BAY AREA MUNICIPAL
STORMWATER COLLABORATIVE (BAMSC)

VERSION 2.0 – MUNICIPAL STORMWATER

REGIONAL OUTFALL TRASH MONITORING QUALITY ASSURANCE PROJECT PLAN

Submitted in compliance with the San Francisco Bay Municipal Regional Stormwater National Pollutant Discharge Elimination System (NPDES) Permit, Order No. R2-2022-0018, Provision C.8.e.

Prepared on behalf of:

Alameda Countywide Clean Water Program
Contra Costa Clean Water Program
San Mateo Countywide Water Pollution Prevention Program
Santa Clara Valley Urban Runoff Pollution Prevention Program
Solano Stormwater Alliance

July 31, 2024

1. (A1) Title and Approval Sheet

Program Title	Trash Monitoring for the Bay Area Municipal Stormwater Collaborative Stormwater Programs
Lead Organization	Bay Area Municipal Stormwater Management Collaborative (BAMSC)
Primary Contact	Chris Sommers
Effective Date	October 1, 2024
Responsible Organization	BAMSC
Revision Number	1.1

Approval Signatures:

Table 1-1. Project Team Approval Signatures

Title	Name	Signature	Date
BAMSC Lead	Chris Sommers		
ACCWP Rep	Jim Scanlin		
CCCWP Rep	Rinta Perkins		
SCVURPPP Rep	Adam Olivieri		
SMCWPPP Rep	Reid Bogert		
SSA Rep	Meg Herston		
Water Board Rep	For Eileen White		
QAPP Author	Paul Salop		

2. (A2) Table of Contents

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List of Acronyms

ACCWP	Alameda Countywide Clean Water Program
AMS	Applied Marine Sciences, Inc.
BASMAA	Bay Area Stormwater Management Agencies Association
BAMSC	Bay Area Municipal Stormwater Collaborative
CBI	Catch Basin Insert
CCCWP	Contra Costa Clean Water Program
CDP	Census Designated Place
COC	Chain of Custody
CPS	Connector Pipe Screen
DM	Data Manager
DMA	Drainage Management Area
DQO	Data Quality Objective
EOA	EOA, Inc.
EPA	US Environmental Protection Agency
ETAP	Escaped Trash Assessment Protocol
FC	Field Crew
FTC	Full Trash Capture System
FTCE	Full Trash Capture System Equivalency
HDS	Hydrodynamic Separator
IMR	Integrated Monitoring Report
LID	Low Impact Development
LOE	Level of Effort
MC	Monitoring Coordinator
MP	Monitoring Plan
MQO	Measurement Quality Objective
MRP	Municipal Regional Stormwater Permit
MRP 3	Municipal Regional Stormwater Permit, Reissued May 11, 2022
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
OVTA	On-land Visual Trash Assessment
PC	Project Coordinator
PPE	Personal Protective Equipment
RPD	Relative Percent Difference
SPM	Stormwater Program Manager
TAG	Technical Advisory Group
TCL	Trash Characterization Lead
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPD	Relative Percent Difference
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SFRWQCB	Regional Water Quality Control Board, San Francisco Region
SMCWPPP	San Mateo Countywide Water Pollution Prevention Program
SOP	Standard Operating Procedure
SSA	Solano Stormwater Alliance
TAG	Technical Advisory Group
TCL	Trash Characterization Lead
UCMR	Urban Creeks Monitoring Report
WQIF	Water Quality Improvement Fund Grant
WY	Water Year

3. (A3) Distribution List and Contact Information

Table 3-1. QAPP Distribution List

Title	Name and Affiliation	Contact Information (Telephone; Email)	QAPP #
QAPP Author	Paul Salop, AMS, Inc.	925-373-7142 salop@amarine.com	1
BAMSC Project Lead	Chris Sommers, EOA, Inc.	510-832-2852 x109 csommers@eoainc.com	2
SW Program Rep	Jim Scanlin, City of Newark / ACCWP	510-578-4539 James.scanlin@newark.org	3
SW Program Rep	Rinta Perkins, CCCWP	925-313-2194, Rinta.Perkins@pw.cccounty.us	4
SW Program Rep	Adam Olivieri, SCVURPPP	510-832-2852, awo@eoainc.com	5
SW Program Rep	Reid Bogert, SMCWPPP	650-599-1433, rbogert@smcgov.org	6
SW Program Rep	Meg Herston, SSA	707-429-8930 mherston@fssd.com	7
Water Board Rep	For Eileen White	510-622-2314 Eileen.White@waterboards.ca.gov	8

4. (A4) Program Organization

4.1. Involved Parties and Roles

The Bay Area Municipal Stormwater Collaborative (BAMSC) was organized in June 2021 by the Bay Area Stormwater Management Agencies Association (BASMAA) Board of Directors to continue the information sharing and permittee advocacy functions of BASMAA in an informal manner after BASMAA's dissolution. BAMSC has taken on an organizing role in supporting the Bay Area stormwater Programs in meeting the permit requirements of the re-issued Municipal Regional Stormwater Permit (MRP 3) issued May 2022 (Order No. R2-2022-0018, NPDES Permit No. CAS612008, SWRCB 2022).

Section C.8.e of MRP3 specifies permit requirements associated with Trash monitoring. MRP3 identifies specific monitoring efforts to be completed during the permit term by the following agencies: (1) Alameda Countywide Clean Water Program (ACCWP), (2) Contra Costa Clean Water Program (CCCWP), (3) San Mateo Countywide Water Pollution Prevention Program (SMCWPPP), (4) Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP), and (5) Solano Stormwater Alliance (SSA). These five Programs have agreed to work in a collaborative fashion to design and implement a trash monitoring project (the Project), with Programs responsible for all monitoring conducted within that Program's jurisdiction, and coordinated efforts to address planning, assessment, and reporting needs common to all.

The collaborative effort will be supported by a Technical Advisory Group (TAG) convened to assist with planning and implementation. TAG members will not be responsible for data collected through project implementation, but will support overall monitoring design and adaptive management.

Individual Programs will be responsible for all data collection, management, quality assurance, and reporting associated with monitoring conducted within their jurisdiction. As such, each will be responsible for ensuring that monitoring efforts meet the specifications of this QAPP.

Figure 4-1 shows the organization structure. Table 3-1 contains contact information for key project participants. Responsibilities of key project personnel are detailed in the sections that follow.

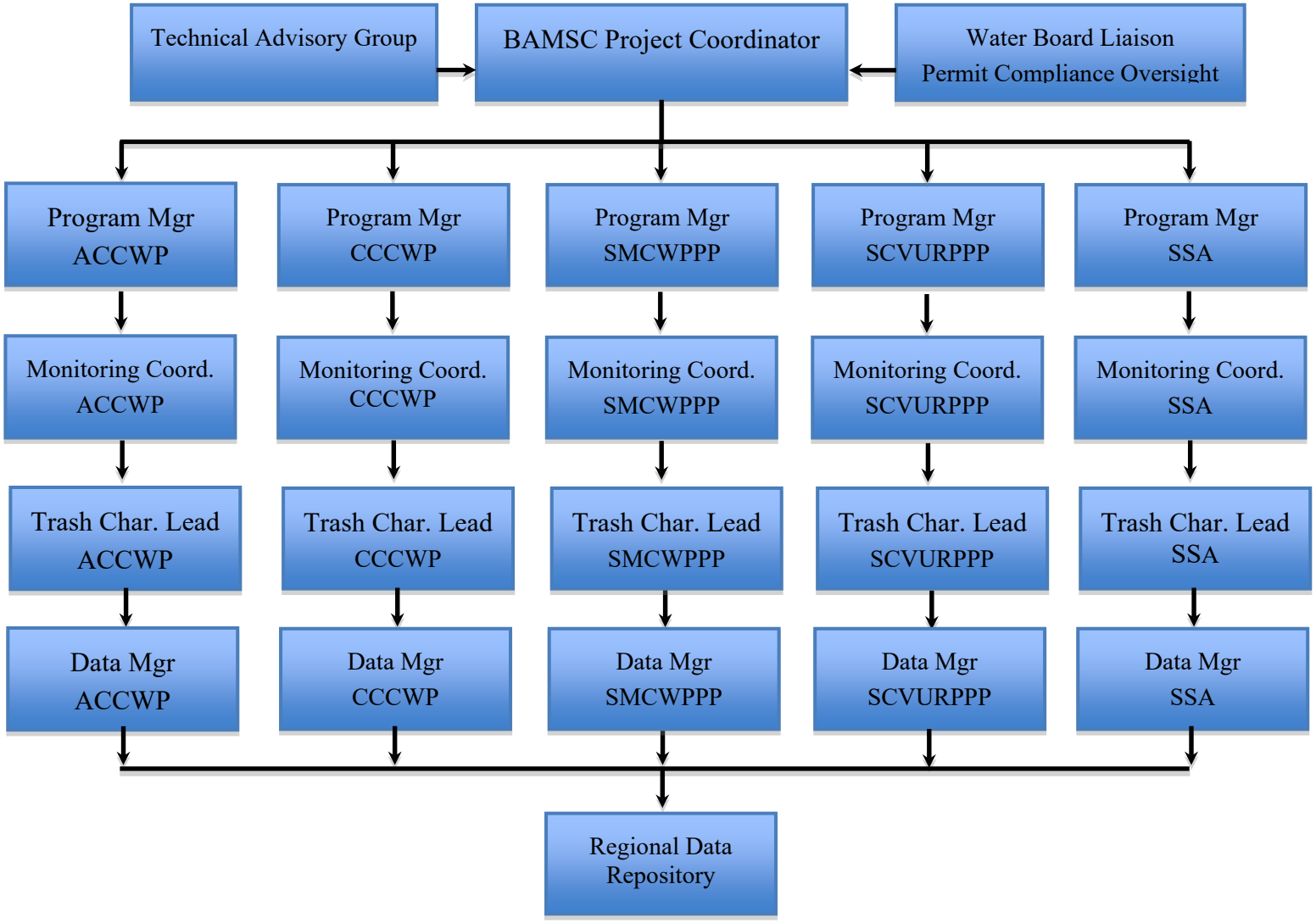

Figure 4-1. Trash Monitoring Project Organizational Structure

4.1.1. BAMSC Project Coordinator

The BAMSC Project Coordinator (PC) will be responsible for coordinating efforts that are completed on a regional basis in support of the Project. They will be responsible for management of any projects initiated to support tasks of regional benefit, including development of the project QAPP. The PC will also be responsible for convening the TAG and supporting TAG members in completion of required efforts.

4.1.1. Technical Advisory Group Role

The PC will be assisted in design and implementation of programmatic activities by a Technical Advisory Group (TAG) consisting of representatives from academia, agencies, and other acknowledged experts in the field of trash monitoring. TAG members will assist the PC in developing a monitoring design that can both practical and informative while best ensuring compliance with MRP3 permit requirements.

4.1.1. Stormwater Program Manager

Each Stormwater Program Manager (SPM) will be responsible for managing all Project-associated activities conducted within a given county. In this role, the SPM will be responsible for day-to-day management or oversight of Project-related activities for their Program, including permitting, budgeting, reporting, and oversight of subcontractors.

4.1.2. Monitoring Coordinator

Each Monitoring Coordinator (MC) will be assigned at the stormwater Program level and will be responsible for all monitoring-related activities conducted for that county. As such, the MC‘s responsibilities will include data collection, quality assurance, and reporting. An individual MC may serve in this role for multiple Programs.

4.1.3. Trash Characterization Lead Role

Each Trash Characterization Lead (TCL) will be assigned at the Program level and will be responsible for conduct of trash characterization efforts consistent with the Project timeline. The TCL’s responsibilities will include ensuring that characterization efforts are conducted consistent with the Outfall Monitoring Plan (OMP, BAMSC 2023) and this QAPP, and that data is transferred to Data Manager for further processing and archival. An individual TCL may serve in this role for multiple Programs.

4.1.4. Data Manager Role

Each Data Manager (DM) will be assigned at the Program level and will be responsible for compilation and archival of all Project-related data, including results of field data collection and characterization efforts. An individual DM may serve in this role for multiple Programs.

4.1.5. Water Board Liaison Role

The Water Board Liaison will be responsible for oversight of the overall Program for Permit compliance. The Liaison will also serve as the link between stormwater Programs and TAG and will serve as initial point of contact for stormwater Programs as part of the adaptive management component of monitoring program design and implementation.

5. (A5) Problem Definition/Background

5.1. Problem Statement

Although many individuals living in California properly dispose of and recycle huge volumes of waste each day, many California creeks, rivers, lakes, and coastal areas are still impacted by trash. Once in receiving waters, trash can degrade water quality and adversely affect humans, fish, wildlife, and aquatic habitats (i.e., beneficial uses). Specific to the San Francisco Bay Area, the MRP 3 Fact Sheet Findings identify that trash is "a pervasive problem within San Francisco Bay, as well as in creeks and shoreline areas throughout the Bay Area" and that "trash adversely impacts the public's enjoyment of the Bay, Ocean, and their watersheds and poses a serious threat to aquatic life and habitat." MRP 3 further finds that "pollutant control actions and further pollutant impact assessments by the Permittees are warranted and required."

MRP 3 Provision C.8.e requires Permittees to design and implement trash monitoring programs within their respective jurisdictions over the course of the permit term. As identified within the permit, there are two distinct components of trash monitoring that will be implemented by collaborating BAMSC Programs: (1) outfall monitoring commencing October 1, 2023 and (2) in-stream monitoring commencing October 1, 2024. This QAPP is intended to help facilitate the development and implementation of trash monitoring plans and assist with regional consistency and scientific defensibility. Version 1 of the QAPP was developed to specifically address monitoring conducted through the outfall monitoring component and will be revised, as necessary, to address efforts related to in-stream monitoring.

5.2. Decisions or Outcomes

Permittees have implemented or caused to be implemented a number of trash control measures to achieve MRP 3 trash load reduction benchmarks and prevent trash from reaching receiving waters. Trash control measures incorporated to date have included Full Trash Capture (FTC) systems installed to address trash at the storm drain inlet/catch basin level (e.g., catch basin inserts (CBIs), connector pipe screens (CPSs)) and at the catchment or sub-catchment level (e.g., hydrodynamic separators (HDSs), and low impact development (LID) features sized to FTC system design standards. Non-structural control measures (e.g., street sweeping) have also been used to control trash levels to a full trash capture equivalency (FTCE) level in specific areas where structural controls have not been installed. The trash reduction benefits of these types of controls are demonstrated by use of On-land Visual Trash Assessments (OVTAs).

MRP 3 has established trash load reduction benchmarks from 2009 levels of 90% reduction by June 30, 2023 and a 100% reduction by June 30, 2025. The Project objective is to verify whether trash control measures have effectively prevented trash from being discharged into receiving waters via stormwater. There are two main management questions that will be addressed through Project implementation:

- Have Permittees' trash management actions effectively prevented trash from their jurisdictions from discharging to receiving waters?
- Are discharges of trash from areas within Trash Management Areas controlled to a low trash generation level causing and/or contributing to adverse trash impacts in receiving waters?

Information generated through Project implementation will be used to address these management questions and therefore help Permittees better understand the effectiveness of control actions currently being implemented.

6. (A6) Program/Task Description

6.1. Work Statement and Produced Products

Project efforts associated with the stormwater outfall monitoring component will include installation of FTC netting devices at a targeted number of outfalls associated with catchments that have been controlled to a low trash generation rate (i.e., < 5gal/acre/yr). As identified in the associated Trash MP, selected catchment / outfall combinations were required to meet strict criteria for their trash generation rate, trash controls, and viability to support monitoring, among a number of other criteria. Monitoring locations are summarized in Table 6-1 and described in detail in the OMP (BAMSC 2023).

Table 6-1. Prospective Monitoring Locations

Program	Waterbody	Catchment Size (ac)	Trash Control Measure Type	Outfall Diameter (in.)	Baseline Trash Generation Category[1]
ACCWP	Dublin Creek (AC-OUTBK)	19	High-flow Capacity FTC System	36	36% high, 56% moderate, 7% low
ACCWP	San Lorenzo Creek (AC-CTYCTR)	3.7	Catch Basin Insert FTC Systems	18	100% moderate
ACCWP	Alamo Canal (AC-PUBSAF)	11	High-flow Capacity, Catch Basin Insert, and Multi-benefit Stormwater Treatment FTC Systems	36	4% high, 96% moderate
ACCWP	Alamo Canal (AC-CIVIC)[2]	13	High-flow Capacity FTC System	24	98% moderate, 2% low
CCCWP	Grayson Creek (CC-PCH)	3.9	Catch Basin Insert FTC Systems	18	75% high, 25% moderate
CCCWP	Walnut Creek (CC-WC)	1	Catch Basin Insert FTC Systems	15	100% moderate
SCVURPPP	San Francisquito Creek (SC-SFC)	60	Multi-benefit Stormwater Treatment FTC System, Other Tash Controls	42	79% moderate, 21% low
SCVURPPP	Stevens Creek (SC-STE)	137	High-flow Capacity and Multi-benefit Stormwater Treatment FTC System, Other Tash Controls	54	2% very high, 11% high, 13% moderate, 74% low
SCVURPPP	Coyote Creek (SC-COY)	450	High-flow Capacity and Multi-benefit	60	4% high, 74% moderate, 22% low

Program	Waterbody	Catchment Size (ac)	Trash Control Measure Type	Outfall Diameter (in.)	Baseline Trash Generation Category[1]
			Stormwater Treatment FTC System, Other Tash Controls		
SMCWPPP	Drainage to Pilarcitos Creek (SM-PIL)	86	High-flow Capacity FTC System, Other Tash Controls	47	2% very high, 17% high, 32% moderate, 50% low
SMCWPPP	Canal to Steinberger Slough (SM-SBS)	57	Catch Basin Insert and Multi-benefit Stormwater Treatment FTC Systems, Other Tash Controls	30	4% high, 43% moderate, 53% low
SSA	Drainage to Suisun Marsh (SSA-LOTZ)	3	Multi-benefit Stormwater Treatment FTC System	18	25% high, 75% low

Notes:
[1]BAMSC (2023)
[2]Used for WY2024 monitoring only; replaced with site AC-CTYCTR beginning WY2025 at request of Water Board

6.2. Sampling Detail

The Project will include installation of Oldcastle NetTech™ trash capture (or similar) devices with removable 5 mm mesh netting at outfalls draining catchments controlled to low trash generation rates. Stormwater Programs will monitor a prescribed number of storm events as summarized in Table 6-2; minimum number of storms unable to be achieved in a given year due to lack of rainfall may be made up in successive monitoring years.

Table 6-2. Minimum Annual Level of Monitoring Effort by County.

County	Min. # of Sites	Min. # of Wet Weather Monitoring Events per year[1]
Alameda	3	3
Contra Costa	2	3
San Mateo	2	3
Santa Clara	3	3
Solano	1	3

Notes:
[1]Subject to availability of a minimum number of qualifying storm events

Data collection efforts will include quantitative assessments of trash accumulating at identified outfalls associated with individual storm events. Data collection efforts will also include capture of flow measurement data over the course of the wet season to allow extrapolation of volume of trash collected in individual monitoring events to total outflow from a given catchment. Flow will be estimated by measuring water depth within a given outfall and applying the Manning Equation. Flow obstructions and access issues within outfalls / inserts may introduce some level of uncertainty in flow calculations when nets are deployed.

Targeted monitoring events will be required to meet a strict set of mobilization criteria as identified in the Project OMP. These criteria will include the timing within the Water Year, anticipated magnitude, probability of precipitation, and antecedent dry condition.

For given storm events that meet the mobilization criteria for a given catchment, field teams will proceed to the sampling site, confirm working condition of flow measurement equipment, perform qualitative assessments of conditions, and attach netting. At the end of the storm event, field teams will return to the site to retrieve netting and download flow data. Field teams will label and secure the netting for transport to a secure location for dewatering. Following dewatering, trained assessment teams will characterize accumulated trash for a given site / event combination per the protocols identified in the OMP.

6.3. Project Schedule

The schedule of activities related to Project planning, fieldwork, and reporting deliverables is summarized in Table 6-3.

Table 6-3. Schedule of Project Activities.

Activity	Date of Initiation	Planned Date of Completion	Deliverable
Sampling site selection	10/1/22	5/15/23	
Engineering design	3/1/23	5/31/23	Design and cost estimates
Trash Monitoring TAG meeting #1	-	3/15/23	
Develop draft Outfall Monitoring Plan (MP)	3/1/23	5/15/23	Draft OMP
Develop draft QAPP	3/15/23	5/15/23	Draft QAPP
Draft project MP, QAPP to TAG	3/15/23	5/15/23	
Trash Monitoring TAG meeting #2	-	5/22/23	
Trash Monitoring TAG review draft MP, QAPP	5/15/23	6/2/23	
Submit final MP, QAPP to Water Board Staff	6/2/23	7/31/23	Approved OMP, QAPP
Monitoring planning and prep	6/1/23	9/30/23	Permitting, equipment procurement, construction
Water Year (WY) 2023 status update	10/1/23	3/31/24	Trash Monitoring Status Report in

Activity	Date of Initiation	Planned Date of Completion	Deliverable
			UCMR
WY 2024 monitoring	10/1/23	4/30/24	MRP 3 §C.8.e.iii(1) minimum Level of Effort (LOE)
WY 2024 data mgmt. and reporting	5/1/24	9/30/24	Data mgmt., quality assurance, interpretation
WY 2024 status update	10/1/24	3/31/25	Trash Monitoring Status Report in UCMR
WY 2024 electronic data delivery	10/1/24	3/31/25	Data delivery to Water Board
WY 2025 monitoring	10/1/24	4/30/25	MRP 3 §C.8.e.iii(1) and (2) minimum LOE
WY 2025 data mgmt. and reporting	5/1/25	9/30/25	Data mgmt., quality assurance, interpretation
WY 2025 status update	10/1/25	3/31/26	Trash Monitoring Status Report in UCMR
WY 2025 electronic data delivery	10/1/25	3/31/26	Data delivery to Water Board
WY 2026 monitoring	10/1/25	4/30/26	MRP 3 §C.8.e.iii(1) and (2) minimum LOE
WY 2026 data mgmt. and reporting	5/1/26	9/30/26	Data mgmt., quality assurance, interpretation
WY 2026 status update	10/1/26	3/31/27	Trash Monitoring Status Report in UCMR
WY 2026 electronic data delivery	10/1/26	3/31/27	Data delivery to Water Board
WY 2027 monitoring	10/1/26	4/30/27	MRP 3 §C.8.e.iii(1) and (2) minimum LOE
WY 2027 data mgmt. and reporting	5/1/27	9/30/27	Data mgmt., quality assurance, interpretation
WY 2027 status update	10/1/27	3/31/28	Trash Monitoring Status Report in UCMR
WY 2027 electronic data delivery	10/1/27	3/31/28	Data delivery to Water Board

Mobilization time for each individual sampling activity will be used to conduct all the preparations and training sessions needed to get the field crews ready and equipped. The sampling trips will be conducted at varying frequencies and times dependent on Project needs and requirements; exact timing will be determined based upon Project needs, weather conditions, equipment functionality, and catchment characteristics. As appropriate, trash characterization efforts may be coordinated with requirements of an associated EPA Water Quality Improvement Fund grant (WQIF) supporting receiving water trash monitoring efforts, and the above-mentioned reporting products will provide and interpret findings of

characterization efforts. The OMP will provide additional detail.

6.4. Geographical Setting

Project operations will be conducted in selected watersheds within the San Francisco Bay region, within the counties of Alameda, Contra Costa, San Mateo, Santa Clara, and Solano. Sites selected for Project implementation were identified through a rigorous review process that identified a small number of sites throughout the region that achieved specific criteria for inclusion, such as baseline trash generation rate, trash controls present, outfall type, location relative to water level, and accessibility, among others; full details of the selection process are available in the OMP. Catchments are illustrated in Figure 6-1, summarized below by county, and described in more detail in the OMP.

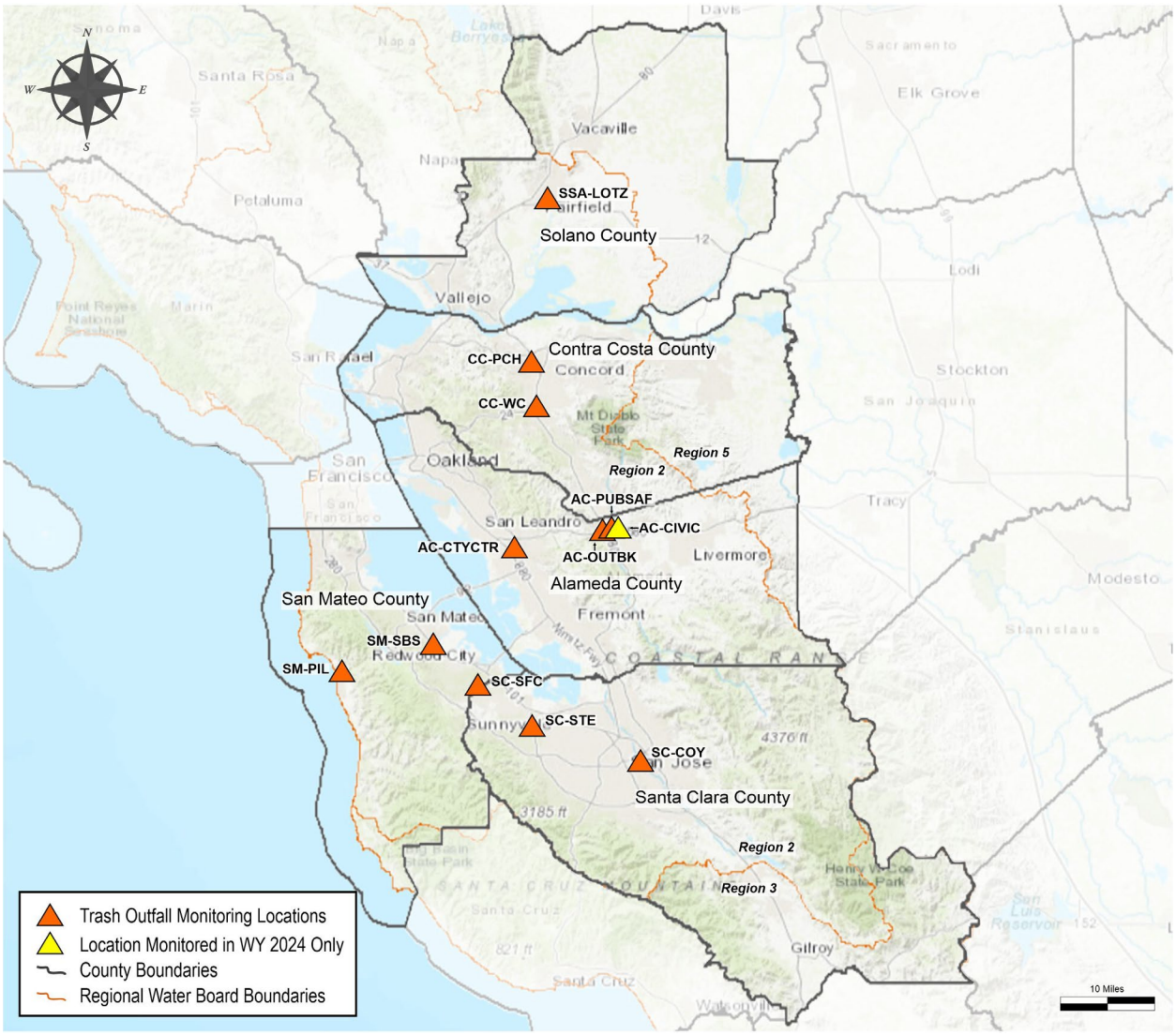

Figure 6-1. Tentative Location of Trash Outfall Monitoring Sites

6.4.1. ACCWP

ACCWP Project-related activities will be conducted at three locations managed by the Zone 7 Water Agency within the City of Dublin. The first site, AC-OUTBK, drains a 19-acre area of predominantly commercial land use, including multiple restaurants and a hotel. The catchment is identified as approximately 36% high, 56% moderate, and 7% low trash generation by area. The catchment is controlled to low trash generation rate by an HDS located just above the outfall.

The second site, AC-PUBSAF, drains an 11-acre area of predominantly commercial and municipal land uses. The catchment is identified as 4% high trash generation and 96% moderate trash generation by area. The catchment is controlled to low trash generation rate by a combination of controls, including HDS units, CBIs, and a LID bioretention feature sized to FTC design specifications.

The third site, AC-CTYCTR, drains an approximately 3.7-acre catchment area north of City Center Drive in the City of Hayward. Land use in the catchment area is a mixture of commercial (74%) and transportation (26%). Baseline trash generation rates for the catchment area were identified as 100% moderate by area. The catchment area is controlled to a low trash designation by use of CPS units installed at three inlets upstream of the outfall.

One additional site, AC-CIVIC, was monitored by ACCWP in WY2024 but replaced with site AC-CTYCTR beginning in WY2025 at the request of the Water Board per the August 31, 2023 conditional approval letter allowing initiation of monitoring activities. This site drains a 13-acre area of predominantly municipal land uses. The catchment is identified as 98% moderate trash generation and 2% low baseline trash generation rate by area, with the low areas associated with a recreational ballfield. The catchment is controlled to low trash generation rate by an HDS located just above the outfall.

6.4.2. CCCWP

The first Contra Costa County site, CC-PCH, drains an approximately 13.9-acre catchment area in the Census Designated Place (CDP) of Pacheco. Urban land use in the catchment area is characterized by retail centers (75%), commercial businesses (24%) and a neighborhood park (1%). Baseline trash generation rates for the catchment were identified as approximately 25% moderate and 75% high by area. The catchment is controlled to a low trash designation by use of catch basin inserts (85%) and FTCE efforts (15%). -

The second monitoring location, site CC-WC, drains an approximately one-acre catchment area in the parking lot of Civic Park in Walnut Creek. Baseline trash generation rate for the catchment was identified as 100% moderate. The catchment area is controlled to a low trash designation by use of a catch basin insert just upgradient of the outfall.

6.4.3. SMCWPPP

The first SMCWPPP monitoring location, SM-PIL, is associated with a 47-inch-diameter outfall that drains a 70-acre catchment area along Pilarcitos Creek in the City of Half Moon Bay. This catchment area consists of a shopping center, a high school, and a small portion of Highway 1. The catchment is almost entirely treated with HDS devices.

The second location, SM-SBS, is associated with a 30-inch-diameter outfall that drains a 57-acre catchment area along Steinberger Slough in the City of San Carlos. This catchment area consists of

residential, commercial, and industrial land uses. A total of 31 acres within the overall catchment are treated with CPS devices.

6.4.4.SCVURPPP

SCVURPPP Project-related activities will be conducted at locations within the cities of Palo Alto, Mountain View, and San Jose. The first monitoring location, SC-SFC, is associated with a 30-inch-diameter outfall to San Francisquito Creek that drains a 60-acre catchment in the City of Palo Alto, which includes the Stanford Shopping Center and the Hoover Medical Campus. There are three LID projects in the catchment that provide approximately seven acres of full trash capture treatment. Trash reduction from other management actions (i.e., FTCE) have been documented at four street locations surrounding the catchment using OVTA methodology.

The second site, SC-STE, is located at a 62-inch-diameter outfall that drains a 137-acre catchment area along Stevens Creek in the City of Mountain View. This catchment area consists of primarily single/multi-family residential land uses and commercial land uses along El Camino Real. The catchment area contains two FTC devices that treat approximately 12 acres. Trash reduction from other management actions in the watershed has been documented using OVTA survey data.

For the third site, SC-COY, the monitoring location is a 60-inch-diameter outfall to Coyote Creek that drains a 450-acre catchment area in the City of San Jose. This catchment area consists of primarily industrial, commercial and park land uses, including the San Jose Giants stadium complex, City of San Jose Corporation Yard and recreation uses in Kelley Park. The catchment contains one large HDS, one CPS, and one LID feature that treat a combined 230 acres. Trash reduction from other management actions in the watershed has been documented for the remaining 200 acres using OVTA survey data.

6.4.5.SSA

SSA's proposed study site, SSA-LOTZ is associated with an existing Amtrak Park and Ride Lot located between Lotz Way and Highway 12 in Suisun City, which is also being used for Low Impact Development (LID) monitoring. The surrounding catchment is approximately 3 acres and includes mostly transportation related uses (i.e., an asphalt parking lot, landscaping, and highway roadway). The overall retrofit project, which is planned for 2023 construction, incorporates two trash capture devices and 4,856 square feet of LID bioswale creation at the eastern edge of the existing parking lot and has been sized to FTC design standards.

6.5. Constraints

Delays in regulatory permitting, equipment procurement, and emergency/unforeseen construction problems impacting the MS4 or access to the planned monitoring locations for a given storm, vandalism or equipment failure at unstaffed locations, or unanticipated safety concerns could result in fewer locations or samples being reported in a given year or across the permit term.

Another constraint is the uncertainty associated with sampling wet weather events. This Project is complicated by the uncertain relationship between precipitation timing and intensity and the onset and duration of flow at the project stations. Communication with the Monitoring Coordinator will limit the probability of false starts, but due to the nature of the station set up and pre-sampling efforts required, go / no-go decisions will need to be made several days in advance of the storm events. First flush events may

also happen before the start of a given water year. Storms that are predicted as design storm events may also not present in that manner. Given that three storm events per year are required, individual Programs will err on the side of caution in selection of storm events, prioritizing completing sampling of three events over waiting for a design storm.

A final constraint is monitoring blackout dates surrounding holidays when monitoring will not take place despite the presence of a qualifying storm event. Following are the typical wet season monitoring blackout periods:

- Thanksgiving holiday (Wednesday through Sunday)
- Christmas/New Year's Day holiday period (Christmas Eve through New Year's Day)
- President's Day Weekend (Saturday and Sunday)
- Easter Weekend (Saturday and Sunday)

7. (A7) Quality Objectives and Criteria for Measurement Data

The quantitative measurements that estimate the true value or concentration of a physical or chemical property always involve some level of uncertainty. The uncertainty associated with a measurement generally results from one or more of several areas: (1) natural variability of a sample; (2) sample handling conditions and operations; (3) spatial and temporal variation; and (4) variations in collection or analytical procedures. Stringent QA and QC procedures are essential for obtaining unbiased, precise, and representative measurements and for maintaining the integrity of the sample during collection, handling, and analysis, and for measuring elements of variability that cannot be controlled. Stringent procedures also must be applied to data management to assure that accuracy of the data are maintained.

Data Quality Objectives (DQOs) are established to ensure that data collected are sufficient and of adequate quality for the intended use. DQOs include both quantitative and qualitative assessment of the acceptability of data. The qualitative goals for the Project include representativeness and comparability, and the quantitative goals include completeness and precision.

DQOs for the Project are described in narrative form in the sections below. Data acquisition activities will include both on-site field measurements and offsite characterization activities.

7.1. Representativeness

The representativeness of data is the ability of the sampling locations and the sampling procedures to adequately represent the true condition of the sample sites. Field personnel will strictly adhere to the field sampling protocols to ensure the collection of representative, uncontaminated samples. The most important aspects of quality control associated with sample collection are as follows:

- Field personnel will be thoroughly trained in the proper use of sample collection equipment and will be able to distinguish acceptable versus unacceptable samples in accordance with pre-established criteria as identified in the Project OMP.

- Field personnel are trained to recognize and avoid potential sources of sample contamination (e.g., not securing sample netting and allowing loss or gain of extraneous materials).

- Trash collected associated with a particular monitoring event should represent a significant proportion of that sampling event. Trash nets are designed to detach from the NetTech™ structures if and when flow obstructions cause flow to bypass the end of pipe in order to prevent flooding. The performance of NetTech™ technology relative to detachment is unknown at this time, but is anticipated to have a greater likelihood of detachment with increasing storm magnitude. Given that nets will be used for monitoring DMAs controlled to low trash level rather than full trash capture purposes, however, the likelihood of nets detaching during storm events will be minimized compared to typical applications.

Criteria for acceptable representativeness for monitoring duration are adopted from Caltrans (2020) and shown in Table 7-1. Given the nature of the sampling design and equipment employed, we do not anticipate nets detaching over the course of monitoring events.

Table 7-1. Requirement for Percent Storm Capture for Storm Representation

Total Event Precipitation	% Storm Capture Requirement[1]
<1”	80%
≥1”	75%

[1]Percent storm capture is the percent of flow volume represented by a composite sample. It is calculated by dividing the flow volume that passed the sampling station during sample collection by the total flow that passed the sampling station during the entire monitoring event.

7.2. Comparability

Comparability is the degree to which data can be compared directly to other relevant studies. For this investigation, assessment methods were adapted from those employed for similar investigations to characterize trash on land and in receiving waters (e.g. Rapid Trash Assessment (RTA) protocol, BASMAA Regional Trash Generation Project, BASMAA Trash Receiving Waters Monitoring Project, BASMAA Tracking California Trash project, Ocean Protection Council (OPC) Trash Playbook).

7.3. Completeness

Completeness is defined as the percentage of valid data collected and analyzed compared to the total expected to be obtained under normal operating conditions. Overall completeness accounts for both sampling (field measurements / assessments) and assessment (post-field analyses).

Completeness is expressed as overall completeness for a given parameter for each component of the Project. Under ideal circumstances, the objective is to collect 100 percent of all field samples desired, with successful characterizations on 100 percent of trash samples (including QC samples). However, circumstances surrounding sample collections and handling are influenced by numerous factors, including weather, equipment failure, shipping / transportation damage, and sampling crew error. Any loss due to one of these factors is expected to be made up over the course of the Project. An overall completeness of 100% of the minimum requirement for trash sampling and characterizations by Program at the end of the Permit term is considered acceptable for the Project. A secondary completeness requirement of 90% applies to all other Project-related data collection activities (e.g., flow data).

7.4. Sensitivity

For the purpose of this Project, trash is defined as material that cannot pass through a 5 mm mesh screen. Therefore, any material smaller than that size is likely to be excluded from characterization efforts. The means for achieving the sensitivity DQO for the Project is by use of netting with maximum 5 mm mesh size for all trash capture devices used in monitoring.

7.5. Precision

Precision is used to measure the degree of mutual agreement among individual measurements of the same property under prescribed similar conditions. Overall precision usually refers to the degree of agreement for the entire sampling, operational, and analysis system. It is derived from reanalysis of individual samples (laboratory replicates) or multiple collocated samples (field replicates) analyzed on equivalent instruments and expressed as the relative percent difference (RPD) or relative standard deviation (RSD).

Analytical precision will be determined from duplicate analyses of field samples.

Analytical precision is expressed as the RPD for duplicate measurements.

$$RPD = ABS([X1 - X2] / [(X1 + X2) / 2])$$

Where: X1 = the first sample result
X2 = the duplicate sample result.

7.6. Accuracy

There are no standards / certified reference materials for trash therefore accuracy will not be assessed for the Project. In order to support accurate trash characterizations, collaborating Programs have developed a photo library of representative items for proposed trash categories, included as an appendix to the OMP (BAMSC 2023).

8. (A8) Special Training Needs / Certification

8.1. Specialized Training or Certification

All monitoring fieldwork will be performed by contractor staff that has appropriate levels of experience and expertise to conduct the work, as determined by the MC for each Program. As appropriate, a subset of sampling personnel may be required to undergo or have undergone OSHA training / certification for confined space entry in order to undertake particular aspects of sampling within areas deemed as such (e.g., installation / retrieval of flow measurement sensors).

Additional task-specific training on specific field-related efforts will be provided on an as-needed basis. These may include training on data collection and maintenance associated with flow measurement equipment, handling of trash nets, and any required safety-related information (e.g., handling of potentially hazardous materials).

Staff conducting trash characterization efforts will be trained in the use of the specific characterization protocol.

8.2. Training and Certification Documents

MCs will be responsible for maintaining all training records associated with Project implementation.

9. (A9) Documents and Records

Procedures for overall management of project documents and records are summarized below.

9.1. Field Documentation

All field data gathered for the Project are to be recorded in field datasheets (BAMSC 2023) and field notebooks, and scanned or transcribed to electronic documents as needed to permit easy access by Project staff and other appropriate parties. An electronic data form using the Fulcrum application (or equivalent) will be considered as well.

9.1.1. Sampling Plans, COCs, and Sampling Reports

Field sampling, handling, and reporting procedures will be conducted in accordance with the OMP. Field sampling crews will generate records of sample collection and will be responsible for maintaining these records in an accessible manner and submitting to the respective MC.

9.1.2. Field Datasheets

Field personnel will collect a variety of information in the field to support interpretive efforts, including qualitative assessments of site characteristics, storm-event associated data, and status of all Project-related equipment and its functioning. All field data gathered by this project will be recorded on standardized field data entry forms. The OMP describes protocols for use with field datasheets or electronic field data forms.

9.1.3. Field Logbooks

In addition to completing field data sheets, sampling personnel will record other relevant information in bound logbooks or using electronic devices. The OMP describes protocols for use with field logbooks.

9.1.4. Photographic Documentation

The OMP describes protocols for handling photographic documentation.

9.2. Trash Characterization Documentation

The Project requires specific actions to be taken associated with trash characterization efforts, including requirements for bulk trash assessments, quality control, and archival of project-specific information. Each of these aspects is described below.

9.2.1. Characterization Datasheets

Separate from the field efforts, trash assessment personnel will be responsible for identifying all trash collected for a given site / event combination consistent with the selected characterization protocol. All characterization data gathered by this Project will be recorded on standardized field data entry forms. The OMP (BAMSC 2023) includes the datasheet template and describes protocols for use with field datasheets or electronic field data forms.

Following conclusion of individual or multi-event characterization efforts, the TCL will transfer characterization datasheets to the MC or their designee for review of completeness, errors, and general QA/QC. Once this review is completed, all results meeting DQOs and results having satisfactory explanations for deviations from objectives shall be reported in tabular format on electronic media, in a

format modeled upon the EPA Escaped Trash Assessment Protocol (ETAP) reporting spreadsheet.[1]

9.3. Project Management Documentation

Further aspects of the management of project documents and records are summarized below.

9.3.1. QAPP

This QAPP and its revisions will be kept by the PC and distributed to the appropriate parties involved with the Project. Table 3-1 shows the QAPP distribution list.

Proposed revisions to the QAPP will be approved by the Water Board representative or their designee and then the revised QAPP will be submitted to the list of project personnel shown on Table 3-1. The revised QAPP will be accompanied by a memorandum compiling and summarizing the proposed changes and with instructions indicating that the revision supersedes earlier versions of the QAPP.

9.3.2. Project Information Archival

Persons responsible for maintaining records for the Project are shown in Table 9-1. A back-up copy of all electronic records will maintained off-site.

Table 9-1. Document and Record Retention, Archival, and Disposition

Type	Retention (years)	Archival	Disposition
Field Datasheets	5	MC	Recycling
Chain of Custody Forms	5	MC	Recycling
Calibration Logs for Field Equipment	5	MC	Recycling
Characterization Datasheets	5	MC	Recycling
Electronic characterization data	5	MC/PM	Maintain indefinitely
QAPP, MP, Project Reports	5	MC/PM	Maintain indefinitely

The MC will oversee the actions of all personnel with records retention responsibilities for a given Program, and will arbitrate any issues relative to records retention and any decisions to discard records.

[1] https://www.epa.gov/trash-free-waters/epas-escaped-trash-assessment-protocol-etap.

10. (B1) Sampling Process Design

The Project is designed to address the Management Questions listed in Element 5 and to comply with the monitoring methods prescribed in MRP3 §C.8.e. Sample locations and the timing of sample collection will be selected using the directed sampling design principle. This is a deterministic approach in which points are selected deliberately based on knowledge of their attributes of interest as related to the environmental site being monitored. This principle is also known as "judgmental," "authoritative," "targeted," or "knowledge-based." Individual monitoring aspects are summarized below and will be described in more detail in the Program-specific MPs.

10.1. Water Quality Measurement and Trash Characterization

Measurement and characterization efforts will support the Project's effectiveness evaluations of trash control options, as described previously (see Section 6.2). The Project OMP will provide more details regarding water quality monitoring and measurement methodologies and undergo review and approval by the TAG before this type of fieldwork commences.

10.2. Sampling Uncertainty

There are multiple sources of potential sampling uncertainty associated with the Project, including: (1) measurement error; (2) natural (inherent) variability; (3) sample misrepresentation (or poor representativeness); and (4) sampling bias (statistical meaning). Measures incorporated to address these areas of uncertainty are discussed below:

(1) Measurement error combines all sources of error related to the entire sampling and analysis process (i.e., to the measurement system). All aspects of dealing with uncertainty due to measurement error are described elsewhere within this QAPP.

(2) Natural (inherent) variability occurs in any environment monitored, and is often much wider than the measurement error. Previous studies have demonstrated the high degree of variability in environmental media and especially the heterogeneous nature of stormwater runoff. This will be taken into consideration when interpreting results of the effectiveness evaluations of the trash control mechanisms tested.

(3) Sample misrepresentation happens at the level of an individual sample or field measurement where an individual sample collected or measurement taken is a poor representative for overall conditions encountered. To address this situation, the Project will implement a number of QA-related measures described elsewhere within this QAPP.

(4) Sampling bias relates to the sampling design employed and whether the appropriate statistical design is employed to allow for appropriate understanding of environmental conditions. To a large degree, the sampling design required for the Project is judgmental, which will therefore incorporate an unknown degree of sampling bias into the Project. There are small measures that have been built into the sampling design to combat this effect (e.g., variety of control mechanisms, geographic spread across region), but overall this bias will need to be taken into consideration when interpreting results of the various investigations.

Further detail on measures implemented to reduce uncertainty will be described in the Project OMP.

11. (B2) Sampling Methods

The Project involves the collection of trash samples associated with stormwater runoff from catchments controlled to low trash generating rate. Field collections will be conducted by field contractors using techniques designed to respond to site-specific conditions, Project requirements, and associated constraints. These methods are summarized below and presented in more detail in the OMP. To the extent practicable, the Project will utilize previously-developed Standard Operating Procedures (SOPs) (Table 11-1) to reflect understanding gained through previous, related projects.

11.1. Field Monitoring

All samples collected for trash characterization will be collected using consistent techniques that allow for comparisons across monitoring sites. Specific methods are described below.

11.1.1. Stormwater Runoff

Samples will be collected within stormwater conveyances by use of NetTech™ (or similar) full trash capture devices used to trap material that would otherwise be delivered to receiving waters from each study catchment. Following conclusion of an individual sampling event, nets will be secured and transferred to an off-site location for dewatering. At the conclusion of dewatering, vegetative debris will be separated from trash, and bulk accumulated trash will be transferred to an individual storage container until time of characterization. Detailed methods are identified within the OMP (BAMSC 2023).

11.1.2. Flow Measurement

The effectiveness evaluations of trash controls will include measurements of flow to allow extrapolation of trash data associated with individual monitoring events. The OMP will describe in detail how this will be accomplished. The OMP will undergo review and approval by the TAG before this type of fieldwork commences.

11.2. Sampling Containers

Unlike many water quality monitoring projects, there is no requirement for sampling containers to be non-contaminating. Sampling containers will be sized to fit material accumulating in a given site / event combination and will only be required to have the integrity to store the sampled material without loss and free of debris that could be confused with accumulated material. The individual Programs will be responsible for ensuring integrity of the containers. If sampling containers lose their integrity during the sample handling process they will be discarded and replaced with a spare container. Details of sampling containers used by a specific Program to collect field samples are identified in the OMP.

11.3. Sample ID Numbers

Every sample must have a unique sample number so that the analytical results from each sample can be differentiated from every other sample. This information should follow the sample through the chain-of-custody (COC), assessment, and interpretation and reporting processes. The naming convention is described within the OMP.

11.4. Sample Equipment Cleaning

Nets should be inspected for accumulated trash, rips, or wear as they are emptied into temporary storage containers, and again prior to re-installation for a successive sampling event. Field staff should follow any manufacturer's recommendations provided for cleaning and inspection to best ensure viability of the product.

11.5. Waste Disposal

Proper disposal of all waste is an important component of field activities. At no time will any waste be disposed of improperly. The proper methods of waste disposal will be described in the OMP.

11.6. Responsibility and Corrective Actions

If monitoring equipment fails, sampling personnel will report the problem in the comments section of their field notes and will not record data values for the variables in question. Actions will be taken to replace or repair broken equipment as soon as possible after their identification.

11.7. Standard Operating Procedures

SOPs expected to be used as part of implementation and are included in Table 11-1.

Table 11-1. List of Project SOPs

SOP	Location
Standard Operating Procedure for Trash Characterization	Appendix to Monitoring Plan

In addition, contractor-specific plans and procedures may be required for specific aspects of Project implementation (e.g., health and safety plans, disposal procedures for hazardous items).

12. (B3) Sample Handling and Custody

Sample handling and chain of custody procedures are described in detail in the OMP. One member of each sampling team will be identified as "Team Lead", and will be responsible for overall collection and custody of samples during field sampling. The field crews will have custody of samples during field sampling and COC forms will accompany all samples from time of collection to that of characterization. COC procedures require that possession of samples be traceable from the time the samples are collected until completion and submittal of characterization results.

In general, all samples will be maintained in netting or transferred to other porous containment device to allow for collected trash to dewater prior to characterization. Upon completion of dewatering (or potentially when nets are required for re-deployment), trash samples will be transferred to a secondary container for storage until time of characterization; this container will be non-porous and sized to accommodate accumulated trash (e.g., 5-gallon bucket, heavy-duty trash bags, HDPE sample container).

12.1. Shipping Containers

It is not anticipated that any samples will be shipped over the course of Project implementation, but will instead be hand-delivered to location of characterization. All samples will, however, be handled, prepared, transported, and stored in a manner so as to minimize loss or degradation of accumulated trash and while in care of an individual Program. Sample containers will be clearly labeled with an indelible marker and accompanied by COC forms.

12.2. Sample Hold Times

There are no hold times associated with the Project to ensure sample integrity. However, all characterization efforts will be completed within the timeframes required to ensure compliance with MRP requirements.

13. (B4) Method Selection

13.1. Reporting Limits

Not applicable

13.2. Sample Disposal

After trash characterization efforts have been completed for a given set of samples and results have been accepted by the MC, they will be disposed by each Program in compliance with all federal, state, and local regulations. Special care should be given to any materials identified as potentially hazardous waste as identified in contractor health and safety plans referenced in the OMP.

14. (B5) Quality Control

Data collected during Project implementation fall in two main categories: (1) trash characterization and (2) flow measurement. Quality control aspects for each facet of monitoring are discussed in detail in the sections that fallow.

14.1. Trash Characterization Quality Control

Trash characterization QC samples must satisfy Project MQOs and frequency requirements. MQOs are specified in Appendix A. Due to the relatively small number of samples generated per Program and anticipated number of characterization events, frequency requirements are completed on an annual basis. Different aspects of the trash characterization QC program are summarized below.

14.1.1. Calibration, Volumetric

For any volumetric measurements recorded as a part of Project implementation, Project-related measurement tools will be specified and employed as a means of incorporating measurement consistency across Programs and over time. Given the variation in catchment sizes represented within the overall Project and the number of trash categories to be assessed, there is likely to be a range of volumetric measurement tools required to support implementation. Therefore, for all characterization efforts, Project personnel will have available a variety of containers for obtaining measurements. These will range in size from 100 mL graduated cylinders to 5-gallon (approx. 19 L) buckets. For those containers that do not contain internal measurement gradations, TCLs will estimate category volumes by measuring depth of accumulated trash in the container as a proportion of overall depth and apply in proportion to container volume (e.g., a container filled to 60% of its depth will generate a volumetric measurement estimated as 60% of its capacity). Trash will not be compacted prior to collecting measurements.

14.1.2. Replicate Assessments

The Project will adopt the same terminology as SWAMP in defining replicate samples, wherein replicate analyses are distinguished from duplicate analyses based simply on the number of involved analyses. Duplicate analyses refer to two sample preparations, while replicate analyses refer to three or more.

Replicate analyses will be conducted on specific site / event combinations at a frequency identified in Appendix A. A separate assessment team from the one conducting initial analyses will be responsible for conducting any replicate analyses. Assuming replicate analyses meet Project requirements for precision, the results from the original analysis will be used for interpretative purposes.

14.2. Flow Measurement Quality Control

Field QC results must meet the MQOs and frequency requirements specified in Appendix A, where frequency requirements are provided. Specific field quality control samples may also be required by the method or SOP selected for sample collection and analysis. If project MQOs conflict with those prescribed in the utilized method or SOP, the more rigorous of the objectives must be met.

14.2.1. Instrument Calibration

Prior to initial measurement, utilized instruments must be calibrated following the procedures outlined in the relevant manufacturer's user manual or SOP. Each reference must specify acceptance criteria that demonstrate instrument stability and an acceptable calibration. If instrument calibration does not meet the

specified acceptance criteria, the measurement process is not in control and must be halted. The instrument must be successfully recalibrated before collecting measurements.

14.3. Field Corrective Action

The field organization is responsible for responding to failures in their sampling and field measurement systems. If monitoring equipment fails, personnel are to record the problem according to their documentation protocols. Failing equipment must be replaced or repaired prior to subsequent sampling events (or as soon as possible for continuous measurements). It is the combined responsibility of all members of the field team organization to determine if the performance requirements of the specific sampling method have been met, and to collect additional samples if necessary.

15. (B6) Instrument/Equipment Testing, Inspection and Maintenance

Any field measurement equipment used will be checked for operation in accordance with manufacturer's specifications. This includes battery checks and routine replacement and cleaning of parts as specified by the manufacturer. All equipment will be inspected for damage when first employed and again when returned from use. As required, maintenance logs will be kept and each piece of equipment will have its own log that documents the dates and description of any problems, the action(s) taken to correct problem(s), maintenance procedures, system checks, follow-up maintenance dates, and the person responsible for maintaining the equipment. A list of anticipated field measurement equipment to be used for Project monitoring is shown in Table 15-1. The OMP will describe in detail what equipment will be used and the testing, inspection, and maintenance of the associated equipment.

Table 15-1. Testing, Inspection and Maintenance of Field Sampling Equipment

Instrument / Equipment	Test / Maintenance	Frequency of Checking	Responsible Person
Water level logger	Battery and data storage capacity	Every six weeks or as indicated by prior usage	MC
Barometric pressure logger	Battery and data storage capacity	Every six weeks or as indicated by prior usage	MC

16. (B7) Instrument/Equipment Calibration and Frequency

16.1. Field Measurements

Any monitoring equipment used should be visually inspected during mobilization to identify problems that would result in loss of data. The OMP will describe calibration of the flow monitoring equipment used for the Project.

16.2. Laboratory Analyses

16.2.1. In-house Analyses

Not applicable.

16.2.2. Contract Laboratory Analyses

Not applicable.

17. (B8) Inspection/Acceptance for Supplies and Consumables

Each sampling and characterization event conducted for Project will require use of appropriate consumables to best ensure integrity of samples and safety of sampling personnel. MCs will be responsible for ensuring that all supplies are appropriate prior to their use. Inspection requirements for sampling consumables and supplies are summarized in Table 17-1.

Table 17-1. Inspection / Acceptance Testing Requirements for Consumables and Supplies

Project-related Supplies	Inspection / Testing Specifications	Acceptance Criteria	Frequency	Responsible Person Sampling Containers
Sampling supplies	Visual	No evident contamination or damage	Each purchase and use	MC

18. (B9) Non Direct Measurements, Existing Data

The Project builds upon previous investigations conducted by MRP3 Permittees and others in the stormwater monitoring arena. These previous investigations will help inform site selection and development of monitoring / characterization methods, but are not expected to be used for direct comparisons of data generated through the various efforts.

Programs will also incorporate measurement data from weather stations proximate to sampling sites. To the extent possible these will be NOAA reporting stations, but local weather stations may be substituted as appropriate.

19. (B10) Data Management

The MC or their designee will be responsible for management of all data generated in the field and laboratory throughout the data collection, management, and reporting process for a given Program.

19.1. Field Data Management

Record keeping of field measurements data for the proposed project will employ standard record-keeping and tracking practices. Any manual field measurements will be entered in bound log books and/or field datasheets while in the field, or equivalent electronic devices. This field measurement data will be entered into an Excel file and then quality control (QC) checked for entry errors by a different person. Backup copies of all data files will be made by the person performing data entry on the same day that the files were generated or that any changes were made to them.

Field measurement data entered into electronic devices will be downloaded in Excel format and then QC checked by field personnel familiar with the data that was collected. Following processing, electronic field data will be transferred to the respective DM for archival.

19.2. Trash Characterization Data Management

Record keeping of characterization data for the Project will employ standard record-keeping and tracking practices. All characterization data will be manually recorded on standardized worksheets, or entered directly into equivalent electronic devices. All manually-recorded data will be transferred to Excel worksheets as soon as possible following characterization activities. All characterization data will be manually checked for data entry errors before forwarding to DM for archival.

Field datasheets employed for the Project are formatted consistent with a Microsoft Excel® spreadsheet that is used for electronic data entry. Once data are entered into the spreadsheet and assigned an appropriate event code (consisting of site ID + date), each DM will be responsible for data storage for their respective Program. A compilation of all individual Program-related characterization data will be generated using R Studio code, running R version 4.0.2 (R Core Team 2020) to include data for all monitoring events into a single password-protected Excel® spreadsheet. Similar coding can be used for a regional compilation if required for interpretive purposes.

20. (C1) Assessments and Response Actions

20.1. Mobilization

The MC or their designee will review all field equipment, instruments, containers, and paperwork to ensure that everything is ready prior to each sampling event. All sampling personnel will be given a brief review of the goals and objectives of the sampling event and the sampling procedures and equipment that will be used to achieve them. It is important that all field equipment be prepped and ready to use when it is needed. Therefore, prior to using all sampling and/or field measurement equipment, each piece of equipment will be checked to make sure that it is in proper working order. Equipment maintenance records will be checked to ensure that all field instruments have been properly maintained and that they are ready for use. Essential items (e.g., datasheets, laptop, labels, waterproof pens) will be checked before each field event to make sure that there are sufficient supplies to successfully support each sampling event.

It is important to make sure that all field activities and measurements are properly recorded in the field. Therefore, prior to starting each field event, necessary paperwork such as logbooks and chain of custody record forms will be checked to ensure that sufficient amounts are available for the field event. In the event that a problem is discovered during mobilization it will be noted in the field logbook and corrected before the field crew is deployed. The actions taken to correct the problem will also be documented in the field logbook.

20.2. Demobilization

At the conclusion of field sampling events, the MC should debrief sampling personnel and, as necessary, document any problems that arose during sampling activities, along with recommendations for correcting the problem. These reviews will ensure that any deviations from planned methodologies are documented and addressed.

20.3. Project Data Reviews

The MC or their designee will be responsible for reviewing flow and trash characterization data for completeness and performance against Project MQOs. The data will also be checked to make sure that appropriate methods were used and that all required QC data are available. Data reviews will be conducted following receipt of each data package to ensure that all information is complete and any deviations from planned methodologies are either corrected or the reasons for deviations are documented. Any data that is discovered to be incorrect or missing will immediately be reported to the both the MC and SPM. The SPM and MC have the authority to request re-processing of any data if the review reveals any factors that would compromise the quality of the data and resulting conclusions from the Project.

21. (C2) Reports to Management

The anticipated reporting requirements associated with the Project are described below and summarized in Table 21-1. MCs are expected to stay in close communication with SPMs on Project progress, but no formal reporting mechanisms are required to document that communication.

21.1. Data Delivery

Results of characterization process will be delivered by each assessment team to each respective MC at the conclusion of each assessment effort. The MC's designee shall review the draft results against QAPP requirements and identify any deficiencies requiring resolution. At the point where there are no remaining QA concerns, the reporting template will be considered final and will be submitted to the respective DM.

Flow measurement data will be delivered by field team staff to the MC at the conclusion of each monitored event or periodic time interval as appropriate. The MC's designee shall review the draft results against QAPP requirements and identify any deficiencies requiring resolution. At the point where there are no remaining QA concerns, the reporting template will be considered final and able to be used for interpretative purposes in Project reports.

21.2. Progress Reports

Progress will be reported annually through the updates submitted by each Program as part of UCMR reporting requirements.

This information is summarized in Table 21-1 below. Draft or final reports may also be made available upon request to Project participants not listed below, including municipalities and TAG members.

Table 21-1. Reports to Management

Type of Report	Frequency	Projected Delivery Dates(s)	Person(s) Responsible for Report Preparation	Report Recipients
Interim progress reports (UCMR)	Annual	March 31st of each monitoring year (except 2026)	SPM	WB
Integrated Monitoring Report (IMR)	Once	March 31, 2026	SPM	WB

22. (D1) Data Review, Verification, and Validation

Defining data review, verification, and validation procedures helps to ensure that Project data will be reviewed in an objective and consistent manner. Data review is the in-house examination to ensure that the data have been recorded, transmitted, and processed correctly. The MC will assign a designee responsible for data review. This includes checking that all technical criteria have been met, documenting any problems that are observed and, if possible, ensuring that deficiencies noted in the data are corrected.

In-house examination of Project data will be conducted to check for typical types of errors. This includes checking to make sure that the data have been recorded, transmitted, and processed correctly. The kinds of checks that will be made will include checking for data entry errors, transcription errors, transformation errors, calculation errors, and errors of data omission.

Data generated by project activities will be reviewed against MQOs that were developed and documented in Section 7 and Appendix A.

QA/QC requirements are documented in Sections 14, 15, 16, and 17 and the data will be checked against this information. Checks will include evaluation of duplicate analyses for trash characterizations and standard checks on field measurement data for flow measurements.

Field data consists of all information obtained during sample collection and field measurements, including that documented in field log books and/or recording equipment, photographs, and chain of custody forms. Checks of field data will be made to ensure that it is complete, consistent, and meets the data management requirements documented in Section 19.

Data verification is the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual specifications. Each Program will conduct independent data verification, as described in Section 14.

Data validation is a process that evaluates the information after the verification process to determine data quality and any limitations. Data validation evaluates whether data are of acceptable quality with respect to the intended end use as described in Section 5.2 (Decisions or Outcomes).

Data will be separated into three categories: (1) data that meet all acceptance requirements, (2) data determined unacceptable for use, and (3) data that may be conditionally used and but are qualified as to their deficiencies.

23. (D2) Verification and Validation Methods

Defining the methods for data verification and validation helps to ensure that project data are evaluated objectively and consistently. Many of these methods have been described in Section 22. Additional information is provided below.

All of the trash characterization data will be checked as part of the verification methodology process. Results of replicate analyses will be the main means of assessing validity of the data. Results of calibrations will be the main means of assessing accuracy of flow measurement data.

Any data that are discovered to be incorrect or missing during the verification or validation process will immediately be reported to the MC and SPM. The MC will be responsible for reporting and correcting any errors that are found in the data during the verification and validation process.

If there are any data quality problems identified, the MCs and SPMs will coordinate to try to identify whether each problem is a result of project design, sampling, staff training, or other issues. If the source of the problems can be traced to one or more of these basic activities then the person or people in charge of the areas where the issues lie will be contacted and efforts will be made to immediately resolve the problem. If the issues are too broad or severe to be easily corrected then the appropriate people involved will be assembled to discuss and try to resolve the issue(s) as a group. The SPM has the final authority to resolve any issues that may be identified during the verification and validation process.

24. (D3) Reconciliation with User Requirements

The purpose of this Project is to generate an improved understanding of the effectiveness of stormwater management practices in the Bay Area in relation to trash management. Information from field personnel, reviews of data versus MQOs, data verification reports, data validation reports, independent data checking reports, and error handling reports will be used to determine whether or not the Project's objectives have been met. Characterization and flow measurement data will be analyzed for completeness to ensure that project DQOs are met. The field statistical data will be compared against the MQOs documented in Section 7 and Appendix A.

Data from all characterization efforts will be summarized in tables. Additional data may also be represented graphically when it is deemed helpful for interpretation purposes.

Project data will be collected from a wide variety of sites with differing land use conditions, trash controls, and sampling environments.

The above evaluations will provide a comprehensive assessment of how well the Project meets its objectives.

The data obtained through Project implementation by the collaborating stormwater Programs will improve stormwater management efforts in the San Francisco Bay area by expanding our collective knowledge of trash control effectiveness. The products and information from this Project will inform efforts to effectively allocate resources to reduce the volume of trash reaching receiving waters.

25. References

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26. Appendix A – Measurement Quality Objectives for Field Measurements

Table 26-1. Measurement Quality Objectives for Trash Characterizations

Quality Control Metric[1]	Frequency of Analysis	Measurement Quality Objective
Replicate Volume (per category)	Minimum once per Program per year	RPD<25% (n/a for any category with <50 mL recorded volume)

[1] Precision will be assessed at least annually by comparing measurements of replicate units under the same conditions. Relative Percent Difference (RPD) is the difference between two repeated measurements expressed as a percentage of their average. *%RPD = (sample result - duplicate result) * 100*

Table 26-2. Measurement Quality Objectives for Project Field Measurements

Analyte	Units	Accuracy[2] (unit)	Precision (unit or RPD) [1]	Resolution[2]
Water level	in or m	±1%	±10%	NA

[1] These terms used to assess if an instrument or method is useful to a study and are provided by the manufacturer.