywide Program assisted the STLS with selecting these monitoring stations.
- The two WY 2018 RMP STLS stormwater runoff sample stations located in South San Francisco and had both previously been sampled in WY 2016 using similar methods. PCBs concentrations in the WY 2016 samples were relatively low. However, in the WY 2018 resamples, PCBs concentrations (total PCBs and particle ratio) were elevated (particle ratios greater than 0.5 mg/kg) and roughly an order of magnitude higher than in WY 2016 (except that the PCBs particle ratio for one of the samples was at a similar elevated level for both events).
- Low PCBs concentrations in a composite stormwater runoff sample from the bottom of a WMA catchment suggest that either PCBs sources are not prevalent in the catchment or the sample is a "false negative." False negatives could be the result of low rainfall/runoff rates failing to mobilize sediments from source areas, or many other factors. The RMP is currently conducting an "Advanced Data Analysis" that will include attempting to develop a method to normalize results from this type of stormwater runoff monitoring based upon storm intensity.
- The Countywide Program evaluated the WY 2018 stormwater runoff and sediment monitoring data along with data from previous years collected in San Mateo County by the Countywide Program and other parties (e.g., the RMP's STLS). The evaluation results were used to update the existing provisional designation of WMAs as high, medium, or low priority. This provisional prioritization informs selecting WMAs for additional future investigation and identifying WMAs that provide opportunities for implementing cost-effective PCBs controls. Figure 4 is a map illustrating the current status of WMAs in San Mateo County, based upon the provisional prioritization.

- It is important to emphasize the provisional nature of these prioritizations, and especially the uncertainty surrounding designating a WMA as low priority due to a single bottom-of-catchment composite stormwater runoff sample having a low PCBs particle ratio. As noted above, low PCBs concentrations in any single stormwater runoff sample could be a false negative if the storm was too small to mobilize sediments with associated PCBs, or other factors. For example, based upon the WY 2018 resampling results, the above two WY 2016 RMP STLS stormwater runoff samples located in South San Francisco may have been false negatives.
- The PCBs monitoring data collected to-date has informed identification of several potential source properties located in the City of San Carlos. The Countywide Program is working with the City regarding next steps at these sites. This included recently developing and submitting to the Regional Water Board referrals of two areas for potential further PCBs investigation and abatement:
    - 270 Industrial Road (Delta Star) / 495 Bragato Road (Tiegel), which are adjacent properties in San Carlos.
    - 977 and 1007/1011 Bransten Road, another set of adjacent properties in San Carlos.
- The mean and median PCBs concentrations in WY 2018 sediment samples (n = 50) were somewhat lower than in previous years. In addition, in WY 2018 only 1 of the 50 sediment samples collected had a PCBs concentration that exceeded 1.0 mg/kg. One other sample had a PCBs concentration between 0.5 and 1.0 mg/kg. All of the remaining samples had a PCBs concentration below 0.5 mg/kg. In general, the WY 2018 POC monitoring data suggest that the PCBs monitoring program in the public ROW in San Mateo County may be approaching diminishing returns in terms of identifying new source properties.
- However, the stormwater runoff resamples in South San Francisco suggest the possibility of false negatives for PCBs in some WMAs provisionally designated low priority based on stormwater runoff data from previous years. The RMP's ongoing "Advanced Data Analysis" is evaluating normalizing results based upon storm intensity and the results may help inform planning any future stormwater runoff monitoring of this type.
- Samples for copper analysis were collected from two bottom-of-the-watershed locations during two monitoring events: a January storm event and during spring baseflow. Copper concentrations were higher in the storm samples compared to the baseflow samples, suggesting an influence by stormwater runoff. Similar concentrations at both sites was consistent with a lack of local sources.
- Samples for nutrient analysis were collected from two bottom-of-the-watershed locations during two monitoring events: a January storm event and during spring baseflow. Nutrient concentrations (nitrogen and phosphorus) were higher in the storm samples compared to the baseflow samples, suggesting an influence by stormwater runoff.
- None of the WY 2018 SMCWPPP or third-party water samples collected in San Mateo County exceeded applicable water quality objectives (WQOs).
- SMCWPPP participated in a BASMAA monitoring study that satisfied the provision C.12.e requirement to collect 20 composite caulk/sealant samples throughout the MRP permit area. The final project report was included with the Countywide Program's FY 2017/18 Annual Report, submitted to the Regional Water Board on September 30, 2018 (BASMAA 2018).

- SMCWPPP participated in a the BASMAA Regional Best Management Practices (BMP) Effectiveness Study which was developed to satisfy provision C.8.f requirements to collect at least eight PCBs and mercury samples that address Management Question No. 3 (Management Action Effectiveness). The study investigated the effectiveness of hydrodynamic separator (HDS) units and various types of biochar-amended bioretention soil media (BSM) at removing PCBs and mercury from stormwater. Results of the study are summarized by BASMAA (2019a and b), reports that are appended to SMCWPPP's WY 2018 UCMR.

5.0 NEXT STEPS

The Countywide Program will continue its POC monitoring program in compliance with Provision C.8.f of the MRP. As in previous years, yearly minimum requirements will be met for all monitoring parameters. In WY 2019, the Countywide Program will continue to:

- Conduct PCBs and mercury monitoring that focuses on San Mateo County WMAs containing high interest parcels with land uses potentially associated with PCBs such as old industrial, electrical and recycling. This monitoring will continue to be coordinated with stormwater runoff monitoring in San Mateo County catchments by the RMP's STLS.
- Assist the RMP's STLS to select its PCBs and mercury monitoring stations that are located in in San Mateo County catchments. The Countywide Program recently worked with the STLS to select its WY 2019 PCBs and mercury monitoring stations.
- Collect grab sediment samples for PCBs and mercury analysis within San Mateo County WMAs, targeting selected catchments and parcels of interest. During WY 2019, SMCWPPP will collect approximately 25 sediment samples (this fieldwork is scheduled for April 2019). Objectives will include attempting to identify source properties within WMAs, identifying which WMAs provide the greatest opportunities for implementing cost-effective PCBs controls, and prioritizing WMAs for potential future investigations.
- Evaluate the WY 2019 POC monitoring data collected in San Mateo County by SMCWPPP and other parties (e.g., the RMP's STLS), along with data from previous years. This will include tracking the results of the RMP's ongoing "Advanced Data Analysis," which includes an evaluation of normalizing stormwater runoff PCBs monitoring results based upon storm intensity. The results may help inform planning future stormwater runoff monitoring of this type (if any) in San Mateo County.
- Evaluate the cost-effectiveness of conducting additional POC monitoring (e.g., sediment and stormwater runoff sampling for PCBs and mercury, including the use of remote sediment samplers during storms) in future Water Years that would further inform implementation of controls in priority WMAs.
- Coordinate the POC monitoring program with planning scenarios for control measure implementation in priority WMAs in San Mateo County. High priority will continue to be given to the Pulgas Creek pump station north and south drainages (WMA 31 and WMA 210), which are the two WMAs in San Mateo County with the greatest number of samples with elevated concentrations of PCBs in sediment and stormwater runoff samples to-date.
- Attempt to identify new source properties for referral to the Regional Water Board, based on the evaluation of the results to-date from the POC monitoring program and other appropriate data, as they become available.
- Participate in the RMP, including the RMP's STLS, STLS Trends Strategy, and CEC Strategy.
- Work with the State's SPoT monitoring program to help address Management Question No. 5 (Trends). This will include tracking the results from the SPoT station near the mouth of San Mateo Creek in the City of San Mateo. SPoT collected sediment samples from this station in June 2018 and analyzed for a number of pollutants, including mercury, copper, and organic pollutants (but not PCBs), but the results are not yet available.

- Collect samples for copper analysis, primarily to address Management Question No. 4 (Loads and Status) and/or No. 5 (Trends). Details of the WY 2019 copper monitoring approach are currently under development.
- Collect samples for nutrient analysis. These samples will be collected from mixed land use watersheds during baseflow to address Management Question No. 4 (Loads and Status). Details of the WY 2019 nutrient monitoring approach are currently under development.

6.0 REFERENCES

AMS, 2012. Quality Assurance Project Plan. Clean Watersheds for a Clean Bay – Implementing the San Francisco Bay's PCB and Mercury TMDL with a Focus on Urban Runoff. EPA San Francisco Bay Water Quality Improvement Fund Grant # CFDA 66.202. Prepared for Bay Areas Stormwater Management Agencies Association (BASMAA) by Applied Marine Sciences.

BASMAA, 2016. Creek Status Monitoring Program Quality Assurance Project Plan, Final Draft Version 3. Prepared for Bay Area Stormwater Management Agency Association (BASMAA) Regional Monitoring Coalition by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, and Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program and the Contra Costa Clean Water Program.

BASMAA, 2018. Evaluation of PCBs in Caulk and Sealants in Public Roadway and Storm Drain Infrastructure. Prepared for Bay Area Stormwater Management Agency Association (BASMAA) by EOA, Inc., KLI, and SFEI. August 16, 2018.

BASMAA, 2019a. Pollutant Removal from Stormwater with Biochar Amended Bioretention Soil Media (BSM). Prepared for Bay Area Stormwater Management Agency Association (BASMAA) by OWP at Sacramento State, EOA Inc., KLI, and SFEI. March 2019.

BASMAA, 2019b. Pollutant of Concern Monitoring for Management Action Effectiveness – Evaluation of Mercury and PCBs Removal Effectiveness of Full Trash Capture Hydrodynamic Separator Units. Prepared for Bay Area Stormwater Management Agency Association (BASMAA) by OWP at Sacramento State, EOA Inc., KLI, and SFEI. March 2019.

Gilbreath, A.N., Hunt, J. and McKee, L.J. 2019 (in preparation). Pollutants of concern reconnaissance monitoring progress report, water years 2015-2018. A technical report prepared for the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP). San Francisco Estuary Institute, Richmond, California.

Houtz, E.F., Sutton, R., Park, J-S., and Sedlak, M., 2016. Poly- and perfluoroalkyl substances in wastewater: Significance of unknown precursors, manufacturing shifts, and likely AFFF impacts. Water Research v. 95, pp. 142-149.

Lin, D. Sutton, R., Shimabuku, I., Sedlak, M., Wu, J., and Holleman, R. 2018. Contaminants of Emerging Concern in San Francisco Bay: A Strategy for Future Investigations 2018 Update. SFEI Contribution No. 873. San Francisco Estuary Institute, Richmond, CA.

Lin, D. and Sutton, R. 2018. Alternative Flame Retardants in San Francisco Bay: Synthesis and Strategy. SFEI Contribution No. 885. San Francisco Estuary Institute, Richmond, CA.

Phillips, B.M., Anderson, B.S., Siegler, K., Voorhees, J., Tadesse, D., Webber, L., Breuer, R. 2016. Spatial and Temporal Trends in Chemical Contamination and Toxicity Relative to Land Use in California Watersheds: Stream Pollution Trends (SPoT) Monitoring Program. Fourth Report – Seven-Year Trends 2008-2014. California State Water Resources Control Board, Sacramento, CA.

Regional Water Board, 2012. San Francisco Bay Nutrient Management Strategy. San Francisco Regional Water Quality Control Board.

Regional Water Board, 2015. San Francisco Bay Region Municipal Regional Stormwater NPDES Permit. San Francisco Regional Water Quality Control Board Order R2-2015-0049, NPDES Permit No. CAS612008. November 19, 2015.

Sedlak, M.D., Benskin, J.P., Wong, A., Grace, R., and Greig, D.J., 2017. Per and polyfluoroalkyl substances (PFASs) in San Francisco Bay wildlife: Temporal trends, exposure pathways, and notable presence of precursor compounds. Chemosphere v. 185, pp. 1217-1226.

Sedlak, M.D., Sutton, R., Wong, A., Lin, D. 2018. Per and polyfluoroalkyl substances (PFASs) in San Francisco Bay: Synthesis and Strategy. San Francisco Estuary Institute, Richmond, CA. Contribution # 867. 130 pages.

Siegler, K. 2018. The UC Davis Marine Pollution Studies Laboratory at Granite Canyon. Personal communication, August 2018.

Senn, D.B. and Novick, E., 2014. Scientific Foundation for the San Francisco Bay Nutrient Management Strategy. Draft FINAL. October 2014.

SMCWPPP, 2015. PCBs and Mercury Source Area Identification, Water Year 2015 POC Monitoring Report. Prepared for San Mateo Countywide Water Pollution Prevention Program (SMCWPPP) by EOA, Inc., Oakland, California. September 2015.

SMCWPPP, 2016a. Progress Report: Identification of Watershed Management Areas for PCBs and Mercury. San Mateo Countywide Water Pollution Prevention Program. April 1, 2016.

SMCWPPP, 2016b. Identifying Management Areas and Controls for Mercury and PCBs in San Mateo County Stormwater Runoff. San Mateo Countywide Water Pollution Prevention Program. September 30, 2016.

SMCWPPP, 2017a. Urban Creeks Monitoring Report, Water Quality Monitoring, Water Year 2016 (October 2015 – September 2016). Prepared for San Mateo Countywide Water Pollution Prevention Program (SMCWPPP) by EOA, Inc., Oakland, California. March 31, 2017.

SMCWPPP, 2017b. Control Measures Plan for PCBs and Mercury in San Mateo County Stormwater Runoff. San Mateo Countywide Water Pollution Prevention Program. September 30, 2017.

SMCWPPP, 2018a. Urban Creeks Monitoring Report, Water Quality Monitoring, Water Year 2017 (October 2016 – September 2017). Prepared for San Mateo Countywide Water Pollution Prevention Program (SMCWPPP) by EOA, Inc., Oakland, California. March 31, 2018.

SMCWPPP, 2018b. Updated Control Measures Plan for PCBs and Mercury in San Mateo County Stormwater Runoff. San Mateo Countywide Water Pollution Prevention Program. September 30, 2018.

SMCWPPP, 2018c. Pollutants of Concern Monitoring Report. Water Year 2018 Accomplishments and Water Year 2019 Planned Allocation of Effort. San Mateo Countywide Water Pollution Prevention Program. October 15, 2018.

Sutton, R., Sedlak, M., and Yee, D., 2013. Contaminants of Emerging Concern in San Francisco Bay: A Strategy for Future Investigations. San Francisco Estuary Institute, Richmond, CA. Contribution # 700.

Sutton, R. and Sedlak, M., 2015. Contaminants of Emerging Concern in San Francisco Bay: A Strategy for Future Investigations. 2015 Update. San Francisco Estuary Institute, Richmond, CA. Contribution # 761.

Sutton, R., Sedlak, M., Sun, J. and Lin, D., 2017. Contaminants of Emerging Concern in San Francisco Bay: A Strategy for Future Investigations. 2017 Revision. San Francisco Estuary Institute, Richmond, CA. Contribution # 851.

Attachment 1

Quality Assurance / Quality Control Report

Pollutants of Concern Monitoring - Quality Assurance/Quality Control Report, WY 2018

1.0 INTRODUCTION

The San Mateo Countywide Pollution Prevention Program (SMCWPPP) conducted Pollutants of Concern (POC) Monitoring in Water Year (WY) 2018 to comply with Provision C.8.f (Pollutants of Concern Monitoring) of the National Pollutant Discharge Elimination Program (NPDES) Municipal Regional Permit for the San Francisco Bay Area (i.e., MRP). Monitoring included analysis for polychlorinated biphenyls (PCBs), total mercury, total and dissolved copper, suspended sediment concentration (SSC), and nutrients (i.e., ammonia, nitrate, nitrite, total Kjeldahl nitrogen, orthophosphate, and total phosphorus).

This project utilized the Clean Watersheds for Clean Bay Project (CW4CB) Quality Assurance Project Plan (QAPP; BASMAA 2013) as a basis for Quality Assurance and Quality Control (QA/QC) procedures. Missing components were supplemented by the Bay Area Stormwater Management Agencies Association (BASMAA) Regional Monitoring Coalition (RMC) QAPP (BASMAA 2016) and the QAPP for the California Surface Water Ambient Monitoring Program (SWAMP), specifically for nutrient and copper samples, respectively. Data were assessed for seven data quality attributes, which include (1) Representativeness, (2) Comparability, (3) Completeness, (4) Sensitivity, (5) Contamination, (6) Accuracy, and (7) Precision. These seven attributes were compared to Data Quality Objectives (DQOs), which 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 – representativeness and comparability are qualitative while completeness, sensitivity, precision, accuracy, and contamination are quantitative assessments. Specific DQOs are based on Measurement Quality Objectives (MQOs) for each analyte.

The MQOs for each of the POC analytes are summarized in Table 1 for water and Table 2 for sediment. As there was no reporting limit listed in the QAPP for copper, results were compared to the SWAMP recommended reporting limits for inorganic analytes in freshwater. Overall, the results of the QA/QC review suggest that the data generated during this study were of sufficient quality for the purposes of the project. While some data were flagged based on the MQOs and DQOs identified in the QAPPs, none of the data was rejected. Further details regarding the QA/QC review are provided in the sections below.

Table 1. Measurement quality objectives for analytes in water from the Clean Watersheds for a Clean Bay (CW4CB) Quality Assurance Project Plan (BASMAA 2013) and BASMAA RMC Quality Assurance Project Plan (BASMAA 2016)

Sample	Nutrients[1]	Hardness[1]	SSC[2]	Copper[2]	Mercury[2]	PCBs[2]
Laboratory Blank	< RL	<RL	< RL	< RL	< RL	< RL
Reference Material (Laboratory Control Sample) Recovery	90-110%	80-120%	NA	75-125%	75-125%	50-150%
Matrix Spike Recovery	80-120%	80-120%	NA	75-125%	75-125%	50-150%
Duplicates (Matrix Spike, Field, and Laboratory)[3]	RPD < 25%	RPD < 25%	RPD < 25%	RPD < 25%	RPD < 25%	RPD < 25%
Reporting Limit	0.01mg/L for all except: Ammonia (0.02mg/L) TKN[4] (0.5mg/L)	1 mg/L[5]	0.5 mg/L	0.10 µg/L[6]	0.0002 µg/L (0.2 ng/L)	0.002 µg/L (2000 pg/L)

RL = Reporting Limit; RPD = Relative Percent Difference

[1] From the BASMAA QAPP

[2] From the CW4CB QAPP

[3] NA if native concentration for either sample is less than the reporting limit

[4] TKN = Total Kjeldahl Nitrogen

[5] No hardness RL listed in either QAPP. Value is from SWAMP-recommended reporting limits for conventional analytes in freshwater. (https://www.waterboards.ca.gov/water_issues/programs/swamp/docs/tools/19_tables_fr_water/1_conv_fr_water.pdf)

[6] No copper RL listed in either QAPP. Value is from SWAMP-recommended reporting limits for inorganic analytes in freshwater. (http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/tools/19_tables_fr_water/4_inorg_fr_water.pdf)

Table 2. Measurement quality objectives for analytes in sediment from the Clean Watersheds for a Clean Bay (CW4CB) Quality Assurance Project Plan (BASMAA 2013).

Sample	Total Solids	Mercury	PCBs
Laboratory Blank	< RL	< RL	< RL
Reference Material (Laboratory Control Sample) Recovery	N/A	75-125%	50-150%
Matrix Spike Recovery	N/A	75-125%	50-150%
Duplicates [1] (Matrix Spike, Field, and Laboratory)	RPD < 25%	RPD < 25%	RPD < 25%[2]
Reporting Limit	0.1%[3]	30 µg/kg 0.03 mg/kg 30,000 ng/kg	0.2 µg/kg 0.0002 mg/kg 200 ng/kg

RL = Reporting Limit; RPD = Relative Percent Difference

[1] NA if native concentration for either sample is less than the reporting limit

[2] Only applicable for matrix spike duplicates. Method specific for field and laboratory duplicates

[3] RL for total solids in water

2.0 REPRESENTATIVENESS

Data representativeness assesses whether the data were collected so as to represent actual conditions at each monitoring location. For this project, all samples were assumed to be representative if they were collected and analyzed according to protocols specified in the CW4CB QAPP and RMC QAPP. All field and laboratory personnel received and reviewed the QAPPs, and followed prescribed protocols including laboratory methods.

3.0 COMPARABILITY

The QA/QC officer ensures that the data may be reasonably compared to data from other programs producing similar types of data. For POC monitoring, individual stormwater programs try to maintain comparability within the RMC. The key measure of comparability for all RMC data is the California Surface Water Ambient Monitoring Program.

Electronic data deliverables (EDDs) were submitted to the San Francisco Bay Regional Water Quality Control Board (SFRWQCB) in Microsoft Excel templates developed by SWAMP, to ensure data comparability with SWAMP. In addition, data entry followed SWAMP documentation specific to each data type, including the exclusion of qualitative values that do not appear on SWAMP's look up lists[1]. Completed templates were reviewed using SWAMP's online data checker[2], further ensuring SWAMP-comparability.

[1] Look up lists available online at http://swamp.waterboards.ca.gov/swamp_checker/LookUpLists.php.

[2] Checker available online at http://swamp.waterboards.ca.gov/swamp_checker/SWAMPUpload.php

4.0 COMPLETENESS

Completeness is the degree to which all data were produced as planned; this covers both sample collection and analysis. For chemical data and field measurements an overall completeness of greater than 90% is considered acceptable for RMC chemical data and field measurements.

During WY 2018, SMCWPPP collected 100% of planned samples. Four aqueous samples were collected and analyzed for nutrients (ammonia, nitrate, nitrite, total Kjeldahl nitrogen, phosphorus, and orthophosphate), copper, and hardness. A total of 13 aqueous samples were collected in WY 2018 and analyzed for PCBs, mercury, and SSC. Fifty (50) sediment samples were also collected in WY 2018 and analyzed for PCBs, mercury, and total solids.

5.0 SENSITIVITY

5.1. Water

Sensitivity analysis determines whether the methods can identify and/or quantify results at low enough levels. For the aqueous chemical analyses in this project, sensitivity is considered to be adequate if the reporting limits (RLs) comply with the specifications in RMC QAPP Appendix E (RMC Target Method Reporting Limits) and the CW4CB QAPP Appendix B (CW4CB Target Method Reporting Limits).

A summary of the target and actual reporting limits for each analyte is shown in Table 3. The reporting limits for all nitrate, suspended sediment concentration (SSC), copper, and hardness samples, plus the ammonia samples collected in January and mercury samples collected in March exceeded their respective target reporting limits.

Table 3. Target and actual reporting limits for SMCWPPP pollutants of concern monitoring in water in WY 2018

Analyte	Unit	Target	Actual	Exceeds Target RL?
Ammonia	mg/L	0.02	0.02-0.1	Yes
Nitrate	mg/L	0.01	0.1-0.2	Yes
Nitrite	mg/L	0.01	0.005	No
Total Kjeldahl Nitrogen	mg/L	0.5	0.1	No
Phosphorus	mg/L	0.01	0.01	No
Orthophosphate	mg/L	0.01	0.01	No
Suspended Sediment Concentration	mg/L	0.5	0.95-1.6	Yes
Copper	µg/L	0.1	0.1-0.5	Yes
Hardness	mg/L	1	5-10	Yes
Mercury	ng/L	0.2	0.5-2.5	Yes
PCBs	pg/L	2000	19.3-210	No

5.2. Sediment Analysis

Approximately 4% of sediment PCB samples (364 of 9460) did not meet the CW4CB reporting limit requirement of 200 ng/kg. However, all exceedances were due to elevated concentrations, which required dilutions to conduct the analysis.

The target reporting limit for mercury (0.03 mg/kg) was met for all samples. No analytical reporting limit was listed by the laboratory for total solids results in WY 2018. However, all total solids results were several orders of magnitude above the target reporting limit of 0.1%. The

laboratory was instructed to use the target reporting limit of 0.1% for future analyses of total solids samples.

6.0 CONTAMINATION

For chemical data, contamination is assessed as the presence of analytical constituents in blank samples.

6.1. Water Analysis

Several laboratory and equipment (filter) blanks were run during the nutrient, copper, and hardness analyses. All associated blanks were non-detect. Analytes were detected in two laboratory blanks for mercury, but no analytes were detected in any PCB laboratory blanks.

6.2. Sediment Analysis

Several laboratory blanks were analyzed during sediment analysis. Mercury was detected in several blanks above the method detection limit, but below the reporting limit. Similarly, several PCBs were detected in a laboratory blank at concentrations below the reporting limit. The PCBs that were detected in laboratory blanks include the following:

- PCB 008
- PCB 011
- PCB 018/30
- PCB 020/28
- PCB 031
- PCB 052
- PCB 083/99
- PCB 090/101/113
- PCB 093/95/100
- PCB 110/115
- PCB 129/138/163
- PCB 132
- PCB 147/149
- PCB 153/168
- PCB 180/193
- PCB 187
- PCB 194
- PCB 198/199
- PCB 206
- PCB 209
- Total Di-PCB
- Total Tri-PCB
- Total Tetra-PCB
- Total Penta-PCB
- Total Hexa-PCB
- Total Hepta-PCB
- Total Octa-PCB
- Total Nona-PCB
- Total PCBs

Since concentrations were detected below the reporting limit, all laboratory blanks met the MQOs.

7.0 ACCURACY

Accuracy is assessed as the percent recovery of samples spiked with a known amount of a specific chemical constituent. The analytical laboratory evaluated and reported the Percent Recovery (PR) of Laboratory Control Samples (LCS; in lieu of reference materials) and Matrix Spikes (MS)/Matrix Spike Duplicates (MSD), which were recalculated and compared to the target ranges in the RMC and CW4CB QAPPs. If a QA sample did not meet MQOs, all samples in that batch for that analyte were flagged.

7.1. Water Analysis

All laboratory LCS and MS/MSD samples for nutrients, hardness, copper, mercury, and SSC were within their respective MQOs except for one SSC LCS in April, one total Kjeldahl nitrogen and two nitrite matrix spikes in January, and two phosphorous matrix spike samples in June. The associated samples were consequently flagged. Twenty-four (24) laboratory control samples exceeded the MQOs for PCBs, and all associated samples were flagged. No MS/MSD samples were analyzed for PCB congeners in water. However, the analytical laboratory affirmed that laboratory control and

duplicate laboratory control samples were analyzed in lieu of matrix spike and duplicate matrix spike samples for the PCBs. In this case, it is acceptable to compare the percent recoveries calculated from the laboratory control samples to the MQOs for matrix spike percent recoveries. Given that the MQOs are the same in both cases, no other exceedances were found.

7.2. Sediment Analysis

All mercury laboratory control samples met their corresponding MQOs, but 81 LCS for PCB did not meet their MQOs. No MS/MSD samples were taken for PCB analytes in sediment. Laboratory control spike and duplicate laboratory control spike samples were again analyzed in lieu of matrix spike and duplicate matrix spikes for the PCB analytes with no exceedances observed.

8.0 PRECISION

Precision is the repeatability of a measurement and is quantified by the Relative Percent Difference (RPD) of two duplicate samples. Three measures of precision were used for this project – matrix spikes duplicates, laboratory duplicates, and field duplicates. The MQO for RPD specified by both the CW4CB QAPP and the BASMAA QAPP is <25%.

8.1. Water Analysis

8.1.1. Laboratory Duplicates

Matrix spike duplicates and laboratory control sample duplicates for nutrients, copper, hardness, and mercury were well below the targeted range of < 25%. As previously stated, duplicate laboratory control samples were analyzed in place of duplicate matrix spike samples to assess precision in the measurement of PCB concentrations. Given that the RPD MQOs are the same in both cases, no other exceedances were found.

No laboratory duplicates were analyzed for any analytes besides suspended sediment concentration, and suspended sediment concentration does not have an RPD MQO against which to compare.

8.1.2. Field Duplicates

One nutrient field duplicate was collected during WY 2018 creek status monitoring and is considered representative of nutrient sampling for POC monitoring. The field duplicate sample met the MQO for RPD for all analytes except for total Kjeldahl nitrogen and ammonia. Refer to the SMCWPPP Creek Status Monitoring QA/QC Report for more information.

Field duplicates were collected for copper, nutrients, and hardness during the January event in San Mateo County and the May event in Santa Clara County on behalf of SMCWPPP. The duplicate samples collected in January met the RPD MQO for all analytes except ammonia. Similarly, the duplicate samples collected in May met the RPD MQO for all analytes except ammonia and phosphorus. Additionally, a field duplicate was collected in San Mateo County for aqeuous mercury, PCBs, and SSC. The RPDs for all analytes except mercury and several PCB congeners met the MQO. The PCB congeners whose RPDs that exceeded the MQO include the following:

- PCB 061/70/74/76
- PCB 090/101/113
- PCB 093/95/100
- PCB 105
- PCB 110/115
- PCB 118
- PCB 194
- PCB 203
- Total Octa-PCB
- Total Penta-PCB
- Total Tetra-PCB

8.2. Sediment Analysis

8.2.1. Laboratory Duplicates

Two mercury matrix spike duplicates exceeded the corresponding MQO. Six laboratory duplicates were run for total solids and were well below the MQO (<25%). No mercury or PCB laboratory duplicates were run during the sediment analysis.

8.2.2. Field Duplicates

Five sediment field blind duplicates were collected in WY 2018. The field duplicates exceeded the RPD MQO for mercury and 102 PCBs. The sample taken at SM-SSF-01-J had the lowest amount of analytes exceeding the MQO with 16 total exceedances. The sample taken at SM-BUR-03-E had the highest amount of analytes exceeding the MQO with 40 total exceedances. The analytes that exceeded the MQO include the following (the number of samples that exceeded the MQO for that analyte are included in parentheses):

- Mercury (1)
- PCB 006 (1)
- PCB 007 (1)
- PCB 009 (1)
- PCB 011 (3)
- PCB 012/13 (1)
- PCB 016 (1)
- PCB 017 (2)
- PCB 018/30 (2)
- PCB 019 (1)
- PCB 021/33 (1)
- PCB 025 (1)
- PCB 026/29 (2)
- PCB 032 (3)
- PCB 035 (2)
- PCB 036 (1)
- PCB 040/41/71 (1)
- PCB 045/51 (2)
- PCB 046 (1)
- PCB 050/53 (2)
- PCB 052 (1)
- PCB 058 (1)
- PCB 059/62/75 (2)
- PCB 063 (1)
- PCB 079 (1)
- PCB 084 (1)
- PCB 086/87/97/109/119/125 (1)
- PCB 088/91 (1)
- PCB 089 (2)
- PCB 090/101/113 (1)
- PCB 093/95/100 (2)
- PCB 094 (1)
- PCB 096 (1)
- PCB 098/102 (2)
- PCB 103 (2)
- PCB 107 (1)
- PCB 108/124 (1)
- PCB 110/115 (1)
- PCB 114 (2)
- PCB 118 (1)
- PCB 122 (2)
- PCB 126 (1)
- PCB 128/166 (1)
- PCB 129/138/163 (2)
- PCB 131 (1)
- PCB 132 (1)
- PCB 133 (1)
- PCB 134 (1)
- PCB 135/151/154 (1)
- PCB 136 (1)
- PCB 137 (1)
- PCB 139/140 (2)
- PCB 141 (2)
- PCB 144 (1)
- PCB 145 (1)
- PCB 146 (1)
- PCB 147/149 (2)
- PCB 148 (1)
- PCB 150 (1)
- PCB 152 (1)
- PCB 153/168 (2)
- PCB 156/157 (1)
- PCB 158 (1)
- PCB 159 (1)
- PCB 162 (1)
- PCB 169 (1)
- PCB 170 (2)
- PCB 171/173 (1)
- PCB 172 (1)
- PCB 174 (3)
- PCB 177 (1)
- PCB 179 (2)
- PCB 180/193 (2)
- PCB 183/185 (2)
- PCB 184 (1)
- PCB 187 (2)
- PCB 188 (1)
- PCB 190 (2)
- PCB 191 (1)
- PCB 194 (1)
- PCB 195 (1)
- PCB 196 (1)
- PCB 197 (3)
- PCB 198/199 (2)
- PCB 200 (1)
- PCB 201 (1)
- PCB 203 (2)
- PCB 206 (1)
- PCB 207 (1)
- PCB 208 (1)
- PCB 209 (2)
- Total Di-PCB (3)

- Total Hepta-PCB (2)
- Total Hexa-PCB (1)
- Total Octa-PCB (2)
- Total PCBs (1)
- Total Penta-PCB (1)
- Total Tetra-PCB (1)
- Total Tri-PCB (1)

9.0 REFERENCES

Bay Area Stormwater Management Agency Association (BASMAA). 2013. Quality Assurance Project Plan. Clean Watersheds for a Clean Bay – Implementing the San Francisco Bay's PCB and Mercury TMDL with a Focus on Urban Runoff. Revision Number 1. EPA San Francisco Bay Water Quality Improvement Fund Grant # CFDA 66.202. Prepared for Bay Area Stormwater Management Agencies Association (BASMAA) by Applied Marine Sciences (AMS). August 2013.

Bay Area Stormwater Management Agency Association (BASMAA) Regional Monitoring Coalition. 2016. Creek Status Monitoring Program Quality Assurance Project Plan, Final Draft Version 3. 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 the Contra Costa Clean Water Program. 128 pp.

Surface Water Ambient Monitoring Program (SWAMP). 2018. Quality Assurance Program Plan. May 2018. 140 pp.

Attachment 2

WY 2018 Embedded Sediment Monitoring Locations and Analytical Results

Permittee	WMA	WY 2017 Sample ID	Date Collected	Latitude	Longitude	Total PCBs (mg/kg)	Mercury (mg/kg)
Belmont	60	SM-BEL-60-A	5/22/2018	37.52699	-122.27609	0.002	0.214
		SM-BEL-60-B	5/22/2018	37.52667	-122.27568	0.003	0.019
		SM-BEL-60-C	5/22/2018	37.52297	-122.27790	0.010	0.170
		SM-BEL-60-I (Dup)				0.000	0.21
		SM-BEL-60-D	5/22/2018	37.52281	-122.27776	0.020	0.226
		SM-BEL-60-E	5/22/2018	37.52200	-122.27684	0.018	0.090
		SM-BEL-60-F	5/22/2018	37.52295	-122.27849	0.023	0.119
		SM-BEL-60-G	5/22/2018	37.52701	-122.27293	0.007	0.077
Brisbane	17	SM-BRI-02-B	5/29/2018	37.68798	-122.40584	1.020	0.120
		SM-BRI-02-C	5/29/2018	37.68796	-122.40441	0.044	0.070
		SM-BRI-02-D	5/29/2018	37.68975	-122.41143	0.007	0.040
		SM-BRI-02-G	5/29/2018	37.68781	-122.40592	0.011	0.060
		SM-BRI-02-H	5/29/2018	37.68933	-122.40681	0.014	0.050
		SM-BRI-02-I	5/29/2018	37.68743	-122.40316	0.043	0.230
		SM-BRI-02-E (Dup)				0.035	0.21
Burlingame	142	SM-BUR-03-C	5/23/2018	37.59087	-122.36455	0.014	0.071
		SM-BUR-03-D	5/23/2018	37.59043	-122.36304	0.032	0.120
		SM-BUR-03-E	5/23/2018	37.59030	-122.36303	0.030	0.146
		SM-BUR-03-J (Dup)				0.031	0.14
		SM-BUR-03-F	5/23/2018	37.59119	-122.36517	0.023	0.053
		SM-BUR-03-G	5/23/2018	37.59098	-122.36502	0.029	0.060
		SM-BUR-03-H	5/23/2018	37.59134	-122.36547	0.015	0.060
		SM-BUR-03-I	5/23/2018	37.59049	-122.36408	0.033	0.075
Daly City	350	SM-DCY-01-A	5/29/2018	37.70427	-122.41417	0.009	0.060
Redwood City	379	SM-RCY-07-E	5/29/2018	37.48604	-122.21158	0.036	0.066
		SM-RCY-07-F	5/29/2018	37.48554	-122.21191	0.044	0.060
		SM-RCY-12-G	5/22/2018	37.48419	-122.21715	0.006	0.095
San Carlos	59	SM-SCS-01-O	5/22/2018	37.51538	-122.26179	0.306	0.157
	75	SM-SCS-01-P	5/22/2018	37.51643	-122.26308	0.763	0.060
	210	SM-SCS-06-M	5/22/2018	37.49772	-122.24688	0.248	0.100
		SM-SCS-06-N	5/22/2018	37.49731	-122.24662	0.060	0.050
San Mateo	89	SM-SMO-09-A	5/23/2018	37.54157	-122.30636	0.035	0.070
	408	SM-SMO-07-D	5/23/2018	37.55756	-122.30338	0.014	0.110
		SM-SMO-07-E	5/23/2018	37.55402	-122.30207	0.004	0.039
		SM-SMO-07-F	5/23/2018	37.55515	-122.30259	0.003	0.060
		SM-SMO-07-G	5/23/2018	37.55513	-122.30234	0.002	0.040
		SM-SMO-07-H	5/23/2018	37.55674	-122.30272	0.017	0.100

Permittee	WMA	WY 2017 Sample ID	Date Collected	Latitude	Longitude	Total PCBs (mg/kg)	Mercury (mg/kg)
		SM-SMO-07-I	5/23/2018	37.55757	-122.30439	0.008	0.130
		SM-SMO-07-J	5/23/2018	37.55840	-122.30395	0.009	0.130
South San Francisco	291	SM-SSF-07-B	5/24/2018	37.64722	-122.41981	0.022	0.831
		SM-SSF-07-C	5/24/2018	37.64534	-122.42094	0.209	0.064
	295	SM-SSF-04-G	5/29/2018	37.64229	-122.40323	0.010	0.105
	316	SM-SSF-01-J	5/24/2018	37.65270	-122.39367	0.031	0.050
		SM-SSF-01-K (Dup)				0.032	0.07
	359	SM-SSF-03-F	5/24/2018	37.64449	-122.39690	0.055	0.073
		SM-SSF-03-G	5/24/2018	37.64458	-122.39694	0.007	0.076
		SM-SSF-03-H	5/24/2018	37.64463	-122.39747	0.017	0.090
	362	SM-SSF-05-H	5/24/2018	37.63642	-122.40572	0.008	0.080
	1001	SM-SSF-03-E	5/24/2018	37.64792	-122.40022	0.085	0.070
		SM-SSF-05-C	5/24/2018	37.64013	-122.40653	0.060	0.057
		SM-SSF-05-D	5/24/2018	37.63774	-122.40618	0.012	0.070
		SM-SSF-05-E	5/24/2018	37.64090	-122.40648	0.015	0.102
		SM-SSF-05-F	5/24/2018	37.64025	-122.40633	0.351	0.060
		SM-SSF-05-G	5/24/2018	37.64072	-122.40652	0.014	0.176
		SM-SSF-05-I (Dup)				0.013	0.183

Attachment 3

Summary of PCBs and Mercury Monitoring Results To-date for San Mateo County WMAs

WMA ID	Permittee	Area (acres)	Area High Interest Parcels (acres)	Percent High Interest Parcels	Sediment Samples			Water Samples		
					n	[PCBs] Median (ppm)	[PCBs] Range (ppm)	n	[PCBs] Particle Ratio Median (ppm)	[PCBs] Particle Ratio Range (ppm)
210	San Carlos	141	33	23.2%	47	0.11	0 - 192.91	33	1.78	0.20 - 373.36
17	Brisbane	1,639	55	3.4%	7	0.04	0.01 - 1.22	1	--	0.11
142	Burlingame	20	9	44.3%	9	0.03	0.01 - 0.15	1	--	0.67
359	South San Francisco	23	12	51.2%	3	0.02	0.01 - 0.06	1	--	0.79
408	San Mateo	43	7	16.3%	7	0.01	0 - 0.02	1	--	1.90
60	Belmont	298	6	1.9%	7	0.01	0 - 0.02	2	0.60	0.18 - 1.02
379	Redwood City	802	110	13.7%	44	0.06	0 - 6.93	2	0.14	0.11 - 0.18
291	South San Francisco	194	64	33.1%	19	0.05	0 - 2.72	1	--	0.74
1000	Redwood City	148	108	73.0%	3	0.57	0.02 - 0.75	0	--	--
75	San Carlos	66	38	58.3%	12	0.09	0.02 - 49.4	1	--	6.14
31	San Carlos	99	27	27.2%	26	0.19	0 - 1.61	4	1.12	0.41 - 2.15
1016	San Carlos	142	27	19.0%	8	0.54	0 - 6.19	0	--	--
239	Menlo Park / EPA	36	11	29.1%	5	0.04	0.01 - 0.57	0	--	--
358	South San Francisco	32	7	21.8%	4	0.07	0.01 - 1.46	0	--	--
70	East Palo Alto	490	16	3.3%	4	0.04	0.01 - 0.34	1	--	0.11
314	South San Francisco	66	4	5.4%	2	0.10	0.05 - 0.15	2	0.91	0.86 - 0.95
294	South San Francisco	67	21	31.2%	3	0.19	0.07 - 0.28	1	--	0.37
1001	South San Francisco	413	107	26.0%	17	0.04	0.01 - 0.43	2	1.03	0.35 - 1.71
407	Redwood City	18	10	52.9%	1	0.01	0.01 - 0.01	0	--	--
85	Burlingame	121	13	10.4%	2	0.03	0.03 - 0.03	1	--	0.24
164	Burlingame	241	79	32.6%	4	0.07	0.04 - 0.09	1	--	0.45
336	Redwood City	66	4	6.6%	0	--	--	0	--	--
1011	Redwood City	507	63	12.3%	25	0.03	0 - 0.72	4	0.19	0.17 - 0.23
25	San Mateo	219	6	2.9%	1	--	0.03	1	--	0.15
149	Burlingame	480	5	1.1%	2	0.13	0.07 - 0.19	1	--	0.11

WMA ID	Permittee	Area (acres)	Area High Interest Parcels (acres)	Percent High Interest Parcels	Sediment Samples			Water Samples		
					n	[PCBs] Median (ppm)	[PCBs] Range (ppm)	n	[PCBs] Particle Ratio Median (ppm)	[PCBs] Particle Ratio Range (ppm)
266	Redwood City	91	4	4.1%	0	--	--	1	--	0.00
77	Belmont	86	4	4.7%	0	--	--	0	--	--
59	San Carlos	28	9	32.1%	3	0.18	0.04 - 0.31	0	--	--
356	South San Francisco	10	2	18.0%	2	0.02	0 - 0.03	1	--	0.09
333	Redwood City	15	4	29.4%	1	--	0.02	1	--	0.02
111	San Mateo	95	5	4.8%	2	0.06	0.05 - 0.06	0	--	--
1008	San Mateo	111	1	0.5%	0	--	--	0	--	--
139	Burlingame	63	2	3.0%	0	--	--	0	--	--
181	Daly City	75	12	15.6%	0	--	--	0	--	--
298	South San Francisco	122	3	2.7%	0	--	--	0	--	--
307	Daly City	1,277	5	0.4%	0	--	--	0	--	--
401	Millbrae	52	7	12.6%	0	--	--	0	--	--
238	Menlo Park	345	84	24.2%	4	0.14	0.01 - 0.29	2	0.08	0.04 - 0.12
67	East Palo Alto	95	11	12.0%	2	0.12	0.02 - 0.21	0	--	--
114	San Mateo	85	8	9.3%	1	--	0.23	0	--	--
295	South San Francisco	25	3	11.7%	4	0.155	0 - 0.33	0	--	--
362	South San Francisco	18	9	51.6%	2	0.234	0.01 - 0.46	0	--	--
350	Daly City	317	15	4.8%	1	0.009	0.01	0	--	--
32	Belmont	67	2	3.3%	0	--	--	1	--	0.17
317	South San Francisco	32	9	27.1%	0	--	--	1	--	0.45
66	Menlo Park	64	19	29.8%	1	0.06	0.06	1	--	0.39
1006	Burlingame	306	49	15.9%	5	0.10	0.01 - 0.14	1	--	0.36
319	South San Francisco	99	31	31.2%	1	--	0.06	1	--	0.08
318	South San Francisco	70	32	45.4%	1	--	0.01	1	--	0.27
1004	Brisbane	804	507	63.0%	4	0.02	0.01 - 0.04	1	--	0.11

WMA ID	Permittee	Area (acres)	Area High Interest Parcels (acres)	Percent High Interest Parcels	Sediment Samples			Water Samples		
					n	[PCBs] Median (ppm)	[PCBs] Range (ppm)	n	[PCBs] Particle Ratio Median (ppm)	[PCBs] Particle Ratio Range (ppm)
156	San Mateo	40	7	17.0%	1	--	0.01	1	--	0.20
323	Redwood City	185	2	0.9%	0	--	--	1	--	0.19
306	South San Francisco	37	7	18.4%	0	--	--	2	0.18	0.17 - 0.18
315	South San Francisco	108	34	31.8%	1	--	0.12	2	0.60	0.17 - 1.02
324	Redwood City	44	1	2.0%	0	--	--	1	--	0.17
141	Burlingame	62	4	6.9%	0	--	--	1	--	0.17
89	San Mateo	98	10	10.3%	2	0.02	0.01 - 0.04	1	--	0.14
327	Redwood City	126	7	5.1%	3	0.05	0 - 0.08	1	--	0.13
337	Redwood City	138	16	11.5%	4	0.04	0.02 - 0.08	1	--	0.12
293	South San Francisco	654	58	8.9%	2	0.04	0.01 - 0.07	1	--	0.12
254	Redwood City	39	4	9.9%	1	--	0.09	1	--	0.11
316	South San Francisco	117	26	21.9%	3	0.02	0 - 0.03	1	--	0.10
72	East Palo Alto	26	12	44.4%	2	0.02	0.02 - 0.02	1	--	0.08
267	Redwood City	75	16	20.9%	1	--	0.01	1	--	0.06
388	Redwood City	42	1	1.4%	0	--	--	1	--	0.05
71	Menlo Park	1,394	22	1.6%	1	--	0.01	1	--	0.04
296	South San Francisco	1,272	7	0.6%	0	--	--	1	--	0.03
292	San Bruno	220	37	16.9%	19	0.12	0 - 0.18	1	--	0.01
313	South San Francisco	77	11	14.3%	1	--	0.01	0	--	--
1005	Millbrae	791	59	7.4%	1	--	0.01	0	--	--
1007	San Mateo	87	7	8.4%	1	--	0.01	0	--	--
1014	Menlo Park	176	18	10.3%	3	0.02	0.01 - 0.03	0	--	--
354	South San Francisco	10	4	44.7%	1	--	0.02	0	--	--
403	San Mateo	48	1	1.4%	1	--	0.02	0	--	--
332	Menlo Park	17	1	5.1%	1	--	0.03	0	--	--

WMA ID	Permittee	Area (acres)	Area High Interest Parcels (acres)	Percent High Interest Parcels	Sediment Samples			Water Samples		
					n	[PCBs] Median (ppm)	[PCBs] Range (ppm)	n	[PCBs] Particle Ratio Median (ppm)	[PCBs] Particle Ratio Range (ppm)
1009	San Mateo	175	43	24.3%	2	0.03	0.03 - 0.04	0	--	--
1015	East Palo Alto	52	48	92.7%	2	0.04	0.02 - 0.06	0	--	--
253	Redwood City	280	16	5.8%	1	--	0.05	0	--	--
16	Burlingame	24	8	31.4%	1	--	0.05	0	--	--
1012	Menlo Park	54	42	79.4%	1	--	0.06	0	--	--
101	San Mateo	221	10	4.3%	1	--	0.08	0	--	--
1002	South San Francisco	316	66	20.9%	3	0.08	0.02 - 0.12	0	--	--
357	South San Francisco	17	3	18.5%	1	--	0.09	0	--	--
1010	Foster City	273	8	3.1%	0	--	--	0	--	--
1013	Redwood City	40	4	8.9%	0	--	--	0	--	--
1017	San Mateo	19	4	21.1%	0	--	--	0	--	--
120	San Mateo	10	1	4.9%	0	--	--	0	--	--
138	Burlingame	15	5	29.9%	0	--	--	0	--	--
207	San Carlos	82	7	8.2%	0	--	--	0	--	--
247	Menlo Park	239	20	8.5%	0	--	--	0	--	--
252	Menlo Park	108	5	4.9%	0	--	--	0	--	--
261	Atherton	1,679	3	0.2%	0	--	--	0	--	--
269	Redwood City	45	4	9.2%	0	--	--	0	--	--
290	San Bruno	2,017	9	0.4%	0	--	--	0	--	--
297	South San Francisco	30	2	6.7%	0	--	--	0	--	--
311	South San Francisco	111	3	2.8%	0	--	--	0	--	--
325	Redwood City	21	1	4.8%	0	--	--	0	--	--
329	Colma	806	4	0.5%	0	--	--	0	--	--
334	Redwood City	19	4	18.3%	0	--	--	0	--	--
335	Redwood City	24	0	0.0%	0	--	--	0	--	--

WMA ID	Permittee	Area (acres)	Area High Interest Parcels (acres)	Percent High Interest Parcels	Sediment Samples			Water Samples		
					n	[PCBs] Median (ppm)	[PCBs] Range (ppm)	n	[PCBs] Particle Ratio Median (ppm)	[PCBs] Particle Ratio Range (ppm)
352	South San Francisco	40	7	16.7%	0	--	--	0	--	--
378	Menlo Park	138	4	2.9%	0	--	--	0	--	--
395	Millbrae	480	8	1.6%	0	--	--	0	--	--
399	San Mateo	32	1	4.6%	0	--	--	0	--	--
405	Redwood City	22	22	100.0%	0	--	--	0	--	--
57	San Carlos	63	4	5.6%	0	--	--	0	--	--
68	East Palo Alto	317	0.5	0.2%	0	--	--	0	--	--
80	San Carlos	21	1	4.7%	0	--	--	0	--	--
90	San Mateo	21	0.3	1.4%	0	--	--	0	--	--
92	San Mateo	136	4	2.7%	0	--	--	0	--	--
Other -	Unincorporated	10,917	343	3.1%	3	0.00	0 - 0.04	0	--	--
Other -	Woodside	7,286	5	0.1%	1	--	0	0	--	--
Other -	Menlo Park	2,487	25	1.0%	1	--	0.02	0	--	--
Other -	Colma	1,139	5	0.4%	4	0.03	0 - 16.81	0	--	--
Other -	San Carlos	2,517	2	0.1%	1	--	0.06	0	--	--
Other -	East Palo Alto	274	4	1.4%	1	--	0.07	0	--	--
Other -	Redwood City	6,030	6	0.1%	6	0.07	0.01 - 0.34	0	--	--
Other -	San Mateo	5,800	55	0.9%	1	--	0.09	0	--	--
Other -	South San Francisco	1,554	3	0.2%	1	--	0.19	0	--	--
Other -	Atherton	2,315	1	0.0%	0	--	--	0	--	--
Other -	Belmont	2,511	5	0.2%	0	--	--	0	--	--
Other -	Brisbane	245	0.4	0.2%	0	--	--	0	--	--
Other -	Burlingame	1,827	9	0.5%	0	--	--	0	--	--
Other -	Daly City	1,131	11	1.0%	0	--	--	0	--	--
Other -	Foster City	2,065	0	0.0%	0	--	--	0	--	--

WMA ID	Permittee	Area (acres)	Area High Interest Parcels (acres)	Percent High Interest Parcels	Sediment Samples			Water Samples		
					n	[PCBs] Median (ppm)	[PCBs] Range (ppm)	n	[PCBs] Particle Ratio Median (ppm)	[PCBs] Particle Ratio Range (ppm)
Other -	Hillsborough	3,974	3	0.1%	0	--	--	0	--	--
Other -	Millbrae	1,309	3	0.2%	0	--	--	0	--	--
Other -	Portola Valley	5,790	0	0.0%	0	--	--	0	--	--
Other -	San Bruno	542	0	0.0%	0	--	--	0	--	--