



RMP
REGIONAL MONITORING
PROGRAM FOR WATER QUALITY
IN SAN FRANCISCO BAY

sfei.org/rmp

2017 RMP Margins Sediment Cruise Plan

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**Regional Monitoring Program
for Water Quality in San Francisco Bay**

**2017 Bay Margins Sediment Study
Cruise Plan**



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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 m² 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 Ottawa 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 Tucson, 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.

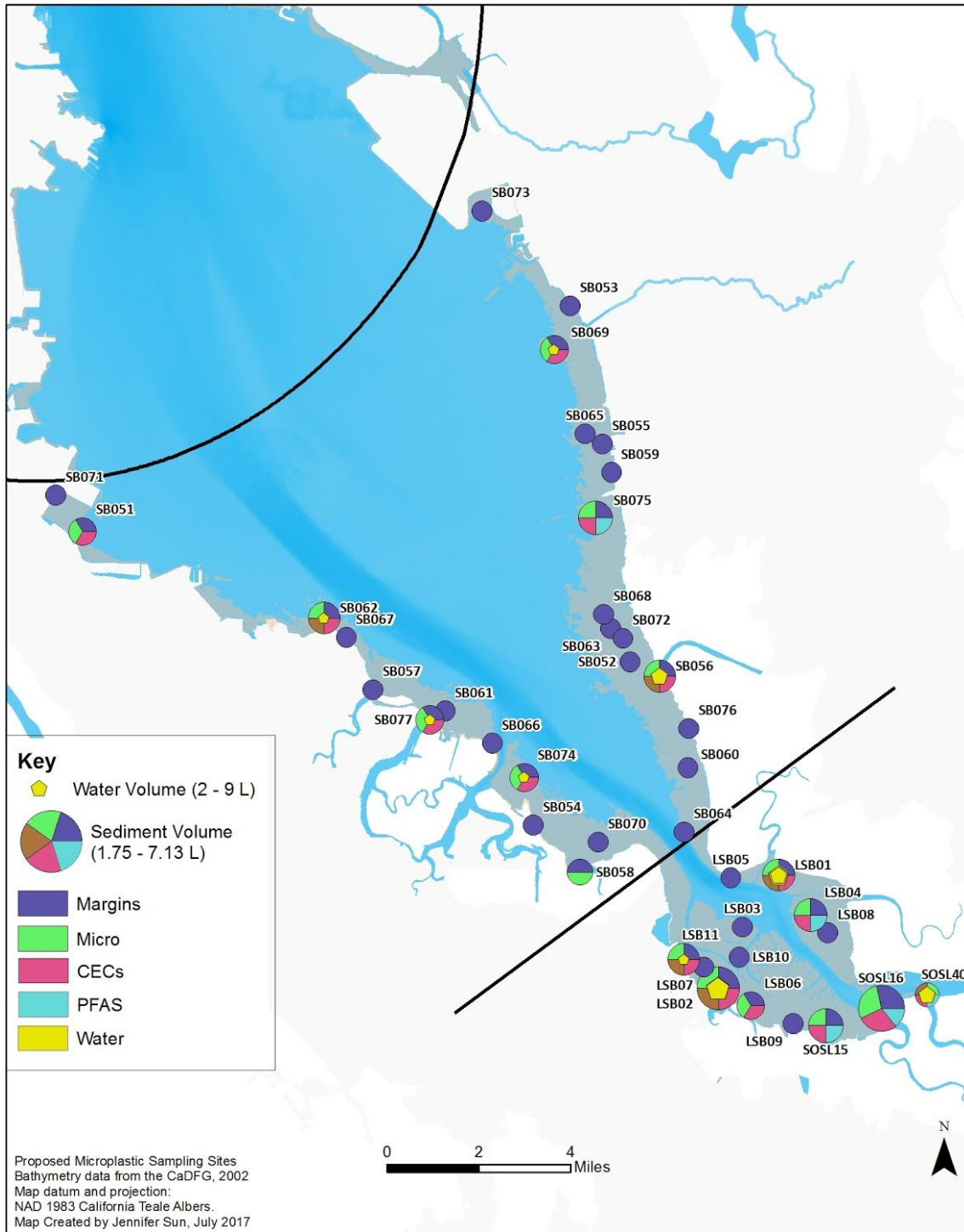
Sites that are not at their expected depth but are still within acceptable habitat and depth range (MHW to 1 foot below MLW) at their planned coordinates will be sampled at the target coordinates.

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.

Proposed Margins Sites



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 $\sim 210\text{mV}$ relative to true Eh (hydrogen electrode): $\text{Eh} = \text{ORP reading} + 210\text{mV}$ (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, $\sim 5\text{cm}$ diameter or larger, $\sim 5\text{cm}$ 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., $>2\text{cm}$), 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>