RMP
REGIONAL MONITORING
PROGRAM FOR WATER QUALITY
IN SAN FRANCISCO BAY

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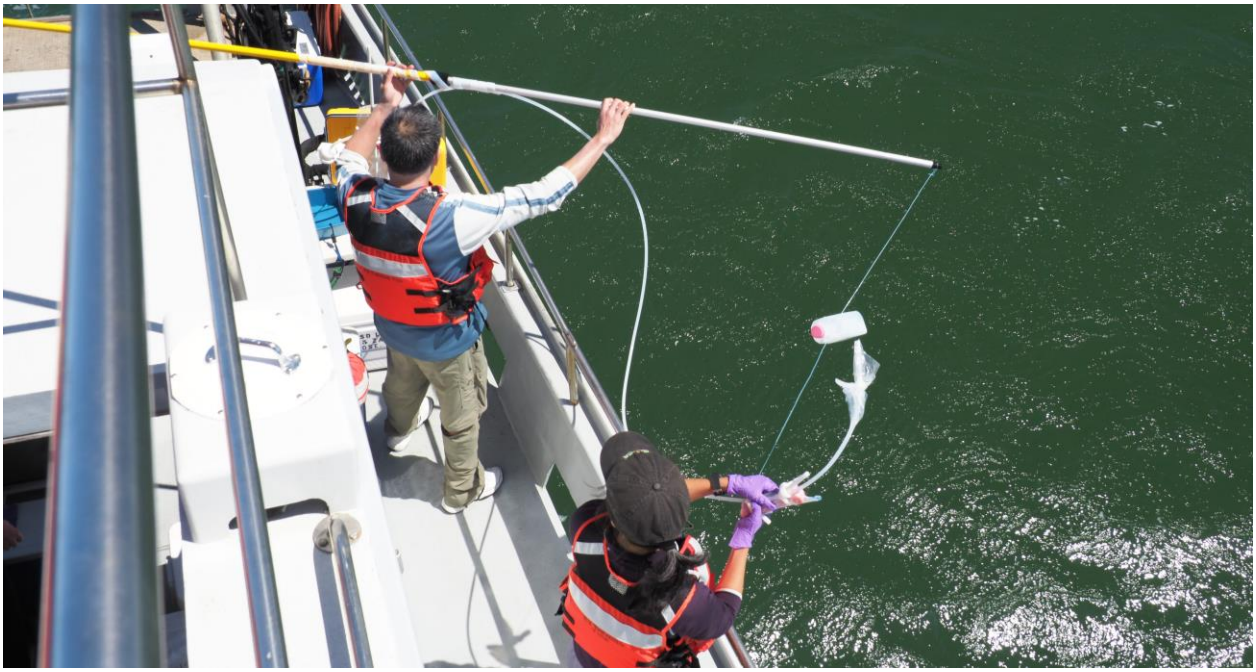

2017 RMP Field Sampling Report

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Regional Monitoring Program
for Water Quality in San Francisco Bay

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Contents

1. Introduction

Program Structure and Objectives

The Regional Monitoring Program for Water Quality in San Francisco Bay (RMP) is the primary source for long-term contaminant monitoring information for the Bay. The RMP is an innovative and collaborative effort among the scientific community, the San Francisco Bay Regional Water Quality Control Board (Water Board), and the regulated discharger community. The Program was initiated by the Water Board as a pilot study in 1989 and has been collecting water, sediment, and bivalve tissue data since its official inception in 1993. Regular monitoring of sport-fish tissue and bird eggs for toxic contaminants was incorporated into the Program in 1997 and 2006, respectively. Additionally, margins sediment monitoring commenced in 2015 and occurred again in 2017.

The Program monitors the different matrices included in "status and trends" monitoring on varying schedules. Additional monitoring occurs as part of short-term "special studies" or pilot studies focused on new regions, matrices, or contaminants of immediate or increasing regulatory interest. In 2017, the RMP conducted monitoring for contaminants in South Bay margins sediment, and in water samples as part of the Bay-wide Water Cruise.

The purpose of this report is to document how RMP Status and Trends samples were collected in 2017. The report is organized into chapters on the Water Cruise and the Margins Sediment Cruise. Each chapter contains information on:

- The locations where these samples were collected,
- The field sampling methods,
- The target analytes, laboratories, and analytical methods for each matrix,
- Any problems encountered or non-conformances to planned procedures, and
- The number and type of samples archived for short- and long-term storage.

This report does not include any of the laboratory results for the samples or other data analysis.

The appendix to this report contains details of RMP contractors, sampling locations information, a summary of analytes reported, and any additions to the running list of changes to the RMP sampling and analysis methods.

Additional information about field methods, analytical methods, and quality assurance/quality control are in the RMP's Program QAPP (SFEI, 2017c).

2. Water Monitoring for Toxic Contaminants

Background

For over two decades, the RMP has monitored water in the Bay for trace elements, organic contaminants, and conventional water quality parameters. Water sampling was conducted annually from 1993 to 2011. A biennial sampling schedule began in 2013.

Target Analytes for the 2017 Water Cruise

In 2017, water sampling covered the planned field parameters and Status and Trends (S&T) analytes including aquatic toxicity plus several add-on studies for nutrients and emerging contaminants. Nutrient parameters were collected at a single site outside of the Bay to provide data to inform boundary conditions for Bay nutrient modeling. At six sites, split samples were collected for a laboratory intercomparison study for both dissolved selenium and particulate selenium with three labs. Additional emerging contaminant samples were also collected at all sites for the analysis of bisphenols, phosphate flame retardants, and neonicotinoids. No samples were archived for future analyses.

Table 2.1 shows the full list of target analytes, laboratories, and analytical methods.

Sampling Sites

In 2017, 22 sites were sampled for water (Figure 2.1). Five of these were the historic targeted stations (BA30-Dumbarton Bridge, BC10-Yerba Buena Island, BC20-Golden Gate, BG20-Sacramento River, and BG30-San Joaquin River). The remaining 17 sites were randomly distributed through the five segments of the Bay as follows: three per segment with the exception of the Lower South Bay, which had five.

Two of the original target random sites were "pre-abandoned" during planning and replaced with alternate sites and one of the target sites was sampled farther than 200m from the target coordinates, due to access or navigation restrictions. See the “Difficulties Encountered” section to view details about these deviations from the sampling plan.

Sampling at all 22 sites in the revised station list was successfully completed. The actual station codes, field coordinates, sampling dates, samples collected, quality assurance and quality control (QA/QC) samples collected, and notes are shown in Table 2.2.

Samples for all parameters were collected at all 22 sampling locations with the following exceptions: samples for aquatic toxicity were collected at 9 stations; samples for the selenium lab intercomparison study were collected at 6 stations; and nutrients were only sampled at the historic Golden Gate station located outside of the estuary.

Figure 2.1. Map of 2017 Water Cruise sampling locations

Field Methods

The 2017 Water Cruise involved sampling at five historic sites and seventeen randomized sites from 8/29/17 to 9/7/17. All water samples were collected aboard the USGS research vessel, *RV Turning Tide*, between August 28 and September 7, 2017.

Details regarding sample containers, sample collection, field filtering, and sample handling procedures are recorded in the 2017 Water Cruise Plan (Appendix 1) and Water Cruise Report (Appendix 2).

Difficulties Encountered

Sites

Due to the unpredictable nature of sampling in the Bay and Delta, two sampling sites were unable to be sampled during the cruise. In each case, access routes around shallow flats were unable to be located; for this reason site LSB068W was replaced with site LSB073W and site SU053W was replaced with site SU054W.

In addition, site CB043W was sampled outside of the target 200m distance of the site coordinates (measured as approximately 210m) due to the shallow water depth. Use of the replacement site for CB043W would have precluded completion of the remainder of the cruise sites within the target number of days.

Hold Times

Neonicotinoid samples collected on 8/30, 8/31, 9/6, and 9/7, exceeded the planned hold time of 9 days. Samples arrived at the lab within the hold time period, but were not pre-treated in time due to mishandling of start date and shortage of containers at the lab. Only samples collected on 8/29 met 9 day hold time. Remaining samples collected were pre-treated within 15 days and are outlined below:

- 8/30 samples pre-treated on day 14 after sample collection.
- 8/31 samples pre-treated on day 12.
- 9/6 samples pre-treated on day 11.
- 9/7 samples pre-treated on day 12.

Selenium Intercomparison Study

RMP staff planned for a dissolved Se intercomparison study at 5 sites for 2017. Stations for the dissolved fraction samples were changed at the onset of the cruise to be consistent with the sampling stations for particulate Se. This included moving planned LSB073W, SB071W, and

SPB042W dissolved fraction samples to BA30, BC10, and BG20, respectively. Also, a duplicate sample for the intercomparison study was collected at BC10 instead of SU051W to save time on filtering.

Due to delayed communications from the intercomparison labs, dissolved fraction intercomparison samples collected during the first week for SIU and USGS labs, at sites BA30 and BC10 were not acidified at time of collection. When the preservation issue was identified by the labs, samples were acidified at AMS after approximately 45 hours and 96 hours to samples collected at BC10 and BA30, respectively. Consequently, a sixth sampling site, CB043W was added to the study. All dissolved fraction intercomparison samples for these two labs collected the 2nd week of the Cruise were collected in pre-preserved containers. The dissolved fraction samples for the CCSF portion of the intercomparison study were all collected non-preserved and immediately field frozen on dry ice.

One of the dissolved Se samples for CCSF was mistakenly collected in glass, while the other samples were collected in HDPE plastic.

Broken Sample Containers

The Se sample from BC10 was broken during transit to BAL. Therefore, both Se separation methods were run with the remaining sample in the 125 mL bottle.

Two 125 mL samples for dissolved Se analysis broke at BAL and the 1 L samples were used instead.

A filter container for analysis of particulate metals broke in transit and the filter was transferred into a new container at BAL.

Other

At station BC20, only one chlorophyll sample was filtered with a small GF filter and crucible provided by the lab. Due to time constraints and the difficulty of using the small filter, an additional two samples were collected and filtered using a large GF filter typically used for POC and DOC.

Nutrient samples, Ortho-P, NH4, NO2, and NO3, were collected using a FlipMate device at BC20. Multiple of the FlipMate containers spilled during transit, but the lab was given the go-ahead to complete analyses.

The blind duplicate for the particulate metals analysis was collected at SU051W instead of SPB042W due to a mistake during the day SPB042W was collected. As a result, the blind duplicate for the metals particulate analysis matched the site where the blind duplicate for dissolved metals analysis was collected.

Due to an error in deployment, the CTD data collected on the final day of the cruise was recorded as a single compilation rather than individual casts. Usable data were retrieved for four of the five stations sampled (BG20, BG30, SU052W, and SU054W), but meaningful data were not obtained for the fifth station (SU051W). Additionally, the depth bins for measurements recorded on this day will vary slightly from the typical 0.25m bins reported. Time casts appear unaffected.

Target Analytes, Laboratories, and Analytical Methods

The laboratories and analytical methods used to measure Status and Trends and add-on analytes are presented in Table 2.1 below. For a full list of subcontractors involved with the Water Cruise, see Appendix 1. SFEI maintains copies of the detailed protocols for all laboratory analyses.

Table 2.1 Target Sediment Analytes: A summary table of the 2017 target analytes, analytical laboratories, method codes, and reporting units.

Analyte Type	Analyte Group	Analyte	Number of Sites	Lab	Method	Reporting Unit
Current RMP Status and Trends Parameters	Field Parameters	Dissolved oxygen, conductivity, water temperature, optical backscatter density	22	AMS	SeaBird CTD instrument	mg/L, S/m, degC, FTU[1]
		dissolved oxygen, conductivity/salinity, pH, water temperature	22	SFEI	Hand-held YSI (556 MPS)	mg/L, µS/cm, none, degC
	Water Parameters	Particulate organic carbon	22	ALS	EPA 440	µg/L
		Dissolved organic carbon	22	ALS	EPA 9060	µg/L
		Hardness	22	ALS	SM 2340 C	mg/L
		Suspended Sediment Concentration	22	ALS	ASTM D3977-97	mg/L
		Cyanide	22	ALS	SM 4500-CN I v20	µg/L
		Particulate Copper	22	BAL	EPA 1638M	µg/L
		Dissolved copper	22	BAL	EPA 1640M	µg/L

Analyte Type	Analyte Group	Analyte	Number of Sites	Lab	Method	Reporting Unit
		Particulate selenium[5]	22	BAL	EPA 1638M	µg/L
		Dissolved selenium[5]	22	BAL	EPA 1640M[2]	µg/L
		Particulate methyl mercury	22	BAL	EPA 1630M	ng/L
		Dissolved methyl mercury	22	BAL	EPA 1630M	ng/L
	Water Toxicity Samples	Water Toxicity	9	PER	EPA 821/R-02-014	% Survival
		TIEs[3]	2	PER	--[4]	--
Add-On	Nutrients Add-Ons	Total Phosphorus	1	CCCSD	SM 4500-P E, digest: PB	mg/L
		Organic Nitrogen	1	CCCSD	SM 4500 N org B v20	mg/L
		Chlorophyll-a	1	CCCSD	EPA 445.0	mg/m^3
		Silica	1	ALS	SM 4500-SiO2 C	mg/L
		Nitrate	1	CCCSD	SM 418 D v16	mg/L
		Nitrite	1	CCCSD	SM 4500-NO2 B	mg/L
		Orthophosphate	1	CCCSD	SM 4500-P E	mg/L
		Ammonium	1	CCCSD	SM 4500-NH3 F v20,21	mg/L

Analyte Type	Analyte Group	Analyte	Number of Sites	Lab	Method	Reporting Unit
	Emerging Contaminant Studies	Particulate Bisphenols	22	SIU	ChenLab_BPs_Solid_031517	ng/g
		Dissolved Bisphenols	22	SIU	ChenLab_BPs_Water_031517	ng/L
		Particulate Phosphate Flame Retardants	22	SIU	ChenLab_OPFRs_Solid_053017	ng/g
		Dissolved Phosphate Flame Retardants	22	SIU	ChenLab_OPFRs_Water_053017	ng/L
		Neonicotinoids	22	AXYS	MLA-114	ng/L

1. FTU = Formazin Turbidity Unit
2. Method conducted with both reductive precipitation and column separation
3. Collected from BG 20& BG 30 for possible future analyses
4. The TIE evaluation will only be conducted after any results of the chronic survival test has an endpoint of less than 50% survival and after receiving written authorization from SFEI.
5. Three additional labs - ODU, CCSF, & USGS (see Appendix 1) - performed Se analyses to participate in a laboratory intercomparison study

Sampling Site Locations and Samples Collected

Table 2.2 Water Cruise sampling stations: A summary table of the 2017 field coordinates, sampling dates, samples collected, quality assurance and quality control (QA/QC) samples collected, and notes.

Site Codes	Region	Actual Latitude	Actual Longitude	Sample Date	Samples Collected[1]	Notes & QA/QC Collected[2]
BG20	Rivers (Historic)	38.05974	-121.81106	8/31/2017	FP, WP, TOX, SAO, ECAO	Replaced SAO sampling at SPB042W. 2 extra water toxicity samples collected for potential TIE analysis
BG30	Rivers (Historic)	38.02051	-121.80578	8/29/2017	FP, WP, TOX, SAO, ECAO	2 extra water toxicity samples collected for potential TIE analysis
BC10	Central Bay (Historic)	37.82158	-122.3494	8/31/2017	FP, WP, TOX, SAO, ECAO	Replaced SAO sampling at SB071W. Duplicate collected for ICPSe
BC 20	Central Bay (Historic)	37.79325	-122.67191	9/7/2017	FP, WP, NAO, ECAO	Duplicates collected for: TP, ON, Chla, Si, NOs, OP, NH4. Extra volume for lab QA/QC tests: TPx3, ONx3, Chla, NOsx3, OPx3, NH4x3
BA 30	South Bay (Historic)	37.51414	-122.13523	9/7/2017	FP, WP, TOX, SAO, ECAO	Replaced SAO sampling at LSB067W
SU051W	Suisun Bay	38.06707	-122.09318	9/7/2017	FP, WP, TOX, SAO, ECAO	Duplicates collected for: PCu, DCu, PSe, DSe, PMeHg, DMeHg
SU052W	Suisun Bay	38.06332	-122.04515	9/7/2017	FP, WP, ECAO	
SU054W	Suisun Bay	38.05083	-121.94359	9/7/2017	FP, WP, ECAO	Replaced SU053W
SPB042W	San Pablo Bay	38.03777	-122.36373	9/6/2017	FP, WP, TOX, ECAO	
SPB043W	San Pablo Bay	38.06857	-122.46705	9/6/2017	FP, WP, ECAO	
SPB044W	San Pablo Bay	38.0226	-122.39331	9/6/2017	FP, WP, ECAO	
CB043W	Central Bay	37.92638	-122.47891	9/6/2017	FP, WP, TOX, SAO, ECAO	Sampled >200m from target coordinates. Added SAO last minute.
CB045W	Central Bay	37.82911	-122.38966	8/31/2017	FP, WP, ECAO	
CB046W	Central Bay	37.64362	-122.31657	8/30/2017	FP, WP, ECAO	Duplicates collected for: PMeHg, PCu, Pse. Extra volume for lab QA/QC tests: PMeHg, PCu, PSe
SB071W	South Bay	37.62107	-122.33468	8/30/2017	FP, WP, TOX, ECAO	

Site Codes	Region	Actual Latitude	Actual Longitude	Sample Date	Samples Collected[1]	Notes & QA/QC Collected[2]
SB072W	South Bay	37.63003	-122.21366	8/30/2017	FP, WP, ECAO	Duplicates collected for: CN, SSC, DOC, POC, H, DMeHg, DCu, DSe
SB073W	South Bay	37.62424	-122.26116	8/30/2017	FP, WP, ECAO	Blanks collected for: CN, SSC, Bis, PFR, Neo, DOC, POC, PMeHg, PCu, PSe, H, DMeHg, DBu, DSe
LSB067W	Lower South Bay	37.47056	-122.06518	8/29/2017	FP, WP, TOX, ECAO	Duplicates collected for: Bis, PFR, Neo
LSB069W	Lower South Bay	3.48894	-122.08203	8/29/2017	FP, WP, ECAO	
LSB070W	Lower South Bay	37.4935	-122.10501	8/29/2017	FP, WP, ECAO	
LSB072W	Lower South Bay	37.47573	-122.07069	8/29/2017	FP, WP, ECAO	Duplicates collected for: Bis, PFR, Neo
LSB073W	Lower South Bay	37.49181	-122.08545	8/29/2017	FP, WP, ECAO	Replaced LSB068W

1. Key for samples collected:

FP: "Field Parameters" including those collected with the CTD (Dissolved oxygen, conductivity, water temperature, optical backscatter density) and those collected with the YSI (dissolved oxygen, conductivity/salinity, pH, water temperature)

WP: "Water Parameters" including dissolved organic carbon (DOC), particulate organic carbon (POC), hardness (H), suspended sediment concentration (SSC), cyanide (CN), particulate copper (PCu), dissolved copper (DCu), particulate selenium (PSe), dissolved selenium (DSe), particulate methyl mercury (PMeHg), and dissolved methyl mercury (DMeHg)

TOX: "Water Toxicity" collected at 9 sites

NAO: "Nutrients Add-Ons" collected at 1 site including analysis of total phosphorus (TP), Organic Nitrogen (ON), Chlorophyll-a (Chla), Silica (Si), Nitrate & Nitrite (NOs), Orthophosphate (OP), Ammonium (NH4)

SAO: "Selenium Add-Ons" for laboratory intercomparison study at 6 sites including analysis of particulate selenium (ICPSe) and dissolved selenium

ECAO: "Emerging Contaminant Add-Ons" including analyses of bisphenols (Bis), phosphate flame retardants (PFR), and neonicotinoids (Neo)

2. See abbreviations for QA/QC samples in the text of "Key for samples collected" above.

3. South Bay Margins Sediment Cruise

Background

Since 1993, the RMP has routinely monitored contaminants in surface sediments (top 5 cm) collected at stations in Bay waters at depths greater than 1m below mean lower low water (referred to as "open Bay"). Sediment sampling was conducted annually from 1993-2012. Biennial sampling was adopted for a brief period after 2012 (i.e., sampled in 2014), then reduced to once every four years (i.e., next sampling event to occur in 2018). Subsequently, the RMP began biennial sampling of sediment in shallower regions of the. In 2015, a pilot study was conducted to monitor margins sediment in Central Bay, where contaminant concentrations of key legacy contaminants (PCBs and mercury) were expected to be the highest. In 2017, a second round of Bay margins monitoring was conducted in regions south of Central Bay, including South Bay, Lower South Bay, and "Extreme" Lower South Bay (or the southern sloughs).

Target Analytes for the 2017 South Bay Margins Sediment Cruise

The target analytes for sediment samples collected during the South Bay Margins Sediment Cruise are summarized in Table 3.1. The table also lists the target analytes for water and sediment samples for emerging contaminant studies that were collected at the same time.

Sampling Sites

In 2017, 41 Bay margins sites were sampled between June 5 and July 20, 2017. The fieldwork for this monitoring effort was conducted by Coastal Conservation and Research (CCR) as a subcontractor to the RMP (CCR, 2017). This second round of Bay margins sampling focused on regions south of the Bay Bridge, running approximately from the San Francisco Airport to the southern sloughs and back up the eastern edge of the Bay to the Oakland Airport. Sampling sites within the study area were split into three sub-regions: South Bay, Lower South Bay, and "Extreme" Lower South Bay.

The number of sites sampled within each sub-region was proportional to the area of margins habitat located within that sub-region, including 27 sites in South Bay, 11 sites in Lower South Bay, and 2 sites in Extreme Lower South Bay. Sites were selected using a randomized probabilistic design that was applied separately to each sub-region. In addition to these 40 sites, one deterministic site was added at the mouth of Coyote Creek for the analysis of emerging contaminants parameters.

Sampling at all 41 sites in the revised station list was successfully completed. No sites were abandoned or moved during the cruise. The actual station codes, field coordinates, sampling

dates, samples collected, quality assurance (QA) samples collected, and notes are shown in Table 3.2. A map of the sampling locations is shown below in Figure 3.1.

Sediment samples from the 40 probabilistic sites were analyzed for Status and Trends parameters, including mercury, methylmercury, trace metals, PCBs, and various ancillary parameters. Of these 40 probabilistic sites, additional sediment was collected from 15 sites for selected add-on studies. Water was also collected from 11 of the probabilistic sites and the deterministic site for analysis of pesticides, musks, and bioanalytical tools analyses. The deterministic site was not sampled for field parameters, legacy contaminants, or S&T archives, but was sampled emerging contaminant studies.

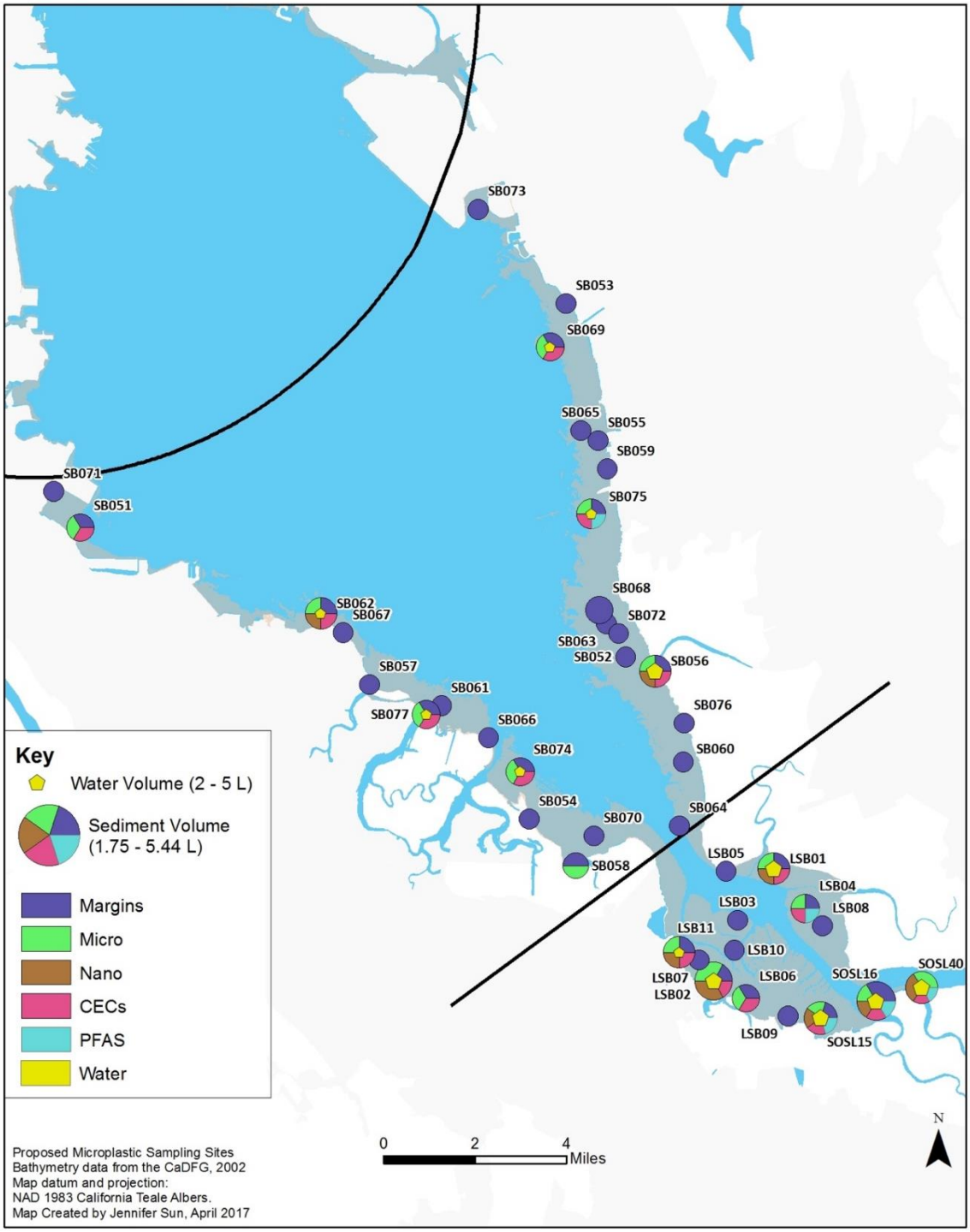

Figure 3.1. Map of 2017 Margins Sediment Sampling Locations. This is the pre-sampling map used to summarize target locations, analytes, and sample volumes. There were no non-conformances that would cause a visible difference in order to summarize the actual sampling effort. For a list of non-conformances visit the "Problems Encountered and Non-Conformances" section of this report.

Field Methods

The 2017 Margins Cruise involved sampling at forty probabilistic sites and one deterministic site. All samples were collected aboard an 18' Boston Whaler equipped with frame and hydraulics for deploying a 0.1 m^2 modified Van Veen sediment grab. All samples were collected into 1 L amber glass bottles by submerging the bottle below the water surface as far as possible based on the sampler's arm length.

Details regarding sample containers, sample collection, and sample handling procedures are recorded in the 2017 South Bay Sediment Margins Cruise Plan (Appendix 3) and Cruise Report (Appendix 4).

Difficulties Encountered

The locations of QA samples for analysis of pesticides in water were modified and a few non-targeted analyses of pesticides in water using liquid chromatography-mass spectrometry (WNTAPLC) samples were lost at the very beginning of sampling. Not enough bottles were prepared for pesticide water sampling; only one bottle was prepared for both non-targeted analyses of pesticides in water using gas chromatography-mass spectrometry (WNTAPGC) and WNTAPLC analyses, whereas two bottles were needed. This resulted in the following deviations from the original plan:

- WNTAPLC samples were not collected from LSB11 on 6/5.
- WNTAPLC samples were not collected from LSB01 on 6/6.
- Only a WNTAPLC replicate, but not a WNTAPGC replicate, was collected from LSB02 on 6/5. The WNTAPGC replicate sample was collected at SB056 on 7/17 when more bottles were available.
- Only the WNTAPGC MS/MSDs, but not the WNTAPLC MS/MSDs, were collected from SOSL16 on 6/7. The WNTAPLC MS/MSDs were collected at a SB056 on 7/17 when more bottles were available.
- Both WNTAPLC and WNTAPGC field blanks were not collected from SOSL40 on 6/6, but instead were collected from SB062 on 7/19 when more bottles were available.

The USGS Denver laboratory had a water sample vial crack during processing for the LSB11 sample. A replacement sample was collected at SB073 on 7/18.

Non-targeted analysis sediment samples sent to Duke University were delayed 24 hours due to a FedEx problem. Samples were partially thawed upon arrival.

Target Analytes, Laboratories, and Analytical Methods

The laboratories and analytical methods used to measure Status and Trends and add-on analytes are presented in Table 3.1 below. For a full list of subcontractors involved with the Margins Sediment Cruise, see Appendix 3. SFEI maintains copies of the detailed protocols for all laboratory analyses.

Table 3.1 Target Sediment Analytes: A summary table of the 2017 target analytes, analytical laboratories, method codes, and reporting units.

Analyte Type	Analyte Group	Analyte	Number of Sites	Lab	Method	Reporting Unit
Current RMP Status and Trends Parameters	Field Parameters	pH	41	CCR	Cole Parmer pH Meter - Model 20	pH
		Oxidation-Reduction Potential	41	CCR	WTW Sentix ORP	mV
	Legacy Contaminants	Grain Size	40	ALS-Kelso	ALS SOP GEN - PSP Rev 08	% dw
		Total solids	40	ALS-Kelso	EPA 160.3	% ww
		Total solids	40	AXYS	EPA 1668A HA	% ww
		Total solids	40	BAL	SM 2540 G	% ww
		Total solids	40	SFPUC	EPA 3550C	% ww
		Total Carbon; Total Nitrogen	40	ALS-Tuscon	EPA 440	% dw
		Total Hydrogen	40	ALS-Tuscon	NERL 440	% dw
		Total Organic Carbon	40	ALS-Kelso	ALS SOP GEN - ASTM Rev 09	% dw

Analyte Type	Analyte Group	Analyte	Number of Sites	Lab	Method	Reporting Unit
		Mercury	40	BAL	BAL-3101 Rev 004 - EPA 1631	mg/kg dw
		Methyl Mercury	40	BAL	EPA 1630M	µg/Kg dw
		Trace Metals: Al, As, Cd, Cu, Fe, Pb, Mn, Ni, Se, Ag, Zn	40	SFPUC	EPA 6020AM	mg/Kg dw
		PCBs: 209 Congeners	40	AXYS	EPA 1668A HA	µg/Kg dw
Emerging Contaminant Studies	Sediment Samples	Microplastics	16	University of Toronto	Note 1	Note 1
		Nanoplastic	16	University of Michigan	Note 1	Note 1
		Pesticides	12	SFEI; USGS-Sac	Note 1	Note 1
		Musks	12	SFEI; USGS-Den	Note 1	Note 1
		Non-Targeted Analysis - GC/MS	15	SFEI; San Diego State University	Note 1	Note 1
		Non-Targeted Analysis - LC/MS	15	SFEI; Duke University	Note 1	Note 1
		Bioanalytical Tools	6	SFEI; University of Florida	Note 1	Note 1
	Water Samples	Musks	12	SFEI; USGS-Sac and USGS-Den	Note 1	Note 1
		Pesticides	12	SFEI; USGS-Sac and USGS-Den	Note 1	Note 1
		Bioanalytical Tools	6	SFEI; University of Florida	Note 1	Note 1

1. The methods and units for these emerging contaminant studies will be described fully in the reports for these studies.

Sampling Site Locations and Samples Collected

Table 3.2 Margins Sediment Cruise sampling stations: A summary table of the 2017 field coordinates, sampling dates, samples collected, quality assurance and quality control (QA/QC) samples collected, and notes. All sites listed in Table 3.2 were probabilistic except for SOSL40 which was deterministic.

Site Code	Region	Actual Latitude	Actual Longitude	Sample Date	Samples Collected[1]	Notes & QA/QC Collected[2]
SB051	South Bay	37.601767	-122.362000	7/6/2017	FP, LC, STA, P, NTDN	Blank collected for: MP
SB052	South Bay	37.564817	-122.142950	7/7/2017	FP, LC, STA	
SB053	South Bay	37.676183	-122.169983	7/18/2017	FP, LC, STA	
SB054	South Bay	37.512800	-122.179733	7/17/2017	FP, LC, STA	
SB055	South Bay	37.633217	-122.155950	7/19/2017	FP, LC, STA	
SB056	South Bay	37.560516	-122.130917	7/17/2017	FP, LC, STA, P, NTDN, PM, BT	Duplicate collected for WNTAPGC. Extra volume for lab QA/QC tests collected for WNTAPLC
SB057	South Bay	37.554167	-122.244883	7/20/2017	FP, LC, STA	
SB058	South Bay	37.498400	-122.160950	7/7/2017, 7/17/17	FP, LC, STA, P	Site sampled on 7/7/17 for field parameters, legacy contaminants, and S&T archives. Sampled again on 7/17/17 for microplastics collection.
SB059	South Bay	37.624417	-122.152033	7/19/2017	FP, LC, STA	
SB060	South Bay	37.531883	-122.119017	7/7/2017	FP, LC, STA	
SB061	South Bay	37.548067	-122.216183	7/19/2017	FP, LC, STA	
SB062	South Bay	37.576433	-122.265000	7/19/2017	FP, LC, STA, P, NTDN, PM	Blanks collected for: WNTAPGC, WNTAPLC
SB063	South Bay	37.575233	-122.150950	7/7/2017	FP, LC, STA	
SB064	South Bay	37.511683	-122.120050	7/7/2017	FP, LC, STA	
SB065	South Bay	37.636233	-122.162983	7/18/2017	FP, LC, STA	
SB066	South Bay	37.538200	-122.197017	7/17/2017	FP, LC, STA	
SB067	South Bay	37.570450	-122.255933	7/20/2017	FP, LC, STA	

Site Code	Region	Actual Latitude	Actual Longitude	Sample Date	Samples Collected[1]	Notes & QA/QC Collected[2]
SB068	South Bay	37.579633	-122.154016	7/4/2017	FP, LC, STA	
SB069	South Bay	37.662500	-122.175967	7/18/2017	FP, LC, STA, P, NTDN, PM	
SB070	South Bay	37.507917	-122.154000	7/7/2017	FP, LC, STA	
SB071	South Bay	37.612767	-122.372833	7/6/2017	FP, LC, STA	
SB072	South Bay	37.572183	-122.145967	7/7/2017	FP, LC, STA	
SB073	South Bay	37.705683	-122.206017	7/18/2017	FP, LC, STA, PM	LSB11 water sample for musks lost during processing. Musks in sediment and pesticides were not sampled. Resampled at SB073 on 7/18/17.
SB074	South Bay	37.527750	-122.184000	7/17/2017	FP, LC, STA, P, NTDN, PM	
SB075	South Bay	37.609950	-122.158050	7/19/2017	FP, LC, STA, P, PFAS, NTDN, PM	
SB076	South Bay	37.544250	-122.118967	7/7/2017	FP, LC, STA	
SB077	South Bay	37.545117	-122.222117	7/19/2017	FP, LC, STA, P, NTDN, PM	
LSB01	Lower South Bay	37.498767	-122.082000	6/6/2017	FP, LC, STA, P, NTDN, PM, BT	
LSB02	Lower South Bay	37.462900	-122.105033	6/5/2017	FP, LC, STA, P, NTDN, PM, BT	Duplicates collected for: LC, MP, NP, DY, NPE, WNTAPLC. Extra volume for lab QA/QC tests collected for: SMU, WMU
LSB03	Lower South Bay	37.482233	-122.096083	6/5/2017	FP, LC, STA	
LSB04	Lower South Bay	37.486383	-122.068883	6/6/2017	FP, LC, STA, P, PFAS, NTDN	Blanks collected for: MP, SNTAP, DY, NPE
LSB05	Lower South Bay	37.497617	-122.100950	6/8/2017	FP, LC, STA	
LSB06	Lower South Bay	37.457617	-122.092033	6/8/2017	FP, LC, STA, P, NTDN	
LSB07	Lower South Bay	37.469300	-122.111000	6/8/2017	FP, LC, STA	
LSB08	Lower South Bay	37.481100	-122.061950	6/8/2017	FP, LC, STA	
LSB09	Lower South Bay	37.452150	-122.074950	6/8/2017	FP, LC, STA	
LSB10	Lower South Bay	37.472700	-122.097167	6/5/2017	FP, LC, STA	
LSB11	Lower South Bay	37.471600	-122.119150	6/5/2017	FP, LC, STA, P, NTDN, PM	
SOSL15	Southern Sloughs	37.451800	-122.061950	6/7/2017	FP, LC, STA, P, PFAS, NTDN, PM, BT	

Site Code	Region	Actual Latitude	Actual Longitude	Sample Date	Samples Collected[1]	Notes & QA/QC Collected[2]
SOSL16	Southern Sloughs	37.457600	-122.039950	6/7/2017	FP, LC, STA, P, PFAS, NTDN, PM, BT	Duplicates collected for: LC, MP, NP, DY, NPE, SP, SMU, WMU. Extra volume for lab QA/QC tests collected for WNTAPGC
SOSL40	Southern Sloughs	37.462083	-122.022217	6/6/2017	FP, P, PFAS, NTDN, PM, BT	Blanks collected for: NP, SNTAP, SP, SMU, WMU. Deterministic site.

1. Key for samples collected:

FP: "Field Parameters" including pH, oxidation reduction potential, sediment color, description of sediment composition (sand, mud, etc.), and anoxic transition depth (41 sites)
LC: "Legacy Contaminants" including analyses of sediment grain size, Sediment Quality Parameters, Mercury and methylmercury, Trace Metals, PCBs (40 sites)
STA: "Status & Trends Archives" including analyses of organics, trace metals, and Poly- and perfluoralkyl substances (PFAS) (40 sites)
P: "Plastics" including analyses of microplastics and nanoplastics as well as microplastics samples for archives (16 sites)
PFAS: samples collected and archived for the analysis of PFAS (5 sites)
NTDN: including analysis of non-targeted analysis by GC/MS and LC/MS, Dyes, and Nonylphenol ethoxylates (15 sites)
PM: pesticides and musks in sediment and water (12 sites)
BT: bioanalytical tools in sediment and water (6 sites)

2. Key for QA/QC samples collected:

S: "Standard Margins Samples"
MP: Microplastics
NP: Nanoplastics
SNTAP: Non-targeted analyses of pesticides in sediment
DY: Dyes
NPE: Nonylphenyl Ethoxylates
SP: Pesticides in sediment
SMU: Musks in sediment
WNTAPGC: Non-targeted analyses of pesticides in water using gas chromatography-mass spectrometry
WNTAPLC: Non-targeted analyses of pesticides in water using liquid chromatography-mass spectrometry
WMU: Musks in water

Sample Archives

Additional sediment samples were collected and archived at both -18 °C (short-term archive at Schaefer's) and -150 °C (long-term archive at the National Institute of Standards and Technology) for potential future analyses, including historic margins archives as well as those archived as part of add-on studies. These samples are presented below in table 3.3.

Table 3.3 Archive Sediment Sample Target Analyses: A summary table of the 2017 archive samples, storage location, and special field handling requirements.

Analyte Group	Analyte	Storage Location	Container Type	Target # of Containers in Archives	Actual # of Containers in Archives
Status and Trends	Labile NON PFC Emerging Contaminants	Schaefer's	60 ml clear short glass jar; PC class	40	42
	Non-PFC Organics or Trace Metals	NIST	22 ml standard vial, round interior - Teflon container	120	120
	Non-PFC Organics	Schaefer's	60 ml clear short glass jar; PC class	160	162
	Trace Metals	Schaefer's	250 ml PE jar	40	42
	PFCs	NIST	10 ml PP Cryovials	80	80
	PFCs	Schaefer's	10 ml PP Cryovials	120	122
Emerging Contaminants	Microplastics Archive	Schaefer's	1 L amber glass, wide-mouth jar, PC class	16	16
	Perfluorinated Alkyl Substances (PFAS)	Schaefer's	500 mL HDPE jar, no teflon lid	5	5
	Dyes	Schaefer's	125 mL short glass jar, QC class	15	18
	Nonylphenol Ethoxylates	Schaefer's	125 mL short glass jar	15	18

1. Target # of Containers in Archive = (Target # Containers / Site) * (Number of Sites).

4. References

SFEI. 2017. Quality Assurance Program Plan for The Regional Monitoring Program for Water Quality in San Francisco Bay. San Francisco Estuary Institute, Richmond, CA. http://www.sfei.org/documents/2017-quality-assurance-program-plan-regional-monitoring-program-water-quality-san-francisco-bay

5. Appendices

Appendix 1 – 2017 Water Cruise Plan

RMP
REGIONAL MONITORING
PROGRAM FOR WATER QUALITY
IN SAN FRANCISCO BAY

sfei.org/rmp

2017 RMP Water Cruise Plan

Prepared by
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Don Yee, San Francisco Estuary Institute
Amy Franz, San Francisco Estuary Institute
Phil Trowbridge, San Francisco Estuary Institute
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CONTRIBUTION NO. 845 / August 2017

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2017 RMP Water Cruise Plan

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8/25/17

1. Introduction

This report details plans associated with the annual Regional Monitoring Program for Water Quality in the San Francisco Estuary (RMP) water cruise. The RMP water sampling program was redesigned in 2002 to adopt a randomized sampling design at thirty-one sites in place of the twenty-six base program stations sampled previously. In 2007, the number of sites was decreased to twenty-two stations, and it remains as such for 2017.

2. Key Personnel and Approvals

Oversight of the 2017 Water Cruise is by AMS and SFEI senior managers shown in Table 1. These key personnel have indicated their approval of the Cruise Plan by adding their initials and date in the far right column.

Personnel participating in the cruises are shown on Table 2. AMS staff will be responsible for oversight of sampling operations, compliance with cruise plan and quality assurance guidelines, maintenance of the sample field log, chain-of-custody procedures, and CTD profiling. Captain Vallee will be responsible for vessel operation and safety. SFEI staff will alternate trace metals and ancillary sampling. Other representatives of program sponsors may be aboard the *RV Turning Tide* during portions of the cruise to observe sampling operations.

Contact information for participating laboratories are shown in Table 3.

Table 1. Approvals of Cruise Plan

Name	Affiliation	Duties	Cell	Initial and Date to Indicate Approval of Plan
Paul Salop	AMS	Cruise Manager	510-323-6523	
Phil Trowbridge	SFEI	RMP Program Manager	603-340-5220	PT 8/25/17
Jay Davis	SFEI	RMP Lead Scientist	530-304-2308	
Don Yee	SFEI	RMP QA Officer	510-508-2995	
Amy Franz	SFEI	RMP Data Manager	510-282-5012	AF 8/25/17
Rebecca Sutton	SFEI	RMP Senior Scientist (CECs)	510-701-7050	RAS 8/23/17

Table 2. Personnel for Water Cruise

Name	Affiliation	Duties	Cell
Paul Salop	AMS	Cruise Manager	510-323-6523
Aroon Melwani	AMS	Cruise Manager	831-917-9243
Winn McEnery	AMS	Cruise Manager	707-832-2091
Natalie Dornan	AMS	Cruise Manager	916-813-6592
Don Yee	SFEI	Field Sampling	650-530-0603
Amy Franz	SFEI	Field Sampling	510-282-5012
Diana Lin	SFEI	Field Sampling	714-932-8085
Jennifer Sun	SFEI	Field Sampling	949-202-6671
Phil Trowbridge	SFEI	Field Sampling	603-340-5220
Adam Wong	SFEI	Field Sampling	530-400-5192
Lawrence Sim	SFEI	Field Sampling	818-606-8467
Emily Clark	SFEI	Field Sampling	770-375-0629
Katie McKnight	SFEI	Field Sampling	252-725-9883
Shira Bezalel	SFEI	Photography	510-761-3321
Chris Vallee	USGS	Captain, RV Turning Tide	916-764-2419
Jerry Eldorado	Aloha Trans	Logistics	925-640-1600

Table 3. Laboratory Contact Information

Lab / Company	Name	Phone	Shipping Address
BAL	Lydia Greaves	206-632-6206	18804 North Creek Parkway, Suite 100 Bothell, WA 98011
ALS	Shar Sami	360-501-3293	1317 South 13th Avenue Kelso, WA 98626
PER	Scott Ogle	707-207-7760	2250 Cordelia Rd. Fairfield, CA 94534
CCCSD	Tri Nguyen	925-229-7216	5019 Imhoff Place Martinez, CA 94553
Southern Illinois University	Yan Wu (US lab contact) Da Chen (PI - email only)	618-305-5701 dachen@siu.edu	1125 Lincoln Drive Life Science II, Room 251 Southern Illinois University Carbondale, IL 62901
SGS AXYS	Sean Campbell	250-655-5834	2045 Mills Road West Sidney, BC, Canada V8L 5X2
Cutter Lab	Gregg Cutter	(757) 683-4929	Old Dominion University 4600 Elkhorn Ave. Norfolk, VA 23529-0276
USGS Lab	Robin Stewart	650-329-4550	345 Middlefield Rd. MS496 Menlo Park, CA 94025

3. Cruise Plan

3.1. Sample Process Design

All sampling will be conducted from the *RV Turning Tide*. The objectives of the sampling effort are to collect the following:

Collect Real-time Data on Field Parameters

1. Real-time data over the duration of sampling for conductivity, temperature, optical back scatter (OBS), and dissolved oxygen (DO) by AMS (1 meter CTD cast for duration of sampling, plus a full water column profile where water depth allows).
2. Water samples from 22 sites for on-board (field meter) measurement of DO, pH, salinity, conductivity, and temperature by SFEI.
3. Document current and recent weather conditions at each site.

Collect Water Samples - Total Fraction (Unfiltered water samples)

4. 22 sites (and 1 replicate and 1 blank) for analysis of Weak Acid Dissociable (WAD) Cyanide by colorimetry (ALS)
5. 22 sites (and 1 replicate and 1 blank) for analysis of SSC (ALS)
6. 9 sites (and 0 replicates) for analysis of aquatic toxicity by Pacific EcoRisk (PER). In addition, 2 extra 5-gal carboys will be collected at BG20 and BG30 each for potential TIEs.
7. 22 sites (and 2 replicates and 1 blank) for analysis of bisphenols and phosphate flame retardants (SIU).
8. 22 sites (and 2 replicates and 1 blank) for analysis of neonicotinoids by SGS AXYS
9. 1 site (and 1 replicate, plus extra samples for lab QC taken at the same site) for analysis of total phosphorous (CCCSD)
10. 1 site (and 1 replicate, plus extra samples for lab QC taken at the same site) for analysis of organic nitrogen (CCCSD)

Collect Water Samples - Particulate Fraction (Filters)

11. 22 sites (and 1 replicate and 1 blank) for Particulate Organic Carbon (POC) analysis by ALS Environmental (ALS) [1 filter per sample]
12. 22 sites (and 2 replicates and 1 blank and 1 extra sample for lab matrix spike) for analysis of MeHg by ethylation/CVAFS, Cu by column chelation and ICP-MS, and Se by column chelation and ICP-MS (BAL) [3 filters of 0.4 um pore size, 47 mm diameter per sample]
13. 5 sites for analysis of Se for lab intercomp study (Cutter lab) [3 filters per site, same type as BAL]
14. 5 sites for analysis of Se for lab intercomp study (USGS lab) [3 filters per site, same type as BAL]
15. 5 sites for analysis of Se for lab intercomp study (CCSF lab) [1 to 3 filters per site, same type as BAL] This task should be only done as filtering time allows. Try for at least one filter at all 5 intercomp stations, more than one filter as time allows. Separately packed filters if possible (small ziplocks rather than multiple in a single centrifuge tube)
16. 1 site (and 1 replicate and 1 extra sample for lab QC) for analysis of chlorophyll-a (CCCSD)

Collect Water Samples - Dissolved Fraction (Filtrate)

17. 22 sites (and 2 replicate and 1 blank) for analysis of MeHg by ethylation/CVAFS (BAL)
18. 22 sites (and 2 replicate and 1 blank) for analysis of Cu by column chelation and ICP-MS (BAL)
19. 22 sites (and 2 replicate and 1 blank) for analysis of Se by IC column separation and ICP-MS (BAL)
20. 22 sites (and 2 replicate and 1 blank) for analysis of Se by RP separation and ICP-MS (BAL)
21. 5 sites for analysis of Se for lab intercomp study (Cutter lab) in glass
22. 5 sites for analysis of Se for lab intercomp study (USGS) in glass
23. 5 sites for analysis of Se for lab intercomp study (CCSF), in HDPE
24. 22 sites (and 1 replicate and 1 blank) for analysis of DOC (ALS)
25. 22 sites (and 1 replicate) for analysis of hardness (ALS)
26. 1 site (and 1 replicate) for analysis of silica (ALS)

Filtered (using labeled FlipMate Filter Assemblies)

27. 1 site (and 1 replicate plus extra samples at the same site for lab QC) for analysis of nitrate, nitrite (CCCSD)
28. 1 site (and 1 replicate plus extra samples at the same site for lab QC) for analysis of orthophosphate (CCCSD)
29. 1 site (and 1 replicate plus extra samples at the same site for lab QC) for analysis of ammonium (CCCSD)

Table 4: RMP Samples to be Collected by Site. Numbers of samples at each site indicated.

			Cruise Date -->	8/29						8/30					8/31			9/6				9/7					
Parameter	**Type**	**Lab**	**Sampling Plan**	**BA30**	**LSB068W**	**LSB069W**	**LSB067W**	**LSB072W**	**LSB070W**	**Blank @ SB073W**	**SB073W**	**SB072W**	**SB071W**	**CB046W**	**BC20**	**CB045W**	**BC10**	**CB043W**	**SPB043W**	**SPB044W**	**SPB042W**	**SU051W**	**SU053W**	**SU052W**	**BG20**	**BG30**	**Total**
CTD profile	Field	AMS	22 sites	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	22
DO, SC, pH, T, Sal	Field	SFEI	22 sites	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	22
POC	Filter	ALS	22 sites, 1 field blank, 1 field dupe	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	24
DOC	Water - Vac Pump Filtrate	ALS	22 sites, 1 field blank, 1 field dupe	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	24
MeHg, Cu, Se	Filter	BAL	22 sites, 1 field blank, 2 field dupes, plus extra dupe at CB046W for lab QC.	3	3	3	3	3	3	3	3	3	3	9	3	3	3	3	3	3	6	3	3	3	3	3	78
Se	Filter	Cutter	5 sites + 1 dupe	3													3					6			3	3	18
Se	Filter	USGS	5 sites + 1 dupe	3													3					6			3	3	18
Se (optional)	Filter	CCSF	5 sites	1													1					1			1	1	5
CN (WAD)	Water - Unfiltered	ALS	22 sites, 1 field blank, 1 field dupe	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	24
SSC	Water - Unfiltered	ALS	22 sites, 1 field blank, 1 field dupe	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	24
MeHg	Water - Peri Pump Filtrate	BAL	22 sites, 1 field blank, 2 field dupes	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	1	1	1	1	25
Cu	Water - Peri Pump Filtrate	BAL	22 sites, 1 field blank, 2 field dupes	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	1	1	1	1	25
Se	Water - Peri Pump Filtrate	BAL	22 sites, 1 field blank, 2 field dupes	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	1	1	1	1	25
Se	Water - Peri Pump Filtrate	BAL	22 sites, 1 field blank, 2 field dupes	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	1	1	1	1	25
Se	Water - Peri Pump Filtrate	Cutter	5 sites				1						1					1			1	1					5
Se	Water - Peri Pump Filtrate	USGS	5 sites				1						1					1			1	1					5
Se (optional)	Water - Peri Pump Filtrate	CCSF	5 sites				1						1					1			1	1					5
Hardness	Water - Peri Pump Filtrate	ALS	22 sites, 1 field blank, 1 field dupe	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	24

Table 4: RMP Samples to be Collected by Site. Numbers of samples at each site indicated.

			Cruise Date -->	8/29						8/30					8/31			9/6				9/7					
Parameter	**Type**	**Lab**	**Sampling Plan**	**BA30**	**LSB068W**	**LSB069W**	**LSB067W**	**LSB072W**	**LSB070W**	**Blank @ SB073W**	**SB073W**	**SB072W**	**SB071W**	**CB046W**	**BC20**	**CB045W**	**BC10**	**CB043W**	**SPB043W**	**SPB044W**	**SPB042W**	**SU051W**	**SU053W**	**SU052W**	**BG20**	**BG30**	**Total**
Tox (& TIE)	Water - Unfiltered	PER	9 sites, extra volume at 2 sites.	1			1						1				1	1			1	1			3	3	13
Bisphenols & Phosphate Flame Retardants	Water - Unfiltered	SIU	22 sites, 1 field blank, 2 field dupes	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	25
Neonics	Water - Unfiltered	SGS-AXYS	22 sites, 1 field blank, 2 field dupes	2	2	2	4	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	50
Organic N	Water - Unfiltered	CCCSD	1 site, 1 field dupe, extra volume for QC tests.												5												5
NO3, NO2	Water - FlipMate Filtrate	CCCSD	1 site, 1 field dupe, extra volume for QC tests.												5												5
NH4	Water - FlipMate Filtrate	CCCSD	1 site, 1 field dupe, extra volume for QC tests.												5												5
Total P	Water - Unfiltered	CCCSD	1 site, 1 field dupe, extra volume for QC tests.												5												5
OrthoP	Water - FlipMate Filtrate	CCCSD	1 site, 1 field dupe, extra volume for QC tests.												5												5
Silica	Water - Peri Pump Filtrate	ALS	1 site, 1 field dupe.												2												2
Chla	Filter	CCCSD	1 site												3												3

Table 5: Containers and Handling Requirements for Samples.

Parameter	Type	Lab	Container	Handling Requirements
CTD profile	Field	AMS	None	CTD deployment
DO, SC, pH, T, Sal	Field	SFEI	None	Grab measurement on board vessel
POC	Filter	ALS	1 filter per site	Field filtered; quick freeze on dry-ice to –20C.
DOC	Water - Vac Pump Filtrate	ALS	250 ml HDPE	Field filtered (filtrate of POC sample); has 1-2 mL H2SO4 in bottle so do not rinse or overfill. Store on wet-ice. Do not freeze.
MeHg, Cu, Se	Filter	BAL	3 filters per sample, all put into 1 50-mL tube	Field filtered; quick freeze on dry-ice to –20C.
Se	Filter	Cutter	3 filters per sample, all put into 1 50-mL tube	Use the same filters and process as for BAL. Analysis by hydride generation, AAS detection
Se	Filter	USGS	3 filters per sample, all put into 1 50-mL tube	Use the same filters and process as for BAL. Analysis by hydride generation-isotope dilution ICP-MS.
Se (optional)	Filter	CCSF	1 filter per sample, 50ml tube (or ziploc)	Use the same filters and process as for BAL. ONLY as sample volume & filtering time allow, use ziploc if not enough tubes. More filters (max 3) OK if enough time, each filter & recorded vol separate (CCSF will analyze some as lab dupes if conc high enough).
CN (WAD)	Water - Unfiltered	ALS	500 mL HDPE	Do not rinse. Bottles are preloaded with NaOH. Store on wet-ice. Check pH after sample collection. Store on wet-ice. Additional NaOH may be needed to reach pH>12. In this case, additional NaOH needs to be obtained.
SSC	Water - Unfiltered	ALS	1 L	Store on wet ice.
MeHg	Water - Peri Pump Filtrate	BAL	250 ml FLPE	No rinse; has 2 ml 6% HCl preloaded in sample bottles. Store on wet-ice.
Cu	Water - Peri Pump Filtrate	BAL	1 L HDPE	Store on wet-ice. Analysis of Cu by Column Chelation
Se	Water - Peri Pump Filtrate	BAL	1 L glass	Store on wet-ice. Analysis of Se by EPA 1640 with RP separation.
Se	Water - Peri Pump Filtrate	BAL	125 mL glass	Store on wet-ice. Analysis of Se by EPA 1640 with IC column separation.
Se	Water - Peri Pump Filtrate	Cutter	1 L glass	use the same containers and process as for BAL
Se	Water - Peri Pump Filtrate	USGS	1 L glass	use the same containers and process as for BAL
Se (optional)	Water - Peri Pump Filtrate	CCSF	1 L HDPE	insufficient 1L glass for CCSF, use some of leftover HDPEs originally meant for total metals. Store on wet-ice.
Hardness	Water - Peri Pump Filtrate	ALS	125 ml PE	Store on wet-ice.

Table 5: Containers and Handling Requirements for Samples.

Parameter	Type	Lab	Container	Handling Requirements
Tox (& TIE)	Water - Unfiltered	PER	20 L carboy	Place on wet ice. Deliver to PER morning after sampling (36 hrs hold time). Collect 2 extra carboys at BG20 and BG30.
Bisphenols & Phosphate Flame Retardants	Water - Unfiltered	SIU	4 L amber glass	Fill approx ¾ full (leave headspace). Store on wet ice. 3 day hold time. AMS will ship bisphenol samples the day after they are collected except for 8/31 and 9/7. On 8/31, SFEI will deliver samples to FedEx, boat should be returning to dock early for nutrient sample delivery. On 9/7, if there is not time for same-day delivery, AMS will ship the following Monday.
Neonics	Water - Unfiltered	SGS-AXYS	2 1-L amber glass per site	Amber glass, fill with 1-2 cm headspace. Keep in dark and cooled at 4 deg C (wet ice). (9-day hold time in the dark at 4 deg C). AMS will ship samples on blue ice overnight on 8/30, 9/5, 8/11.
Organic N	Water - Unfiltered	CCCSD	HDPE	Do not field filter. Collect full bottle with 0.5" headspace for mixing. Do not flush container because of preservative. Add H2SO4 to the container beforehand, about 0.5-ml per liter. Check the pH when you are back on land and add more acid as needed to achieve pH<2. Use pH paper provided by lab. Keep at or below 4 deg C. 3 samples at BC20: sample, field dupe, extra volume for MS/MSD.
NO3, NO2	Water - FlipMate Filtrate	CCCSD	FlipMate Unit, 125 mL container	Field filter via FlipMate after collection. Collect full bottle with 0.5" headspace for mixing. Do NOT acidify. Keep at or below 4 deg C. 3 samples at BC20: sample, field dupe, extra volume for MS/MSD.
NH4	Water - FlipMate Filtrate	CCCSD	FlipMate Unit, 125 mL container	Field filter via FlipMate. Collect full bottle with 0.5" headspace for mixing. Keep at or below 4 deg C. 3 samples at BC20: sample, field dupe, extra volume for MS/MSD.
Total P	Water - Unfiltered	CCCSD	HDPE	Collect full bottle with 0.5" headspace for mixing. Preserve with H2SO4 to a pH < 2 by preloading bottls with H2SO4 day of, and test with pH strips; add additional acid as necessary. No field filtering. Keep at or below 4 deg C. 3 samples at BC20: sample, field dupe, extra volume for MS/MSD.
OrthoP	Water - FlipMate Filtrate	CCCSD	FlipMate Unit, 125 mL container	Field filter via FlipMate within 15 minutes of collection. Collect full bottle with 0.5" headspace for mixing. Keep at or below 4 deg C. 3 samples at BC20: sample, field dupe, extra volume for MS/MSD.
Silica	Water - Peri Pump Filtrate	ALS	500 mL HDPE	Field filtered (BAL cartridge filters). Store at 4 deg C (28 day hold time). Mark as saltwater on COC.
Chla	Filter	CCCSD	1 filter (25 mm GF/F filter)	Use provided porcelain filter crucible and filtration flask. Field filter at least 100 mL (as much as practical on each filter) within 2 hours of sample collection. Place filter in centrifuge tube and freeze on dry ice. Keep frozen if not delivered day-of. (deliver ASAP, 1 day hold time). Record sampled volume on COC. Do NOT add methanol (will extracted with acetone).

3.2. Sampling Methods

Field Parameters

CTD Profiler

The following steps describe the CTD deployment and data management process:

1. Initialize CTD via laptop.
2. Disconnect communication cord from CTD and replace rubber cap.
3. Ensure that rope is securely fasted to vessel and to CTD containment cage.
4. Ensure that DI syringe is disconnected from CTD input.
5. Turn CTD on by moving switch completely to on position (fully up).
6. Place CTD into the water, with intake approximately 1 meter below water surface (typically a bit lower in the column to allow for any seas).
7. Leave CTD deployed for duration of sampling.
8. When sampling is completed, slowly lower CTD to the bottom (at a rate less than 1' per second) until rope goes slack or the end of the rope is reached. With strong currents, the rope may extend at a severe angle precluding its reaching the bottom. As soon as the CTD reaches the bottom, immediately begin moving to surface so as to minimize the amount of sediment pulled into the intake. The CTD can be moved to the surface at any rate as data is only collected on the downcast.
9. When CTD is at the surface, return to the vessel deck and place the switch in the off position (fully down).
10. Download the data between stations.
11. At day's end (or after stations where CTD intake may have become fouled with sediment or vegetation) rinse the CTD with distilled water, flush the intake with a minimum of three syringes full of distilled water, and store the CTD with a full syringe of DI inserted onto the intake and partially emptied into the CTD.
12. Replace batteries when battery level drops below 7 volts.

YSI Hand-Held Field Meter

Field parameters (DO, conductivity, salinity, and pH) will be collected using a YSI water quality meter provided by SFEI. The YSI meter should be calibrated for conductivity, pH, and DO at the start of each day, and calibration results recorded on the station field sheet and laptop access form. When recording field readings, the sampler should ensure that the YSI electrode is fully submerged and not surrounded by any bubbles.

The following steps describe the YSI deployment and data management process:

Programming the YSI

1. Hit 'Esc' to go to menu
2. Arrow down to "Logging Setup"
3. Go to 'edit site list' – delete old sites or just add in new sites
4. Enter sites then press enter to store the site
5. Hit 'esc' to get out of the menu

Calibrating the YSI

- Calibrate the YSI for conductivity, pH and DO once per day at the beginning of the day prior to sampling
    - Conductivity
        - fill the calibration cup 1/3 full with 12,800 uS/cm standard (enough to submerge both the metal tip probe with no trapped air pocket in the side port – note that the port assembly has substantial volume and may overflow the cup if it is overfilled)
        - submerge the probe in the calibration cup, and allow the meter reading to equilibrate
        - hit 'esc' to go to menu, go to 'calibrate,' and choose 'Specific Conductance' (NOT 'Conductivity')
        - set the calibration standard to 12.8 mS/cm, and press enter to calibrate
    - pH
        - fill the calibration cup 1/4 full with pH 7 buffer (probe is near the tip)
        - submerge the probe in the calibration cup, and allow the meter reading to equilibrate
        - hit 'esc' to go to menu, go to 'calibrate,' choose 'pH', and choose '2 point'
        - set the calibration standard to 7, and press enter to calibrate
        - pour out the pH 7 buffer, rinse the cup and probe, and repeat with pH 10 buffer
    - DO
        - fill the calibration cup about 1/8 full with DI water, screw on to the probe, and shake vigorously to wet the DO probe
        - unscrew the cup and pour out the water
        - loosely screw the cap back onto the probe, and allow the meter reading to equilibrate
        - hit 'esc' to go to menu, go to 'calibration,' choose 'DO 2 mil PE (Blue),' choose 'DO %,' and set the barometric pressure to 760 mmHg (sea level)
        - press enter to calibrate
- Rinse the probe and calibration cup with DI water in between calibrations. Make sure the calibration cup is dry before adding new calibration solution.

- No calibration is needed for salinity or temperature

Running the YSI

1. hit ‘esc’ to go to the menu
2. go to logging setup menu and set the logging interval to 5 minutes
3. go to ‘start logging’ and press enter
4. select site from site list and press enter
5. screw the metal cage onto the probe sensor assembly
6. lower the probe sensor assembly to 1 m below the water surface, and fix cable to the boat railing to keep the probe at that depth for the duration of the time on station
7. to stop logging – go to ‘stop logging’ and hit enter
8. record DO, pH, salinity, conductivity, temperature, site code, and sampling date/time on the YSI field sheet, usually requested near start or middle of time on station

Lab Parameters

Pump station set-up, sample collection, and take-down

Trace metal samples will be collected using clean hands-dirty hands protocol. This requires three samplers:

1. Red text = "Super Dirty" = no gloves (touches pump and table, sampling pole, bungees)
2. Orange text = "Dirty Hands" = vinyl or nitrile gloves (vinyl is ideal for Trace Metals sampling) (touches outer bags, un-bagged bottles, ringstand & clamps, covered pump switches, coolers, weight and float set-up)
3. Green text = "Clean Hands" = vinyl gloves (optionally nitrile inside) provided by BRL for Trace Metal sampling and nitrile gloves for CTR sampling (touches double-bagged bottles and "inside" bag, last 3 inches of tubing, and filter only)

Replace gloves as frequently as needed if a contaminated surface is touched or a glove is ripped

STATION SET-UP (first station of each day)

1. Super Dirty sets up table, pump, and tubing stand. Wrap the middle of the plastic tubing holder on the sampling pole.
2. Dirty puts on a pair of nitrile gloves and opens the outside bag of vinyl gloves, optionally opening the inner bag without directly touching the bag (e.g. using inner face of outside bag to peel apart inner bag opening)
3. Clean puts on nitrile gloves, opens inner bag if needed, and pulls out a pair of vinyl gloves by the cuffs and puts them on carefully, touching a minimum of the glove outside with nitrile (e.g. touch the cuff only on the first glove. Once one hand is in vinyl, minimize touching the cuff of the first glove, which was semi-dirtied by touching with nitrile).
4. Once Clean puts vinyl gloves on – DO NOT TOUCH ANYTHING – HANDS OFF EVERYTHING EXCEPT INSIDE THE TUBING BAG AND TUBING ENDS
5. Dirty opens outside tubing bag.
6. Clean opens inside tubing bag and pulls out the tubing by grabbing both ends (2-3 inches from the ends) and holding the middle loops. Be careful not to allow either end of the tubing to touch other surfaces on the boat (personnel, clothing, etc). Do not let go of tubing. It is acceptable to allow the middle of the tubing to touch other surfaces if necessary for maneuvering the tubing ends, though this should be minimized if possible.
7. Dirty grabs the tubing at the joint between the rubbery and teflon tubing, and attaches outtake side of tubing (rubbery side near the join with teflon tubing)) to the pump and stand (handling only the stand, clamp, and tubing 6" or more from the end - only Clean touches the last 3 inches of tubing).
8. Dirty covers the pump face (switches etc) with the now empty tubing bag, tucking under bungees, taking care not to touch exposed tubing end (only at first station of each day).
9. Super dirty gets the bag with the floats, weights and ties from storage spot and opens the bag. Dirty gets the floats, weights and ties out of the bag and attaches the weight to the float and the float to the sampling pole using weedwacker line. Attach the weight to the intake end of the teflow tubing using the Masterflex ties, leaving at least 1.5 feet free at the end of the teflon tubing to avoid contamination by the float or weight. Orient the weight such that the free end is pointing

towards the end of the tubing. Clean should continue holding the end of the tubing during this process.

10. Super dirty wraps the plastic holder around the tubing to secure it to the sampling pole (in the midsection of the pole only: the inlet end should be free to angle downward into the water, and the pump end should be free enough to allow lifting of the pole around the rail), and maneuvers pole upward and outward over edge of boat.
11. When ready to deploy, clean hands releases intake end of tubing. Super dirty secures the sampling pole to the boat railing and heavy coolers using bungees. Pole should be pointing out perpendicular from the side of the boat to maximize distance of inlet from the boat.

SAMPLING PROCEDURE

12. Dirty opens cooler. Super Dirty secures cooler open with duct tape or bungee, and arranges coolers/buckets/seats to suit Dirty & Clean preferences.
13. Run the pump at least one minute to flush. Dirty should rinse off gloves in the flush stream, taking care not to touch exposed tubing.
14. Super dirty fills POC/DOC bottle, (and any others that require field filtering) and takes it to the filtering station
15. For each sample, Dirty opens outside bag.
16. Clean opens inside bags and handles & fills bottles with Dirty controlling the pump on/off switch.
17. Dirty fills bottles that are not double-bagged.
18. Fill all total fraction bottles. Clean handles ONLY double-bagged bottles and inner bags.
19. Hand all filled bottles to super dirty to arrange in a storage cooler.
20. When all total fraction bottles, are filled, Dirty opens the outer bag of the filter.
21. Clean pulls out the filter and attaches it to the end of the tubing and puts the inner filter bag back inside the outer..
22. Dirty arranges the clamp jaws to hold the filter. Dirty closes and drops the empty outer filter bag into the cooler – the inner filter bag will be later used to cover the teflon tubing end during transit.
23. Run the pump one minute to flush. Especially at stations where the water looks cloudy/dark in the POC and other bottles, don't run too long, or filter will clog and blow itself off from backpressure.
24. Fill all dissolved fraction bottles.
25. Once done with all samples, Dirty opens the outer filter bag, and clean pulls out the inner filter bag, which will be used to cover the intake end of the tubing during transit.
26. Super dirty pulls pole up.
27. Dirty grabs the weight, careful not to let the intake end strike anything.
28. Clean grabs the intake end of the tubing about two inches above the end, and covers it with the empty inner filter bag (or alternatively an unused plastic glove). The weight is placed in the overflow sink with the covered end not touching anything but pointing in a direction to minimize accidental contact. Avoid laying the tubing on the deck of the boat as much as possible.
29. Leave the filter on the outtake end of the tubing during transit.

At subsequent stations, before beginning the steps listed above:

30. Dirty unclamps the filter and hold the bottom of the filter to stabilize it while Clean removes the filter from the outtake end of the tubing. Clean will touch ONLY the top end of the filter where it joins with the tubing (ie. where the filter has not touched the dirty clamp or previous station's site water)
31. Dirty moves the filter clamp jaws out of the way, being careful not to touch the outtake end of the tubing

32. Super dirty maneuvers the pole upward and outward over the edge of the boat, while Dirty holds the intake end of the tubing by the weight. When ready to deploy, Dirty removes the filter bag (or plastic glove) cover, being careful not to touch the end of the tubing. Super dirty makes sure the pole is extended upward & outward enough, then dirty releases the weight and attached tubing, allowing it to drop outward and downward into the water without striking the boat or anything else.
33. Super dirty secures the sampling pole to the boat railing and heavy coolers using bungees.
34. Proceed to step 12

35. At the end of the day, the weight and ties are removed from the tubing, with the tubing stored in the discarded inner bag from the days tubing, and the weight and ties placed in used outer bag.

Sample labeling

AMS field staff will print out and provide sample labels to sampling personnel prior to arrival on station. The sample ID naming convention is as follows:

RMP-17WC-xxxx

where xxxx is a four-digit number assigned by the sample tracking and labeling application.

For double bagged samples, printed labels are dropped inside the outer bag, and a sharpie is used to write the site code and fraction (T or D) on the label on the outer bag. Labels should be attached directly to bottles without bags, and the site code, analyte, and fraction should be written on the bottle lid.

POC filters should be individually wrapped in foil provided by ALS, which will be placed inside ziplock bags. The ziplock bag should be labeled with the filtered volume.

Blank sample collection

One field blank will be collected prior to field sample collection at station SB073W. This blank will be taken at the beginning of the day, before any other sample collection, to ensure the sample is collecting using a clean sampler (ie. no site water contamination). Prior to field blank sample collection, sample tubing is rinsed with lab blank water for at least 30 seconds (may vary depending on how much water is provided by labs and how much is required for analyses - pump rate is about 1L per minute).

DI water will be provided by BAL for metals, ALS for ancillary parameter blanks, and SIU for bisphenols/phosphate flame retardants (combined sample). Because there is only one POC and DOC field blank, it will be collected from filtered blank waters.

Sample Collection

Sample tubing must be rinsed with site water prior to any sample collection for at least a minute (total fraction) and for only one minute (dissolved fraction, to not clog the filter). The overflow sink drains to a 5 gallon bucket or water jug to avoid contaminating the site with water flowing off the boat deck. If a blank sample will be collected that day, do not attach the float and weight or flush the sampler until after the blank sample has been collected.

The “clean hands” sampler will rinse all bottles without preservative with site water before filling - for ancillary and trace metal samples, all non-preserved sample containers should be rinsed at least twice. To rinse, partially fill a bottle (5-10 seconds, enough to rinse the interior surface), close the cap, shake/swirl thoroughly, and dispose of the rinsate. Bottles with preservative are filled directly, without overflowing. Bottles that will be frozen are filled to 3/4 of the total bottle volume (none on this cruise). See Table 8 for a list of sample bottles by parameter and bottle handling instructions.

Sampling Stations

Samples will be collected at two pump and tubing set-ups, each corresponding to a pump and pre-cleaned sampling tubing assembly. Metals and ancillary parameters will be collected at station 1; and toxicity samples will be collected using a high-volume pump at station 2.

DOC/POC samples will be collected as whole water samples at the metals sampling station, and will be filtered using a vacuum pump and pre-ashed filters inside the boat cabin. Bisphenol/phosphate flame retardant samples will be collected by submerging the sample bottle using a steel sampling pole, and neonicotinoid samples will be collected the same way with the 1-L bottle sampling pole.

Staff will be roughly assigned to sampling stations in the following order:

- Staff 1 (Team 1) - Station 1 “clean hands”
- Staff 2 (Team 1) - Station 1 “dirty hands”
- Staff 3 (Team 2) - Station 1 “super dirty hands”, help setting up toxicity station and with CEC sampling, nutrients
- Staff 4 (Team 2) - CEC sampling, toxicity sampling, POC/DOC filtering, metals particulates filtering
- Staff 5 - CTD, YSI, labeling, help with CEC sampling and toxicity sampling

Additional staff will assist with sample labeling, organization, and equipment cleaning.

Station 1: Metals & Ancillary parameters

A low-volume peristaltic pump will be provided by SFEI and 9 sampling tube assemblies (one each for 5 sampling dates and 4 backups) will be provided by SFEI and pre-cleaned by BAL. Each tubing assembly consists of 16 ft of PVDF and 3 ft of silicone tubing attached with zip ties.

Samples should be collected using clean hands-dirty hands technique in the order listed below. Bagged samples should be collected before unbagged samples within each group (unfiltered samples, and later for in-line filtered samples).

A. DOC/POC

Wear nitrile gloves and filter samples inside the boat cabin to protect bottles from the sun. DOC/POC filtering will serve as rinsing between trace particulate metals filtering, so avoid contamination.

Particulate organic carbon:

1. Rinse with site water and collect samples into clean 2 L sample bottles (metals sampling station)
2. Rinse filter apparatus with squirts of ~100 mL of lab DI water, rinse funnel (potentially with carryover particulates from prev station/cabin environment, especially on the shoulder and/or bottom edge in contact with filter) separate from fritted glass support-keep funnel from touching support unless there is a filter in between.
3. Place pre-ashed filter on the filter apparatus with the grid side facing down. The grid side will have a faint imprint or cross-hatching from resting on a screen during manufacture. That side should stay down in sampling.
   Remove filters from packaging using forceps only
   i. Be sure not to knock filter off center when placing funnel on
   ii. If filter repeatedly moves off center, briefly turn on vacuum to suck it into position while attaching funnel
4. Swirl sample and pour out measured volume of water using graduated cylinders. Record volume and pour all contents into funnel. If filtering fast, quickly prepare for next addition.
5. Swirl sample holding bottle, and add water in 20-100 mL increments to graduated cylinder (add less each time as filter slows), record volume, and dump entire grad cylinder contents to funnel, repeat until filter clogs. Drip rate of around 1 drop per second is enough, move onto next filter.
   i. As fluid level approaches the shoulder of the funnel, check for settled material, and especially if filter nearly clogged/last addition, swirl to knock material off.
   ii. **Do not let filter run dry between additions, and turn off pump well in advance as residual vacuum continues to pull quickly especially when filter is not clogged. Do not add water too quickly or in large volumes: water may become trapped on top of clogged filter. On final addition for a given filter, filter can run dry.**
6. Keep track of total amount of water filtered and record this amount on the field sheet. Also record the pre-assigned number of the filter on the field sheet

i. A contingency if you messed up the volume recording, if there is a balance on board, weigh the filtration flask when done with filter, and after emptying to determine volume of water by difference (convert weight to volume based on station salinity). Worry about getting the filter packed away first though.

7. Carefully lift filter funnel/funnel straight up to avoid knocking off filtered material. Leaving filter pump on can help prevent filter lifting with funnel.
8. Fold filter in half carefully to not expose any filtered material, and taking care not to touch filtered material with forceps. Use a second pair of forceps or the filter funnel if necessary to flatten/fold filter. Try and observe dominant grain of fibers, filter will fold more easily along that direction
9. Individually wrap filters in foil pouches provided by ALS using forceps, and place these pouches inside ziplock bags along with pre-printed label.
10. Label the ziplock bags with the filtered volume and immediately freeze the sample on dry ice.
11. At end of day rinse off collection bottles with DI. Close collection bottles to avoid collecting dust overnight.

Dissolved organic carbon

1. Pour some of the filtrate (water in the bottom of the flask after the POC sample has been collected on the filter) into 250-mL bottles (this will be the DOC fraction).
   *Make sure there is no head space, but do not overfill to keep preservative intact.
2. Refrigerate the DOC, do not freeze.
3. *(skip if particulate metals to be done)* Rinse filtration apparatus with DI between stations, and wipe off and rinse with DI any material accidentally left on forceps when done.

B. Particulate (MeHg, Cu, Se)

1. Rinse filter apparatus with 10% HCl on the boat deck (or into the boat sink) at the beginning of each sampling day. Thoroughly rinse with DI after.
2. Collect samples into cleaned (1x DI rinsed and drained between stations, then 3x rinsed in site water at current site) extra 1 L HDPE bottles from BAL for metals. For intercomp stations, plan on up to 8L (2L max per intercomp lab)
3. *(skip if DOC/POC done immediately prior)* Rinse filter apparatus with squirts of ~100 mL of lab DI water, rinse funnel (potentially with carryover particulates from prev station/cabin environment) separate from fritted glass support- keep funnel from touching support unless there is a filter in between.
4. Place polycarbonate plankton filter on the filter apparatus.
   Remove filters from packaging using forceps only
   i. Be careful to not knock the filter off center placing funnel on
   ii. If filter repeatedly moves off center, briefly turn on vacuum to suck it into position while attaching funnel
5. *(skip if DOC/POC done immediately prior)* Pour 100 mL of lab DI water through filter. Discard that water.
6. Swirl sample and fill graduated cylinder with ~250 mL sample (we will filter as much water as reasonable through each filter, up to 2L max for 3 or fewer filters. Based on experience with POC sample, guess the amount that will easily filter, the polycarbonate filters usually have ~25% less capacity, so add less based on best judgement if the POC was already clogged at 250ml).
   i. For intercomp sites use similar procedure but spread filters for each lab across collected holding bottles (see item 12 below)
7. Rather than refill the grad cylinder and add to filter from the cylinder in increments, because we can mix the holding bottle much more easily, swirl sample holding bottle, and add to graduated cylinder in 20-100 mL increments (amount based on how slow filter already is) record amount, and dump entire grad cylinder content into funnel, and repeat until filter clogs. Drip rate of around 1 drop per second, move onto next filter.
   i. As fluid level approaches the shoulder of the funnel, check for settled material, and especially if filter nearly clogged/last addition, swirl to knock material off.
   ii. **Do not let filter run dry between additions, and turn off pump/release sidearm clamp well in advance as residual vacuum continues to pull quickly especially when filter is not clogged. Do not add water too quickly or in large volumes: water may become trapped on top of clogged filter. On final addition for a given filter, filter can run dry.**
8. Keep track of amount of water filtered and record this amount on the field sheet. You should have been recording volume added to grad cylinder each time before dumping into funnel. Also record the pre-assigned number of the filter on the field sheet IF there is one (more likely for POC than metals filters)..
   i. A contingency if you messed up the volume recording, if there is a balance on board, weigh the filtration flask when done with filter, and after emptying to

determine volume of water by difference (convert weight to volume based on station salinity).Worry about getting the filter packed away first though.

9. Remove filter and carefully fold and place filter in 50 mL centrifuge tubes.
10. Repeat steps 4-9 for second and third filter. BAL is fine with all filters in one tube, final volume for all filters combined recorded.
11. For dupe or Se intercomparison sites, set up 2 filtration stations with Y connector attached to two filtration flasks with pinch locks on each set up tubing to allow independent control*. Be careful to keep track of volume filtered through each filter.
    i. The pinch lock may be counterintuitive as one of the filters get clogged. When filter clogged, the pinch traps the vacuum in the sidearm flask. If in doubt, vacuum off, all pinch locks open will (eventually) get to ambient pressure. When running 2 stations simultaneously, really focus on the faster flowing station until it's kind of slow. It may be wise to just do one (other pinched closed) until slow enough to not need to do panic speed refills.
12. For Se intercomparison sites, combine up to 3 filters, from up to 2L volume, for each lab into one vial. The order for the combinations should be somewhat randomized using the following procedure in case there is a general trend (partitioning, settling) over time:
    i. Prepare 3 vials, one for each lab, hypothetically called A, B, C;
    ii. Put first completed filter (filter 1) into Vial A, 2 in B, 3 in C;
        1. If there is leftover volume in a holding bottle after filter 3 save for CCSF particulate sample. Start with new holding bottle for filter 4
    iii. Put filter 4 into B, 5 into C, and 6 into A;
        1. If there is leftover volume in a holding bottle after filter 6 save for CCSF sample. Start with new holding bottle for filter 7
    iv. Put filter 7 into C, 8 into A, and 9 into B. (If 2L got through 2 filters this step moot)
        1. Save leftover volume for CCSF particulate composite
    v. CCSF intercomp sample is done as time allows, combine leftover unfiltered water bits from bottles for 3 other labs as a composite, and filter as much as time allows. (other labs get composite by including filters from multiple holding bottles, CCSF composite is from combining leftover volumes in the partial used bottles for other labs)

13. Once completed all filters go into freezer/on dry ice
14. At end of day rinse off collection bottles, filter units, and filter flasks with DI. Close collection bottles to avoid collecting dust overnight.

C. Unfiltered Water Samples

1. CN-WAD

   Bottles are pre-loaded with NaOH pellet, and should be preserved to a pH > 12. After sample collection, check pH with pH strip. If additional NaOH is necessary, then need to obtain NaOH pellets for the following cruise dates since the lab did not provide additional NaOH.

2. SSC
Because ALS only sent 1L bottles, guesstimate the sample volume to collect for each station. As a rule of thumb: at any stations deeper than 20 ft with only a hint of color in POC water bottle (Central Bay, Golden Gate), collect 1L. If the sample is slightly cloudy, collect around 500 mL or a bit less (½ full). If the water is cloudy (brownish around the boat, less than 6 ft depth, rocked by wind/waves) collect around 250ml (¼ full). Most sites should be in the slightly cloudy category.

Completed water samples are kept refrigerated or chilled in coolers with wet ice or ice packs (0 to 5 C)

D. Dissolved (or Filtered) Water Samples

After collecting whole water samples, the "clean hands" sampler should attach a pre-cleaned filter provided by BAL to the end of the tubing. The "dirty hands" sampler should use a clamp to hold the filter in place. The filter should be flushed for at least 1 minute before collecting the first dissolved sample.

Fill the containers for the parameters listed above. Bagged samples should be collected before unbagged samples.

1. Trace metals (Cu, Se)
2. MeHg (bottles pre-loaded with HCl preservative - no rinse)
3. Hardness

Completed water samples are kept refrigerated or chilled in coolers with wet ice or ice packs (1 to 5 C)

Station 2: Toxicity

A high-volume peristaltic pump will be provided by AMS and 9 sampling tube assemblies (one per toxicity station) will be pre-cleaned by Pacific Eco Risk. Collect samples into a 5 gallon carboy and place the bottle label directly on the bottle. Sampling personnel should use gloves (nitrile or vinyl OK) while handling the pump and tubing. Bottles should be left with some headspace after filling, surrounded by wet ice, and transported to the laboratory as soon as possible, but well within maximum hold time of 36 hours.

For sites where extra water is collected for TIE analysis (sites BG20 and BG30), two additional carboys will be collected.

Station 3: CECs: Bisphenols and Phosphate Flame Retardants, and Neonicotinoids

Prior to sampling, rinse the outside of bottles in site water before opening the cap. Only remove cap with clean hands in nitrile gloves.

Bisphenol samples will be collected by submerging the sample bottle using a steel sampling pole. Fill containers with about 3L of water (3/4 full). Slowly pull the sampling pole directly out of the water and into the boat with the non-sampling end angled upwards until the bottle can be reached. Pour off any volume required to reach optimal level and cap as soon as possible. Phosphate flame retardants will be analyzed from the same sample.

Neonicotinoid samples will be collected in the same way as the bisphenol samples, leaving 1-2 cm of headspace in the bottle (1L amber glass). Two 1-L bottles will be filled for each sample, with the second bottle collected as backup. Sample bottle will be filled by submerging the sample bottle.

Completed water samples are kept refrigerated or chilled in coolers with wet ice or ice packs (1 to 5 C)

Station 4: Nutrients (Site BC20 only)

A. Dissolved
    a. Nitrate, Nitrite:
        1. Assemble labeled FlipMate unit. FlipMate units are an assembly of filters and cups that make it easy to collect filtered sample with the use of two threaded digestion cups, tubing (provided), and vacuum pressure. The sample is placed in one cup, the filter assembly threaded onto the top of the cup, then the cup and filter are flipped, the receiving cup attached, vacuum tubing attached, vacuum pressure applied, and the sample is then pulled from the sample cup, through the filter assembly, and into the empty cup. FlipMate units come with different filter sizes.
        2. Remove the filter (top) and cap the sample container (bottom) with the cap provided.
        3. Fill sample container with 0.5" of headspace (approximately 100 ml). DO NOT acidify the sample.
        4. Store sample on wet ice after collection.
    b. Orthophosphate: Follow the same procedures to filter sample. *Ortho-P sample must be filtered within 15-min of sample collection.*
    c. Ammonium: Follow the same procedures to filter sample.
    d. Silica: Will be filtered at Station 1 with peristaltic pump through pre-cleaned cartridges for metals analysis after all metals samples have been collected. Store sample on wet ice.
B. Total (Organic-N, Total Phosphorous)
    a. Add provided 5N H_2SO_4 to bottles morning of prior to cruise departure with Eppendorf pipette. Current best estimate is to add 0.5 mL of acid to sample bottles.
    b. On station, fill labeled sample container to 0.5" of headspace.
    c. Store sample on wet ice after collection.
    d. Check pH with provided strips and additional acid as necessary (desired pH is <2). If cruise is very unstable, then add additional acid when back on land.

Completed water samples are kept refrigerated or chilled in coolers with wet ice or ice packs (1 to 5 C)

C. Particulate (Chlorophyll-a):
    1. Filter sample as soon as possible and within 2 hours after sample collection and keep in subdued light to prevent chlorophyll concentrations from changing.
    2. Assemble filtering flask and ceramic crucible to vacuum pump (should not exceed 20 kPa) with 25 mm GF/F filter paper.
    3. Thoroughly agitate sample container to suspend particulates, and pour in clean graduated cylinder. Add as much water sample as will fit through filter (target 100 mL or more up to 4 L). Do not suck filter dry with vacuum during filtering nor at the end. Release vacuum as a last bit of water is drawn through the filter.
    4. Remove filter with tweezers with particulate matter inside. Lightly blot filter with Kimwipe to remove excess water if necessary.
    5. Record volume of water filtered.
    6. Rinse crucible with DI water between samples.
    7. DO NOT add methanol for preservation.
    8. Put filter in the provided HDPE centrifuge tube, and freeze sample on dry ice and in the dark.

3.3. Cruise Schedule

Sampling activities for the 2017 RMP Water Cruise are shown in Table 6. The tentative schedule assumes that an average of forty-five minutes will be required for sampling at each station. Sampling times may also vary depending upon suspended sediment loads, number and type of samples collected, and other factors. The schedule is for planning purposes only, and may be revised during sampling operations to reflect weather conditions, equipment performance, or other factors. Any sites unable to be sampled at the scheduled time will be rescheduled later in the cruise if possible, or will be replaced with the first available site within the segment from the current 2017 sampling schedule (see Appendix A for site locations). A record of all sites not able to be sampled and why will be maintained as part of the cruise recordkeeping.

There are no target sites for 2017 within close proximity to sensitive areas. AMS personnel have arranged to check in with USCG Command Center **(415-399-3547)** as needed in attempt to minimize disruptions to sampling.

Table 6. Tentative Schedule for 2017 RMP Water Cruise

Date	Time	Activity
Aug 28	0900-1400	*RV Turning Tide* transits from Oakley to Redwood City Marina (675 Seaport Blvd, 650-363-1390).
	1400-1700	AMS and SFEI personnel mobilize sampling equipment and load aboard vessel *RV Turning Tide* at **Redwood City Marina.** Aloha Transportation (Aloha) meets vessel at Redwood City Marina and ferries skipper to Driftwood Marina to retrieve personal vehicle.
Aug 29	0700-1530	Mobilize remaining sampling gear aboard vessel at **Redwood City Marina**. Sample BA30, LSB068W, LSB069W, LSB067W, LSB072W, and LSB070W (low tide 3.2' at 13:10; high tide 6.5' at 07:48). Return to **Redwood City Marina** and demobilize vessel.
	1500-1730	Aloha retrieves all samples for transfer to AMS.
Aug 30	0700-1430	Mobilize sampling gear aboard vessel at **Redwood City Marina**. Sample field blank, SB073W, SB072W, SB071W, and CB046W (low tide 3.3' at 13:54, high tide 5.8' at 08:43). Transit to **Emeryville Marina** (3310 Powell St, Emeryville, 510-654-3716) and demobilize vessel.
	1100-1300	Aloha Transportation retrieves dry ice for delivery to vessel and 8/29 toxicity samples for delivery to PER.
	1415-1715	Aloha Transportation meets vessel at Emeryville Marina and retrieves all personnel for transfer to personal vehicles in Redwood City and all samples for transport to AMS.

Aug 31	0700-1315 1000-1200 1315-1700	Mobilize sampling gear aboard vessel at **Emeryville Marina**. Add H2SO4 to organic-N and Total P sample bottles on land. Bring acid and pH strips on boat to test. Sample BC20, CB045W, and BC10. Transit to **Emeryville Marina** and demobilize vessel. Aloha Transportation retrieves dry ice for delivery to vessel and 8/30 toxicity samples for delivery to PER. Aloha Transportation meets vessel at Emeryville Marina and retrieves all samples, delivers 8/31 toxicity samples to PER, nutrient samples to CCCSD (latest delivery is 3:30 pm), bisphenol samples to the Emeryville FedEx Center on Christie Street (latest delivery is 5:00 pm), and all remaining samples to AMS. If nutrient samples are not delivered before closing, then samples need to be frozen and delivered morning of the next day.
Sep 6	0730-1630 1600-1800	Mobilize sampling gear aboard vessel at **Emeryville Marina**. Sample CB043W, SPB043W, SPB044W, and SPB042W (low tide 0.1' at 7:25; high tide 5.9' at 13:46). Transit to **Benicia Marina** (266 East B St., Benicia, 707-745-2628) and demobilize vessel. Aloha Transportation meets vessel at Benicia Marina and retrieves all personnel for transfer to personal vehicles in Emeryville and all samples for transport to AMS.
Sep 7	0700-1445 1200-1700 1430-1700	Mobilize sampling gear aboard vessel at **Benicia Marina**. Sample SU051W, SU053W, SU052W, BG20, and BG30 (low tide 0.3' at 10:07, high tide 5.3' at 16:05). Transit to Driftwood Marina (6338 Bridgehead Rd, Oakley, 925-757-9449) and demobilize vessel. Aloha Transportation transfers 9/6/17 toxicity samples to PER. Meets vessel at Driftwood Marina and retrieves sampling personnel for transit to Benicia Marina and 9/7/17 toxicity samples for transfer to PER. Mr. Salop meets vessel at Driftwood Marina and sampling personnel demobilize all samples and sampling equipment. AMS retains all remaining samples and sampling equipment for delivery to AMS.
Sep 8	TBD	Contingency day, as needed.

3.4. Lodging and Vendors

Recommended lodging options for vessel personnel are shown in Table 7 and addresses for local dry ice vendors are shown in Table 8.

Table 7. Contact Information for Suggested RMP Water Cruise Lodging.

Location	Nights	Hotel
Redwood City	August 28,29	Comfort Inn 1818 El Camino Real Redwood City, CA 650-599-9636
Emeryville	August 30	Extended Stay America 3650 Mandela Pkwy Oakland, CA 510-923-1481
Benicia	September 6	Best Western Heritage Inn 1955 E 2nd St. Benicia, CA 94510 707-746-0401

Table 8. Dry Ice Vendors Proximate to RMP Water Cruise Berthing Locations.

Port City	Vendor	Address / Phone	Hours (M-F)
Redwood City	Albertsons	200 Woodside Place Redwood City 650-873-4212	0700-1600
Emeryville	Arco	889 West Grand Oakland 510-465-4450	24 hrs
Benicia	Concord Airgas	1825 Arnold Industrial Concord 925-825-8822	0700-1700
Oakley	Raley's	2077 Main Street Oakley 925-625-0744	0600-2300

3.5. Sampling Sites

2017 target sampling sites are shown in Figure 4 and listed in Table 9. All coordinates are in WGS-84 datum. The replacement-site pool is shown in Appendix A.

Two target sites for 2017 were removed from the site list during planning for the following reasons:

- CB044W was removed due to its location in the Oakland Inner Harbor near the 7th Street Marine Terminal (Figure 1). It was replaced with site CB046W.
- LSB071 was removed due to its location between the Dumbarton Bridge and the nearby railroad tracks and Hetch Hetchy pipeline, which would make anchoring difficult. It was replaced with site LSB072W.

Coordinates for two additional target sites, LSB068W and SPB043W, are in locations that may be difficult to access safely via vessel. LSB068W is located within a side channel of Lower South Bay with several obstructions noted on nautical charts (Figure 2). SPB043W is located on the far western edge of San Pablo Bay, and would require a long transit across a shallow water area (Figure 3). In both cases, sampling personnel will confirm with the vessel skipper about possible sampling based upon weather conditions present. If either or both are unable to be sampled safely, then the first replacement site for each embayment will be substituted for the target.

Figure 1. Location of 2017 RMP Target Station CB044W

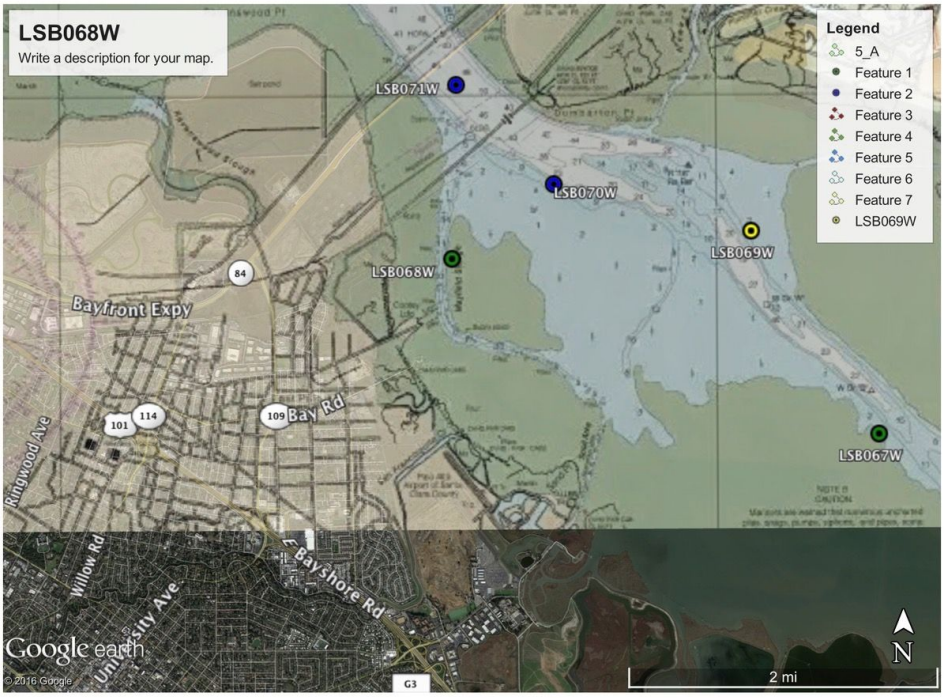

Figure 2. Location of 2017 RMP Target Stations LSB068W and LSB071W

Figure 3. Location of 2017 RMP Target Station SPB043W

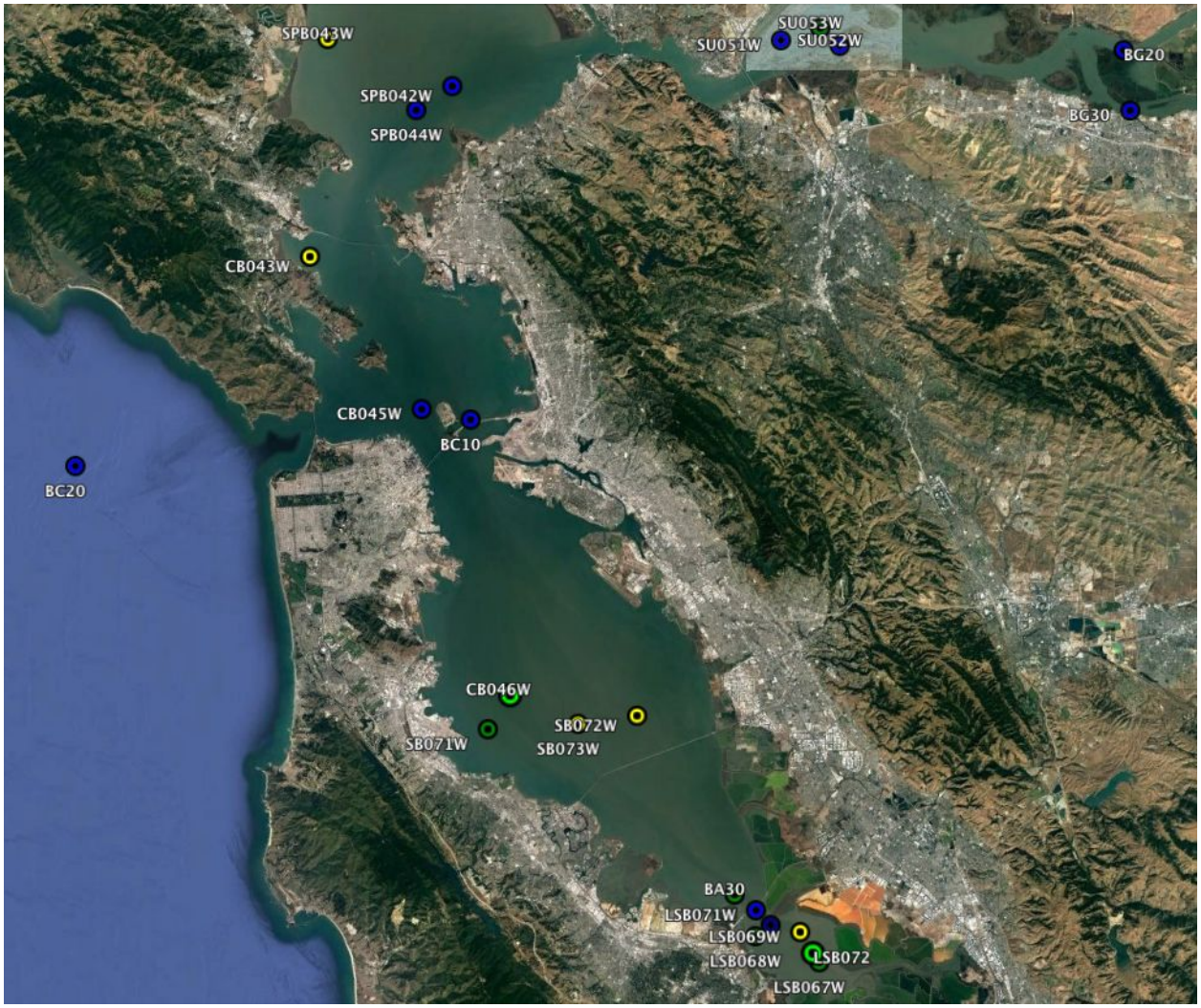

Figure 4. Location of 2017 RMP Target Water Stations

Table 9. Location of 2017 RMP Water Cruise Target Sampling Sites. Coordinates are in the NAD83 datum. The goal is to navigate to within 100 meters of these coordinates. If not possible, the lead scientist on the boat can make the call to accept a larger offset if it is "close enough" and the costs of rejecting the site and taking a replacement site are "too high". If the offset is greater than 200 meters, the station is rejected and replaced with a replacement site.

Region	Site Code	Site Type	Target Latitude	Target Longitude	Depth (ft)
RIV	BG20	Historic	38.05969966	-121.8112677	12+
RIV	BG30	Historic	38.02054094	-121.806267	12+
CB	BC10	Historic	37.8215833	-122.3495	
CB	BC20	Historic	37.7915	-122.67333	12+
SB	BA30	Historic	37.51375	-122.1346166	
SU	SU051W	Random	38.06700374	-122.0937161	12+
SU	SU052W	Random	38.06318259	-122.0453347	12+
SU	SU053W	Random	38.07464632	-122.0613253	6 to 12
SPB	SPB042W	Random	38.03763743	-122.3642433	12+
SPB	SPB043W	Random	38.06832963	-122.466697	3 to 6
SPB	SPB044W	Random	38.02219085	-122.3938438	12+
CB	CB043W	Random	37.92713888	-122.4811147	3 to 6
CB	CB045W	Random	37.82842369	-122.3895021	12+
CB	CB046W	Random	37.64343523	-122.3172908	12+
SB	SB071W	Random	37.62124822	-122.3357213	6 to 12
SB	SB072W	Random	37.62977094	-122.2138478	3 to 6
SB	SB073W	Random	37.6246372	-122.2620191	3 to 6
LSB	LSB067W	Random	37.46959684	-122.0656735	6 to 12
LSB	LSB068W	Random	37.48673013	-122.1177547	6 to 12
LSB	LSB069W	Random	37.4892963	-122.0811839	3 to 6
LSB	LSB070W	Random	37.49390204	-122.1052744	12+
LSB	LSB072W	Random	37.47575067	-122.0705836	12+

APPENDIX A

2017 Replacement Sites. All coordinates are in the NAD83 datum.

Region	Site Code	Target Latitude	Target Longitude	Depth (ft)
LSB	LSB073W	37.49195222	-122.083874	6 to 12
LSB	LSB074W	37.49130613	-122.1007743	12+
LSB	LSB075W	37.47856358	-122.0750837	12+
LSB	LSB076W	37.49450215	-122.0860241	3 to 6
SB	SB074W	37.53722916	-122.1759361	12+
SB	SB075W	37.62919913	-122.2680793	6 to 12
SB	SB076W	37.61765235	-122.2048574	3 to 6
CB	CB047W	37.82830794	-122.4414829	12+
CB	CB048W	37.77690076	-122.3050108	12+
CB	CB049W	37.86502945	-122.3598919	6 to 12
SPB	SPB045W	38.09315797	-122.3372935	3 to 6
SPB	SPB046W	38.05308001	-122.2977416	12+
SPB	SPB047W	38.08404421	-122.4290062	3 to 6
SU	SU054W	38.05072281	-121.9437816	12+
SU	SU055W	38.07262551	-122.0816759	6 to 12
SU	SU056W	38.06362236	-122.0079737	12+

Appendix 2 – 2017 AMS Water Cruise Report

RMP
REGIONAL MONITORING
PROGRAM FOR WATER QUALITY
IN SAN FRANCISCO BAY

sfei.org/rmp

2017 RMP Water Cruise Report

Prepared by

Paul Salop, Applied Marine Sciences

CONTRIBUTION NO. 846 / October 2017

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Cruise Report

2017 RMP Water Cruise

Contract No. 1300

October 18th, 2017

Submitted to:

San Francisco Estuary Institute
4911 Central Ave
Richmond, CA 94804

Submitted by:

APPLIED marine SCIENCES

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1. Introduction

This report details activities associated with the annual Regional Monitoring Program for Water Quality in the San Francisco Estuary (RMP) water cruise. The RMP water sampling program was redesigned in 2002 to adopt a randomized sampling design at thirty-one sites in place of the twenty-six "spine of the Estuary" stations sampled previously. In 2007, the number of sites was decreased to twenty-two stations and it remains as such for 2017.

2. Cruise Report

2.1. Objectives

All sampling was conducted from the *RV Turning Tide*. The objectives of the sampling effort were to collect the following:

Collect Real-time Data on Field Parameters

1. Real-time data over the duration of sampling for conductivity, temperature, optical back scatter (OBS), and dissolved oxygen (DO) by AMS (1 meter CTD cast for duration of sampling, plus a full water column profile where water depth allows).
2. Water samples from 22 sites for on-board (field meter) measurement of DO, pH, salinity, conductivity, and temperature by SFEI.
3. Document current and recent weather conditions at each site.

Collect Water Samples – Total Fraction (Unfiltered water samples)

4. 22 sites (and 1 replicate and 1 blank) for analysis of Weak Acid Dissociable (WAD) Cyanide by colorimetry (ALS)
5. 2 sites (and 1 replicate and 1 blank) for analysis of SSC (ALS)
6. 9 sites (and 0 replicates) for analysis of aquatic toxicity by Pacific EcoRisk (PER), with extra volume collected at BG20 and BG30 to support potential TIE work.
7. 22 sites (and 2 replicates and 1 blank) for analysis of bisphenols and phosphate flame retardants (SIU).
8. 22 sites (and 2 replicates and 1 blank) for analysis of neonicotinoids by SGS AXYS (AXYS)
9. 1 site (and 1 replicate, plus extra samples for lab QC taken at the same site) for analysis of total phosphorous (CCCSD)
10. 1 site (and 1 replicate, plus extra samples for lab QC taken at the same site) for analysis of organic nitrogen (CCCSD)

Collect Water Samples – Particulate Fraction (Filters)

11. 22 sites (and 1 replicate and 1 blank) for Particulate Organic Carbon (POC) analysis by ALS Environmental (ALS) [1 filter per sample]
12. 22 sites (and 2 replicates and 1 blank and 1 extra sample for lab matrix spike) for analysis of MeHg by ethylation/CVAFS, Cu by column chelation and ICP-MS, and Se by column chelation and ICP-MS (BAL) [3 filters of 0.4 um pore size, 47 mm diameter per sample]
13. 6 sites for analysis of Se for lab intercomp study (Cutter lab) [3 filters per site, same type as BAL]
14. 6 sites for analysis of Se for lab intercomp study (USGS lab) [3 filters per site, same type as BAL]
15. 6 sites for analysis of Se for lab intercomp study (CCSF lab) [1 to 3 filters per site, same type as BAL]

16. 1 site (and 1 replicate and 1 extra sample for lab QC) for analysis of chlorophyll-a (CCCSD)

Collect Water Samples – Dissolved Fraction (Filtrate)

17. 22 sites (and 2 replicate and 1 blank) for analysis of MeHg by ethylation/CVAFS (BAL)
18. 22 sites (and 2 replicate and 1 blank) for analysis of Cu by column chelation and ICP-MS (BAL)
19. 22 sites (and 2 replicate and 1 blank) for analysis of Se by IC column separation and ICP-MS (BAL)
20. 22 sites (and 2 replicate and 1 blank) for analysis of Se by RP separation and ICP-MS (BAL)
21. 6 sites for analysis of Se for lab intercomp study (Cutter lab) in glass
22. 6 sites for analysis of Se for lab intercomp study (USGS) in glass
23. 6 sites for analysis of Se for lab intercomp study (CCSF) in HDPE
24. 22 sites (and 1 replicate and 1 blank) for analysis of DOC (ALS)
25. 22 sites (and 1 replicate) for analysis of hardness (ALS)
26. 1 site (and 1 replicate) for analysis of silica (ALS)

Filter (using labeled FlipMate Filter Assemblies)

27. 1 site (and 1 replicate plus extra samples at the same site for lab QC) for analysis of nitrate, nitrite (CCCSD)
28. 1 site (and 1 replicate plus extra samples at the same site for lab QC) for analysis of orthophosphate (CCCSD)
29. 1 site (and 1 replicate plus extra samples at the same site for lab QC) for analysis of ammonium (CCCSD)

2.2. Personnel

The personnel and work assignments for this cruise are shown in Table 1.

Table 1. Personnel for 2017 RMP Water Cruise

Name	Affiliation	Dates Aboard	Duties
Paul Salop	AMS	8/29, 8/30	Cruise Manager
Natalie Dornan	AMS	8/29, 8/30, 8/31, 9/17	Cruise Manager
Winn McEnery	AMS	8/31, 9/6, 9/7	Cruise Manager
Don Yee	SFEI	8/29, 8/30, 8/31	Field Sampling
Amy Franz	SFEI	8/29, 9/6, 9/7	Field Sampling
Jennifer Sun	SFEI	8/30, 8/31, 9/7	Field Sampling
Phil Trowbridge	SFEI	31-Aug	Field Sampling
Adam Wong	SFEI	8/29, 8/30, 9/6 9/7,	Field Sampling
Emily Clark	SFEI	8/30, 9/6, 9/7	Field Sampling
Katie McKnight	SFEI	6-Sep	Field Sampling
Shira Bezalel	SFEI	30-Aug	Photography
Chris Vallee	USGS	8/29 - 9/7	*RV Turning Tide,* Captain
Norbert Vanden Branden	USGS	8/29 - 9/7	*RV Turning Tide,* Mate
Jerry Eldorado	Aloha Trans	NA	Logistics

2.3. Sampling Activities

Sampling activities for the 2017 RMP Water Cruise are shown in Table 2

Table 2. Sampling Activities for 2017 RMP Water Cruise

Date	Time	Activity
August 28	0900 - 1400	RV *Turning Tide* transits from Oakley to Redwood City Marina.
	1400 - 1700	AMS and SFEI personnel mobilize sampling equipment and load aboard vessel RV *Turning Tide* at Redwood City Marina.
August 29	0700 - 1530	Mobilize remaining sampling gear aboard vessel at Redwood City Marina. Sample BA30, LSB069W, LSB073W, LSB067W, LSB072W, and LSB070W. Return to Redwood City Marina and demobilize vessel.
	1500 - 1730	Aloha retrieves all samples for transfer to AMS.
August 30	0700 - 1430	Mobilize sampling gear aboard vessel at Redwood City Marina. Sample field blank, SB073W, SB072W, SB071W, and CB046W. Transit to Emeryville Marina and demobilize vessel.
	1100 - 1300	Aloha Transportation delivers 8/29 toxicity samples to PER.
	1415 - 1715	Aloha Transportation meets vessel at Emeryville Marina and retrieves all personnel for transfer to personal vehicles in Redwood City and all samples for transport to AMS.
August 31	0700 - 1315	Mobilize sampling gear aboard vessel at Emeryville Marina. Pre-preserve organic-N and Total P sample bottles at dock. Sample BC20, CB045W, and BC10. Transit to Emeryville Marina and demobilize vessel.
	1000 - 1200	Aloha Transportation delivers 8/30 toxicity samples to PER.
	1315 - 1700	Aloha Transportation meets vessel at Emeryville Marina and retrieves all samples, delivers 8/31 bisphenol samples to the Emeryville FedEx Center on Christie Street and all remaining samples to AMS.
September 01	1000 - 1300	Aloha Transportation delivers 8/31 nutrient samples to CCCSD and toxicity samples to PER.
September 06	0730 - 1630	Mobilize sampling gear aboard vessel at Emeryville Marina. Sample CB043W, SPB043W, SPB044W, and SPB042W. Transit to Benicia Marina and demobilize vessel.
	1600 - 1800	Aloha Transportation meets vessel at Benicia Marina and retrieves all personnel for transfer to personal vehicles in Emeryville and all samples for transport to AMS.
September 07	0700 - 1445	Mobilize sampling gear aboard vessel at Benicia Marina. Sample SU051W, SU052W, SU054W, BG20, and BG30. Transit to Driftwood Marina and demobilize vessel.
	1200 - 1700	Aloha Transportation transfers 9/6/17 toxicity samples to PER. Meets vessel at Antioch Marina and retrieves bisphenol samples for delivery to Fedex shipping facility.
	1430 - 1700	Mr. Salop meets vessel at Driftwood Marina and sampling personnel demobilize all samples and sampling equipment. AMS retains all remaining samples and sampling equipment for delivery to AMS. Aloha meets vessel at Driftwood Marina and transfers sampling personnel to personal vehicles at Benicia Marina.
September 08	1000-1230	AMS transfers 9/7/17 toxicity samples to PER.

2.4. Discussion

The sample ID system for all samples was as follows:

RMP-17WC-XXXX

Where:

RMP	=	Project
17	=	Cruise Year
WC	=	Matrix (Water Cruise)
XXXX	=	Unique ID number

Due to the unpredictable nature of sampling in the bay and delta, two sampling sites were unable to be sampled during the cruise. In each case, access routes around shallow flats were unable to be located; for this reason site LSB068W was replaced with site LSB073W and site SU053W was replaced with site SU054.

In addition, site CB043W was sampled outside of the target 200 m distance of the site coordinates (measured as approximately 210 m) due to the shallow water depth and the fact that the replacement site was over an hour in transit time in the wrong direction. Use of the replacement site for CB043W would have precluded completion of the remainder of the cruise sites within the target number of days.

RMP staff planned for a dissolved Se intercomparison study at 5 sites for 2017. Stations for the dissolved fraction samples were changed at the onset of the cruise to be consistent with the sampling stations for particulate Se. This included moving planned LSB073W, SB071W, and SPB042W dissolved fraction samples to BA30, BC10, and BG20, respectively. Also, a duplicate sample for the intercomparison study was collected at BC10 instead of SU051W to save time on filtering during the last day.

Due to delayed communications from the intercomparison labs, dissolved fraction intercomparison samples collected during the first week for Cutter and USGS labs at sites BA30 and BC10 were not acidified at time of collection. When the preservation issue was identified by the labs, 8 mL of 10% HCl was subsequently added to the samples at AMS after approximately 45 hours and 96 hours to samples collected at BC10 and BA30, respectively. Consequently, a 6th sampling site, CB043W was added to the study. All dissolved fraction intercomparison samples for these two labs collected the 2nd week of the cruise were collected in pre-preserved containers. The dissolved fraction samples for the CCSF portion of the intercomparison study were all collected non-preserved and immediately field frozen on dry ice.

At station BC20, only one chlorophyll sample was filtered with a small GF filter and crucible provided by the lab. Due to time constraints and the difficulty of using the small filter, an additional two samples were collected and filtered using a large GF filter typically used for POC and DOC. Nutrient samples, Ortho-P, NH4, NO2, and NO3, were collected using a FlipMate device at BC20; multiple of the FlipMate containers spilled during transit, but the lab was given the go-ahead to complete analyses.

On the second to last day of sampling, a blind duplicate for analysis of particulate metals was not collected at SPB042W and was instead was taken at SU051W.

Due to an error in deployment, the CTD data collected on the final day of the cruise was recorded as a single compilation rather than individual casts. We were able to retrieve usable data for four of the five stations sampled (BG20, BG30, SU052W, and SU054W), but were unable to obtain meaningful data for the fifth station (SU051W). YSI data collected by SFEI personnel at SU051W may provide backup surface water data. Additionally, the depth bins for measurements recorded on this day will vary slightly from the typical 0.25 m bins reported. Time casts appear unaffected.

A total of 4 sample containers broke while in transit or at a lab, all at BAL. Se collected at BC10 sent in a 1 L bottle broke during transit. Therefore, both Se separation methods were run using the remaining sample in the 125 mL bottle of dissolved Se. Two 125 mL samples for dissolve Se analysis broke at BAL and the 1 L samples were used instead. A filter container for analysis of particulate metals broke in transit and the filter was transferred into a new container at the lab.

2.5. Sampling Sites

2017 RMP Water Cruise sampling sites are listed in

Table 3. All samples collected are listed in Table 4. Sample containers and sample handling procedures are summarized in Table 5. Weather conditions encountered at time of sampling are shown in Table 6. Snapshot of water quality parameters recorded from SFEI YSI meter are shown in **Table 7**.

Table 3. 2017 RMP Water Cruise Site Coordinates and Water Depth. Sample depths are not corrected for tidal action.

Site Code	Target		Actual		Depth (ft)
	Lat	Long	Lat	Long	
BG20	38.05970	-121.81127	38.05974	-121.81106	10
BG30	38.02054	-121.80627	38.02051	-121.80578	10
BC10	37.82158	-122.34950	37.82158	-122.34940	7
BC 20	37.79150	-122.67333	37.79325	-122.67191	32
BA 30	37.51375	-122.13462	37.51414	-122.13523	8
SU051W	38.06700	-122.09372	38.06707	-122.09318	5
SU052W	38.06318	-122.04534	38.06332	-122.04515	8
SU054W	38.05072	-121.94378	38.05083	-121.94359	18
SPB042W	38.03764	-122.36424	38.03777	-122.36373	13
SPB043W	38.06833	-122.46670	38.06857	-122.46705	2
SPB044W	38.022191	-122.39384	38.02260	-122.39331	14
CB043W	37.92714	-122.48111	37.92638	-122.47891	2
CB045W	37.82842	-122.38950	37.82911	-122.38966	13
CB046W	37.64344	-122.31729	37.64362	-122.31657	11
SB071W	37.62125	-122.33572	37.62107	-122.33468	5
SB072W	37.62978	-122.21385	37.63003	-122.21366	4
SB073W	37.62464	-122.26202	37.62424	-122.26116	4
LSB067W	37.46960	-122.06567	37.47056	-122.06518	6
LSB069W	37.48930	-122.08118	3.48894	-122.08203	2
LSB070W	37.49390	-122.10527	37.49350	-122.10501	10
LSB072W	37.47575	-122.070584	37.47573	-122.07069	13
LSB073W	37.49195	-122.08387	37.49181	-122.08545	3

Table 4. 2017 RMP Water Samples Collected by Site.

SITECODE	CTD -AMS	CN, (WAD) - ALS	SSC - ALS	Toxicity - PER	Bisphenols- SIU	Neonics	POC – ALS	DOC – ALS	MeHg, Cu, Se (P) - BAL	MeHg (D) - BRL	Cu (D) - BRL	Se 1L (D) - BRL	Se 125 mL (D) - BRL	Hardness (D) - ALS	Se (P) - Cutter	Se (P)- USGS	Se (P)- CCSF	Se (D) - Cutter	Se (D)- USGS	Se (D)- CCSF	Organic N, N03, N02, NH4, Total P - CCCSD	Silica - ALS	Chl a - CCCSD
BA30	1	1	1	1	1	2	1	1	3	1	1	1	1	1	3	3	1	1	1	1			
LSB067W	1	1	1	1	2	4	1	1	3	1	1	1	1	1									
LSB069W	1	1	1		1	2	1	1	3	1	1	1	1	1									
LSB073W	1	1	1		1	2	1	1	3	1	1	1	1	1									
LSB072W	1	1	1		2	4	1	1	3	1	1	1	1	1									
LSB070W	1	1	1		1	2	1	1	3	1	1	1	1	1									
FB		1	1		1	2	1	1	3	1	1	1	1	1									
SB073W	1	1	1		1	2	1	1	3	1	1	1	1	1									
SB072W	1	2	2		1	2	2	2	3	2	2	2	2	2									
SB071W	1	1	1	1	1	2	1	1	3	1	1	1	1	1									
CB046W	1	1	1		1	2	1	1	9	1	1	1	1	1									
BC20	1	1	1		1	2	1	1	3	1	1	1	1	1							5	2	3
CB045W	1	1	1		1	2	1	1	3	1	1	1	1	1									
BC10	1	1	1	1	1	2	1	1	3	1	1	1	1	1	6	6	1	1	1	1			
CB043W	1	1	1	1	1	2	1	1	3	1	1	1	1	1	3	3	1	1	1	1			
SPB043W	1	1	1		1	2	1	1	3	1	1	1	1	1									
SPB44W	1	1	1		1	2	1	1	3	1	1	1	1	1									
SPB042W	1	1	1	1	1	2	1	1	3	1	1	1	1	1									
SU051W		1	1	1	1	2	1	1	6	2	2	2	2	1	3	3	1	1	1	1			
SU052W	1	1	1		1	2	1	1	3	1	1	1	1	1									
SU054W	1	1	1		1	2	1	1	3	1	1	1	1	1									
BG20	1	1	1	3	1	2	1	1	3	1	1	1	1	1	3	3	1	1					
BG30	1	1	1	3	1	2	1	1	3	1	1	1	1	1	3	3	1	1					
Total	**21**	**24**	**24**	**13**	**25**	**50**	**24**	**24**	**78**	**25**	**25**	**25**	**24**	**24**	**21**	**21**	**6**	**6**	**4**	**4**	**5**	**2**	**3**

Table 5. Containers and Sample Handling for 2017 RMP Water Cruise (T=total, P=particulate, D=dissolved). Samples to be stored with no additional preservation, on wet ice or refrigerated (4C), and in the dark, unless otherwise noted.

Sample	T/P/D	Lab	Container	Handling Requirements
DO, cond, pH, temp, OBS	T	AMS	None	CTD deployment
DO, cond, pH, temp, sal	T	SFEI	None	Grab measurement on board vessel
CN (WAD)	T	ALS	500 mL HDPE	Preloaded with NaOH to a pH ≥12 and stored on wet ice; 1 dupe, 1 field blank collected; 14 day hold time
SSC	T	ALS	1 L	Stored on wet ice, 1 dupe, 1 field blank collected
Toxicity	T	PER	20 L carboy	Stored on wet ice; 2 extra samples collected at BG20 and BG30; 36 hour hold time
Bisphenols and Phosphate Flame Retardants	T	SIU	4 L amber glass	Stored on wet ice; 1 field blank; 3 day hold time
Neonics	T	SGS-AXYS	2 1-L amber glass per site	Stored on wet ice in dark environment; 2 dupes; 1 field blank; 9 day hold time
POC	P	ALS	1 filter per site	Field filtered and stored with dry ice to (-20C); 1 dupe, 1 field blank collected; 100 day hold time
DOC	D	ALS	250 mL HDPE	Field filtered (filtrate of POC sample) and preloaded with 1-2 mL H2SO4; 1 dupe collected, 1 field blank collected, 28 day hold time
MeHg, Cu, Se	P	BAL	3 filters per sample, all put in a 50mL tube	Field filtered and stored with dry ice (-20C); 2 dupes; 1 field blank; extra dupe at CB046W for lab QC collected
Se	P	Cutter	3 filters per sample, all put in a 50mL tube	Field filtered and stored with dry ice (-20C); 1 dupe collected
Se	P	USGS	3 filters per sample, all put in a 50mL tube	Field filtered and stored with dry ice (-20C); 1 dupe collected
Se	P	CCSF	3 filters per sample, all put in a 50mL tube	Field filtered and stored with dry ice (-20)
MeHg	D	BAL	250 ml FLPE	Preloaded with 1-2 ml of 50% H2SO4; 2 dupes and extra dupe for lab QC collected; 6 month hold time

Sample	T/P/D	Lab	Container	Handling Requirements
Cu	D	BAL	1 L HDPE	Stored on wet ice; Analysis of Cu by Column Chelation; 2 dupes, 1 field blank collected
Se	D	BAL	1 L glass	Stored on wet ice; Analysis of Se by EPA 1640 with RP separation; 2 dupes, 1 field blank
Se	D	BAL	125 mL glass	Stored on wet ice; Analysis of Se by EPA 1640 with IC column separation; 2 dupes; 1 blank.
Se	D	Cutter	1 L glass	First week samples stored on wet ice, preserved at AMS; second week samples pre-preserved with 8 mL HCL, stored on wet ice.
Se	D	USGS	1 L glass	First week samples stored on wet ice, preserved at AMS; second week samples pre-preserved with 8 mL HCL, stored on wet ice.
Se	D	CCSF	1 L HDPE	Stored on dry ice
Hardness	D	ALS	125 mL PE	Stored on wet ice.1 dupe; 1 field blank
Organic N	T	CCSD	HDPE	H2SO4 added prior to collecting sample. Stored on blue ice on vessel, refrigerated overnight; 1 sample, 1 field dupe collected, extra volume for MS/MD collected
NO3, NO2	D	CCSD	FlipMate Unit, 125 mL container	Filtered with FlipMate. Stored on blue ice on vessel, refrigerated overnight; 1 sample, 1 field dupe collected, extra volume for MS/MD collected
NH4	D	CCSD	FlipMate Unit, 125 mL container	Filtered with FlipMate. Stored on blue ice on vessel, refrigerated overnight; 1 sample, 1 field dupe collected, extra volume for MS/MD collected
Total P	T	CCSD	HDPE	H2SO4 added prior to collecting sample. Stored on blue ice on vessel, refrigerated overnight; 1 sample, 1 field dupe collected, extra volume for MS/MD collected:
Ortho P	D	CCSD	FlipMate Unit, 125 mL container	Filtered with FlipMate. Stored on blue ice on vessel, refrigerated overnight; 1 sample, 1 field dupe collected, extra volume for MS/MD collected
Silica	D	ALS	500 ml HDPE	Field Filtered (cartridge filters). Stored below 4 C; 28-day hold time.
Chl-a	P	CCSD	1 filter (25 mm GF/F filter)	1 sample filtered using GF filter; samples filtered using GF filter used for POC/DOC; stored with dry ice; 1 day hold time

Table 6. Weather Conditions for 2017 RMP Water Cruise.

Site	Sea State	Tide Stage & Current (fps)	Wind Speed (kts)	Wind Dir.	Cloud Cover, % Overcast	Comments
Field Blank	Moderate chop	< 1	10.8	North Northwest	60%	
BG20	Chop, white capping	< 1	16	West Southwest	80%	
BG30	Mild chop	1	14.7	NA	80%	
BC10	Calm	1	6	North Northwest	0%	PSe FDs (Cutter, USGS)
BC20	Calm	NA	1.5	North	0%	BLIND7 collected
BA30	Light calm	< 1	6.2	North	100%	
SU051W	Calm	< 1	3	West	95%	BLIND5,6 collected
SU052W	Light chop	1	5.3	Southwest	100%	
SU054W	Calm	1	7.2	West Southwest	NA	
SPB042W	Small chop	< 1	16	Southwest	5%	
SPB043W	White caps, rough	> 1	15	West	15%	
SPB044W	White caps, rough	1.5	17.3	South Southwest	30%	
CB043W	Rippled	1	6.5	East	85%	
CB045W	Calm	1	1.6	North Northwest	5%	
CB046W	White caps, rough	NA	25	West Northwest	0%	
SB071W	Choppy, white caps	NA	17.8	North Northwest	0%	
SB072W	Moderate chop	< 1	4	North Northwest	5%	BLIND3 collected
SB073W	Moderate chop	< 1	10.4	North Northwest	100%	
LSB067W	Calm	1	8	North	50%	BLIND1 collected
LSB069W	Calm	< 1	4.7	North	100%	
LSB070W	Moderate chop	1	21.1	North Northwest	0%	
LSB072W	Wind chop	< 1	19.2	North Northwest	0%	BLIND2 collected
LSB073W	Calm	< 1	8	North	10%	

Table 7. Recorded Water Quality Parameters. All results recorded as snapshot from SFEI YSI meter deployed at approximately 1m depth for duration of sampling. NR=Not recorded.

Site	DO (%)	DO (mg/L)	Cond. (mS/cm)	Temp (°C)	pH	Salinity (ppt)	Comments
BG20	91.8	7.89	165	22.87	6.77	0.08	
BG30	90.6	7.71	0.589	23.32	6.54	0.29	
BC10	94.3	7.18	46.46	20.2	8.28	30.23	
BC20	100.4	8.3	51.08	14.65	8.18	33.54	
BA30	99.7	7.31	47.38	22.36	8.35	30.88	
SU051W	93.1	7.64	16.85	22.05	7.44	9.91	
SU052W	93.1	7.85	7.844	22.68	7.13	4.34	
SU054W	91.2	7.78	22.58	22.87	6.35	1.16	
SPB042W	91.5	7.14	41.3	20.06	8.57	26.51	
SPB043W	89.2	6.71	34.92	23.55	8.66	21.98	
SPB044W	NR	NR	NR	NR	NR	NR	
CB043W	91.4	7.09	38.06	20.7	8.56	24.15	
CB045W	95.2	7.43	46.49	18.56	8.41	30.26	
CB046W	87.6	6.57	45.6	20.95	8.07	29.6	
SB071W	86.6	6.61	47.01	19.62	8.02	30.62	
SB072W	83	6.34	45.66	20.17	7.92	29.64	
SB073W	81.5	6.19	45.91	20.17	7.9	29.83	
LSB067W	89.4	6.51	23.75	23.75	8.55	26.26	
LSB069W	88.3	6.57	40.36	22.44	8.04	25.82	
LSB070W	102.5	7.4	46.51	22.86	8.43	30.23	
LSB072W	100.1	7.31	43.69	22.92	8.4	28.22	
LSB073W	95.7	6.98	46.08	22.42	8.34	29.92	

Appendix 3 – 2017 Margins Sediment Cruise Plan

RMP
REGIONAL MONITORING
PROGRAM FOR WATER QUALITY
IN SAN FRANCISCO BAY

sfei.org/rmp

2017 RMP Margins Sediment Cruise Plan

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CONTRIBUTION NO. 847 / July 2017

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Regional Monitoring Program
for Water Quality in San Francisco Bay

2017 Bay Margins Sediment Study
Cruise Plan

San Francisco Estuary Institute
4911 Central Avenue
Richmond, CA 94804

1. Introduction

This report details plans associated with sediment sampling for the Bay Margins Sediment Study for the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP). Bay margins (i.e., mud flats and adjacent shallow areas of the Bay) are productive and highly utilized by biota of interest (humans or wildlife). This study will provide a spatially-distributed characterization of surface sediment contamination and ancillary characteristics within shallow South Bay, Lower South Bay, and "Extreme" Lower South Bay (i.e. previously named "Southern Sloughs") margin areas.

The specific objectives of the sampling effort are:

1. Measure sediment parameters (pH, ORP) at 41 sites.
2. Collect sediment samples from 40 sites for "standard margins samples" for analysis of:
    - Sediment Grain Size
    - Sediment Quality Parameters (% solids, total solids, CHN, TOC)
    - Mercury and methylmercury
    - Trace Metals (Al, Ag, As, Cd, Cu, Fe, Mn, Ni, Pb, Se, Zn)
    - PCBs (209 Congeners)
3. Collect sediment samples from 40 sites for "standard margins archives" (organics, trace metals, PFAS).
4. Collect sediment samples for add-on studies:
    - Microplastics (16 sites)
    - Nanoplastics (16 sites)
    - Poly- and perfluoralkyl substances (PFAS) (5 sites)
    - Pesticides and musks (12 sites)
    - Non-targeted analysis by GC/MS and LC/MS (15 sites)
    - Dyes (15 sites)
    - Nonylphenol ethoxylates (15 sites)
    - Bioanalytical tools (6 sites)
5. Collection water samples for add-on studies:
    - Pesticides and musks (12 sites)
    - Bioanalytical tools (6 sites)

Add-on samples will be co-located as much as possible. Sites will be categorized into three types:

1. Standard Sites (25 sites): samples listed above in groups 1, 2 and 3 will be collected
2. Standard + Add On Sites (4 sites): all or some of the samples listed in group 4 above will be collected, in addition to those collected at the Standard sites. No water samples will be collected.
3. Standard + Add On + Water Sites (12 sites): all or some of the samples listed in group 5 above will be collected, in addition to those collected at the Standard + Add On sites.

2. Key Personnel and Approvals

The personnel and work assignments for this cruise are shown in Table 1. These key personnel have indicated their approval of the Cruise Plan by adding their initials and date in the far right column.

Table 1. Key Personnel for 2017 RMP Margin Sediment Cruise

Name	Affiliation	Duties	Cell	Initial and Date to Indicate Approval of Plan
Rusty Fairey	CCR	Project Manager	831-737-3409	RF7/31/17
Phil Trowbridge	SFEI	RMP Program Manager	603-340-5220	PT 5/25/17
Jay Davis	SFEI	RMP Lead Scientist	530-304-2308	JD 7/24/17
Don Yee	SFEI	RMP QA Officer	510-508-2995	DY 5/25/17
Amy Franz	SFEI	RMP Data Manager	510-282-5012	AF 7/18/17
Rebecca Sutton	SFEI	RMP Senior Scientist (CECs)	510-701-7050	RAS 7/24/17
Meg Sedlak	SFEI	Program Manager (Microplastics)	510-918-6119	MS 5/25/17

3. Cruise Schedule

The cruise schedule is shown in Table 2. The schedule is for planning purposes only, and may be revised during sampling operations to reflect weather conditions, tide restrictions, equipment performance, or other factors. Any sites unable to be sampled at the scheduled time will be rescheduled later in the cruise, if possible.

Table 2. Anticipated Cruise Schedule for 2017 RMP Sediment Cruise

Date	Time	Activity
6/5 - 6/9		Tentatively scheduled as Sample Week ~13 stations
7/10 - 7/14		Tentatively scheduled as Sample Week ~14 stations
7/17/ - 7/21		Tentatively scheduled as Sample Week ~13 stations

Sites where water samples will be collected will be targeted to take place on a Monday or Tuesday if possible. Water samples must be shipped to their respective laboratories the day after sampling, and cannot be shipped on a Friday or Saturday. Shipping on Thursday (i.e. sampling on Wednesday) should also be minimized.

4. Sampling Procedure

At each station, samples/data will be collected in the following order:

1. 2-7 sediment grabs for pH, oxidation-reduction potential (ORP), and chemistry samples.

2. 2-5 1-L amber glass jars of water for pesticides, musks, and/or bioanalytical tool samples (at a subset of stations only).

3. Field observations should also be noted for each site (e.g,. wind speed, wave height, weather, etc.).

Sediment samples will be collected and processed following the procedures in the following subsections.

Sample Equipment and Cleaning

Intertidal sampling in San Francisco Bay will be conducted from an 18' Boston Whaler equipped with frame and hydraulics for deploying a 0.1 m^2 modified Van Veen sediment grab. The grab is constructed entirely of stainless steel and the jaws and doors are coated with Kynar™ to improve chemical inertness. A stainless steel scoop will be used to remove surface sediments and fill containers. Sample jars intended for PFAS analyses or archives will be used to directly scoop out sediment from the center of the grab sample. Sediment will be scooped directly into sample jars that must be frozen, as well as microplastic and nanoplastic sample jars (attempting to subsample the full 0-5cm depth into each jar as much as practicable). A polycarbonate bucket will be used to store a composite sample for standard margins samples (CHN, TOC, PCBs, trace metals, archives). A glass jar will be used to store a composite sample for CEC samples (pesticides, musks, non-targeted analyses, dyes, nonylphenol ethoxylates, bioanalytical tools), and will be covered with the teflon-lined lid when the jar is not being filled . A second stainless steel scoop that has been specially cleaned will be used to collect the CEC samples.

All sampling and handling will be conducted using clean techniques. Prior to sampling, all sampling equipment will be thoroughly cleaned. Equipment that is pre-cleaned includes the Van Veen grab, sample scoops, compositing (or storage) buckets, foil, polycarbonate coring devices, and wash bottles. The grab will be cleaned with detergent and pressure washed at the lab. The stainless steel scoops used for the CEC sample will be cleaned without detergent; instead they will be rinsed once with deionized water and three times with high-purity acetone, and wrapped in acetone-rinsed foil for transport. Other equipment is washed, with a detergent and deionized water solution, and rinsed three times with deionized water in lab pre-cleaning, which can be substituted by ambient water in the field. Equipment is next rinsed with 1.0 % solution of hydrochloric acid (or equivalent), followed by a rinse with methanol. All equipment besides the grab is stored in clean Ziploc™ bags (including foil-wrapped stainless steel scoops) until used in the field. It is critical that sample contamination be avoided during collection. Sample scoops will be re-cleaned in the lab between uses as needed; other equipment used at different sampling stations should be re-cleaned in the field between uses.

Sample containers will be purchased pre-cleaned directly from a supplier, provided pre-cleaned by the analytical or archive agency, or purchased uncleaned from a supplier and cleaned in the lab (Attachment C). Sample jars used for CEC compositing will be purchased uncleaned from the supplier and will be

cleaned in the lab by rinsing at least three times with high purity acetone. This cleaning method will be used in order to avoid potential residual contamination from detergent products.

Sampling personnel should wear nitrile gloves whenever taking or processing samples to avoid contact contamination (and for personal protection). In addition, airborne contamination is avoided by keeping sample containers, sample scoops and compositing bucket covered when not in use.

Sediment Collection and Sediment Field Measurement Protocol

The A-frame at the side of the vessel will be used for deploying the Van Veen grab. If water depth is insufficient to reach the sampling location by boat, sediment samples will be collected by hand using 4" polycarbonate sediment cores. The quality of grab samples will be ensured by requiring each sample to satisfy a set of criteria concerning the depth of penetration and disturbance of the sediment within the grab. In this way, each sample will normally contain the top 5cm of sediment within the area of the grab jaws. Grab samples will be rejected for the following conditions:

- There is a rock or shell fragment wedged between the jaws of the grab allowing the sample to wash out.
- The sample surface is significantly disturbed.
- The sample is uneven from side to side, indicating that the grab was tilted when it penetrated the sediment.
- The surface of the sample is in contact with the top doors of the grab, indicating over-penetration of the grab and possible loss of material around the doors.

The total number of grabs or cores taken will be recorded by field personnel on the field datasheets.

pH measurements from each grab or exposed sediment (at least 1 per grab) will be recorded by submerging a pH probe into the sediment (or a mini-core from a grab) to a depth of approximately 4 cm and allowing it to equilibrate. pH probes should be checked against pH standards each day before sampling and recalibrated if the measured value varies by more than 0.05 units from the expected value. ORP measurements will be made in a mini-core taken either from a grab or exposed sediment at a depth of 2.5cm according to the RMP Short Sediment ORP measurement SOP (**Attachment A**). Field measurements of pH, ORP and other parameters will be recorded on the Field Data Sheet (**Attachment B-1**).

Sediment samples will be collected to a depth of 5cm and composite samples will be taken until at least 2-3 L (2 liters for chemistry at all stations and additional 1 liter for microplastics at a subset of ten stations) of sediment is collected. Multiple deployments of the grab or hand cores will be composited together to obtain the required volume and to average out ultra-fine scale spatial variation. Sediment grabs showing prior disturbance (e.g., from immediate/recent prior grabs at the same site) should be retaken from an undisturbed area. Hand collected core samples should composite material from a 2-3 m radius (rather than collecting only contiguously adjacent hand cores).

Chemistry Sample Handling and Processing Protocol

After the overlying water has been drained off the grab sample, several sub-samples will be collected directly from the first and second grab. All samples that are directly collected into sample jars should

attempt to representatively include all of the top 5cm (e.g., rather than just scraping off the top 1cm) as much as practicable (e.g., perhaps not possible with small vials), unless otherwise specified for a given sample. Some of these subsamples will be field frozen. At sites where add-on samples will be collected, several sample jars will be filled directly from the third and fourth grabs. Remaining sample will be collected into a glass jar for the CEC composite, and a polycarbonate bucket for the non-CEC composite. The composite samples should include roughly equivalent volumes of sediment from at least three grabs. The subsamples to be collected and the order in which they should be collected are:

- Grab 1 - Half of the grab will be used for the ORP core and disturbed. Use the other side for Hg/MeHg (4 oz jar), and LOST (60 ml jar).
- Grab 2 - Collect 5 PFAS cryovials (PFLT, PFST) first by hand-dipping the containers directly into grab. Collect the PFAS sample if needed at that site. Then collect the 3 POLT Teflon tubes. The POLT Teflon tubes must be collected after the PFLT and PFST cryovials and PFAS sample to avoid cross contamination by PFASs in the Teflon. Any undisturbed sediment remaining in the center of the grab (i.e. not touching the grab itself) will be scooped into the CEC composite glass jar; the remaining sediment will be scooped into the polycarbonate composite bucket.
- Grabs 3 and 4 - Partially fill the CEC composite glass jar with a portion of sediment scooped from the center of the grab. Fill microplastic, nanoplastic, and microplastic archive containers. Any undisturbed sediment will be scooped the polycarbonate bucket for the composite samples.
- Grab 5 - Fill the remainder of the CEC composite glass jar with sediment scooped from the center of the grab. Fill bucket for composite samples to be filled in the laboratory.

Attachment C contains the details for how each field-filled sample should be collected. Important points are reiterated below:

- The mercury sample must be collected and field frozen on dry ice within 20 minutes of sample collection. If the 20 minute time limit is not met, add a note in the collection information with the amount of time that passed between collection and freezing.
- The archive samples intended for labile non-PFAS emerging contaminants (LOST) and non-PFAS organics or trace metals (POLT) must also be field frozen on dry ice.
- The samples for perfluorinated analysis (PFAS) and archives (PFLT, PFST) will be collected from the center of the grab, avoiding contact with the edges of the Van Veen or sediment core that may have been in contact with the grab. For PFLT and PFST samples, the sample container will be used to collect the sample directly into the container. The PFAS sample will be filled using a scoop. The sampler should wear clean nitrile gloves and IF NEEDED should wipe off excess sediment on the top rim and grooves of the vial to allow for a good seal.
- The CEC composite jar will be filled with sediment from at least three different grabs, using a acetone-washed stainless steel scoop. Sediment for the CEC composite should be collected only from the center of the grab, avoiding contact with the detergent-washed grab. The composite jar will remain chilled on wet ice overnight. The sample jar will be delivered to SFEI by FedEx or SFEI staff for sub-sampling into appropriate laboratory specific containers in the lab the following day. Sub-sample containers will be frozen until shipping.
- Microplastic, nanoplastic, and microplastic archive sample jars will be filled directly into each sample jar using a stainless steel scoop.

The remainder of the sediment will be collected and stored at 4 deg C in a polycarbonate bucket in a cooler. This sediment will be homogenized and subsequently sub-sampled to the appropriate laboratory specific containers in the lab within 7 days following collection. **See Attachment C for details.**

The sample groups and total sediment volume that will be collected at each site, as well as the location of field duplicates and field blanks, are summarized in **Attachment D, Table 1.** The volume of sample that needs to be included in the CEC composite is also calculated in **Attachment D, Table 1**; however, a larger composite (i.e. 750 mL or more) at each site is preferred, if volume allows. The number of sample containers that need to be filled with sediment from each site (as designated in Attachment D, Table 1), the volume of sediment required for each container, and sample handling, storage, and shipping requirements are listed in **Attachment C.**

Microplastic, nanoplastic, and PFAS sample bottles should be filled to between 50-75% as sediment volume allows. All other sample bottles should be filled to 75% of total capacity unless otherwise specified, to allow room for expansion on freezing, as needed. Sample containers for MeHg/Hg will be double-bagged in ziploc bags, others (especially glass) may be bagged in ziploc to avoid contamination and then bubble wrap bagged or placed in their original shipping box with cardboard separators to reduce potential container breakage.

Sediment QA/QC Sample Collection

The number of field duplicates and field blanks to be collected for each analyte group at each site are designated in **Attachment D, Table 1. Attachment C** lists the container types for which field duplicates, bottle/field blanks must be collected.

Field duplicates will be collected at two sites, LSB02 and SOSL16. For sediment composites, two separate composites will be collected from different sets of grabs, and will subsequently be subsampled into duplicate samples. Field duplicates will be collected from a second set of grabs sampled immediately after the first set of grabs are sampled.

For pesticides and musks, field duplicates will be collected at SOSL16, while additional sample material will be collected at LSB02 for matrix spike/matrix spike duplicate (MS/MSD) samples. The MS/MSD sample volumes will be collected using the same method as field duplicates. Water samples will be collected in triplicate (1 L for the field sample, 1 L for the MS, and 1 L for the MSD). For sediment samples, no additional volume is needed for the pesticide samples, but two times the standard volume for musks will need to be collected in the “duplicate” sample. The total CEC composite volume listed in **Attachment D, Table 1** reflects the volume needed to be collected in each sample.

Blanks will be collected using several methods, and will be conducted at the designated stations prior to sample collection. For the mercury/TE, PCB, and short term archive samples, two spare bottles will be retained with the set of samples to act as bottle blanks for container type. These containers have been purchased ‘pre-cleaned’ from ESS Vial or VWR, or provided by NIST. Bottle blanks will not be opened and will be kept with other RMP samples in case container contamination issues arise. These bottles do not need to be brought into the field. They can remain in the lab during the cruise.

For pesticides, non-targeted analyses, dyes, and nonylphenol ethoxylate samples, field blanks will be brought into the field and handled similarly to field samples (i.e. the CEC composite glass jar). Bottles

will be placed in the same general location as field sample bottles and opened while the field sample bottles are being filled, while taking care not to contaminate the blank bottles with any splashes of stray water or sediment materials. These blank bottles will also be opened to air in the laboratory while the sample jars are open for composite subsampling.

For the musk samples, field blanks will be collected using baked Ottowa sand provided by the USGS-Denver lab. Clean sand will be handled with field equipment as typical samples are handled.

For the microplastic and nanoplastic samples, field blanks will be collected using blank water. Equipment used to collect field samples (kynar grab, scoops, etc.) will be rinsed with milli-Q water into the blank container. The blank container will otherwise be handled and stored as a typical field sample or trip blank container would be handled.

Water Sample Collection

Water samples will be collected at 12 sites. All samples will be collected into 1 L amber glass bottles by submerging the bottle below the water surface as far as possible based on the sampler's arm length. Jars will be kept closed until dunked to the appropriate depth, opened and filled, capped, and then pulled out from the water's surface. Each bottle will be filled to the neck, capped, and chilled to 4 C. Water samples will be shipped to their respective analytical laboratories as soon as possible after sample collection. Analytical laboratories will be notified immediately prior to each shipment in order to ensure samples will be able to be immediately preserved upon receipt. Samples will not be collected and shipped on a Thursday or Friday, and preferably will be sampled on a Monday or Tuesday.

The sample groups and total water volume that will be collected at each site, as well as the location of field duplicates and field blanks, are summarized in **Attachment D, Table 1.**The number of sample containers that need to be filled with water at each site (as designated in Attachment D, Table 1), and sample handling, storage, and shipping requirements are listed in **Attachment C.** The sampling design is summarized below:

- 1 L will be collected each for pesticides and musks analyses at 12 sites (2 L total)
- 1 L will be collected in triplicate for bioanalytical tools analyses at 6 of the above 12 sites (3 L total)

Water QA/QC Sample Collection

Field duplicates will be collected for pesticides and musks immediately after the first field samples are collected. Field blanks will be collected for pesticides and musks using blank water provided by the USGS-Denver laboratory, by pouring the provided water into the appropriate sample bottles in the field..

No field blanks or field duplicates will be collected for the bioanalytical tools study.

5. Laboratories

Contact information for the laboratories and archive agencies receiving samples from the sampling event, as well as the field contractor, is shown in Table 3.

Table 3. Contact Information for laboratories and contractors for the 2017 Bay Margins Sediment Study

Agency	Role	Contact	Shipping Address	Phone / Email
Laboratory Contacts				
ALS-Kelso	Grain Size, TOC	Howard Boorse Shar Samy	1317 South 13th Ave Kelso, WA 98626	360-577-7222 Howard.Boorse@alsglobal.com 360-501-3293 Shar.Samy@alsglobal.com
ALS-Tucson	CHN	Ralph Poulsen	3860 S. Palo Verde Rd., Suite 302 Tuscon, AZ 85714	520-573-1061 Ralph.Poulsen@alsglobal.com
BRL	Mercury	Lydia Greaves	18804 North Creek Parkway, Suite 100 Bothell, WA 98011	206-753-6127 lydia@brooksapplied.com
SFPUC	Trace metals	Robert Wellbrock	1000 El Camino Real, Millbrae, CA, 94030	650-871-3011 RWellbrock@sfwater.org
SGS AXYS	PCB	Andrew Porat	SGS AXYS Analytical Services, Ltd. 2045 Mills Road Sidney, British Columbia V8L5X2	250-655-5838 aporat@axys.com
Rochman Laboratory (University of Toronto)	Microplastic	Chelsea Rochman	Dr. Chelsea M. Rochman University of Toronto, St. George Ramsay Wright Rm 402 25 Harbord St Toronto, ON M5S3G5	416-978-6952 647-770-8135 chelsea.rochman@utoronto.ca
Banaszak-Holl Laboratory (University of Michigan Dept. of Chemistry)	Nanoplastic	Rachel Merz Mark Banaszak Holl	Rachel Merzel 930 N. University Avenue Chemistry Department (4316 Chem) University of Michigan Ann Arbor, MI 48109-1055	rlmerzel@umich.edu (559) 696-5238. Mark Banaszak Holl 734-763-2283
Higgins Laboratory (Colorado	PFAS	Dr. Chris Higgins	Department of Civil and Environmental Engineering Colorado School of Mines	chiggins@mines.edu (720) 984-2116

School of Mines)			1500 Illinois St. Golden, Colorado 80401	
USGS-Sacramento	Pesticide (water and sediment)	Michelle Hladik Megan McWayne	Hladik/McWayne USGS CA WSC 6000 J Street, Placer Hall Sacramento, CA 95819	916-278-3208 ocrl-cawsc@usgs.gov 916-278-3183 mhladik@usgs.gov 916-278-3127 mmcwayne@usgs.gov
USGS-Denver	Musks (water and sediment)	Ed Furlong	National Water Quality Laboratory U.S. Geological Survey Building 95, Entrance E3 Denver Federal Center Denver, CO 80225-0046	303-236-3941 efurlong@usgs.gov
Ferguson Laboratory (Duke University)	Non-targeted analyses (GC/MS), Dyes, Nonylphenol ethoxylates	Lee Ferguson	Lee Ferguson Duke University 140 Science Drive Gross Hall, Room 380 Durham, North Carolina 27708-9976	919-886-0692 lee.ferguson@duke.edu
Hoh Laboratory (San Diego State University)	Non-targeted analyses (LC/MS)	Eunha Hoh	Attn: Eunha Hoh 5500 Campanile Drive San Diego State University Hardy Tower 119 San Diego, CA 92182-4162	619-594-2393 ehoh@mail.sdsu.edu
Denslow Laboratory (University of Florida)	Bioanalytical tools (water and sediment)	Nancy Denslow	Nancy Deslow Univ of Florida Center for Environmental and Human Toxicology Building 471 2187 Mowry Rd Gainesville, FL 32611	352-294-4643 ndenslow@ufl.edu krollk@ufl.edu
Archive Agency Contacts				
NIST	Long-Term Archives	Amanda Moors	NIST Hollings Marine Laboratory 331 Ft. Johnson Rd. Charleston, SC 29412	843-762-8953 amanda.moors@noaa.gov
AMS	Short-Term Archives	Paul Salop	Applied Marine Sciences 4749 Bennett Dr., Ste. L Livermore, CA 94551	925-373-7142 salop@amarine.com

SFEI	CEC archives	Rebecca Sutton	San Francisco Estuary Institute 4111 Central Avenue Richmond, CA 94804	510-746-7388 rebeccas@sfei.org
SFEI	Microplastic archives	Meg Sedlak	San Francisco Estuary Institute 4111 Central Avenue Richmond, CA 94804	510-746-7311 meg@sfei.org
Field Contractor (equipment shipping)				
Coastal Conservation & Research	Field Contractor	Rusty Fairey	Marine Pollution Studies Lab Moss Landing Marine Laboratories 7544 Sandholdt Rd. Moss Landing, CA 95039	831-771-4161 fairey@mlml.calstate.edu

6. Sampling Sites

Forty-one sites will be targeted in 2017. Coordinates for all RMP sampling sites are shown in Attachment D and Figure 1.

Site Access and Selection

The list of the 41 target sampling sites is shown in Attachment D, Table 1. Sites are distributed among three regions: South Bay, Lower South Bay, and "Extreme" Lower South Bay (i.e., Southern Sloughs). There are 27 target sites in South Bay, 11 target sites in Lower South Bay, and 2 target sites in Extreme Lower South Bay, each of which were selected through a probabilistic site selection scheme. An additional deterministic site was added in Extreme Lower South Bay on Coyote Creek.

Several target analyte groups will be collected at different subsets of sites. "Standard" margins samples, including analyses for mercury, PCBs, trace metals, ancillary parameters, and archives, will be collected at the 40 probabilistic sites. Microplastic samples and microplastic archives will be collected at 16 sites, nanoplastic samples will be collected at 8 sites, PFAS samples will be collected at 5 sites, and a CEC composite will be collected at 15 sites. The CEC composite will be subsampled into up to 7 different samples, each of which will be collected at anywhere between 6 and 15 sites. All non-"standard" margins samples will be collected at the deterministic site on Coyote Creek.

Field teams will navigate to the coordinates for the target sites within the accuracy of the shipboard GPS. However, the field team can move around within 50 meters of the planned site to find a suitable location with target habitat nearby if any of the following logistical problems prevent sampling at the planned site coordinates:

- Access/safety: The site cannot be accessed safely; OR

- Substrate: The substrate at the site is too coarse to collect a cohesive sample, is rocky shoreline, is covered with dense aquatic vegetation, or is shell hash; OR
- Upland area (above MHW): The planned site is in a salt marsh or upland area; OR
- Deep subtidal area: The planned site is deeper than 1 ft below MLW.

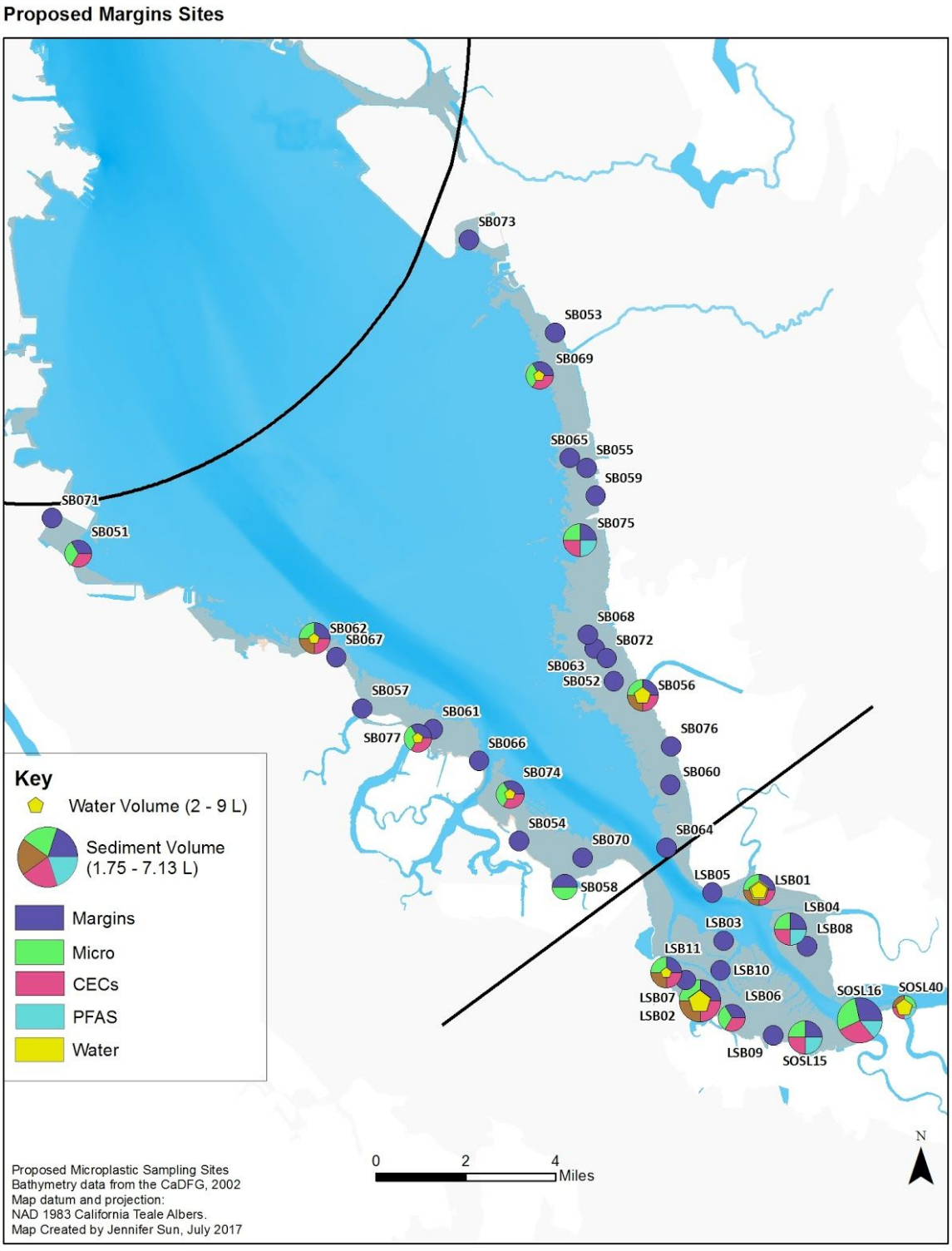
For sites that need to be relocated within the 50 meter allowable radius, the sample should be collected at the expected water depth for the original site to avoid biasing (e.g., biasing by always going to the deepest allowed depth). The expected water depths for the target sites are shown on Table 4.

Sites that are not at their expected depth but are still within acceptable habitat and depth range (MHW to 1 foot below MLW) at their planned coordinates will be sampled at the target coordinates.

If no suitable locations are found within 50 meters, the site will be rejected as not possible to sample. The next available site in the respective overdraw lists in Attachment D, Table 2, will be added in its place depending on the region.

In addition, water samples will be collected at 6 sites for bioanalytical tools analyses, and at 12 sites for analyses of pesticides and musks. The sites, sample numbers, sample volumes, and laboratory shipping locations for water samples are described in Attachment C and Attachment D, Table 1.

Figure 1: 2017 RMP Sediment Cruise Target Sampling Sites. The first 40 target sites and 1 deterministic site on Coyote Creek are symbolized based on approximate sample volume needed to be collected.



7. Sample Labeling

The sample ID system used for the Bay Margins cruise for analytical samples is as follows:

YYRMPMC-STA#-AGX-rep#

Where:

YY = Year (for 2017, YY=17)

RMPMC = Project (RMP Margins Cruise)

STA# = Station ID (e.g., SB051 through SB077, LSB01 to LSB11, etc.)

AGX = Acronym for analyte group. See **Attachment C** for acronyms

Rep# = Replicate number.

The sample ID system used for the Bay Margins cruise for archive samples is as follows:

YYRMPMC-STA#-AGXAARep#

Where:

YY = Year (for 2017, YY=17)

RMPMC = Project (RMP Margins Cruise)

STA# = Station ID (e.g., SB051 through SB077, LSB01 to LSB11, etc.)

AGX = Acronym for analyte group. **See Attachment C for acronyms.**

AA = Archive type (when applicable). (ST = short term, LT = long term)

Rep# = Replicate jar number for each analyte group

Notes on Assigning Rep#: The replicate number should be increased sequentially as needed to characterize a field replicate and duplicates. For example, for mercury samples, there is only one container to be filled for each sample. The Rep# will be 1 for the primary sample and 2 for the field duplicate. In contrast, for PFLT archive samples, there are two containers to be filled for each sample. The Rep# will be 1-1, 1-2 etc. for the primary sample and 2-1, 2-2 etc. for the field duplicates. For field blanks, use “BottleBlank”.

Every container will be labeled with a unique sample ID following this system. The sample ID will be recorded on a field data sheet (**Attachment B-1**).

8. Sample Handling and Custody

Chain of custody records will be maintained throughout the course of the sampling effort. For each set of samples being shipped to a laboratory or archive, CCR will initiate a COC form, include the original form with the sample shipment, and provide a copy/scan of the form to SFEI at the time of the shipment.

Field sample handling, storage, custody, and shipping information are outlined for each sample type in Attachment C. A summary of key points is reiterated below:

- CCR will store all standard margins samples and archives and ship them to their respective laboratory or agency destinations at the end of the field season.
- CCR will also store microplastic, nanoplastic, microplastic archive, and PFAS samples and ship them to their respective laboratory or agency destinations at the end of the field season.
- CCR will ship water samples to their respective destinations as soon as possible after sample collection, and no later than the following morning.
- SFEI staff will pick up PFAS samples and CEC composites the evening of or morning after samples are collected, and deliver these samples to SFEI for subsequent sub-sampling and freezing on the day after sample collection
    - Composite sub-samples that are not funded for analysis will be frozen at SFEI and shipped to AMS for short-term archive at Schaeffer's Cold Storage in Oakland, CA until funding is secured

Agencies should be notified prior to any shipment, and the contacts listed in Table 3 should be included in any FedEx shipment notifications. Samples sent to the USGS laboratories require a copy of an Analytical Services Request (ASR) form to be included with each shipment. The laboratories will provide ASR templates prior to field sampling, which will then only need to be filled in with the sample date. Specific sampling instructions for the USGS-Sacramento laboratory are included in **Attachment E.**

Attachment A

RMP Short Sediment ORP measurement SOP (revised 2015-05 for margins)

The method is modified to take a single reading at 2.5cm depth rather than at 3 depths in standard RMP method. Steps for taking a picture also dropped/made optional.

Oxidation/reduction potential (ORP) readings are taken at each station from a grab core or direct insertion in exposed sediment. Additional readings can also be taken, time permitting. Instrument ORP readings are offset from true "Eh" readings, by an amount specific to the particular electrode type: the Sentix ORP (platinum) probe for the WTW meter is -~210mV relative to true Eh (hydrogen electrode): Eh= ORPreading + 210mV (at 20C). DO NOT make correction to the ORP reading in the field- record what you read.

Materials:

ORP meter and electrode (Oakton ORP Testr 10)

Clear coring tube, ~5cm diameter or larger, ~5cm height

Watch or timer to track probe equilibration time

Collection method:

1. Push the corer tube into the grab, let crew collect the rest of the material.

2. Dig a tool or fingers under to help lift it out

3. Once out, place on a jar lid or other flat surface (to prevent core sliding out of tube).

Measurements:

1. Make a note in the field log of depth below surface any transitions or notable features in the core or surrounding grab (e.g. gray below 4 cm, fine shell fragments throughout). Optionally take a picture of core/grab/in situ sediment cross section.

2. Push the ORP probe, to **2.5cm** depth.

a. If probe hits something hard like shell, rock, or wood fragment, do not force through, as probe tip may break. If close to target depth (e.g., >2cm), keep that location. If a long way from target depth, note the depth of the obstruction, and pull out the probe. In site sediment, just insert at another point.

b. In a core, there is less space to relocate so use a wire or skinny screwdriver to poke at locations to find a way around the object, but do not poke all the way to the target depth (or you may expose that point to air).

c. If a clear path is found with test wire/screwdriver, insert the probe along that path. If near the core edge, be sure the ORP probe orifice (small hole in the probe side about 0.5cm from the tip) is facing toward the core center.

3. Note time/set timer. Record reading after the sensor has equilibrated, about 5-8 min. Record raw ORP, **NOT** Eh conversion.

4. If ORP >0 in anoxic (black/sulfidic) sediment probe may be broken. Switch probe.

5. Dump core, rinse probe in site water, re-cap, and get ready for the next station, or take another reading from the same station if there is enough time.

6. Clean well , rinse/store with DI water in cap at day end.

Attachment E

https://drive.google.com/open?id=0B-DCvkdKIAt2Z0V1XzRMcS1tY2s

Appendix 4 – 2017 CCR Margins Sediment Microplastics Cruise Report

RMP
REGIONAL MONITORING
PROGRAM FOR WATER QUALITY
IN SAN FRANCISCO BAY

sfei.org/rmp

2017 Margins Microplastics Cruise Report

Prepared by

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Marco Sigala, Coastal Conservancy & Research

CONTRIBUTION NO. 847 / July 2017

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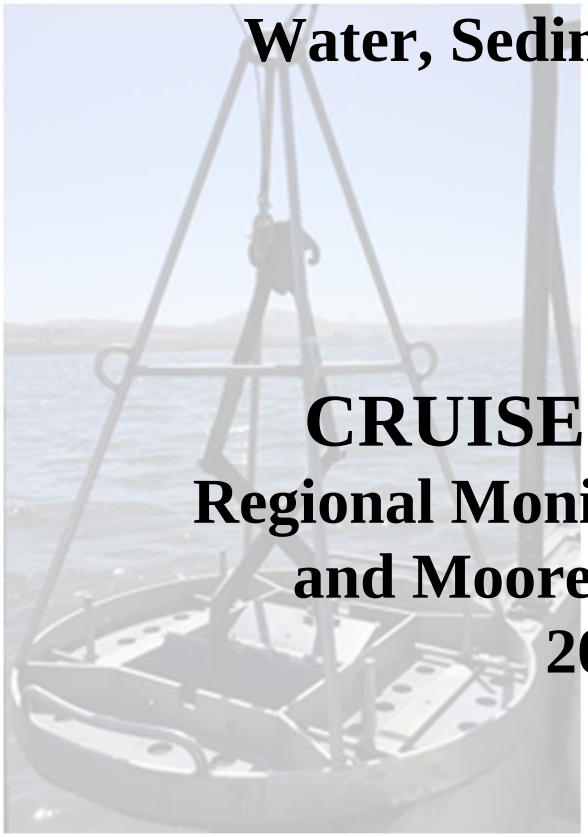
Contaminant and Microplastic Concentrations In San Francisco Bay and Tomales Bay Water, Sediment, and Fish



CRUISE REPORT

Regional Monitoring Program and Moore Foundation 2017

Prepared for the San Francisco Estuary Institute

by

Coastal Conservation & Research
P.O. Box 543, Moss Landing, CA 95039

List of Figures

List of Appendices

Introduction

This report contains information on the summer field sampling efforts conducted by Coastal Conservation & Research (CC&R) in support of two Regional Monitoring Program (RMP) studies: South Bay Margins and Moore Microplastics. The South Bay Margins is the second round of a larger San Francisco Bay study collecting sediment and water in shallow margin areas of the bay. The first round was conducted in Central Bay in 2015. The Moore Microplastics study is a collaborative effort with the Moore Foundation to collect sediment and fish samples in San Francisco and Tomales Bays. The work for both studies was contracted through the San Francisco Estuary Institute (SFEI) to CC&R. Since overall project management and sampling locations were coordinated between the two projects, activities from both studies will be presented as they occurred.

This report includes sample collections over a seven week period (June 5th through July 20th) in 2017 encompassing four trips. A total of 40 sediment and 12 water sites were sampled for the South Bay Margins study (Appendix A) and 27 sediment and 12 fish sites were sampled for the Moore Microplastics study (Appendix B). Duplicate sediment samples were collected where identified by SFEI and some water samples required collection of extra bottles for matrix spike (MS) and matrix spike duplicate (MSD) analyses. Detailed sample counts and protocols can be found in these documents prepared by SFEI:

- 2017 Bay Margins Sediment Study Cruise Plan
- 2017 Cruise Plan for Microplastics in Sediment in San Francisco Bay (North)/Tomales Bay and Fish in San Francisco Bay.

At each Margins site, field measurements were recorded for sediment pH, ORP (Oxygen Reduction Potential; Eh), color, composition (e.g., sand, mud), and anoxic transition depth. The field pH meter was calibrated daily prior to sampling while the ORP meter was calibrated each week prior to sampling. At each Microplastics site where Margins sampling did not occur, habitat observations such as sediment color, odor, and composition were recorded.

Water samples were collected in a 1-liter amber glass jar by dunking the closed jar under water about 0.1 meters, uncapping the jar to fill it, and then re-capping the jar under water before pulling it out and onto the boat. Field blanks were collected at some sites by pouring trace-clean water supplied by USGS directly into an amber glass jar.

Sediment was collected using a stainless steel, Kynar-covered modified Van Veen grab (0.1 m^2 area) penetrating 8-10 cm into the sediment. For Margins sites, some analytical jars were filled directly by scraping the jar into the top sediment layer of the grab. Additional sediment (top 5 cm) was collected using a polyethylene scoop and then placed into either an analytical jar or a 2-liter trace-cleaned polycarbonate tub. A secondary 2-liter glass jar for Contaminants of Emerging Concern (CEC) analyses was filled at some sites using an acetone-cleaned stainless steel scoop. All jars filled on the boat were placed immediately on dry ice while sediment tubs and CEC jars were placed on wet ice. The CEC jar was picked up by SFEI staff each evening and taken to SFEI the following day for processing. For Microplastics sites, a stainless steel scoop was used to fill sediment directly into 1-liter amber glass jars and then jars were placed on wet ice during the week. Jars were stored in a -20ºC freezer upon return to the laboratory.

Polycarbonate tubs were brought back to the lab at the end of each sampling trip and maintained at 4-6°C. Tubs were processed and aliquoted into analytical jars either the day after returning from sampling or the following Monday. Samples were stored in a -20ºC freezer except for grain size, which was refrigerated and stored at 4-6ºC, until shipment to the analytical laboratories.

Field and travel blanks were collected at specific sites depending on the analyte. In some cases, a blank required placing an open jar on the boat console while sampling was conducted or trace-clean sediment was scooped into an analytical jar. For Microplastics field blanks, trace-clean water supplied by SFEI was poured over the scoop and sediment grab and collected directly into the 1-liter amber glass jar.

Fish samples were collected using a cast net or mid-water otter trawl depending on the location and target fish. All fish samples were placed immediately on wet ice on the boat and then placed on dry ice after processing each day before storage in a -20°C freezer upon return to the laboratory.

Water samples were shipped daily using hard-copy Chain-of-Custody (COC) forms provided by USGS or CC&R depending on the receiving laboratory. Sediment grain size samples were shipped in two batches to the laboratory to avoid holding time conflicts. The remaining sediment samples were batched by analyte and shipped to the laboratory in early August. Hard- and soft-copy COCs were provided to the laboratories and SFEI staff.

This report details weekly synopses of sampling efforts and provides figures for sampling locations (see Figures 1-6). Target and actual latitude and longitude coordinates, sample dates, and type of collections are listed in Appendices A (Bay Margins) and B (Moore Microplastics).

Soft copies (pdf files) of field data sheets and CEDEN data templates for field, chemistry, and tissue collections were provided to SFEI.

Trip 1 - Sampling Dates: June 5-9, 2017
Sampling Crew: Rusty Fairey, Marco Sigala

The main objective of this cruise was to target sediment, water, and fish tissue sites using afternoon high tides to access shallow areas in the Lower and Extreme Lower South Bay portions of San Francisco Bay. Thirteen sites were successfully sampled for the standard Bay Margins sediment suite, eight sediment CEC sites, eight sediment Microplastics sites, six water sites, and two sites for fish collections.

Monday, June 5th
The sampling crew started the week driving from MLML to the Alviso Slough boat launch so the crew could access the Lower South Bay region. The crew began sampling site LSB11 at 10:45. The full suite of sediment including the standard Margins, CECs, and Microplastics plus water samples were collected at this site. The crew then moved to site LSB02 where the full suite of sediment and water samples were collected including sediment duplicates and water MS/MSD

samples. Two more sites (LSB10 and LSB03) were sampled for the standard sediment suite before the winds increased and it became unsafe to sample. Both sites had shell hash present in the sediment. All samples were collected and immediately placed on either dry or wet ice depending on the analyte. The crew pulled the boat out of the water around 14:00 and then prepped CEC jars for pick-up by SFEI staff and water samples for overnight delivery via FedEx to the labs.

Tuesday, June 6th
The sampling crew started the day at 07:30 launching the vessel out of the Alviso Slough boat launch and targeted fish using a cast net for a couple hours at SOSL40. No fish were caught. The crew then transited to site LSB01 and began collections at 11:50 in breezy conditions. The full suite of sediment and all water samples were collected. Site LSB04 was sampled next collecting the full suite of sediment jars. Wind speeds increased even more and the crew moved back to the more sheltered site SOSL40. Sediment for Microplastics and CECs but not Bay Margins was collected. Water samples were also collected including field blanks for musks analyses. All samples were collected and processed accordingly. Water samples were shipped via FedEx for overnight delivery to the labs. USGS staff notified SFEI staff that two 1-L water bottles needed to be collected rather than one 1-L bottle. SFEI staff and the field crew reviewed the number of available water bottles and adjusted the collection plan for the next day. More bottles were sent to MLML to cover future water collections.

Wednesday, June 7th
The sampling crew started the morning launching out of Alviso Slough again and throwing cast nets at site SOSL40. Sixteen topsmelt (110-280 mm TL) and eight anchovy (82-108 mm TL) were kept for gut content analyses, wrapped in aluminum foil, and placed on dry ice. The crew then sampled two sites (SOSL15 and SOSL16) for the full suite of sediment and water samples. Duplicate water (musks and pesticides) and microplastics samples were collected at site SOSL16. Samples were processed and placed on wet or dry ice. Sampling ended early so the crew could ship water samples via FedEx for overnight delivery.

Thursday, June 8th
The sampling crew launched the boat from Alviso Slough and transited to the area of LSB06 to look for fish. Mid-water otter trawls were run in the main channel and edge of the bay yielding no fish. The crew moved closer to shore near the Bayshore Sailing Park and threw cast nets catching three topsmelt (108-122 mm TL) and four anchovy (64-92 mm TL). Fish were processed and placed on dry ice before collecting sediment (standard, microplastics, CECs). Four more standard sediment sites (LSB07, LSB09, LSB08, LSB05) were collected and processed accordingly. The sediment at site LSB07 was a coarse sand and shell mixture with a lot of clams present. The ORP measurement was taken from Grab 2 rather than Grab 1. The crew finished the day back at site SOSL40 throwing cast nets to catch an additional 15 topsmelt (106-140 mm TL) and three anchovy (88-112 mm TL). The fish were wrapped in foil and placed on dry ice.

Friday, June 9th
No sediment was collected this day due to a small craft advisory beginning at 10 am. Instead, the crew drove to the Bayshore Sailing Park near site LSB06 and spent five hours throwing cast nets

off the dock into a small channel. Seven topsmelt (120-145 mm TL) and seven anchovy (80-98 mm TL) were caught, wrapped in foil, and placed on dry ice. The crew drove back to MLML where frozen samples were placed in the -20°C freezer.

Sediment tubs from this trip were processed in the lab on Monday, June 12th. Homogenized sediment for each site was aliquoted into analytical jars and then placed in a refrigerator (grain size/TOC) or in a -20ºC freezer.

Trip 2 - Sampling Dates: June 19-23, 2017
Sampling Crew: Rusty Fairey, Marco Sigala

The main objective of this cruise was to sample northern San Francisco Bay (Central, San Pablo, Suisun) and Tomales Bay for the Microplastics study. Eleven sites were sampled for sediment Microplastics and four sites were targeted for fish collections. Meg Sedlak from SFEI joined the crew in Tomales Bay.

Monday, June 19th
The sampling crew drove to Oakland Inner Harbor to launch the boat and sample sites CB105 and CB106 for fish. Cast nets were thrown at the target location and surrounding edges of the bay at CB105. The open water without any structure to centralize the fish made it difficult to catch any fish and no target fish were caught. At site CB106, the crew netted 10 topsmelt (130-150 mm TL) and 13 anchovy (60-94 mm TL). Fish were wrapped in foil and stored on dry ice. The crew pulled the boat out of the water and drove to Benicia.

Tuesday, June 20th
Strong winds were forecasted this day so the crew launched the boat from the Petaluma River launch ramp to work the western edge of San Pablo Bay. Site SPB15 at the mouth of the Petaluma River as it drains into San Pablo Bay was sampled first around 09:20. A sediment duplicate was collected at this site. The crew headed south to site SPB126 to collect a regular microplastics sample as well as a field blank. The crew next moved to the nearby tissue site SPB104 and ran a mid-water trawl in the channel looking for target fish. No fish were caught so a cast net was tried further up the channel without any luck. The crew transited back to SPB15 and threw a cast net up and down the Petaluma River without catching any target fish, although a couple striped bass were caught and released. Sediment samples were processed immediately after collection and placed on wet ice.

Wednesday, June 21st
The wind forecast looked good this day and held surprisingly long enough to sample six sites. The crew first launched out of Martinez and sampled sites SUB53, SUB16, and SUB52. The boat was pulled out of the water and the crew drove to Vallejo to launch the boat closer to San Pablo Bay. Site CAR42 at the mouth of Mare Island was sampled first. This site was located behind a break wall and had an anoxic layer at about 5 cm deep. Site SPB128 was sampled next and then the crew made the long transit to the back northeastern end of San Pablo Bay where site SPB50 was located. Due to the dropping tide and increasing winds at this exposed site, the crew got as close as they could to the target location to sample. This site needs a really high tide with calm

conditions to reach the target. All samples were immediately processed after collection and placed on wet ice. The crew pulled the boat and drove to Tomales Bay.

Thursday, June 22nd
The crew began the day waiting for the incoming tide so the boat could be launched. Site TB109 was sampled around 09:15 for a regular microplastics sample as well as a field blank. The crew went back to the launch ramp to pick up Meg Sedlak from SFEI. The crew headed south to site TB102. The water depth was too shallow to reach the target location and Meg agreed to sample about 0.73 miles away. An anoxic layer was seen at about 3 cm depth and there was a lot of organic matter in the sediment grab. Cast nets were thrown in the vicinity of Millerton without any fish caught. The crew then transited northwest towards TB101 but could only get as close as 0.22 miles from the site due to shallow water. Meg approved and sediment was collected. The crew then searched the area for target fish catching 13 topsmelt (130-220 mm TL) in the vicinity of Hog Island. The crew then headed back to southern Tomales Bay and threw cast nets yielding a total of 28 topsmelt (122-224 mm TL). All sediment and fish samples were processed immediately and placed on wet (sediment) or dry (fish) ice.

Friday, June 23rd
Only anchovy were targeted in Tomales Bay this day. No sediment samples were collected. The crew started at 06:50 at site TB102 running mid-water trawls. Forty anchovy (49-58 mm TL) were caught. The crew then moved to site TB101 to run mid-water trawls and only 10 anchovy (50-92 mm TL) were caught. Fish were processed and placed on dry ice. The crew pulled the boat out of the water and drove back to MLML. Upon arrival, sediment and fish samples were placed in a -20ºC freezer.

Trip 3 - Sampling Dates: July 5-7, 2017
Sampling Crew: Rusty Fairey, Marco Sigala

The main objective of this cruise was to focus on fish sampling in Central (Richmond and Oyster Point) and South Bays the first two days of the shortened sampling week and then finish in South Bay. Eleven sites were successfully sampled for the standard Bay Margins sediment suite, one sediment CEC site, one sediment Microplastics site, and four sites for fish collections. No water samples were collected.

Wednesday, July 5th
The crew travelled from MLML to Richmond to launch the boat and sample in the marina, inner harbor, and shipping channel. Cast nets were thrown along all shoreline edges and mid-water trawls were run in the main channel and inner harbor near site CB10. Only eight topsmelt (42-270 mm TL) and sixteen anchovy (58-72 mm TL) were caught. Fish were processed immediately and placed on dry ice. The crew pulled the boat out of the water around 16:00 and travelled to Oyster Point.

Thursday, July 6th
The crew launched out of Oyster Point and transited to site CB37. Mid-water trawls were run in three different areas around the site and nearby channel between Sierra and Oyster Points. Cast nets were also thrown near and around the Brisbane Marina wall. A total of twenty topsmelt were caught but two samples of ten were created. One sample had a regular size range caught at other sites (140-176 mm TL) while the other sample had a full size range of 2 large, 2 regular, and 6 small fish (50-308 mm TL). One of the trawls ran through a school of anchovy pulling in 60 fish. One regular sample of 10 fish (92-100 mm TL) and an archive sample of 50 fish (wrapped as five groups of 10 fish, 80-90 mm TL) were created. The crew transited south to the San Francisco airport (SFO) to sample sites SB051 and SB071. The standard sediment suite, CEC jar, and microplastics samples plus field blanks for microplastics, nanoplastics, and non-target pesticides were collected at site SB051. Site SB071 within the SFO security zone was sampled next for the standard suite of sediment. It was a very shallow site with a thin algae mat on the surface. All sediment samples were processed and placed on wet or dry ice accordingly. The crew pulled the boat, drove to Redwood City, launched the boat again, and ran three mid-water trawls in the afternoon at site SB074. Only one topsmelt (274 mm TL) and three anchovy (82-94 mm TL) were caught. The fish were processed, placed in foil, and then on dry ice after being caught.

Friday, July 7th
While waiting for the incoming tide after launching from Redwood City, the crew ran mid-water trawls at sites SB074 and SB077. Eleven anchovy (70-88 mm TL) were caught at site SB074 while twelve anchovy (80-116 mm TL) were caught at site SB077. The crew switched gears around 09:30 and began sediment collections along the northeastern edge of South Bay successfully sampling nine standard sediment sites. Seven of the sites (SB068, SB063, SB072, SB052, SB076, SB060, and SB070) had shell hash present in the sediment. The microplastics samples at site SB058 was not collected this day so the crew came back on the next trip. After the sediment collections, the crew went back to site SB074 in the afternoon to throw a cast net in the channel along the banks yielding twelve topsmelt (108-168 mm TL). All sediment and fish samples were processed and placed on wet or dry ice. The crew pulled the boat and returned to MLML. Samples on dry ice and the microplastics samples were placed in a -20ºC freezer.

Sediment tubs from this trip were processed in the lab on Monday, July 10th. Homogenized sediment for each site was aliquoted into analytical jars and then placed in a refrigerator (grain size/TOC) or in a -20ºC freezer.

Trip 4 - Sampling Dates: July 17-20, 2017
Sampling Crew: Rusty Fairey, Marco Sigala

The main objective of this cruise was to complete the remaining 16 sediment Margins, six CEC, seven Microplastics, and seven water sites in South Bay. The crew also threw cast nets at site SB077 to see if any topsmelt could be caught.

Sunday, July 16th
The crew travelled from MLML to Redwood City so they could sample during the early morning high tide on Monday.

Monday, July 17th
The crew launched out of Redwood City and began sampling site SB056 at 06:00. The full sediment suite plus water samples were collected including water duplicate, MS and MSD bottles. The crew then went to site SB058 to collect the microplastics samples not collected during the previous trip. Site SB054 was sampled next for the standard sediment suite. The pH 1 meter stopped working after the first grab so the crew calibrated the pH 2 meter and used it for the remainder of the trip. The full sediment suite plus water samples were collected next at site SB074. The sediment consisted of mostly large shell hash and there was a tide line of surface foam/scum present during the water collections. The crew did not open the water bottles until under the surface so there was minimal to no contact with the surface foam/scum. The crew finished the day collecting a standard sediment suite at site SB066. All samples were processed immediately after collection and placed on wet or dry ice. The crew pulled the boat and prepared water samples for overnight delivery via FedEx and sediment CEC samples for pick up by SFEI staff.

Tuesday, July 18th
The crew launched out of Oyster Point and started at 06:45 collecting the full sediment suite and water samples at site SB069. A lot of shell hash was present in the sediment making it hard to set the anchor. The crew then moved to site SB073 near the Oakland airport to collect the standard sediment suite and water samples. An additional water musk sample was collected since a bottle had broken at the lab. Two more sites (SB053 and SB065) were sampled and the crew ended the day due to the dropping tide. A dense mud and sand mixture was seen at site SB053 while site SB065 had a lot of shell hash present. The crew processed all samples immediately and shipped water samples via FedEx overnight delivery.

Wednesday, July 19th
The crew launched out of Redwood City and began collecting water and the full suite of sediment at 06:45 at site SB075. This site had a lot of worm tubes and the sediment consisted of a sticky mud with shell hash. The ORP read -63 mV but an anoxic zone was not visible. Site SB062 was sampled next for the full suite of sediment plus water samples including a field blank. The sediment was dense with mostly shell hash making it difficult to get pH readings. Two standard sediment sites (SB055 and SB059) were then sampled before finishing with sites SB077 and SB061. The full suite of sediment analyses and water samples were collected at site SB077. All samples were processed accordingly and placed on wet or dry ice. The crew packed and shipped water samples via FedEx overnight delivery.

Thursday, July 20th
The last two sediment sites (SB067 and SB057) were sampled mid-morning for the standard suite of sediment, which was good because the winds increased rapidly with a small craft advisory in the afternoon. While in the protected channel near site SB077, the crew threw a cast net near the electrical towers and along the bank without any topsmelt caught. Sediment samples were processed immediately after collection and placed on wet or dry ice. The crew pulled the boat and travelled back to MLML. Upon arrival, samples on dry ice and microplastics samples were placed in a -20ºC freezer.

The sediment tubs from this trip were processed in the lab on Friday, July 21st. Homogenized sediment for each site was aliquoted into analytical jars and then placed in a refrigerator (grain size/TOC) or in a -20ºC freezer.

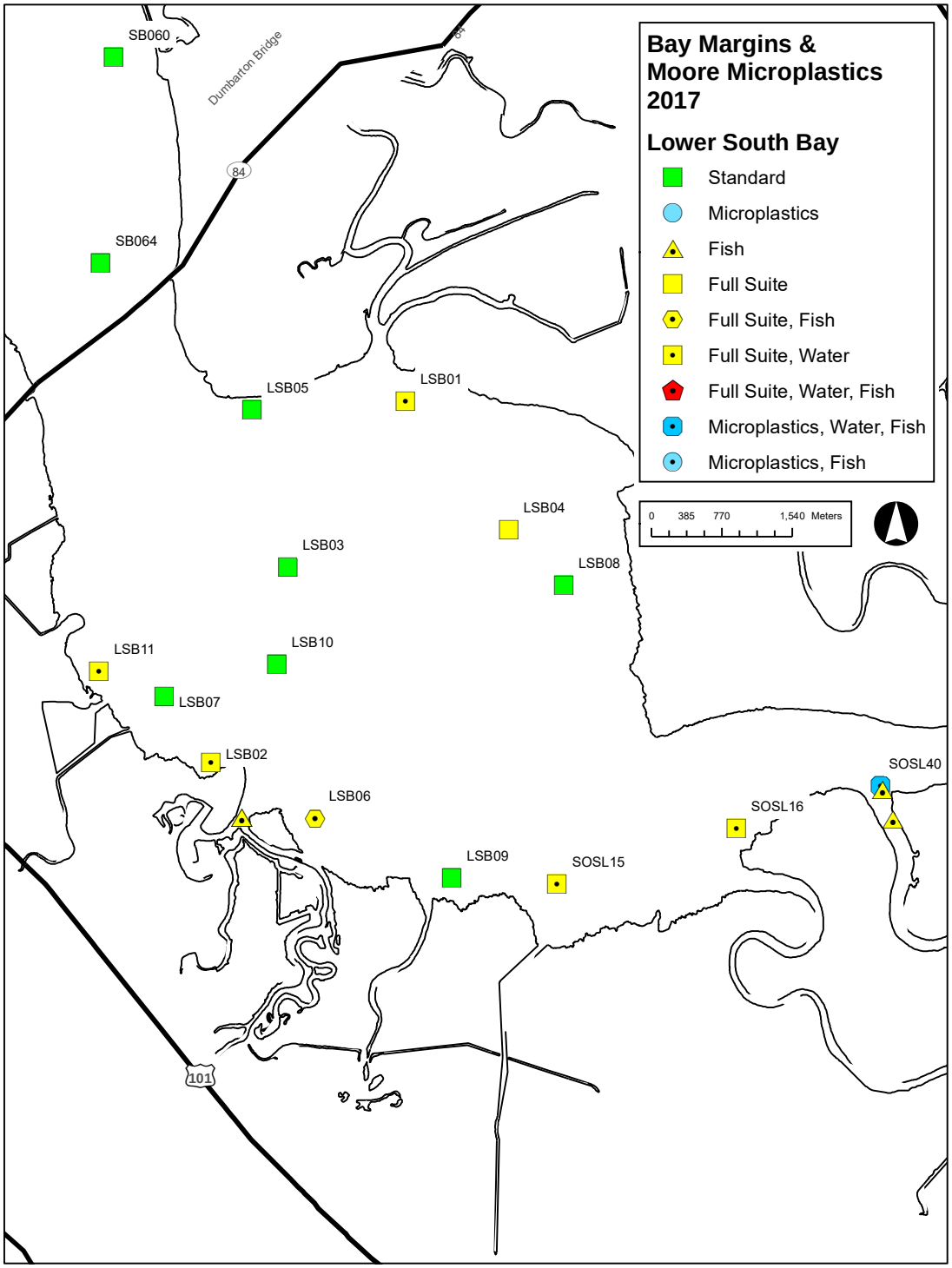


Figure 1: Locations of sediment, water, and/or fish samples visited in Lower South Bay in 2017. Full Suite generally represents Standard, CEC, and Microplastics samples.

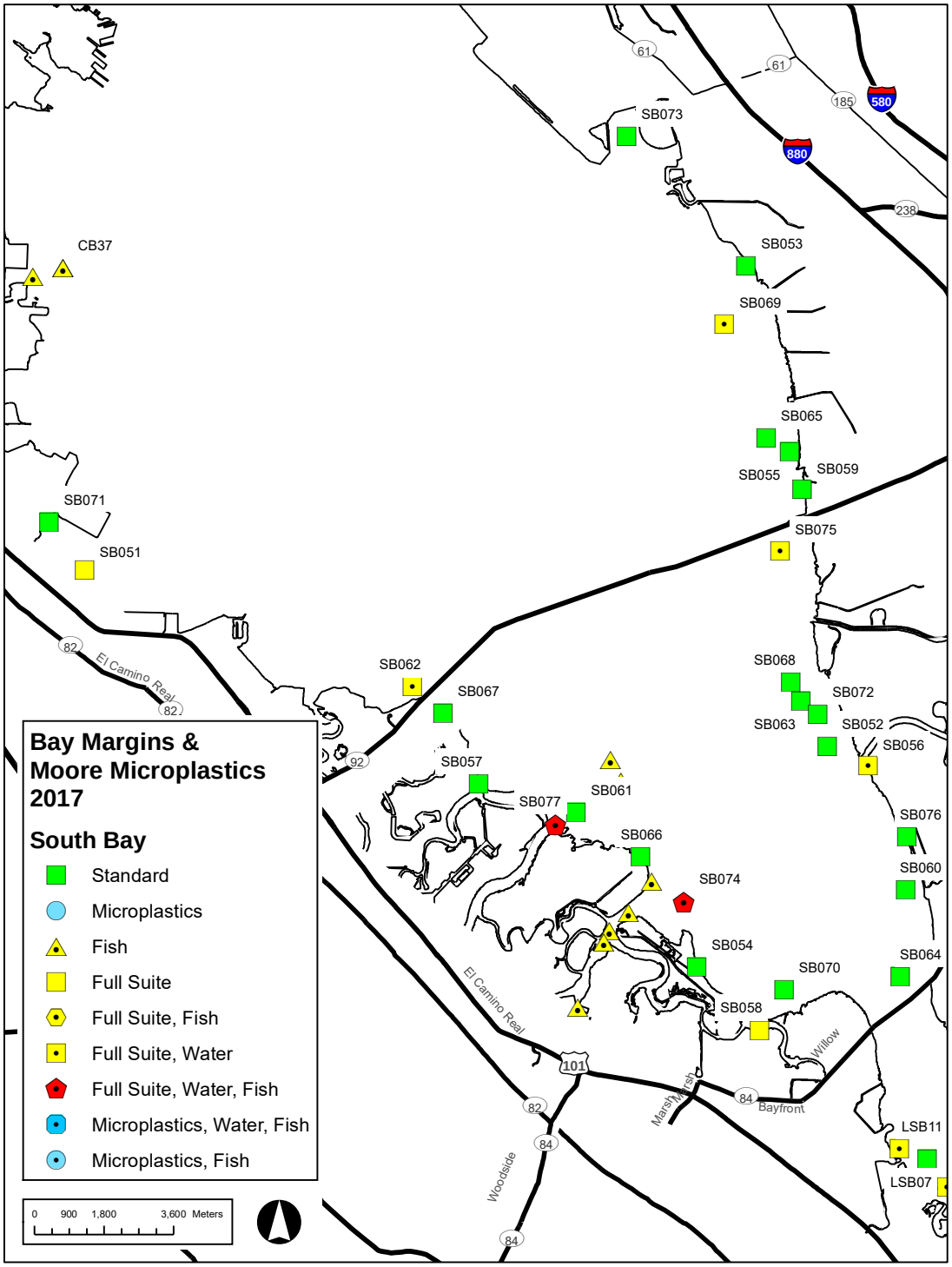


Figure 2: Locations of sediment, water, and/or fish samples visited in South Bay in 2017. Full Suite generally represents Standard, CEC, and Microplastics samples.

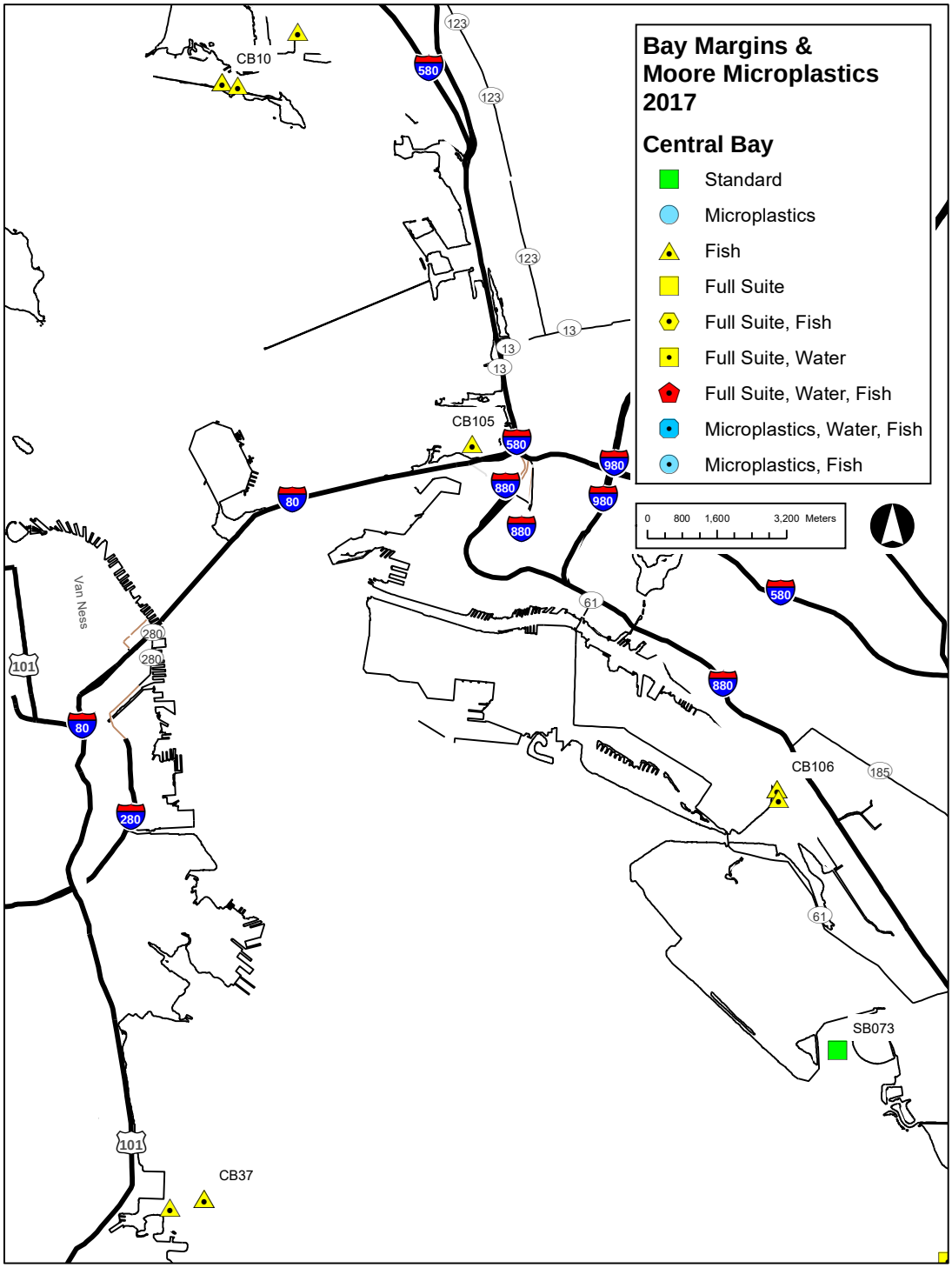


Figure 3: Locations of sediment, water, and/or fish samples visited in Central Bay in 2017. Full Suite generally represents Standard, CEC, and Microplastics samples.

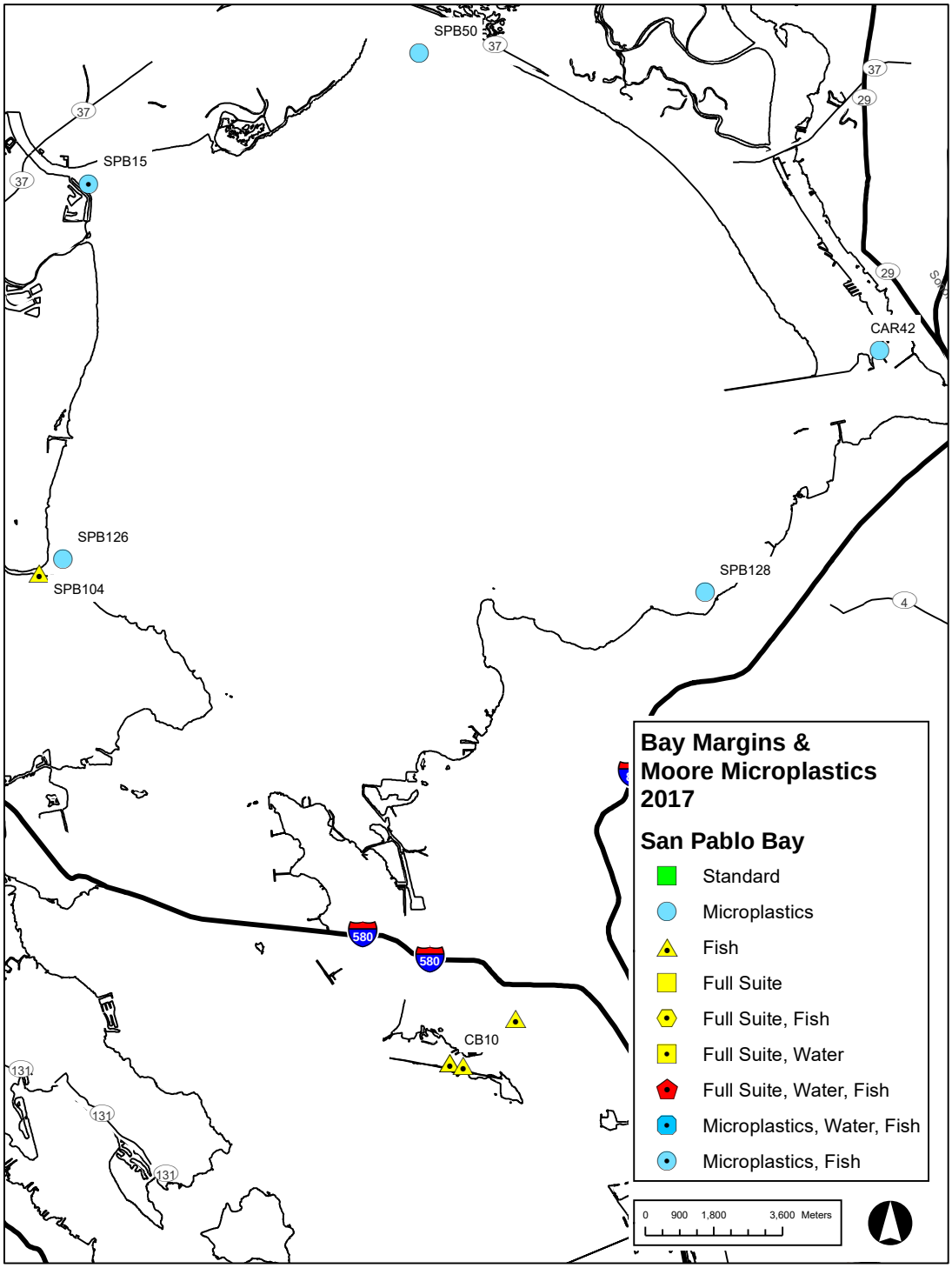


Figure 4: Locations of sediment, water, and/or fish samples visited in San Pablo Bay in 2017. Full Suite generally represents Standard, CEC, and Microplastics samples.

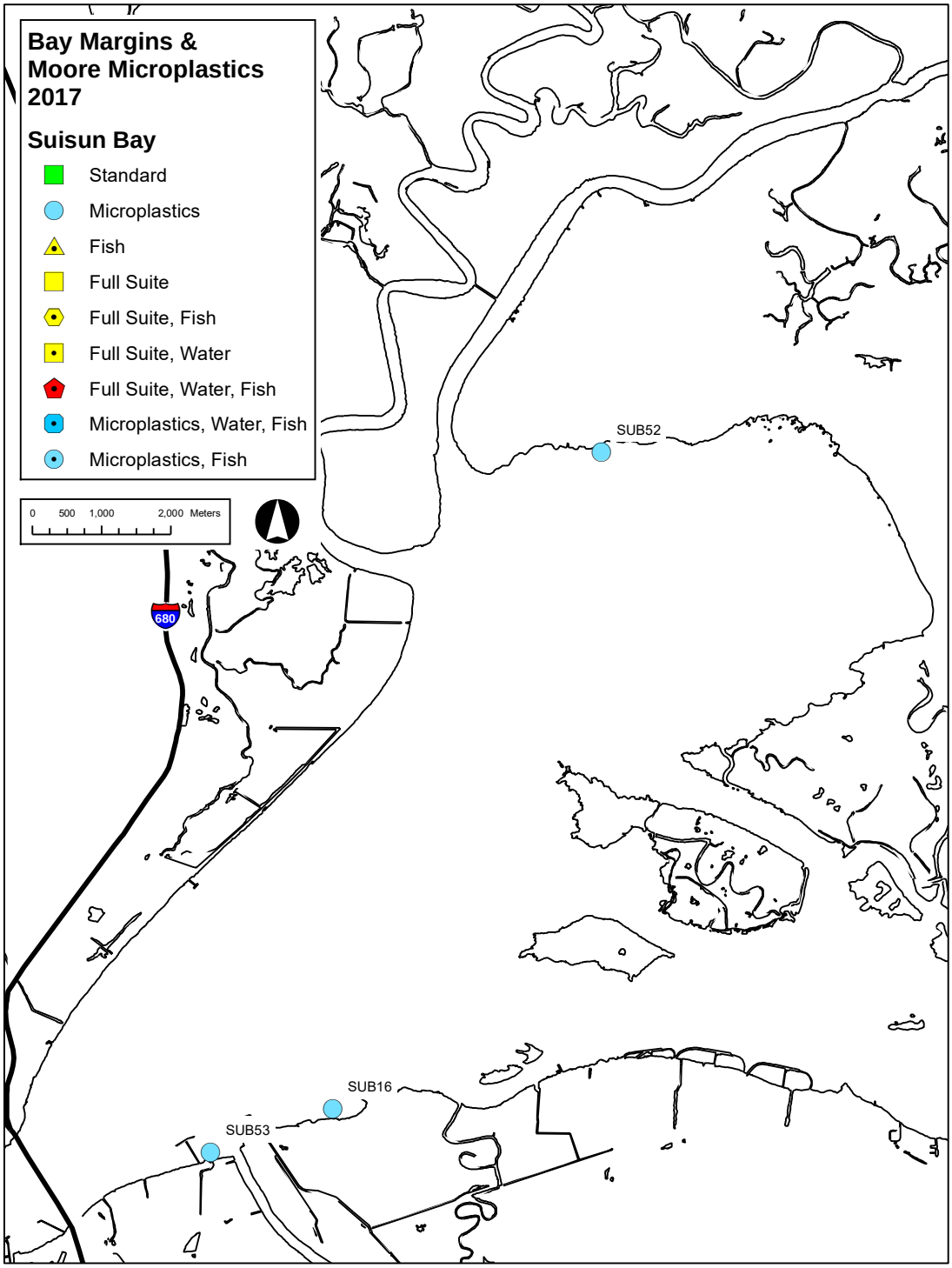


Figure 5: Locations of sediment, water, and/or fish samples visited in Suisun Bay in 2017. Full Suite generally represents Standard, CEC, and Microplastics samples.

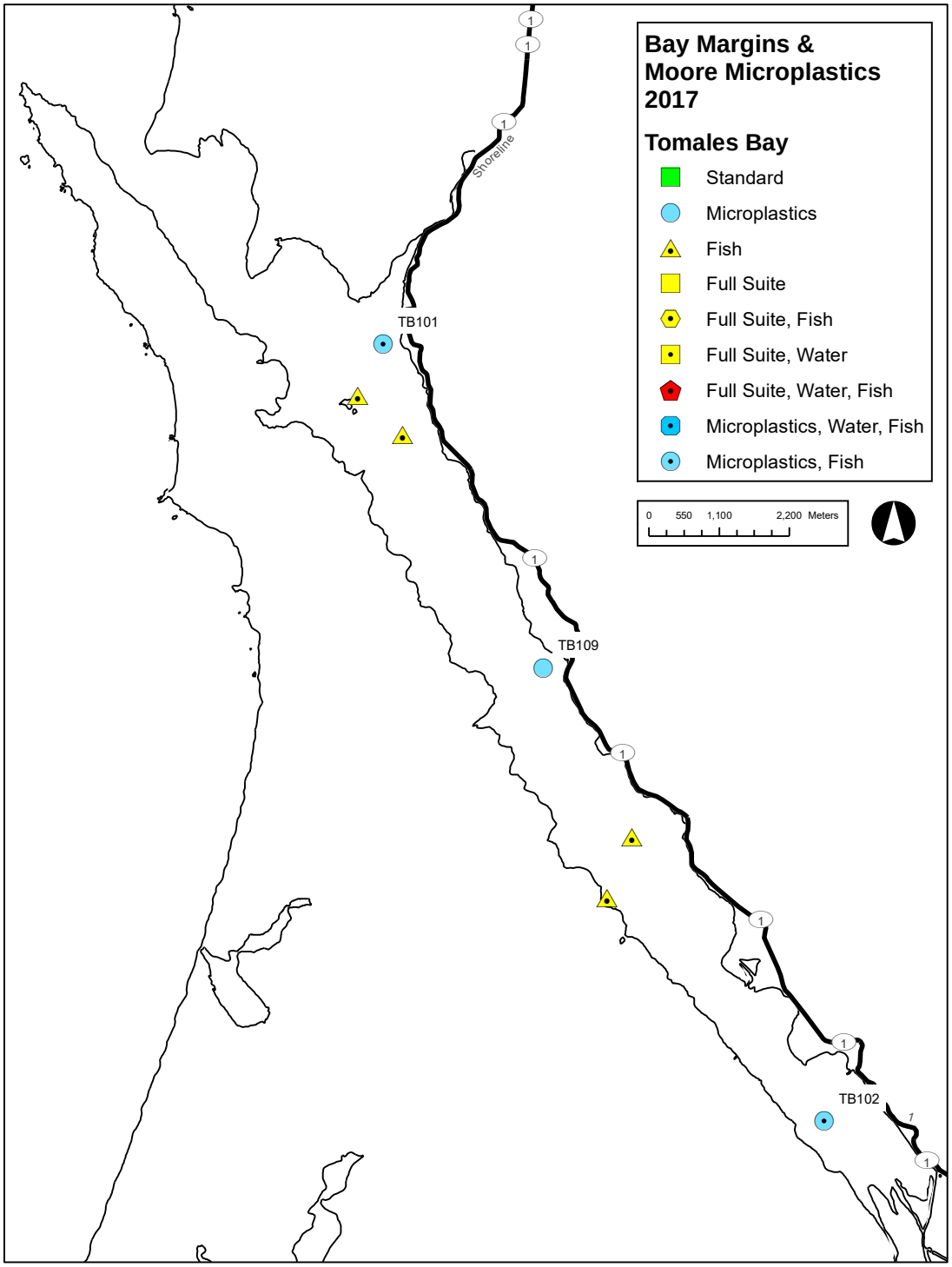


Figure 6: Locations of sediment, water, and/or fish samples visited in Tomales Bay in 2017. Full Suite generally represents Standard, CEC, and Microplastics samples.

Appendix A: Sample date, collection type, and coordinates (target and actual latitude and longitude) for sites visited in the Bay Margins Study focusing on South San Francisco Bay. S = sediment, W = water

Station Code	Station Name	Sample Date	Type	Target Latitude	Target Longitude	Actual Latitude	Actual Longitude
SB051	South Bay	7/6/2017	S	37.601750	-122.362000	37.601767	-122.362000
SB052	South Bay	7/7/2017	S	37.564830	-122.143000	37.564817	-122.142950
SB053	South Bay	7/18/2017	S	37.676410	-122.170000	37.676183	-122.169983
SB054	South Bay	7/17/2017	S	37.512800	-122.180000	37.512800	-122.179733
SB055	South Bay	7/19/2017	S	37.633220	-122.156000	37.633217	-122.155950
SB056	South Bay	7/17/2017	SW	37.560520	-122.131000	37.560516	-122.130917
SB057	South Bay	7/20/2017	S	37.554180	-122.245000	37.554167	-122.244883
SB058	South Bay	7/7/2017	S	37.498330	-122.161000	37.498400	-122.160950
SB059	South Bay	7/19/2017	S	37.624350	-122.152000	37.624417	-122.152033
SB060	South Bay	7/7/2017	S	37.531920	-122.119000	37.531883	-122.119017
SB061	South Bay	7/19/2017	S	37.548060	-122.216000	37.548067	-122.216183
SB062	South Bay	7/19/2017	SW	37.576390	-122.265000	37.576433	-122.265000
SB063	South Bay	7/7/2017	S	37.575210	-122.151000	37.575233	-122.150950
SB064	South Bay	7/7/2017	S	37.511720	-122.120000	37.511683	-122.120050
SB065	South Bay	7/18/2017	S	37.636270	-122.163000	37.636233	-122.162983
SB066	South Bay	7/17/2017	S	37.538220	-122.197000	37.538200	-122.197017
SB067	South Bay	7/20/2017	S	37.570430	-122.256000	37.570450	-122.255933
SB068	South Bay	7/4/2017	S	37.579560	-122.154000	37.579633	-122.154016
SB069	South Bay	7/18/2017	SW	37.662520	-122.176000	37.662500	-122.175967
SB070	South Bay	7/7/2017	S	37.507900	-122.154000	37.507917	-122.154000
SB071	South Bay	7/6/2017	S	37.612960	-122.373000	37.612767	-122.372833
SB072	South Bay	7/7/2017	S	37.572190	-122.146000	37.572183	-122.145967
SB073	South Bay	7/18/2017	S	37.705610	-122.206000	37.705683	-122.206017
SB074	South Bay	7/17/2017	SW	37.527710	-122.184000	37.527750	-122.184000

Station Code	Station Name	Sample Date	Type	Target Latitude	Target Longitude	Actual Latitude	Actual Longitude
SB075	South Bay	7/19/2017	SW	37.609930	-122.158000	37.609950	-122.158050
SB076	South Bay	7/7/2017	S	37.544300	-122.119000	37.544250	-122.118967
SB077	South Bay	7/19/2017	SW	37.545150	-122.222000	37.545117	-122.222117
LSB01	Lower South Bay	6/6/2017	SW	37.498780	-122.082000	37.498767	-122.082000
LSB02	Lower South Bay	6/5/2017	SW	37.462820	-122.105000	37.462900	-122.105033
LSB03	Lower South Bay	6/5/2017	S	37.482230	-122.096000	37.482233	-122.096083
LSB04	Lower South Bay	6/6/2017	S	37.486410	-122.069000	37.486383	-122.068883
LSB05	Lower South Bay	6/8/2017	S	37.497630	-122.101000	37.497617	-122.100950
LSB06	Lower South Bay	6/8/2017	S	37.457570	-122.092000	37.457617	-122.092033
LSB07	Lower South Bay	6/8/2017	S	37.469360	-122.111000	37.469300	-122.111000
LSB08	Lower South Bay	6/8/2017	S	37.481030	-122.062000	37.481100	-122.061950
LSB09	Lower South Bay	6/8/2017	S	37.452150	-122.075000	37.452150	-122.074950
LSB10	Lower South Bay	6/5/2017	S	37.472720	-122.097000	37.472700	-122.097167
LSB11	Lower South Bay	6/5/2017	SW	37.471640	-122.119000	37.471600	-122.119150
SOSL15	Extreme Lower South Bay	6/7/2017	SW	37.451780	-122.062000	37.451800	-122.061950
SOSL16	Extreme Lower South Bay	6/7/2017	SW	37.457580	-122.040000	37.457600	-122.039950
SOSL40	Extreme Lower South Bay	6/6/2017	W	37.462120	-122.022000	37.462083	-122.022217

Number of Sediment Sites Sampled **40**

Number of Water Sites Sampled **12**

Appendix B: Sample date, collection type, and coordinates (target and actual latitude and longitude) for sites visited in the Moore Microplastics Study. Fish were not collected at all sites sampled. S = sediment, F = fish

Station Code	Station Name	Sample Date	Type	Latitude	Longitude	Actual Latitude	Actual Longitude
TB101	Tomales Bay	6/22/2017	SF	38.209260	-122.929150	38.205700	-122.929033
TB102	Tomales Bay	6/22/2017	SF	38.090840	-122.835810	38.097983	-122.845700
TB109	Tomales Bay	6/22/2017	S	38.160730	-122.898500	38.160683	-122.898500
SUB16	Suisun Bay	6/21/2017	S	38.050240	-122.076930	38.050217	-122.076933
SUB52	Suisun Bay	6/21/2017	S	38.136210	-122.034990	38.136217	-122.034983
SUB53	Suisun Bay	6/21/2017	S	38.044090	-122.096900	38.044200	-122.096867
CAR42	San Pablo Bay	6/21/2017	S	38.073690	-122.249550	38.073700	-122.249567
SPB104	San Pablo Bay	6/20/2017	F	38.025080	-122.489690	38.016150	-122.499983
SPB126	San Pablo Bay	6/20/2017	S	38.019600	-122.492960	38.019650	-122.492933
SPB128	San Pablo Bay	6/21/2017	S	38.015650	-122.300240	38.015650	-122.300250
SPB15	San Pablo Bay	6/20/2017	SF	38.108350	-122.488140	38.108383	-122.488233
SPB50	San Pablo Bay	6/21/2017	S	38.141850	-122.389610	38.141350	-122.390017
CB10	Central Bay	7/5/2017	F	37.913650	-122.353800	37.902883	-122.373283
CB105	Central Bay	6/19/2017	F	37.829280	-122.305480	37.829280	-122.305480
CB106	Central Bay	6/19/2017	F	37.757870	-122.219000	37.759350	-122.223517
CB37	Central Bay	7/6/2017	F	37.671217	-122.379016	37.671800	-122.370617
SB051	South Bay	7/6/2017	S	37.601750	-122.362000	37.601767	-122.362000
SB056	South Bay	7/17/2017	S	37.560520	-122.131000	37.560516	-122.130917
SB058	South Bay	7/17/2017	S	37.498330	-122.161000	37.498400	-122.160950
SB062	South Bay	7/19/2017	S	37.576390	-122.265000	37.576433	-122.265000
SB069	South Bay	7/18/2017	S	37.662520	-122.176000	37.662500	-122.175967
SB074	South Bay	7/17/2017	SF	37.527710	-122.184000	37.527750	-122.184000
SB075	South Bay	7/19/2017	S	37.609930	-122.158000	37.609950	-122.158050
SB077	South Bay	7/19/2017	SF	37.545150	-122.222000	37.545117	-122.222117

Station Code	Station Name	Sample Date	Type	Latitude	Longitude	Actual Latitude	Actual Longitude
LSB01	Lower South Bay	6/6/2017	S	37.498780	-122.082000	37.498767	-122.082000
LSB02	Lower South Bay	6/5/2017	S	37.462820	-122.105000	37.462900	-122.105033
LSB04	Lower South Bay	6/6/2017	S	37.486410	-122.069000	37.486383	-122.068883
LSB06	Lower South Bay	6/8/2017	SF	37.457570	-122.092000	37.457617	-122.092033
LSB11	Lower South Bay	6/5/2017	S	37.471640	-122.119000	37.471600	-122.119150
SOSL15	Extreme Lower South Bay	6/7/2017	S	37.451780	-122.062000	37.451800	-122.061950
SOSL16	Extreme Lower South Bay	6/7/2017	S	37.457580	-122.040000	37.457600	-122.039950
SOSL40	Extreme Lower South Bay	6/6/2017	SF	37.462120	-122.022000	37.462083	-122.022217
	Number of Sediment Sites Sampled		**27**				
	Number of Fish Sites Sampled		**12**				

Appendix 5 – Additions to the Log of RMP Status and Trends Program Notes for 2017

Action Codes: A= Analyte added or removed from sampling design; D= Data rejected or not available/data comparability issues; L= Change in laboratory conducting analysis or in laboratory methods; P= Change in program/sampling design; S= Station added or removed; T= Trends analysis performed.

Action Code	Year	Action	Detail/Rationale
L	2015	Brooks Analytical switched to an ion chromotography prep method for dissolved selenium in 2015. Reductive Precipitation (RP) was the old prep method used through 2013.	This method change had a large impact on the data. BAL was asked to conduct an internal method comparison study using 2017 Water Cruise samples to test the effect of this method change.
	2017	A prep method intercomparison study was conducted on RMP water samples at Brooks Analytical for selenium dissolved fraction. Samples were analyzed using both the Reductive Precipitation method and the IC column method.	The purpose of the study in 2017 was to understand the impact of the method change for dissolved selenium.
A	2017	Particulate selenium, particulate methyl mercury, and particulate copper were added to the analyte list for the 2017 Water Cruise.	Pre-2017, only total and dissolved Se, MeHg, and Cu were analyzed. The particulate fractions were calculated by subtracting dissolved from total concentrations.
L	2017	2017 Water Cruise intercomparison study for Se particulate and dissolved fractions. The analytical labs involved were Brooks Analytical, USGS, Old Dominion University (Cutter), and optional lab CCSF.	
A	2015	Nutrients dropped from RMP water cruise samping parameters	A once-every-2-years snapshot of nutrient concentrations is less useful than seasonal readings coordinated to specific events or tide phases so these measurements have been dropped (especially given ongoing nutrient strategy efforts at more relevant temporal and spatial scales). The need for periodic snapshots can be re-evaluated if/when these more localized/intensive efforts are ceased or scaled back. This change was discussed with and approved by the TRC.
	2017	One station was monitored for traditional nutrients parameters in the 2017 Water Cruise.	
A	2017	Total hydrogen was added to the list of reported analytes for the 2017 Water Cruise.	Analysis of total hydrogen is included in the method for analysis of total carbon and nitrogen so hydrogen was simply added to the list of reported analytes.

Appendix 6 – Updated List of RMP Status and Trends Target Analytes for 1993-2017 Analytes Reported

Table 6A: Water Cruise Analytes

Shaded areas indicate that parameters that were analyzed for RMP Status and Trends Sampling. This table, which displays the long-term monitoring frequency of Status and Trends water-quality parameters, does not include any add-ons analytes.

Parameter Type Codes: ANC = Ancillary Parameters, ORGS = Organic Parameters, PESTs = Pesticide Parameters, SYN = Synthetic Parameters, TE = Trace Metal parameters, WaterTOX = Toxicity Parameters

* Data available upon request

Reportable Water Parameter	Parameter Type	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Ammonium as N	ANC	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■				
Chlorophyll a	ANC	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■				
CTD*	ANC		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■		■		■
Dissolved Organic Carbon	ANC	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■		■		■
Hardness as CaCO3	ANC	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■		■		■
Nitrate as N	ANC	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■				
Nitrite as N	ANC	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■				
Oxygen, Dissolved	ANC	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■		■				
Particulate Organic Carbon	ANC												■	■	■	■	■	■	■	■		■		■		■
pH	ANC	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■		■		■		■
Pheophytin a	ANC	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■				
Phosphate as P	ANC	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■				
Salinity (by salinometer)	ANC	■		■	■	■	■	■	■	■	■	■	■	■	■											
Salinity (by SCT)	ANC	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■				
Salinity (by Solomat)	ANC					■																				
Silica	ANC	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■				

Reportable Water Parameter	Parameter Type	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Specific Conductivity	ANC	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■		■		■		■
Suspended Sediment Concentration	ANC										■	■	■	■	■	■	■	■	■	■		■		■		■
Temperature	ANC	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■		■		■		■
Total Suspended Solids	ANC	■	■	■	■	■	■	■	■	■				■	■	■										
Alkanes (C10-C34)	ORGS	■	■	■																						
Dioxins/Furans	ORGS																	■		■						
PAHs (biennially beginning 2008)	ORGS	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			■						
PAHs Alkylated (biennially beginning 2008)	ORGS						■	■	■	■	■	■	■	■	■	■	■			■						
PBDEs (annually)	ORGS										■	■	■	■	■	■	■	■	■	■						
PCBs 209 (biennially beginning 2008)	ORGS																	■		■						
PCBs 40 (biennially beginning 2008)	ORGS	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■		■						
Pharmaceuticals	ORGS														■											
Phthalates	ORGS										■	■														
Chlordanes	PESTs	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■		■						
Chlorpyrifos	PESTs	■	■	■	■	■	■	■	■	■	■	■	■	■				■		■						
Cyclopentadienes	PESTs	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■		■						
Dacthal	PESTs	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■		■						
DDTs	PESTs	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■		■						
Diazinon	PESTs	■	■	■	■	■	■	■	■	■	■	■	■	■				■		■						
Endosulfan I	PESTs	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■		■						
Endosulfan II	PESTs	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■		■						
Endosulfan Sulfate	PESTs	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■		■						
HCHs	PESTs	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■		■						
Hexachlorobenzene	PESTs	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■		■						
Mirex	PESTs	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■		■						
Oxadiazon	PESTs	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■										
p-Nonylphenol	SYN										■	■														
Triphenylphosphate	SYN										■															
Arsenic	TE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■				
Cadmium	TE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■				

Reportable Water Parameter	Parameter Type	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Chromium	TE	■	■	■	■	■	■	■		■																
Cobalt	TE								■	■	■	■	■	■	■	■	■	■	■	■		■				
Copper	TE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■		■		■
Cyanide	TE	■	■															■		■		■		■		■
Iron	TE							■	■	■	■	■	■	■	■	■	■	■	■	■		■				
Lead	TE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■				
Manganese	TE							■	■	■	■	■	■	■	■	■	■	■	■	■		■				
Mercury	TE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■				
Mercury, Methyl	TE							■	■	■	■	■	■	■	■	■	■	■	■	■		■		■		■
Nickel	TE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■				
Selenium	TE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■		■		■
Silver	TE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■				
Zinc	TE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■				
Cell Count	WaterTox	■																		■						
Mean % Normal Development	WaterTox	■	■	■	■	■														■						
Mean % Survival	WaterTox		■	■	■	■	■	■	■	■	■					■				■				■		■
SWI Mean % Normal Alive	WaterTox							■	■	■						■	■			■						

Table 6B: Sediment Analytes

Shaded areas indicate that parameters that were analyzed for RMP Status and Trends Sampling. This table, which displays the long-term monitoring frequency of Status and Trends sediment parameters, does not include any add-ons analytes.

Grey = open Bay sediments, Blue = Bay margins sediments.

Parameter Type Codes: ANC = Ancillary Parameters, ORGS = Organic Parameters, PESTs = Pesticide Parameters, SYN = Synthetic Parameters, TE = Trace Metal parameters, WaterTOX = Toxicity Parameters

* Data available upon request

Reportable Sediment Parameter	Parameter Type	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
% Solids	ANC																									
Ammonia	ANC																									
CTD*	ANC																									
Eh*	ANC																									
Grainsize - Clay <0.0039 mm	ANC																									
Grainsize - Clay <0.005 mm	ANC																									
Grainsize - Fine <0.0625 mm	ANC																									
Grainsize - Granule + Pebble 2.0 to <64 mm	ANC																									
Grainsize - Sand 0.0625 to <2.0 mm	ANC																									
Grainsize - Silt 0.0039 to <0.0625 mm	ANC																									
Hydrogen Sulfide	ANC																									
pH	ANC																									
Total Hydrogen	ANC																									
Total Nitrogen	ANC																									
Total Organic Carbon	ANC																									
Total Sulfide	ANC																									
Benthos	Benthos																									
Dioxins/Furans	ORGS																									

Reportable Sediment Parameter	Parameter Type	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
PAHs	ORGS	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■			
PAHs Alkylated	ORGS	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■			
PBDEs	ORGS										■		■	■	■	■	■	■	■	■	■		■			
PCBs 209	ORGS																	■	■	■	■		■	■		■
PCBs 40	ORGS	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■		■			
Phthalates	ORGS										■	■														
Chlordanes	PESTs	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■		■			
Cyclopentadienes	PESTs	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■		■			
DDTs	PESTs	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■		■			
Fipronil	PESTs																	■	■	■	■		■			
HCHs	PESTs	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■		■			
Hexachlorobenzene	PESTs	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■		■			
Mirex	PESTs	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■		■			
Pyrethroids	PESTs																■	■	■	■	■		■			
Mean % Normal Alive	SedTox	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■					
Mean % Survival	SedTox	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■					
p-Nonylphenol	SYN										■	■														
Aluminum	TE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■		■
Arsenic	TE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■		■
Cadmium	TE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■		■
Copper	TE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■		■
Chromium	TE	■	■	■	■	■	■	■	■	■																
Iron	TE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■		■
Lead	TE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■		■
Manganese	TE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■		■
Mercury	TE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■		■
Mercury, Methyl	TE								■	■	■	■	■	■	■	■	■	■	■	■	■		■	■		■
Nickel	TE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■		■
Selenium	TE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■		■
Silver	TE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■		■
Zinc	TE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■		■