Watching Our Watersheds (WOW) Regional Trash Monitoring Project

Funded through USEPA WQIF Grant

Trash Outfall Monitoring Progress Report

Water Year 2024 (October 2023 – September 2024)

Final March 31, 2025

Submitted in compliance with Provision C.8.h.iii.(2) of NPDES Permit No. CAS612008, Order No. R2-2022-0018

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

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ACCWP	Alameda Countywide Clean Water Program
BAMSC	Bay Area Municipal Stormwater Collaborative
CBI	Catch Basin Insert
CCCWP	Contra Costa Clean Water Program
EO	Executive Officer
GIS	Geographic Information System
HDS	Hydrodynamic Separator
LID	Low Impact Development
MBTS	Multi-benefit Treatment System
MRP	Municipal Regional Permit
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
OVTA	On-land Visual Trash Assessment
POP	Probability of Precipitation
QAPP	Quality Assurance Project Plan
QPF	Quantitative Precipitation Forecast
RCP	Reinforced Concrete Pipe
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SMCWPPP	San Mateo Countywide Water Pollution Prevention Program
SSA	Solano Stormwater Alliance
SWRCB	State Water Resources Control Board
TAG	Technical Advisory Group
UCMR	Urban Creeks Monitoring Report
USEPA	United States Environmental Protection Agency
WOW	Watching Our Watersheds
WY	Water Year

EXECUTIVE SUMMARY

Provision C.8.e of the Municipal Regional Stormwater National Pollutant Discharge Elimination System (NPDES) Permit (MRP 3.0) Order No. R2-2022-0018 issued by the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB or Regional Water Board) directs Permittees to conduct trash monitoring at municipal separate storm sewer system (MS4) outfalls and in receiving waters, and prescribes specific monitoring location criteria, methods and frequencies that must be achieved to address the management and monitoring questions listed in MRP 3.0. This Trash Outfall Monitoring Progress Report, submitted in compliance with Provision C.8.h.iii.(2) of MRP 3.0, documents trash outfall monitoring activities conducted in WY 2024. The report was prepared collaboratively by member Programs of the Bay Area Municipal Stormwater Collaborative (BAMSC). The report describes Provision C.8.e Trash Outfall Monitoring requirements and how each BAMSC Program complied with the requirements during WY 2024.

Provision C.8.e trash monitoring was informed by the Trash Monitoring Technical Advisory Group (Trash TAG), which was formed by BAMSC in WY 2023. The Trash TAG is comprised of impartial science advisors and Regional Water Board staff. In WY 2023, the Trash TAG met twice (March and May 2023) with a focus on obtaining Trash TAG guidance and feedback on the development of the Trash Outfall Monitoring Plan (MP) and Quality Assurance Project Plan (QAPP). Both plans were submitted to the Regional Water Board Executive Officer (EO) for approval on July 31, 2023. On August 31, 2023, the Regional Water Board EO conditionally approved the plans, and updated versions were submitted on July 31, 2024 (BAMSC 2024a and AMS 2024a).

A minimum of 11 MS4 outfalls regionwide must be monitored during a minimum of three wet weather events per year beginning October 1, 2023. Monitoring must be conducted with netting devices (or equivalent devices) attached to the end of outfall pipes or other equivalent location that allows for capture of trash discharging through the MS4. Targeted outfalls must drain areas that are controlled to the low trash generation level (i.e., less than 5 gallons per acre per year) and must be representative with respect to the types of trash controls present across the region. Provision C.8.e.ii also requires direct measurement of flow at the monitoring station (to calculate loading) and collection of data on the type of material collected.

During WY 2024, the BAMSC Stormwater Programs successfully sampled three storm events at 10 of the 11 monitoring locations and collected a total of 30 samples during WY 2024. The SSA sampling location (Site SSA-LOTZ) was not sampled in WY 2024 due to construction delays associated with the Multi-benefit Treatment System (MBTS) that the Solano Stormwater Alliance (SSA) selected for trash monitoring. Trash sampling at the 10 sites was conducted using an Oldcastle NetTech™ Gross Pollutant Trap system (trash net device) with 5 mm mesh size, and flow monitoring was conducted using water level sensors installed in the outfall pipes, upstream of the trash net devices.

Each trash sample was characterized by measuring the overall volume of collected trash and the volume of trash characterized into 13 different categories. In addition, a qualitative assessment of each catchment area draining to the monitored outfall was conducted prior to the first monitoring event to evaluate the levels of trash observed on streets and sidewalks. The assessments included observations of trash sources and trash controls in the catchment.

The total trash volumes standardized by area across the 30 sample events ranged between 0 and 0.41 gallons per acre for each event. Most samples (21 of 30, 70%) were below 0.05 gallons/acre during each event. Only three samples were higher than 0.1 gallons/acre. The highest trash volumes for sites in Alameda and Contra Costa Counties occurred during Event 3, which was one of the largest storms of the year. The highest trash volumes for sites in Santa Clara and San Mateo Counties generally occurred during Event 1, which was the first significant storm of the season. The trash characterization data showed that plastic trash items made up the majority of trash characterized in all samples.

Water flow data was impacted during monitored storm events due to the nets and material captured causing water to back up into the pipes. Flows were therefore calculated using HEC-HMS rainfall-runoff models for timeframes when nets were installed. Rainfall data were obtained for one or more rain gages in proximity to the monitored catchment and rainfall totals were calculated using an inverse distance squared weighted average. Flow data were used to develop annual hydrographs for each site.

Annual trash loading rates were calculated using a simple model that assumed the same trash volume (i.e., average of measured volumes from the three events) was discharged during each storm event of the season with greater than 0.1 inch precipitation in 6 hours and at least 24 hours of antecedent dry conditions. A total of 24 to 30 storms were defined across the 10 monitoring sites. Using this simple method, trash loading rates for the 10 sites ranged from 0 to 4.6 gallons per acre per year. The values are below the low trash generation rate of 5 gallons/acre/year, suggesting that trash controls in the monitored catchments are performing well.

The BAMSC identified several refinements to the Trash Outfall Monitoring Plan for WY 2025. At the request of Water Board staff to increase the geographic representation of outfall monitoring sites in Alameda County, ACCWP will replace site AC-CIVIC, located in the City of Dublin, with a new site AC-CTYCTR, located in the City of Hayward. The BAMSC Programs will also evaluate alternative methods for monitoring trash at storm drain outfalls and findings will be presented to the Trash TAG in WY 2025. Lastly, the BAMSC Programs will evaluate factors that may influence trash loading rates and present data analysis approaches to the Trash TAG in WY 2025.

1. INTRODUCTION

On behalf of all public agencies (i.e., Permittees) subject to the Municipal Regional Stormwater National Pollutant Discharge Elimination System (NPDES) Permit (MRP 3.0) Order No. R2-2022-0018 issued by the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB or Regional Water Board), this Trash Outfall Monitoring Progress Report, Water Year[1] (WY) 2024 was prepared collaboratively by members of the Bay Area Municipal Stormwater Collaborative (BAMSC) Trash Monitoring Workgroup. Members of the BAMSC Trash Monitoring Workgroup include the following countywide stormwater programs:

- Alameda Countywide Clean Water Program (ACCWP)
- Contra Costa Clean Water Program (CCCWP)
- San Mateo Countywide Water Pollution Prevention Program (SMCWPPP)
- Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP)
- Solano Stormwater Alliance (SSA)

This report fulfills the requirements of Provision C.8.h.iii.(2) of MRP 3.0 for summarizing trash monitoring accomplishments from the preceding water year (i.e., WY 2024) conducted in compliance with Provision C.8.e (Trash Monitoring). Section 2.2 below provides a summary of the required information to be included in each annual trash monitoring progress report. The annual trash *outfall* monitoring progress report is presented herein; the annual trash *receiving water* monitoring progress report will be sent to the Regional Water Board as a separate report.

This report was prepared as a task defined under the Watching Our Watersheds (WOW) Regional Trash Monitoring Project, which is funded by a grant from the United States Environmental Protection Agency (USEPA) Water Quality Improvement Fund. The WOW project addresses several MRP Provision C.8.e requirements for trash monitoring, including development of regional trash monitoring progress reports.

[1] Most hydrologic monitoring occurs for a period defined as a water year (WY), which begins on October 1 and ends on September 30 of the named year. For example, WY 2024 began October 1, 2023 and concluded September 30, 2024.

2. BACKGROUND

The level of trash in California's receiving waters has increased substantially over the past few decades, causing one of the state's most significant water quality issues (SWRCB 2015). Over the last decade, MRP Permittees have invested significant public resources to implement source controls and stormwater infrastructure improvements and upgrades to reduce the amount of trash discharged from their municipal separate storm sewer systems (MS4s) to receiving waters. Many of these actions are prescribed by Provision C.10 of the MRP which mandates that Permittees achieve a 100% reduction of trash in stormwater discharges from baseline (2009) levels by June 2025.

With the adoption of MRP 3.0 in 2022, the Regional Water Board also added significant trash monitoring requirements. Provision C.8.e of MRP 3.0 directs the Permittees to conduct trash monitoring at MS4 outfalls and in receiving waters, and prescribes specific monitoring location criteria, methods, and frequencies that must be achieved to address the management questions and monitoring questions listed below. Provision C.8.e.v required Permittees to submit a “collective” (i.e., regional) trash monitoring plan that demonstrates how the requirements in Provision C.8.e will be met. The Permittees submitted the trash monitoring plan to the Regional Water Board Executive Officer (EO) for approval on July 31, 2023.

The Trash Monitoring Plan was designed to address the following management and monitoring questions listed in MRP 3.0:

Management Questions

1. Have Permittees’ trash management actions effectively prevented trash from their jurisdictions from discharging to receiving waters?
2. 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 water?

Monitoring Questions

1. What is the trash condition and approximate level of trash (volume, type, and size) within and discharging into receiving waters in areas that receive MS4 runoff controlled to a low trash generation via the installation of full trash capture devices, or the implementation of other trash management actions equivalent to full trash capture systems?
2. Does the level of trash in the receiving water correlate strongly with the conditions of the tributary drainage area of the MS4?

2.1 Monitoring Approach

Provision C.8.e.ii describes the specific monitoring methods, number of sites, types of sampling events, and frequency to be implemented during the term of the permit (i.e., 2022-2027). A summary of these requirements is described below.

Outfall Monitoring

Beginning October 1, 2023, a minimum of 11 outfalls regionwide must be monitored during a minimum of three wet weather events per year. The required allocation of sites among the stormwater programs is listed in Table 1. Monitoring must be conducted with netting devices (or equivalent devices) attached to the end of the outfall pipe or other equivalent location that allows for capture of trash discharging through the MS4. Targeted outfalls must drain areas that are controlled to the low trash generation level and must be representative with respect to the types of trash controls present across the region. Provision C.8.e.ii also requires direct measurement of flow at the monitoring station (to calculate loading) and collection of data on the type of material collected.

Receiving Water Monitoring

A pilot program to directly sample sections of receiving waters that receive runoff primarily from MS4 outfalls that drain tributary areas controlled to the low trash generation level must begin October 1, 2024. At least six receiving water sites regionwide must be monitored during at least three wet weather events per year. The required allocation among the counties is listed in Table 1. Targeted storm events should be likely to result in discharges of trash through the MS4 system, and targeted receiving water monitoring locations should not be downstream of direct discharge sites (e.g., homeless encampments, illegal dumping sites). Provision C.8.e.ii also requires direct measurement of flow at the monitoring station (to calculate loading) and collection of data on the type of material collected.

Table 1. Number of MRP 3.0-required trash monitoring sites for each monitoring program

County	# of Outfall Sites	# of Receiving Water Sites
Alameda	3	2
Contra Costa	2	1
Santa Clara	3	2
San Mateo	2	1
Solano	1	0
Totals	**11**	**6**

2.2 Technical Advisory Group

To assist in the development and implementation of a scientifically-sound Trash Monitoring Plan, Provision C.8.e.iv requires Permittees to form and convene a Technical Advisory Group (TAG) composed of impartial science advisors and Regional Water Board staff. The Trash Monitoring TAG (Trash TAG) members include monitoring experts from throughout California:

- **Tony Hale, PhD** - Director of the Environmental Informatics Program at the San Francisco Estuary Institute (SFEI)
- **Shelly Moore** - Executive Director of the Moore Institute for Plastic Pollution Research
- **Tom Mumley, PhD**[2] - Assistant Executive Officer at the San Francisco Bay Regional Water Board
- **Dawn Petschauer** - Stormwater Program Administrator at the City of Pasadena
- **Ted Von Bitner, PhD** - Assistant Vice President at WSP USA

[2] Dr. Mumley retired from his position at the Regional Water Board in June 2024. His replacement on the TAG is currently under discussion.

To date, four Trash TAG meetings have been convened, with a total of eight meetings planned over the entire monitoring project. During WY 2023, meetings #1 and #2 were conducted in March and May 2023, respectively, with focus on obtaining Trash TAG guidance and feedback on the development of the Trash *Outfall* Monitoring Plan and Quality Assurance Project Plan (QAPP). In WY 2024, meetings #3 and #4 were conducted in March and May 2024, respectively, with focus on obtaining Trash TAG guidance and feedback on the development of the Trash *Receiving Water* Monitoring Plan and QAPP. Meeting summaries for Trash TAG meetings that occurred during WY 2024 are provided in Attachment A.

Meeting #5 is planned to take place in early 2025 and will focus on providing results and analyses from the first year of trash outfall monitoring (i.e., WY 2024) and TAG review of potential adaptations to future monitoring approaches. Subsequent meetings will be held at least annually to provide continued feedback regarding the implementation of both Trash Monitoring Plans.

Provision C.8.e.v also requires Permittees to provide opportunities for input on development of the Trash Monitoring Plan(s) by interested parties and scientific experts other than those participating in the TAG. As described in the trash outfall and receiving water monitoring plans, this requirement was satisfied by seeking input from stakeholders that participate in the BAMSC Trash Subcommittee (which include California Department of Transportation [Caltrans], local watershed groups, USEPA, university professors and academics, and Save the Bay) and other organizations, such as San Francisco Bay Keeper.

2.3 Trash Monitoring Plan and QAPP

In WY 2023, the BAMSC Trash Monitoring Workgroup developed a Regional Trash Outfall Monitoring Plan (Version 1.0) (BAMSC 2023) and QAPP (Version 1.0) that met the requirements of Provision C.8.e of the MRP. The Regional Trash Outfall Monitoring Plan and QAPP were submitted to the Regional Water Board EO for approval on July 31, 2023, in compliance with the deadline required in Provision C.8.e.vi of MRP 3.0. On August 31, 2023, the Regional Water Board EO conditionally approved both plans, requiring that an updated version with changes be submitted on July 31, 2024. During the subsequent year, the BAMSC Workgroup revised the Regional Trash Outfall Monitoring Plan (Version 2.0) (BAMSC 2024a) and QAPP (Version 2.0) (AMS 2024a) in response to the conditional approval and submitted those documents on July 31, 2024.

2.4 Reporting Requirements

Along with each annual urban creeks monitoring report, Provision C.8.h.iii.(2) of MRP 3.0 requires Permittees to annually submit a single collective regionwide trash monitoring annual progress report no later than March 31. The required information and associated sections of the report are listed below:

a) Narrative description of monitoring conducted, including the number of sites monitored and the number of monitoring events completed (Section 3.4.1);

b) Description of storms events that were sampled, including the date(s) and times when samples were collected, intensity and duration of the storm event, a description of where along the hydrograph the storm event was sampled, and justification used to determine the storm event was of appropriate size to displace and/or mobilize the transport of trash though the MS4 system (Section 3.4.1, Attachment B);

c) Narrative description, including maps, of any MS4 outfalls, homeless encampments and illegal dumping sites, located upstream of each outfall monitoring sample site (Attachment B);

d) Description and the results of data analysis methods, including statistical analyses (Sections 3.4.2 and 3.4.4);

e) Results and lessons learned (Section 4.2);

f) Data quality assurance procedures that were implemented for samples collected (Section 3.5);

g) Monitoring events (including locations and methods) planned for the subsequent fiscal year(s) (Section 5.2); and

h) Updates of required Initial Trash Monitoring Plan elements (Section 5.2, Attachment B).

In addition, by no later than March 31, 2026, the Permittees shall collectively submit a comprehensive trash monitoring report coincident with the Integrated Monitoring Report, which encompasses all prior water years and, at a minimum, includes all items listed above.

3. TRASH OUTFALL MONITORING

During WY 2024, Member Programs from the BAMSC Trash Monitoring Workgroup conducted trash monitoring at 10 of the 11 regionwide outfall monitoring locations. Due to contracting and construction delays, the Solano County site was not monitored by SSA in WY 2024; facility construction is anticipated to be completed in time to conduct WY 2025 monitoring.

Key components of the outfall monitoring program are summarized in the section below. These components include:

- Monitoring Site Locations
- Sampling Methods
- Data Analysis Methods
- Results
- Data Quality Assessment

3.1 Monitoring Site Locations

Eleven trash outfall locations were selected for trash monitoring. Sites are listed in Table 2 and mapped in Figure 1.

Table 2. Trash outfall monitoring locations

County	Station ID	Waterbody	Location	Latitude	Longitude	Catchment Size (acres)	Outfall Diameter (in)
Alameda	AC-PUBSAF	Alamo Canal	Dublin	37.70317	-121.91971	11	36
Alameda	AC-OUTBK	Dublin Creek	Dublin	37.69947	-121.92793	19	36
Alameda	AC-CIVIC	Alamo Canal	Dublin	37.70333	-121.91934	13	24
Contra Costa	CC-PCH	Grayson Creek	Pacheco	37.98345	-122.0684	3.9	18
Contra Costa	CC-WC	Walnut Creek	Walnut Creek	37.90346	-122.05934	1.0	15
San Mateo	SM-PIL	Canal to Pilarcitos Creek	Half Moon Bay	37.46929	-122.43381	86	47
San Mateo	SM-SBS	Canal to Steinberger Slough	San Carlos	37.5123	-122.25785	57	30
Santa Clara	SC-SFC	San Francisquito Creek	Palo Alto	37.44581	-122.17226	60	42
Santa Clara	SC-STE	Stevens Creek	Mountain View	37.37815	-122.06934	137	54
Santa Clara	SC-COY	Coyote Creek	San Jose	37.32246	-121.86009	400	60
Solano	SSA-LOTZ	Suisun Marsh	Suisun City	38.243309	-122.038655	3	36

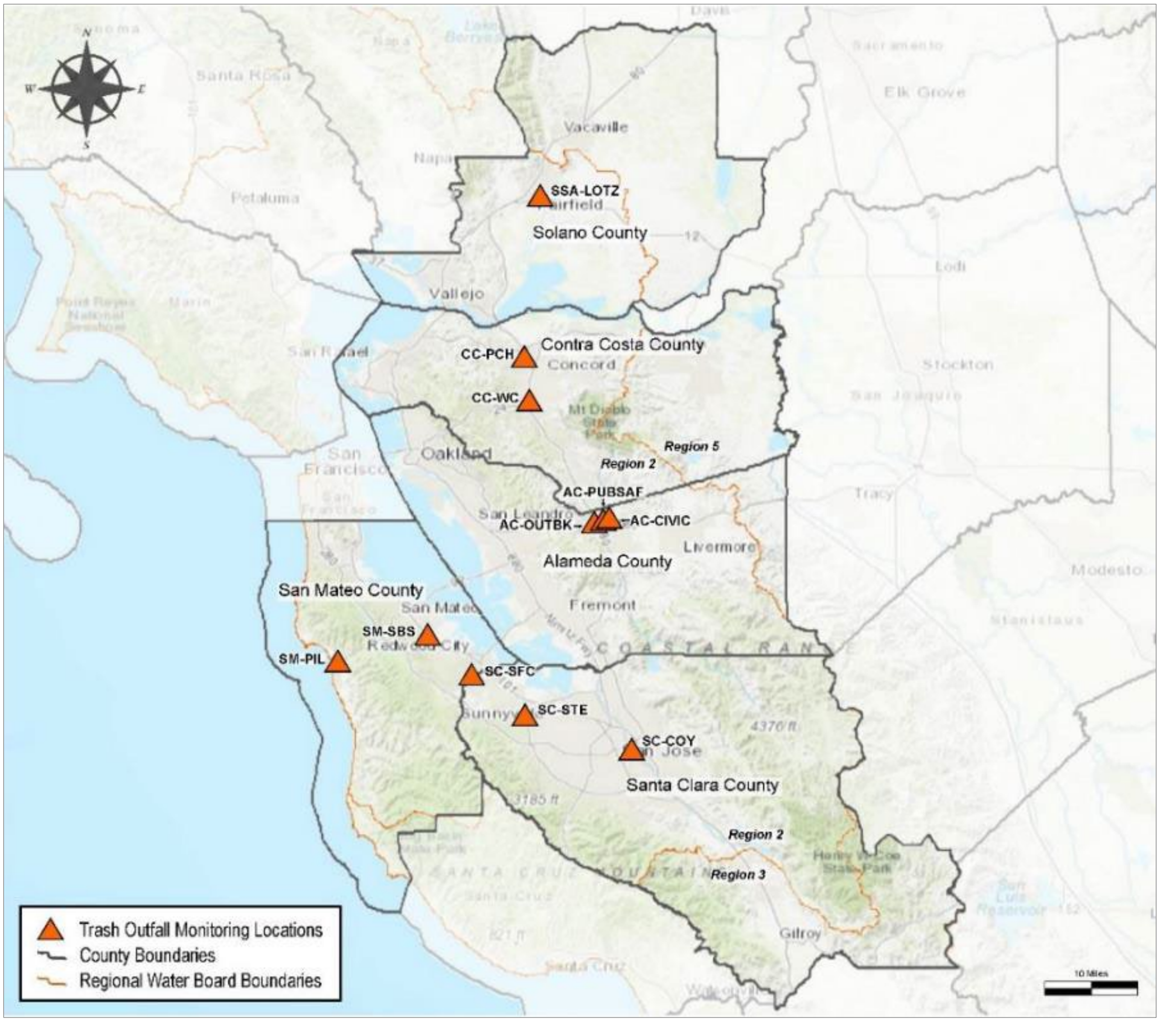

Figure 1. Trash outfall monitoring sites

3.2 Sampling Methods

The BAMSC Trash Monitoring Workgroup developed a regionally consistent approach for outfall monitoring and data evaluation, informed by Trash TAG member recommendations.

3.2.1 Sampling Equipment

The following equipment was installed at each trash monitoring outfall for which monitoring was conducted in WY 2024 (Figure 2):

- Oldcastle NetTech™ Gross Pollutant Trap system (trash net device), or equivalent,[3] with 5 mm mesh size
- Water level sensor to monitor flow rate (e.g., In Situ Level TROLL® water level sensor)

[3] Solano Stormwater Alliance will use a basket type netting system, manufactured by Fabco Industries, installed at the underdrain of low impact development facility.

The trash net component was installed prior to and removed following each targeted storm event. Water level sensors were used to measure the flow depth inside the storm drain pipe, just upstream of the trash net device. Water depth measurements were recorded for the entire wet season.

Figure 2. Monitoring equipment installed at each storm drain outfall monitored in WY 2024

Trash net device (left) Water level sensor (right)

3.2.2 Qualitative Assessment of Trash in Catchments

A qualitative assessment of each monitoring catchment was conducted, at a minimum, during the month of September 2023, prior to the first monitoring event. The assessments included observations of trash and trash controls in the catchment area draining to the outfalls, and observations of trash at the outfall and its vicinity (e.g., creek bank, drainage ditch). Assessment observations were documented in Catchment Characterization Log Sheets. Depending on the size of the catchment, the characterization events were conducted as windshield or walking surveys and included the entire catchment or specific areas of interest (e.g., uncontrolled trash generation areas) (see Section 4 and Attachment B for site-specific details).

3.2.3 Sampling Events

Each BAMSC Trash Monitoring Workgroup Member Program is required to monitor trash at outfalls during three storm events each water year over the duration of the MRP, beginning October 1, 2023 (WY 2024–WY 2027). The type of storm that is targeted for a particular sampling event may vary based on the characteristics of the catchment, the prior storms monitored at a given location, information gained through previous monitoring, or other factors; but in general, mobilization criteria will follow these guidelines:

- Quantitative precipitation forecast (QPF) of approximately 0.25 inches of rain or greater over 24-hour period;
- Probability of precipitation (POP) of approximately 70% or greater; and
- Antecedent dry period of approximately 72 hours or greater (defined as no event exceeding 0.1 inch of cumulative rainfall over 24-hour period).

Using these guidelines, each BAMSC Member Program also attempted to meet the MRP suggested criteria - to monitor the following types of storms:

- Storms that trigger trash discharge and trash transport through the MS4 (0.25 inches of rain over 24-hour period);
- The first significant storm event of each water year; and
- One storm per year that is forecasted to exceed the full capture design standard storm (i.e., the one-year, one-hour storm event).

The uncertainties related to weather forecasting may have precluded collection of these events. Similarly, the first significant storm event may have occurred before the start of a given water year and may fall outside of the monitoring window or occur when field staff are unavailable to mobilize (e.g., holidays).

3.2.4 Sample/Data Collection

Following each monitoring event, trash nets were removed from the outfall and transported to an offsite dewatering and storage location. Nets were stored at a secure location for approximately one week to allow for the water to drain out of the net. Following the dewatering period, the material was removed from the net and placed on a large table for separating trash from organic debris (e.g., soil, sand, leaves, branches). Trash was placed into storage containers (i.e., plastic or mesh bags) and the organic debris was disposed of appropriately.

3.2.5 Trash Characterization

Each trash sample was characterized by measuring the volume of collected trash following protocols defined in the *Standard Operating Procedure for Trash Characterization* (Appendix E of BAMSC 2024). Trash was sorted into 13 different categories, then measured for volume using a variety of containers that ranged in size from a 50 mL graduated cylinder to a 5-gallon bucket. The total volume of trash items that did not fit into a 5-gallon bucket was estimated and noted on the data collection form.

3.2.6 Flow Measurement/Calculations

At the end of storm events and throughout the winter, field crews downloaded data from water level sensors located in each outfall. Flow rates from outfalls were derived by converting water level data to flow data using Manning's Equation for a partially full pipe. Flow data are used to generate trash loading estimates and confirm discharge through the MS4 during storm events. Water level/flow data were collected from October 1, 2023 to April 30, 2024 to assess the entire wet season[4] and potential timeframe for trash discharge.

Water level data at some outfall locations experienced periodic conditions that prohibit the application of Manning's Equation to accurately calculate flow. In such situations, when outfall sites or periods are identified to have a less predictable relationship between water level and flow,

[4] California weather is generally characterized by a wet season (i.e., October 1 through April 30) and an extended dry season (i.e., late spring through early fall) (Caltrans 2020).

United States Army Corps of Engineers (USACE) hydrologic modeling software or linear regression models was used to better estimate flow. Flow data model accuracy was assured by calibrating the model to field collected flow data and by comparing values measured in similar sized catchments where land use determinations align.

Water level loggers were retrieved in the early dry season to avoid device vandalism and return equipment to the manufacturer for annual factory calibration.

3.3 Data Analysis Methods

A combination of graphics and statistical methods were used to calculate and assess trash loading rates and trash types across sites and across time. The parameters evaluated included trash discharge rates during monitored storm events, stormwater runoff volumes and flow rates, and the types of trash observed in stormwater discharges.

The annual trash loading rate (in gallons/acre/year) for each monitored catchment was estimated by extrapolating trash volumes collected during single storm events (in gallons/acre) to the annual hydrograph developed through flow (and/or precipitation) monitoring. Information about the magnitude and duration of each storm event throughout the year, including monitored events, was used in these calculations. Initially, a simple method of applying average trash volume collected for the three sample events monitoring during WY 2024 at a given site was applied equally across all storm events during the WY. Over time, a rating curve of trash discharge (in gallons/acre) based on storm characteristics (e.g., intensity, duration, antecedent dry period) will be developed for each monitoring site, and updated as new data are collected. These rating curves will be used to estimate trash discharge for non-monitored storm events to recalculate annual trash loading rates for each site.

Annual trash load data were also evaluated within the context of the contributing catchment area (e.g., types of trash control measures present, trash generation rates, land use, overall catchment size).

3.4 Results

This section presents data results for all monitoring sites. Details for each site are presented in the Program summary results in Attachment B.

3.4.1 Sample Events

Oldcastle NetTech inserts were successfully installed at 10 BAMSC monitoring sites during the dry season of WY 2023. However, due to manufacturing delays, the NetTech netting devices were not delivered until late October through early November of 2023. As a result, the trash outfall monitoring was delayed until storms arrived in mid -November 2023. Despite the delay, trash monitoring was conducted during the first seasonal flush at all 10 sites.

The BAMSC Stormwater Programs successfully sampled three storm events at 10 of the 11 monitoring locations and collected a total of 30 samples during WY 2024. The SSA (Solano) sampling location (Site SSA-LOTZ) was not sampled in WY 2024 due to construction delays associated with the Multi-benefit Treatment System (MBTS) that SSA selected for trash monitoring.

The dates and times for deployment and retrieval of trash nets and the total duration of each sample event are shown in Table 3. The duration of each defined storm event that occurred during net deployment is also shown. For the vast majority of trash sample events, the net was manually removed following the storm. However, for sample events at two sites in Santa Clara County and one site in San Mateo County, the net detached during the storm event on January 18, 2024. The date/time for the end of these sampling events was estimated using flow data (i.e., rapid change in water depths were observed when net detached). The sample period (i.e., time that the net was attached) for these three sample events ranged from 70% to 75% of the overall storm period.

The storm characteristics for each sample event, including antecedent dry period (days), total precipitation, rainfall intensity (inches/hour), peak flow rate (cfs), and total flow volume (cf) are summarized in Table 3. Antecedent dry period was calculated by summing the number of days since a storm (defined as greater than 0.1 inch in 6 hours) occurred prior to the sample event. Note this definition of a storm is different than what was used for mobilization (i.e., 0.25 inches over a 24-hour period) (Section 3.2.3). A more conservative definition for storm events that may transport trash was used to estimate the annual trash loading rates. Targeting smaller storms, such as 0.1 inches over a 6-hour time period, in the future, may provide useful information on the lower size limit for a storm that transports trash through the MS4.

Table 3. Sample period and duration, rainfall and flow characteristics for each monitoring event.

Site	Event No	Date/Time Net Attached	Date/Time Net Retrieval[1]	Sample Duration (Hours)	Storm Duration (Hours)	Antecedent Dry (days)[2]	Rainfall Total (in)	Rainfall Max Intensity (in/hr)	Peak Flow (cfs)	Total Flow (cf)
AC-PUBSAF	1	11/13/23 | 13:40	11/21/23 | 09:21	188	8	9	0.4	0.07	1.6	6,189
	2	01/18/24 | 11:50	01/23/24 | 10:07	118	15	3	1.5	0.23	4.3	25,328
	3	01/30/24 | 13:40	02/02/24 | 09:10	68	14	6	1.2	0.2	3.6	20,311
AC-OUTBK	1	11/13/23 | 15:35	11/21/23 | 09:05	185	8	9	0.4	0.07	2.6	14,459
	2	01/30/24 | 14:35	02/02/24 | 08:10	66	14	6	1.2	0.2	4.4	54,277
	3	02/14/24 | 11:20	02/21/24 | 12:25	169	20	9	1.9	0.37	6	90,133
AC-CIVIC	1	11/13/23 | 13:53	11/21/23 | 09:37	188	8	9	0.4	0.07	0.6	4,069
	2	01/18/24 | 10:45	01/23/24 | 10:30	120	15	3	1.5	0.23	0.9	14,680
	3	01/30/24 | 12:58	02/02/24 | 09:40	69	14	6	1.2	0.2	0.9	11,899
CC-PCH	1	11/13/23 | 12:30	11/20/23 | 13:00	168	16	>30	0.6	0.22	0.5	6,861
	2	01/18/24 | 12:45	01/23/24 | 13:15	121	13	3.4	0.9	0.21	0.5	6,986
	3	01/30/24 | 13:00	02/02/24 | 10:00	69	18	7.2	1.5	0.4	2.4	12,870
CC-WC	1	11/13/23 | 11:30	11/20/23 | 11:30	168	25	11.5	0.6	0.15	0.1	975
	2	01/18/24 | 11:45	01/23/24 | 12:00	120	16	1.6	1.1	0.22	0.2	3,128
	3	01/30/24 | 12:00	02/02/24 | 11:30	72	46	6.2	1.2	0.25	0.2	3,060
SM-PIL	1	11/13/23 | 08:15	11/20/23 | 11:00	171	39	7.3	1.3	0.27	2.2	13,514
	2	01/18/24 | 11:10	01/23/24 | 07:30	116	34	2.7	2.9	0.92	7.8	92,688
	3	01/30/24 | 17:00	02/02/24 | 08:00	63	44	7.1	1.2	0.34	1.7	23,365
SM-SBS	1	11/13/23 | 09:30	11/20/23 | 08:30	167	6	>30	0.7	0.3	3.8	17,304
	2	01/18/24 | 09:50	**01/22/24 | 03:20**	89	15	3.2	2.1	0.8	8.5	84,381
	3	01/30/24 | 16:05	02/02/24 | 09:00	65	40	6.3	1.7	0.3	2.3	63,530
SC-SFC	1	11/13/23 | 10:20	11/20/23 | 09:15	167	6	>30	0.5	0.22	3.9	20,192
	2	01/18/24 | 09:00	**01/22/24 | 04:10**	91	15	3.2	1.4	0.94	44.4	187,148
	3	01/30/24 | 15:15	02/02/24 | 10:20	67	48	6.3	1.6	0.36	4.5	77,768
SC-STE	1	11/13/23 | 11:00	11/20/23 | 11:00	168	15	>30	0.6	0.16	1.6	15,633
	2	01/18/24 | 09:30	**01/22/24 | 03:20**	90	14	3.0	0.9	0.42	10	106,060
	3	02/29/24 | 08:00	03/04/24 | 09:00	97	59	8.7	1.3	0.21	3.2	112,460

Site	Event No	Date/Time Net Attached	Date/Time Net Retrieval[1]	Sample Duration (Hours)	Storm Duration (Hours)	Antecedent Dry (days)[2]	Rainfall Total (in)	Rainfall Max Intensity (in/hr)	Peak Flow (cfs)	Total Flow (cf)
SC-COY	1	12/15/23 | 09:30	12/18/23 | 12:30	75	26	27	0.5	0.23	5.4	20,987
	2	12/29/23 | 08:45	01/02/24 | 08:05	95	9	8.9	1	0.33	8.8	92,733
	3	01/18/24 | 08:00	01/23/24 | 12:00	124	20	1.3	1.5	0.39	17.9	354,312

1 Net retrieval date/time indicated in bold reflect estimated time net was detached during the storm event.

2 Antecedent dry periods may be different across sites due to variable rainfall patterns that result in defined storms for some locations and not others.

3.4.2 Trash Characterization

The trash volumes measured for each of the 13 trash categories, as well as the entire volume of trash across the 30 trash samples collected at the 10 outfalls, are presented in Table 4.

- Trash volumes at the Alameda sites ranged from 0 to 4.1 gallons per sampling event. The highest trash volume was recorded during Event 3 at site AC-OUTBK. The trash volumes for all other sample events were below 0.7 gallons.
- Trash volumes at the Contra Costa sites ranged from 0 to 1.6 gallons per sampling event. The highest trash volume occurred during Event 3 at site CC-PCH. Trash volumes at site CC-PCH for Events 1 and 2 were 0.23 and 0.32 gallons, respectively. No trash was identified in any of the three sample events at site CC-WC.
- Trash volumes at the San Mateo sites ranged from 0.4 to 5.7 gallons per sampling event. The highest volumes occurred during Event 1 at sites SM-PIL and SM-SBS, 5.7 and 2.9, respectively.
- Trash volumes at the Santa Clara sites ranged from 0.5 to 12.7 gallons per sampling event. Approximately 12 gallons of trash were collected during Event 1 at all three sites in Santa Clara, as well as during Event 3 at site SC-COY.

The total trash volumes standardized by area across the 30 sample events are illustrated in Figure 3. Most samples (21 of 30, 70%) were below 0.05 gallons/acre for each event. Only three samples were higher than 0.1 gallons/acre. The highest trash volumes per unit area occurred during Event 3 at site AC-OUTBK (0.22 gallons/acre[5]) and site CC-PCH (0.41 gallons/acre) and during Event 1 at site SC-SFC (0.21 gallons/acre).

The total volume for the combined seven plastic trash categories accounted for 72 of the 87 gallons of trash (84%) collected and characterized during the 30 sample events (Table 4 and Figure 4). The total volume in the "*Other Plastic Items/Pieces*" trash category was 52 gallons, which accounted for 71% of all plastic trash items observed (Figure 5). These "Other Plastic Items/Pieces" were primarily comprised of plastic packaging for food and beverage goods purchased at convenience and grocery stores. "*Single-use Plastic Food/Drink Ware*", "*Expanded Polystyrene* (*EPS) Foam Food Ware*" and "*Single-use Plastic Bags*" trash collectively accounted for about 16% of the plastic trash items. Most cities in the San Francisco Bay area have adopted County ordinances that ban the distribution of some type of trash in these categories. Additionally, the State of California recently adopted a ban on expanded polystyrene foam foodware on January 1, 2025. Eleven percent of the plastic trash items were associated with "*EPS Foam Other"* trash. "*Smoking Products*" accounted for approximately 2% of the plastic trash items.

A comparison of trash items observed for all four counties is presented in Figure 6. The proportion of "*Other Plastic*" trash items was highest in San Mateo County (80%), followed by Santa Clara and Contra Costa County (58-59%) and Alameda County (21%). Organic/Paper was the predominant trash item in Alameda County (55%) and was entirely associated with two large cardboard boxes collected in the net during Event 3 at site AC-OUTBK, which may have been placed inside the outfall prior to the monitoring event for possible use as a sleeping pad. The combination of "*Single-*

[5] Trash volume included a large cardboard box that was likely crammed into the storm drain inlet and not transported through the MS4 during the storm event.

use Plastic Food/Drink Ware” and “*EPS Foam Food Ware*” (i.e., banned materials) was highest in Contra Costa County (24%), followed by Santa Clara and Alameda (15-16%) and only 3% in San Mateo County. The proportion of tobacco products trash items was highest in Contra Costa County (10%) compared to all other counties.

Table 4. Volume of trash, sorted into 13 categories, measured in 30 trash samples collected from 10 storm drain outfalls

County	Site	Event	Plastic Trash Items (oz)							Non-Plastic Trash Items (oz)						Trash Volume by Site		
			Single-Use Carryout Plastic Bags	Expanded Polystyrene (EPS) Foam Food Ware	(EPS) Foam Other	Single- Use Plastic Food Drink Ware	Smoking Products, Traditional	Smoking Products, Other	Other Plastic Items / Pieces	Organic / Paper	Fabric	Metal	Glass	Mixed	Biohazard	Total Ounces	Total Gallons	Gallons/ acre
Alameda	PUBSAF	1	0.0	0.0	8.1	0.0	0.4	0.0	16	0.0	0.0	0.7	0.0	0.0	0.6	26	0.2	0.02
	PUBSAF	2	0.0	0.0	1.4	6.0	1.2	2.0	5	37.2	2.0	0.5	0.0	0.0	0.0	55	0.4	0.04
	PUBSAF	3	0.0	0.0	0.0	0.0	0.7	6.8	25	5.1	0.0	0.0	0.0	0.0	0.0	38	0.3	0.03
	OUTBK	1	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.00
	OUTBK	2	0.0	0.0	12.0	12.0	0.0	0.0	64	0.0	0.0	1.0	0.0	0.0	0.0	89	0.7	0.04
	OUTBK	3	0.0	0.2	0.0	84.0	0.1	1.7	20	411.4	6.8	0.2	0.0	0.9	0.0	525	4.1	0.22
	CIVIC	1	0.0	0.0	0.7	0.0	0.1	0.0	10	0.0	0.0	0.0	0.0	0.0	0.0	11	0.1	0.01
	CIVIC	2	0.0	0.0	1.0	30.0	0.4	0.0	17	11.8	0.0	0.0	0.0	0.0	0.0	60	0.5	0.04
	CIVIC	3	0.0	0.0	18.6	11.8	0.5	0.0	22	15.2	0.0	0.0	0.0	0.0	0.0	68	0.5	0.04
Contra Costa	PCH	1	0.0	0.0	0.0	12.7	0.3	0.0	16	0.2	0.0	0.0	0.0	0.0	0.0	29	0.2	0.06
	PCH	2	0.0	0.5	7.6	0.0	0.1	0.0	33	0.0	0.9	0.0	0.0	0.0	0.0	42	0.3	0.08
	PCH	3	0.0	25.4	5.1	28.1	0.5	27.1	114	2.5	0.0	1.0	0.8	0.0	0.0	204	1.6	0.41
	WC	1	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.00
	WC	2	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.00
	WC	3	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.00
San Mateo	PIL	1	0.0	0.0	14.0	12.0	6.0	12.0	600	60.0	12.0	14.0	0.0	0.0	0.0	730	5.7	0.08
	PIL	2	0.0	0.0	22.0	40.0	1.7	2.5	520	23.7	15.9	12.0	0.0	0.0	0.0	638	5.0	0.07
	PIL	3	0.0	0.0	28.0	0.0	2.4	0.0	102	27.1	5.1	12.0	0.0	0.0	0.0	177	1.4	0.02
	SBS	1	0.0	0.0	40.0	6.0	0.5	20.0	297	1.7	8.5	0.0	0.1	0.0	0.0	374	2.9	0.05
	SBS	2	0.0	0.0	3.4	0.9	0.3	5.1	36	0.1	2.5	0.0	0.0	0.0	0.0	49	0.4	0.01
	SBS	3	0.0	0.0	4.2	3.4	0.3	1.7	105	0.0	1.7	0.0	0.0	0.0	0.0	117	0.9	0.02

County	Site	Event	Plastic Trash Items (oz)							Non-Plastic Trash Items (oz)						Trash Volume by Site		
			Single-Use Carryout Plastic Bags	Expanded Polystyrene (EPS) Foam Food Ware	(EPS) Foam Other	Single- Use Plastic Food Drink Ware	Smoking Products, Traditional	Smoking Products, Other	Other Plastic Items / Pieces	Organic / Paper	Fabric	Metal	Glass	Mixed	Biohazard	Total Ounces	Total Gallons	Gallons/ acre
Santa Clara	SFC	1	29.1	42.7	58.2	333.7	0.5	36.4	970	29.1	40.0	54.5	0.0	0.0	0.0	1594	12.5	0.21
	SFC	2	0.0	0.0	85.3	45.1	0.2	0.0	88	0.0	3.4	0.7	0.0	0.0	0.0	222	1.7	0.03
	SFC	3	0.0	0.0	0.3	1.7	1.0	1.7	65	1.7	0.0	0.3	0.0	0.0	0.0	72	0.6	0.01
	STE	1	0.0	3.4	142.2	222.2	3.4	16.0	973	6.8	142.2	100.3	0.0	10.1	0.0	1620	12.7	0.09
	STE	2	0.0	0.0	1.7	32.1	0.7	0.0	27	1.7	0.0	1.0	0.0	0.0	0.0	64	0.5	0.00
	STE	3	0.0	24.0	32.0	123.3	1.7	6.0	371	15.0	20.0	17.0	0.0	7.0	2.0	619	4.8	0.04
	COY	1	0.0	16.0	78.0	78.0	2.5	8.5	920	18.0	40.0	363.0	0.0	20.0	1.0	1545	12.1	0.03
	COY	2	0.0	48.0	170.7	79.0	1.7	2.0	199	6.0	16.0	17.0	0.0	48.0	0.0	587	4.6	0.01
	COY	3	50.0	32.0	256.0	72.0	1.7	4.2	982	5.0	40.0	96.0	0.0	16.0	0.0	1555	12.1	0.03
Total Volume (oz)			**79**	**192**	**991**	**1,234**	**29**	**154**	**6,598**	**679**	**357**	**691**	**1**	**102**	**4**	**11,110**	**87**	
Total Volume by Item (gal)			**1**	**2**	**8**	**10**	**0**	**1**	**52**	**5**	**3**	**5**	**0**	**1**	**0**			
Percent of Total Volume			**0.7**	**1.7**	**8.8**	**10.9**	**0.3**	**1.4**	**58.3**	**6.0**	**3.2**	**6.1**	**0.0**	**0.9**	**0.0**			

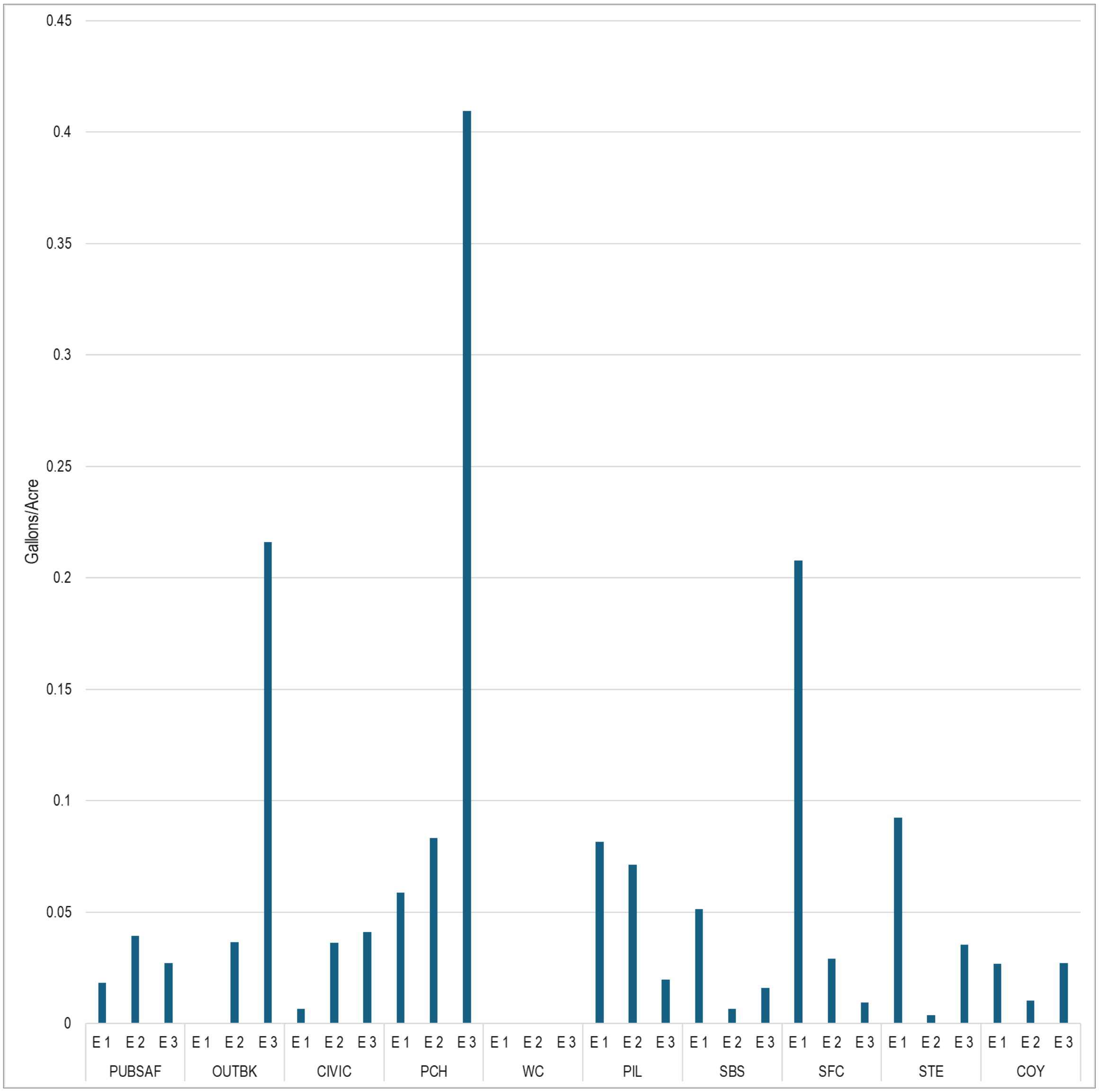

Figure 3. Total trash volume, standardized by area, for 30 trash samples collected from 10 storm drain outfalls

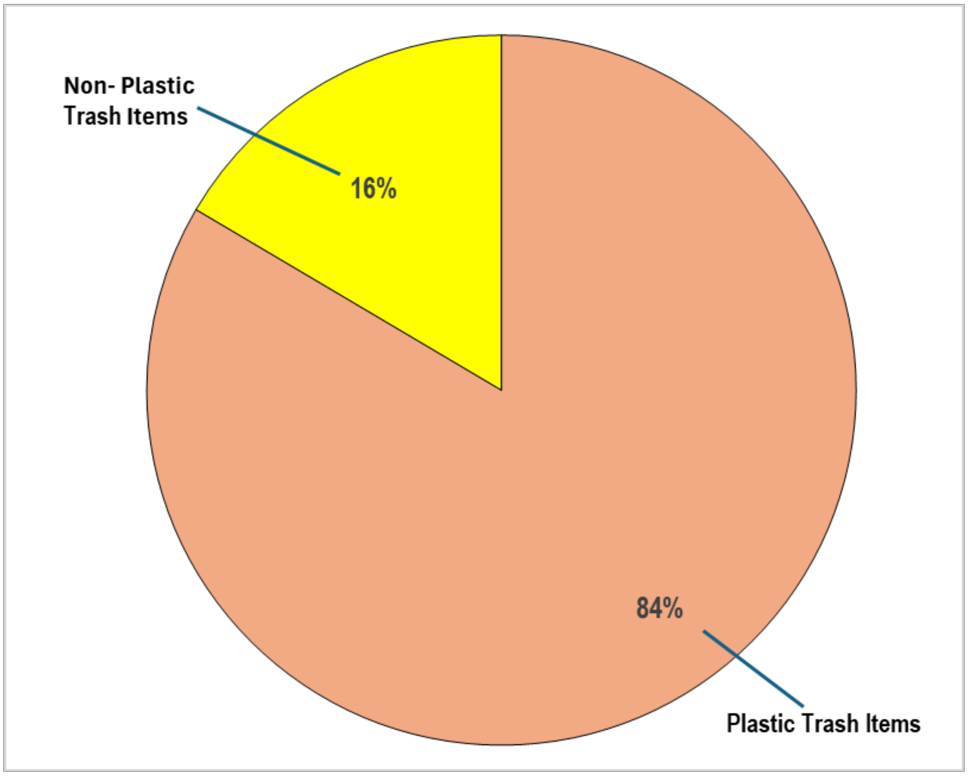

Figure 4. Comparison of plastic versus non-plastic trash items measured in 30 samples collected at storm drain outfalls

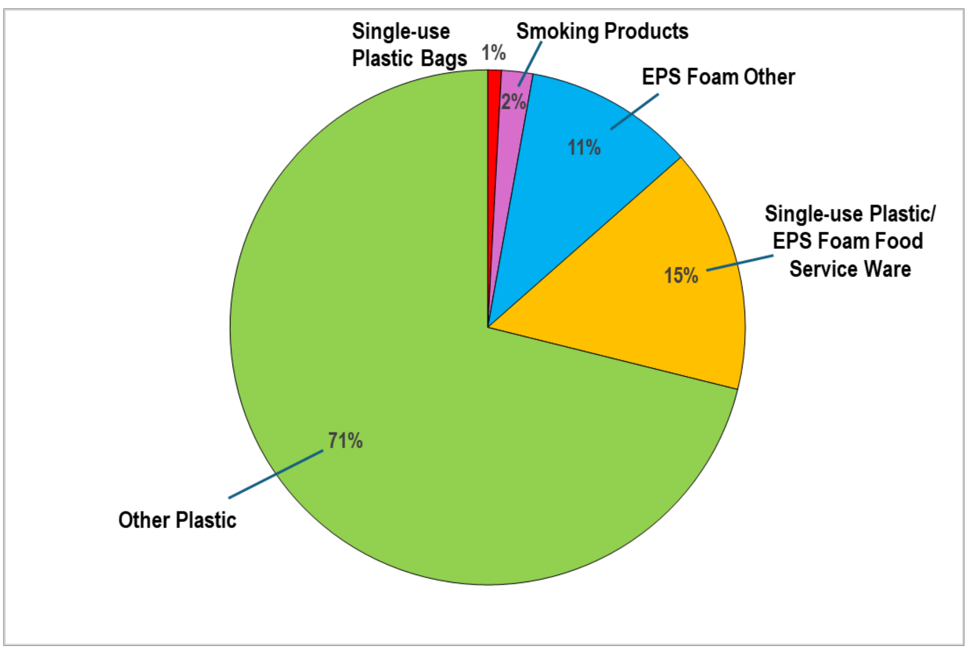

Figure 5. Comparison of plastic trash items measured in 30 samples collected at storm drain outfalls

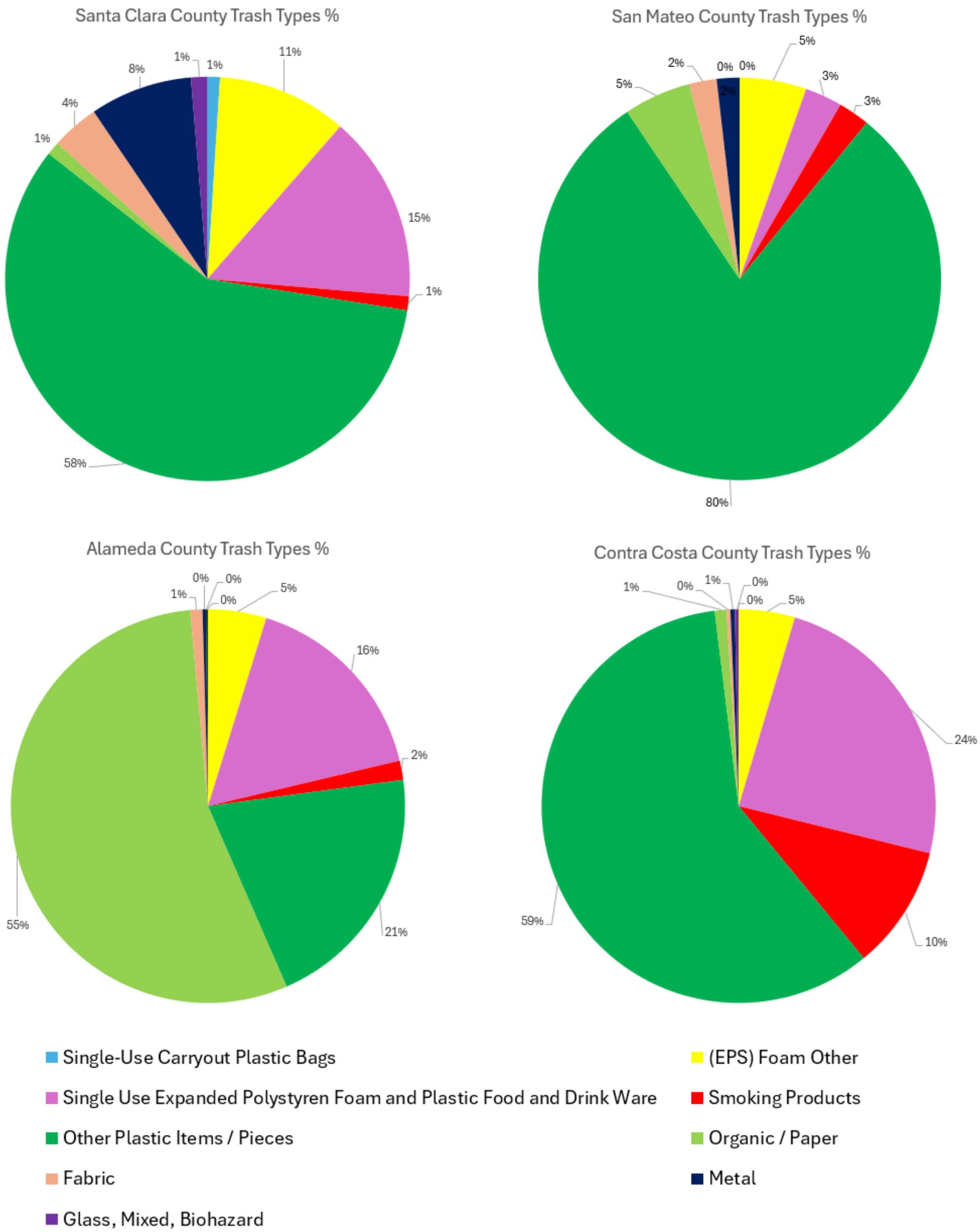

Figure 6. Trash composition in samples collected at storm drain outfalls, grouped by county

3.4.3 Rainfall and Flow

Rainfall data compiled from selected rain gages were evaluated to define the total number of storm events at each monitoring site that occurred during WY 2024. For Alameda monitoring stations, rainfall data was compiled from a weather station operated by the Zone 7 Water Agency which is in close proximity to all three WY 2024 monitoring locations (approximately 0.5, 0.2, and 0.1 miles distant to the three monitoring stations). Rainfall data for all remaining sites were compiled using regional Weather Underground stations in proximity to catchment areas. Weather stations were filtered for quality control using the method outlined in De Vos et al. (2019). Once weather stations were selected, rainfall totals were calculated using an inverse distance squared weighted average and storm events were defined using the following criteria:

- At least 0.1 inches precipitation in 6 hours (Caltrans 2020)
- 24 hours of antecedent dry conditions (i.e., no rainfall)
- Event ends when < 0.1 inch of rain occurs over 6 hours

Note: these criteria were used as a more conservative definition of a storm that might transport trash and contribute to annual loads and thus, are different than the criteria described in Section 3.2.3 used to mobilize for sampling events.

The total number of storms that occurred at each monitoring site using the above definition is shown in Table 5. These storms are presumed to be large enough to transport trash into the MS4.

Table 5. Total number of storms at each monitoring site during wet season WY 2024

County	Site	Total Storms > 0.1”
Alameda	AC-CIVIC	24
	AC-OUTBK	24
	AC-PUBSAF	24
Contra Costa	CC-PCH	25
	CC-WC	29
Santa Clara	SC-SFC	27
	SC-STE	23
	SC-COY	26
San Mateo	SM-PIL	30
	SM-SBS	27

Flow data were generated using Manning’s Equation for a partially full pipe. If field conditions restricted the application of Manning’s Equation to accurately calculate flow, either linear regression or rainfall-runoff models were developed as described in Section 3.2.6. Annual hydrographs for each site are presented in Attachment B, with storms that were monitored during the WY indicated on each hydrograph.

3.4.4 Trash Load

There are several storm/flow characteristics that may influence trash loading rates from the MS4 catchments. Some of these factors are identified in Table 4, including:

- Antecedent dry period;
- Rainfall intensity;
- Peak flow; and
- Total flow.

Comparison of trash volumes, standardized by area, and maximum rainfall intensities for the 10 MS4 catchments (and 30 sample events) is shown in Figure 7.

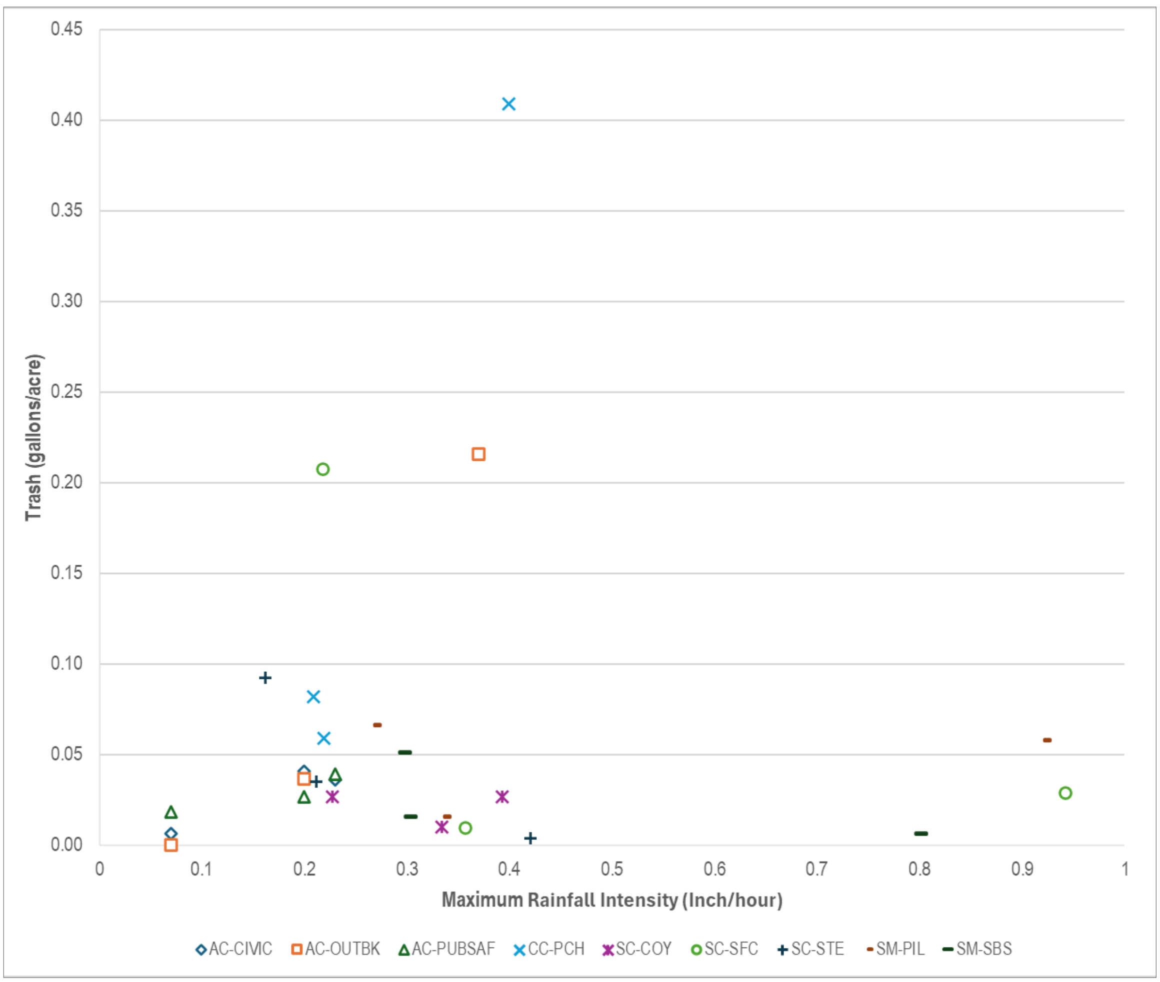

Figure 7. Comparison of trash discharge rates and maximum rainfall intensity at 10 outfall monitoring sites

There does not appear to be a correlation between trash volume and maximum rainfall intensity in the current regional dataset. A similar lack of relationship was observed with other factors evaluated, such as peak flow and antecedent dry period. The potential influence of these factors on trash loading rates will be explored in the future as more data become available. These relationships, if observed, will assist with developing more robust trash load rate estimates for each catchment. In the interim, a simple method of calculating annual trash loading rates was used in WY 2024. For each site, the average trash volume generated over the three sample events, standardized by catchment area, was multiplied by the total number of storms that occurred over the WY 2024 wet season (Table 6). As discussed previously, storm events were defined using the following criteria:

- At least 0.1 inches precipitation in 6 hours (Caltrans 2020)
- 24 hours of antecedent dry conditions (i.e., no rainfall)
- Event ends when < 0.1 inch of rain occurs over 6 hours

The annual trash loading rates for the 10 sites ranged from 0 to 4.6 gallons/acre/year, which were all below the loading rate defined for low trash generation (5 gallons/acre/year).

Table 6. Annual trash loading rates for 10 MS4 catchments monitored during WY 2024

County	Site	Catchment Area (acres)	Average Trash Volume (gal)	Total Number of Storms > 0.1”	Total Volume Trash (gal)	Trash Generation Rate (gal/yr/acre)
Alameda	AC-CIVIC	13	0.36	24	8.64	0.7
	AC-OUTBK	19	1.6	24	38.4	2.0
	AC-PUBSAF	11	0.31	24	7.44	0.7
Contra Costa	CC-PCH	3.9	0.72	25	18	4.6
	CC-WC	1.0	0	29	0	0
Santa Clara	SC-SFC	60	4.9	27	132	2.2
	SC-STE	137	6	23	138	1.0
	SC-COY	401	9.6	26	250	0.6
San Mateo	SM-PIL	86	4	30	120	1.4
	SM-SBS	57	1.4	27	38	0.7

3.5 Statement of Data Quality

WY 2024 marked the initial year of trash monitoring being conducted by BAMSC Member Programs. Monitoring activities included the collection of continuous flow data at each monitored outfall and the collection and characterization of trash discharged from outfalls during a minimum of three sampling events at each site. All monitoring data were validated following procedures described in the QAPP (Version 2.0) (AMS 2024). Review of monitoring data quality associated with each of these components is included below by data type, and where relevant, described more fully in individual Program write-ups included in Attachment B.

3.5.1 Hydrologic Data

BAMSC Programs deployed the same model of water level logger at each WY 2024 monitoring site. However, two issues that were identified during either monitoring activities or data processing steps that necessitated modeling to be incorporated to address interferences that presented themselves over the course of implementation.

First, at a subset of stations, in-storm site observations indicated that water was backing up into the monitored outfalls with or without nets attached, thereby artificially increasing water depth and biasing water level measurements. These stations include:

- ACCWP - None
- CCCWP - None
- SCVURPPP - None
- SMCWPPPP - PIL, SBS

For these stations, flow was estimated for the entire monitoring window using precipitation records and rainfall-runoff models. Modeled data results are discussed in more detail by individual Program and sampling site in Attachment B.

Second, at a different subset of monitoring stations, QA review of water level monitoring data indicated a stark difference in the relationship between rainfall and measured flow data for the storms where nets were attached vs. those for which they were not. These stations include:

- ACCWP - OUTBK, PUBSAF, CIVIC
- CCCWP - None
- SCVURPPP - COY, STE, SFC
- SMCWPPPP - None

Although the trash capture nets are designed to allow water to pass through them, accumulated vegetation and trash captured by the nets tended to back water up in the outfalls and artificially elevate water levels while nets were attached. Moving water level loggers farther upslope in the outfalls does not appear to be a viable solution given the generally shallow slopes of the pipes and limited distance upstream of the outfalls before trash controls or junctions with other storm drain lines.

For sites where flow data was only affected when nets were deployed, the precipitation and flow measurements for storm events with no nets attached were used to derive estimated flow for sample events with nets attached. ACCWP used linear regression models to estimate flows for the sample events. All other Stormwater Programs used HEC-HMS models. The models are described in more detail by individual Program and sampling site in Attachment B.

3.5.2 Trash Characterization Data

As part of the data quality review process, BAMSC Programs review all aspects of the data collection, analysis, and reporting process to identify any deviations from Project QAPP requirements (AMS 2024). Minor deficiencies (e.g., incomplete datasheets, data entry errors) may be addressed at the local level. More significant deficiencies or those that may affect future data collection and reporting efforts are detailed in a Corrective and Preventative Action Report (CPAR), which describes the discrepancies identified, proposed response actions, and dispensation of affected data.

There were two issues identified during trash characterization data quality review that required development of a CPAR. Both issues are related to replicate analyses, which are required and specified in the QAPP (AMS 2024). Each issue is summarized below and the completed CPARs are provided in Attachment C.

The first issue is associated with the characterization team not performing the minimum number of replicate analyses specified in the QAPP. The QAPP indicates that a duplicate characterization will be conducted for one sample collected by each Program in each calendar year. For WY 2024, the characterization team only performed duplicate analyses on two samples.

The second issue is associated with the results of the duplicate samples not achieving QAPP control limits for individual trash categories. Most categories of trash that were enumerated within the two duplicate samples did not meet the minimum size requirement in the QAPP that required calculation of the Relative Percentage Difference (RPD). However, for one trash category in the January 30, 2024 sample from site SM-PIL, the category of "*Other Plastic Items*" generated a 32% RPD, above the QAPP control limit of 25%. The overall volumes measured for both duplicate samples did, however, achieve QAPP control limits.

All WY 2024 trash characterization efforts were conducted during a single event held on April 22, 2024. Therefore, any deficiencies identified will be addressed and reflected in WY 2025 monitoring efforts per the associated CPAR. Neither of the above issues, however, affects the ability of the Project to develop loading estimates for comparison against the low trash generating criterion of 5 gallons of trash per acre per year.

4. DISCUSSION

4.1 Investigation of Trash Generation Based on Monitoring Results

Prior to conducting trash outfall monitoring in WY 2024, each BAMSC Member Program conducted trash characterization assessments within each catchment upstream of the outfalls to be monitored. The assessments included visual observations and written and photo-documentation of trash present along the roadway curbs and gutters, and to the extent possible, within the catch basins and storm drains. Trash sources observed in the catchment were documented with GPS coordinates and/or marked on maps. The trash catchment assessment results are included in the Program-specific trash outfall monitoring results in Attachment B. As indicated, these sources were reported to Permittees for follow-up management actions, which are also reported in Attachment B.

Maintenance records for all full trash capture devices located in the monitored catchments are also reported in Attachment B. This information may include dates when devices were cleaned and amount of material removed from each device, if known. Other trash controls (i.e., outside of full trash capture devices) that Permittees are implementing in each of the Trash Management Areas that overlap with the catchment area for the monitoring sites were summarized as well.

The preliminary annual trash loading results from WY 2024 (presented in Section 3.4.4) for all 10 sites were below the 5 gallons/acre/year threshold, indicating that trash controls are performing adequately in the monitored catchments. As a result, Programs did not conduct follow-up investigations into the specific sources of trash observed in netting devices. Assessments in the catchments will continue to be conducted each year prior to monitoring seasons to document potential sources of trash in each catchment, and on an as-needed basis throughout the wet season.

4.2 Lessons Learned

Lessons learned from the first year of trash outfall monitoring are summarized below. Site specific/Program specific related information is provided in Attachment B.

Storm Selection

- The design storm (i.e., one-year, one-hour storm event) is difficult to predict from the information that is provided in national weather service forecasts.
- Trash nets detached at three sites during a targeted storm event that was greater than the “design storm” for full trash capture devices. At least at some of the sites, the design storm appears to be the upper limit of the storm size that can be practically sampled with netting devices attached to outfalls.
- During WY 2024, sampling teams selected storms that were predicted to be at least 0.25 inches over 24 hours to satisfy suggested criteria in MRP 3.0 to be assured that monitoring events are targeting storms that likely trigger trash transport and discharge through the MS4. As a result, there were many storms below this threshold that were not sampled. There remains some uncertainty as to whether trash is transported through the MS4 during storms below this threshold.

- Several storms were not sampled during WY 2024 due to criteria described in the monitoring plan that require monitored storms to have more than 72 hours of antecedent dry periods. There is some uncertainty as to whether trash may still be discharged from MS4s during storms associated with antecedent dry periods that are less than 3 days. For example, a larger storm that follows a smaller storm 1-2 days later can potentially still discharge trash from an MS4. This criterion is assumed to be a relevant contributing factor for calculating annual trash loads.

Flow Data Collection

- At all but two sites monitored in WY 2024 the deployment of nets affected water level measurements. As a result, rainfall-runoff models were developed for impacted sites to calculate flow for sampled events (and throughout the entire wet season at two sites). At most sites, the model was calibrated with flow data collected during storms without nets attached.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Conclusions for the first year (WY 2024) of trash outfall monitoring include:

- Trash samples were successfully collected during three storm events at 10 of 11 MS4 outfall locations.
- The first significant storm event (defined as predicted storm that is at least 0.25 inches over 24 hours) was sampled at all 10 sites, except for site SC-COY, when the sample was lost due to vandalism.
- The predicted full trash capture "design" storm event was successfully sampled at all 10 sites.
- Water depth measurements were collected at 10 outfall monitoring sites for the purpose of calculating flow rates. However, water depth measurements were inaccurate as some sites during sample events due to backed up water in the pipes from nets with captured trash and organic debris. As a result, rainfall-runoff or linear regression models were developed to calculate flow during all sample events. The rainfall-runoff models were calibrated using flow rates calculated with Manning's equation from water depth measurements recorded during storm events occurring without the nets. At two sites (SM-PIL and SM-SBS), water depth measurements were impacted during all storm events (with and without the net) due to backed up flow in low gradient channel and/or tidal/groundwater influence at the outfall. For these sites, the models could not be calibrated by field measurements.
- Based on 30 trash samples collected regionally, plastic material comprised 84% of the trash collected. "*Other Plastic*" represented 71% of the plastic material. Other important plastic trash items include "*Single Use Food/Drink Ware*", "*EPS Foam Food Ware"* and "*Single-use Plastic Bags*", which combined amount was 16% of the plastic trash items. Most Cities in the San Francisco Bay area have adopted bans for the distribution of all three trash items. In addition, the State of California adopted a ban on polystyrene foam foodware on January 1, 2025.
- Based on first year of data and preliminary estimates using a simple method to calculate the annual trash load, it appears that the trash controls implemented in the catchments, whether full trash capture devices or other types of controls, have successfully reduced the generation of trash or intercepted trash prior its discharge at the MS4 outfalls . Trash discharged over the course of the first year of monitoring was below the low trash generation level of 5 gallons/acre/year at all 10 sites.

5.2 Refinements for the Next Water Year

General refinements to the monitoring approach planned for WY 2025 are summarized below. Specific refinements for individual monitoring sites and/or Programs are provided in Attachment B.

- At the request of Water Board staff to increase the geographic representation of outfall monitoring sites in Alameda County, ACCWP replaced site AC-CIVIC, located in the City of

Dublin, with a new site AC-CTYCTR, located in the City of Hayward. Details on the new site are presented in Attachment B.

- Both Water Board staff and Trash TAG members provided comments on the Trash Outfall Monitoring Plan regarding additional evaluation to determine the overall geographical representativeness of the trash outfall monitoring sites. The BAMSC Programs acknowledge that the geographic representativeness of the selected sites is affected by inherent constraints to identify storm drain outfalls that are suitable for monitoring using trash nets due to logistical and permitting issues. As a result, BAMSC is planning to evaluate alternative methods for monitoring trash at storm drain outfalls and findings will be presented to the Trash TAG in early 2025.

- As more data become available following trash outfall monitoring during WY 2025, the BAMSC Programs will evaluate additional factors that may influence trash loading rates. BAMSC will present data analysis approaches to the Trash TAG in early 2025.

6. REFERENCES

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SWRCB (State Water Resources Control Board). 2015. Amendment to the Water Quality Control Plan for the Ocean Waters of California to Control Trash and Part 1 Trash Provisions of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California. Final Staff Report including the Substitute Environmental Documentation.

Attachment A

Trash TAG Meeting Summaries

Trash Monitoring Technical Advisory Group (TAG)
Meeting #3
Monday, March 4, 2024, 9:00 am – 11:30 am

Attendees:

- TAG Members:
  - Tom Mumley (RWQCB)
  - Dawn Petschauer (City of Pasadena)
  - Tony Hale (SFEI)
  - Shelly Moore (Moore Institute for Plastic Pollution Research)
  - Ted Von Bitner (WSP)
- Other Attendees:
  - Chris Sommers, Bonnie de Berry, Paul Randall, Helek Rutten, Vishakha Atre (EOA)
  - Zach Rokeach (RWQCB)
  - Erica Yelensky and Luisa Valiela (USEPA)
  - Paul Salop (Applied Marine Sciences)
  - Emily Corwin (Solano Stormwater Alliance)
  - James Scanlin (City of Newark)
  - Martin Bailey and Michelle Sim (City of Fremont)
  - Simret Yigzaw (City of San Jose)
  - Eric Donaldson and Jonathan Owens (Balance Hydrologics)
  - Lisa Austin and Lisa Welsh (Geosyntec Consultants)
  - Rinta Perkins (CCCWP)
  - Nicole Wilson (LWA)
  - Reid Bogert (C/CAG)
  - Carolynn Box (private consultant)

Introductions
Attendees introduced themselves and stated their role within the TAG.

Review of TAG purpose and scope of work; Administrative Items
Chris Sommers (EOA) reviewed the meeting agenda and provided an overview of the WOW grant tasks and deliverables. The WOW grant funding will be primarily used for complying with the Receiving Water (RW) Monitoring requirements in the Stormwater Municipal Regional Permit (MRP). Additional tasks that will be funded by the grant include a litter source control study, a litter outreach campaign, OVTA data analysis, a methods guidance document, development of a trash data portal and a trash symposium to share results. Tom Mumley (RWQCB) asked whether grant funding could cover Receiving Water (RW) monitoring beyond that level that is required by the MRP. Chris clarified that the main purpose of the grant funding is to complete the MRP required monitoring, but the grant supports additional tasks that will support trash control measure implementation and address additional information gaps related to trash monitoring. The WOW consultant team will keep the TAG posted if cost-efficiencies are experienced as the monitoring funded by the WOW project is conducted, and if these efficiencies make grant funding available to expand our planned monitoring.

Methods for Sampling Trash Transported in Receiving Waters
Eric Donaldson (Balance Hydrologics) provided information on the RW trash monitoring methods previously used by researchers and recommendations for RW monitoring for the WOW Project. Based on the literature review, the WOW Team recommends using weighted box trawl to conduct sampling. The

sampling will be conducted from bridge-based locations and will be vertically stratified through the water column with a focus on sampling surface and mid-water-columns positions at the thalwag. Video will also be used to document surface trash. The collected trash will be transported, dewatered, and stored at designated locations for characterization. The sampling method will be re-evaluated each year and modified, if needed. The TAG members discussed the sampling methods. Highlights of the discussion are provided below:

- The quantity of trash flowing in the thalweg and margins of a channel could be different. Consider setting up a camera to capture a wide view of the channel since there will be trash bypass in the margins. A selfie-stick could be set to look down on the sampling crew, bridge surface, and creek in one sustained view.
- Have more than one box trawl at each location to ensure a quick sampling procedure since it will take time to drop, sample, raise, and clean each sampler.
- Consider setting a maximum capacity for the trawl to establish QA/QC parameters and assist with identifying "extreme" conditions.
- For staff safety reasons, sampling will be done during daytime hours. However, sampling will start early in the morning and continue into the evening hours.

Site Selection Process

Paul Randall (EOA) presented an overview of the site selection process and the preliminary list of monitoring sites selected. The site selection process is based on MRP requirements, avoidance of waterbodies with a migratory (MIGR) beneficial use, location of bridges, co-location with existing stream gauges, channel conditions at feasible bridge sites, upstream trash generation rates, existing trash controls, upstream direct discharges, and geographical/spatial distribution. Paul asked if RWQCB staff could help coordinate permits from the CA Department of Fish and Wildlife (CDFW). Zach Rokeach (RWQCB) responded that CDFW will need to be involved early in the process. Paul will reach out to RWQCB staff with information on the sites. The TAG discussed the site selection process and asked some clarifying questions. Highlights of the discussion are provided below:

- Tony Hale (SFEI) asked if any of the RW sites align with the outfall monitoring sites. Paul responded that one RW monitoring site is directly upstream of an existing outfall monitoring site on Alamo Canal.
- Some TAG members recommended conducting a pre-season sampling/observation creek walk to document sources of direct discharges of trash (e.g., encampments). They also recommended documenting sites that do not have barriers to prevent wind-blown trash from entering receiving waters.
- Tony recommended utilizing satellite imagery timed with monitoring events to make some determination about potential trash sources, especially if there are anomalies observed. He also asked if there were more sites for backup in case direct discharges become an issue for some channels.

Outfall Monitoring Update

Paul provided a summary of trash outfall monitoring efforts and preliminary results for Water Year 2023. All but one of the eleven outfall monitoring locations were equipped with nets (Solano has had construction delays). Three sampling events have been completed at ten sites. There were some challenges with accurately monitoring flow during large storm events due to water backing up. The first flush was successfully sampled except for one location in San Jose due to vandalism. Larger storms exerted a lot of force on full nets and led to some equipment failures. Preliminary estimates indicate that the first flush had the most trash. Samples had between <0.1% to 26% of trash and <0.01 to 0.25 gallons/acre of trash. The trash characterization will be done in spring/summer of 2024. TAG member discussion topics include:

- Zach asked if failed sampling events had data collected on the timing of the failure and net release during the storm. Paul responded that depth flow sensor data indicates timing of net release, which can be compared to rain gage data to determine timing of net release in relation to magnitude of rainfall.
- Tom mentioned that caution be used on the interpretation of trash results with regards to trash generation rates that were estimated using OVTA data. He requested that trash generation rates be supported with empirical data.

Chris mentioned the plan for BAMSC to develop a scope to conduct a literature review of alternative methods for monitoring trash in stormwater discharges/outfalls. The scope will be further discussed at the next TAG meeting.

Action Items
The following action items were identified at the meeting:
- Plan and organize the next TAG meeting in May 2024.
- Distribute Draft RW Trash Monitoring Plan and QAPP to the TAG for review prior to the May TAG meeting.

Trash Monitoring Technical Advisory Group (TAG)
Meeting #4
Wednesday, May 15, 2024, 9:00 am – 12:00 pm

Attendees:

- TAG Members:
  - Tom Mumley (RWQCB)
  - Dawn Petschauer (City of Pasadena)
  - Tony Hale (SFEI)
  - Shelly Moore (Moore Institute for Plastic Pollution Research)
  - Ted Von Bitner (WSP)
- Other Attendees:
  - Chris Sommers, Bonnie de Berry, Paul Randall, Helek Rutten, Vishakha Atre (EOA)
  - Zach Rokeach, Imtiaz-Ali Kalyan (RWQCB)
  - Erica Yelensky (USEPA)
  - Paul Salop (Applied Marine Sciences)
  - Simret Yigzaw (City of San Jose)
  - Eric Donaldson and Jonathan Owens (Balance Hydrologics)
  - Lisa Austin and Lisa Welsh (Geosyntec Consultants)
  - Nicole Wilson (LWA)
  - Reid Bogert (C/CAG)
  - Carolynn Box (private consultant)
  - Sean Noble, Kevin Lewis (KEI)

Introductions

Attendees introduced themselves and stated their role within the TAG.

Action Items and Key Outcomes from Meeting #3

Chris Sommers (EOA) reviewed the meeting agenda and provided an overview of the Action Items from the previous meeting.

- *Action Item 1 - Plan and organize the next TAG meeting in May 2024* – Today's meeting is the 4th TAG meeting. The next TAG meeting will be held in early 2025.
- *Action Item 2 - Distribute Draft Receiving Water Trash Monitoring Plan and QAPP to the TAG for review prior to the May TAG meeting* – The Draft Receiving Water Trash Monitoring Plan and QAPP was distributed to the TAG for review. A spreadsheet has been created for submitting comments.

Draft Receiving Water (RW) Trash Monitoring Plan (v.1.0) and QAPP

Chris and Paul Randall (EOA) provided an overview of the sampling design and site selection, including an overview of the Municipal Regional Permit (MRP) requirements and the management questions. Eric Donaldson (Balance) described the field characterization methods and QA/QC. Eric and Paul talked about data interpretation and reporting. Attendees discussed the RW Trash Monitoring Plan and QAPP. Highlights of the discussion are provided below:

- Tony Hale (SFEI) provided feedback on the site selection criteria. He noted that the final criterion concerns the identification of a "range of urban conditions". He asked whether it would be important to select areas based on a range of management actions (e.g., trash capture devices, education, green infrastructure, signage, etc.) since the first MRP management question focuses on the efficacy of management actions. This data might be helpful to determine whether some management actions are more effective than others. Chris said that management actions are being considered in site selection.

- Tom Mumley (Regional Water Board) noted that most of the selected sites have a have a substantial amount of low trash generation drainage areas. In addition, a large percentage of upstream significant trash generating areas for the selected sites are addressed by "other trash controls". He recommended documenting these other trash controls. Chis said that this information is available and will be documented. Tom and Ali expressed concerns that less trash may be observed in these areas.
- Zach noted that the Water Board has not yet approved the use of bioretention areas as full capture systems.
- Tony asked if avoiding streams with migration was the biggest factor in the site selection process. Paul noted that it was an important factor; however, there were enough streams without migration so eliminating the streams with migration was not an issue.
- Dawn asked about coordinating with Caltrans regarding BMPs they are implementing to address trash. Chris said that this is being done. Caltrans staff may attend the BAMSC Monitoring Committee meetings.
- Add bolt/cable cutters to the list of safety equipment in case the trawl nets get entangled with trees floating downstream.
- Consider lowering the 0.25 inches storm size criteria for sites in Santa Clara County.
- Erica asked for more information on the trash characterization process and whether any brand identification will be done. Tony added it might be important to handle expanded polystyrene (EPS) and other fragile materials carefully to avoid post-collection fracturing, which would inflate counts. Paul clarified that all trash items are not being tallied. Large items are being tallied by volume. Brand names are not being identified.
- Consider having the video at sites focus on the team as well as the water surface. This will help capture any anomalies in the trash collection process.
- Some attendees felt that it would be useful to conduct duplicate sampling, i.e., bringing another team to do side-by side sampling. Others felt that increasing the frequency might be more beneficial. It was agreed that these approaches would be considered in Year 2. Tom recommended documenting all decisions and discussing when the TAG meets next year.

Chris reminded attendees to submit their comments on the RW Monitoring Plan and QAPP by May 27, 2024.

Stormwater Outfall Trash Monitoring Preliminary Results (WY 2024)
Paul provided a summary of trash outfall monitoring efforts, preliminary trash characterization results, and flow measurements and calculations for Water Year 2023. Three sampling events have been completed at ten sites. All collected trash has been characterized. Both reusable and single-use plastic bags are being counted. This will help identify how the reduction in single-use plastic bags correlates with municipal ordinances mandating bag bans.

- Three different methods will need to be used to calculate flow across all 10 sites. At most sites, flow will be calculated using depth sensors installed in pipe upstream of trash nets. The three sites in Santa Clara, the depth sensors did not accurately record depth during each monitoring event as result of net backing up flow into the pipe. For these sites, rating curves will be

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developed using flows measured during non-sampling events. At the San Carlos site in San Mateo, the flow sensor did not accurately record depth of flow due to tidal influence. For this site, modelling will be used to estimate flows to develop an annual hydrograph.
- Zach asked if depth sensor at the San Carlos site could be installed further upstream the extent of tidal influence. The upstream locations are at manholes along Industrial Av; access to depth sensors would not be very feasible. Alternative locations at selected sites will be investigated.

Adaptations/Revisions to Outfall Trash Monitoring Plan and QAPP (V.2.0)
Chris summarized the adaptation/revisions to the Outfall Trash Monitoring Plan based on Water Board comments. At least one outfall monitoring site in Alameda is being changed to improve geographical coverage. He asked for the TAG's initial input on Water Board's request to look for alternative methods to measure trash from MS4 discharges. The discussion is summarized below:

- Some attendees noted that outfall nets are the best option.
- Consider using inlet covers as trash capture devices. Chris noted that this cannot be done as it could lead to flooding.
- Consider installing camera-based sensors attached to poles to track trash. SFEI explored this approach, but resources were not available to implement.

Attendees discussed ways to prevent vandalism of outfall nets. Suggestions included working closely with the surrounding community to explain the project, signage, and increasing patrolling by rangers in the areas prone to vandalism.

Action Items
The following action items were identified at the meeting:

- Plan and organize the next TAG meeting in 2025.
- Address TAG comments and submit Receiving Water Monitoring Plan and QAPP to the Water Board on July 31, 2024.

Attachment B

Trash Outfall Monitoring – Results by County

Alameda Countywide Clean Water Program (ACCWP)

Contra Costa Clean Water Program (CCCWP)

San Mateo Countywide Clean Water Program (SMCCWP)

Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP)

Solano Stormwater Alliance (SSA)

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B1 ALAMEDA COUNTY CLEAN WATER PROGRAM (ACCWP)

B1.1 Introduction

Consistent with MRP 3.0 Provision C.8.e, ACCWP selected three MS4 outfall locations in Alameda County for trash outfall monitoring in WY 2024. Each of the three monitoring sites is located within the City of Dublin, California (Figure AC-1). The first outfall location (AC-OUTBK) drains directly to Dublin Creek. Sites AC-CIVIC and AC-PUBSAF both drain to Alamo Canal. Characteristics of each monitoring location and corresponding drainage area are provided below.

Outback (AC-OUTBK)

Site AC-OUTBK is a 36-inch diameter reinforced concrete pipe (RCP) that drains an approximately 19-acre catchment area bounded by I-580 and San Ramon Road in the City of Dublin (Figure AC-2). Land use in the catchment area is predominantly commercial. Baseline trash generation rates are approximately 7% low, 56% moderate, and 36% high by area. The catchment area is controlled to a low trash designation by use of a high-capacity treatment system (hydrodynamic separator or HDS) installed approximately 30 feet upstream of the outfall. Trash management actions in the catchment have resulted in reducing the estimated trash generation rate from 13.4 (baseline) to 2.5 (current) gallons/acre/year.

The outfall at site AC-OUTBK drains to a concrete landing on the north bank of Dublin Creek, which is constrained in the immediate area by I-580 on the south and development on the north. ACCWP installed an Oldcastle™ NetTech insert device for monitoring at this location. The outfall is owned by the Zone 7 Water Agency (Zone 7). The surrounding banks are mostly earthen with interspersed grade control structures and exhibit a high density of trash that is likely blown in from the adjacent highway. There are also indications of use of the banks in the project vicinity by unhoused populations via observations of campsites and accumulations of discarded trash and belongings.

Dublin Public Safety Complex (AC-PUBSAF)

Site AC-PUBSAF is a 36-inch RCP that drains an approximately 11-acre catchment area, which includes the Dublin Public Safety Complex and a commercial block west of Clark Avenue in the City of Dublin (Figure AC-3). Land use in the catchment area is predominantly commercial. Baseline trash generation rates for the catchment area are approximately 4% high and 96% moderate by area. The catchment area is controlled to a low trash designation by a combination of a privately-owned HDS unit (approximately 44% of the overall catchment area), catch basin inserts (5%), and two multi-benefit stormwater treatment systems (bioretention facilities) (48%). Trash management actions in the catchment have resulted in reducing the estimated trash generation rate from 8.1 (baseline) to 2.6 (current) gallons/acre/year.

The outfall drains to a sloped concrete apron on the west bank of Alamo Canal approximately 500 feet upstream of I-580. ACCWP installed an Oldcastle™ NetTech insert device for monitoring at this location. The outfall is owned by Zone 7. The surrounding banks are earthen and typically exhibit relatively low densities of trash accumulation.

Dublin Civic Center (AC-CIVIC)

Site AC-CIVIC is a 24-inch RCP that drains an approximately 13-acre catchment area west of the Dublin Civic Center and Public Library in the City of Dublin (Figure AC-4). Land use in the catchment area is predominantly commercial. Baseline trash generation rates for the catchment area are identified as approximately 2% low and 98% moderate by area. The catchment area is controlled to a low trash designation by use of an HDS installed just upstream of the outfall. Trash management actions in the catchment have resulted in reducing the estimated trash generation rate from 7.4 (baseline) to 2.5 (current) gallons/acre/year.

The outfall drains onto a concrete apron on the east bank of Alamo Canal approximately 600 feet upstream of I-580. The outfall is owned by Zone 7. ACCWP installed an Oldcastle™ NetTech insert device for monitoring at this location. The surrounding banks are earthen and typically exhibit relatively low densities of trash accumulation. A section of the bank just upstream of the outfall was covered with plastic sheeting throughout WY 2024 due to erosion occurring in this area.

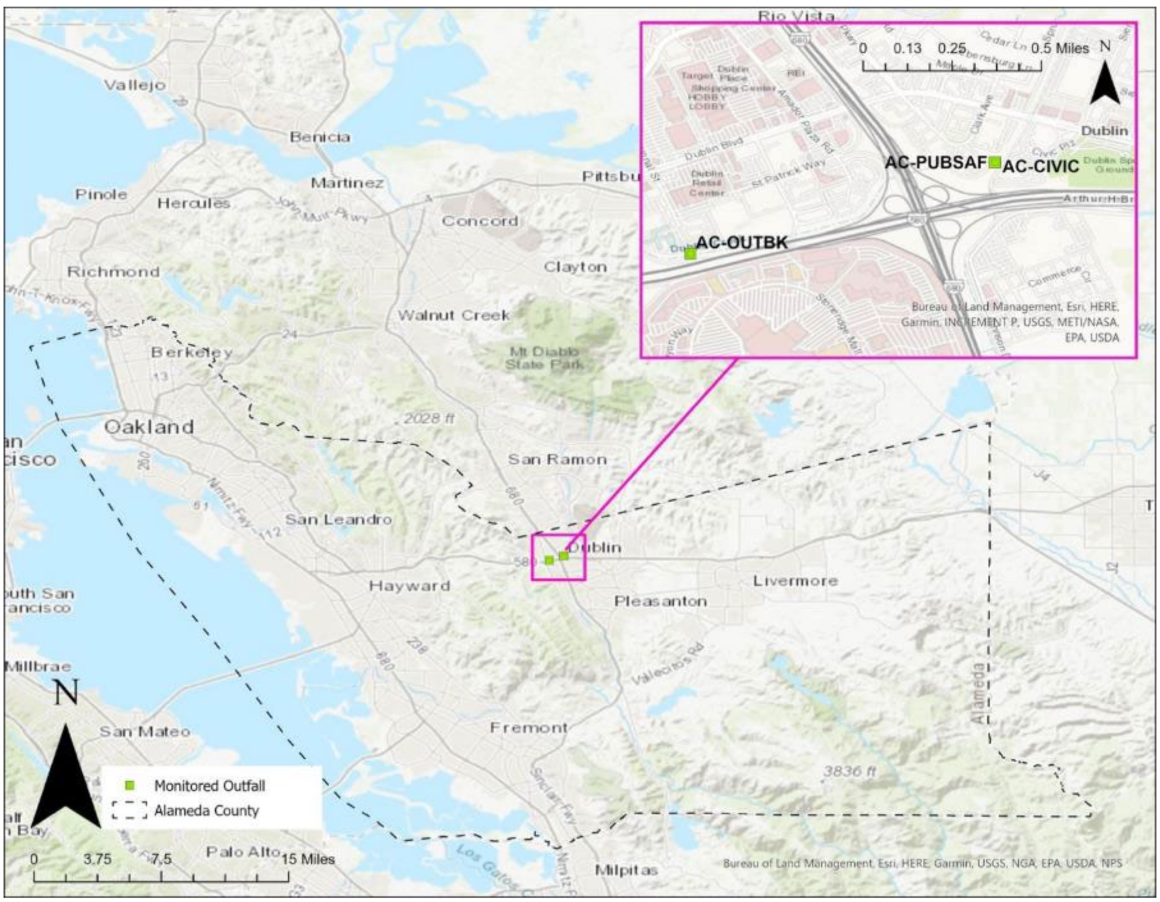


Figure AC-1. Trash outfall monitoring locations in Alameda County

Figure AC-2. AC-OUTBK outfall prior to the installation of the NetTech monitoring device (north bank of Dublin Creek, Dublin)

Figure AC-3. AC-PUBSAF outfall prior to the installation of the NetTech monitoring device (west bank of Alamo Canal, Dublin)

Figure AC-4. AC-CIVIC outfall with the NetTech monitoring device
(east bank of Alamo Canal, Dublin)

B1.2 Results

B1.2.1 Sample Events

Three successful sample events were conducted at each of the three ACCWP monitoring locations during WY 2024, with one additional failed sample attempt at site AC-OUTBK due to potential loss of material from the trash net. The dates and times for net deployment and retrieval and the duration of sample collection for the three sample events are presented in Table AC-1. Summary statistics for rainfall and flow for each sample event are also provided. Additional results showing rainfall totals and flow measurements for each sample event, as well as over the entire wet season, are presented in Section B1.2.3 below.

ACCWP received and installed NetTech inserts in mid-October 2024. Due to a manufacturing delay, the associated NetTech trash collection nets were not received until early November 2024, which caused a delay in opening of the WY 2024 monitoring season. A summary of the WY 2024 sample events is presented below.

Event 1

During the first sample event of the season for the three ACCWP sites, nets were deployed over a seven-day period in mid-November (Table AC-1). The forecast achieved the Monitoring Plan storm event selection criteria with a QPF of 0.55 inches and POP > 70%. The predicted storm timing for the first sample event was delayed several days after net deployment and the majority of rain arrived on the last two days of monitoring. Actual precipitation totaled 0.4 inches over the duration of deployment at all three sites, with a peak of 0.07 inches/hour as measured at the Zone 7 weather station. Event 1 was preceded by nine days of dry conditions. Samples were successfully collected at each of the three monitoring sites.

Event 2

ACCWP deployed nets over a five-day period at the three sites in mid-January 2024. For this event, the forecast included a QPF above 1 inch with a greater than 90% POP; the forecast also indicated a possible design storm event, with associated flash flood warnings for the City of Dublin. Actual precipitation over this deployment period totaled 1.5 inches with a peak intensity of 0.23 inches/hour. Event 2 was preceded by approximately three days of dry conditions (Table AC-1). During net retrievals for this event, the end of the net attached at site AC-OUTBK was found to be partially opened. Due to the potential loss of material, this sample was discarded, and a replacement monitoring event was planned for this site. Samples were collected successfully from AC-PUBSAF and AC-CIVIC.

Event 3

ACCWP deployed nets over a three-day period at the three sites in late January and early February. At the time of net deployment, the forecast for this storm included a QPF of 2.1 inches with a 95% POP; the forecast also indicated a potential design storm event with flash flood warnings for the City of Dublin. Actual precipitation for the event measured at 1.2 inches with a peak intensity of 0.2 inches/hour. The antecedent dry condition for this storm was approximately six days. Samples were successfully collected from all three sites. This was the second successful monitoring event at AC-OUTBK and the third and final event sampled at AC-PUBSAF and AC-CIVIC.

Event 4 (AC-OUTBK only)

Due to potential loss of material at site AC-OUTBK during mid-January sampling, ACCWP deployed the net at this site for a fourth storm to collect a third sample. ACCWP deployed the net at AC-OUTBK for approximately seven days in mid-February 2024. At the time of net deployment, the forecast for this storm included a QPF of 2.2 inches with an 85% POP for the six-day period following deployment. Actual precipitation for the event was recorded as 1.9 inches, with a peak intensity of 0.37 inches/hour, which was slightly below both the measured maximum intensity over the course of WY 2024 (0.378 inches/hour on March 6, 2024) and the one-year, one-hour design storm of 0.43 inches/hour for Dublin (https://hdsc.nws.noaa.gov/hdsc/pfds/). The antecedent dry condition for this storm was approximately nine days. A sample was successfully collected from AC-OUTBK for the third and final event.

B1.2.2 Trash Characterization

Trash collected for all ACCWP sampling events were sorted into 13 trash categories defined for the Project and measured for volume (Table AC-2). Event 1, the first significant storm event of the water year, generated the lowest volumes of trash at all three locations. It was preceded by two smaller storm events that did not achieve mobilization criteria—an approximately 0.1-inch storm on October 22, 2024 and an approximately 0.2-inch storm on November 5, 2024. Events 2 and 3 exceeded 1 inch total precipitation at all sites.

Table AC-1. Summary of net deployment and storm period, antecedent dry period, and rainfall total and intensity for trash outfall sampling events in Alameda County in WY 2024

Site	Sample ID	Net Deploy Start Date	Net Deploy End Date	Sample Duration (hours)	Storm Duration (hours)	Antecedent Dry (days)	Precipitation Total (in)	Max Intensity (in/hr)	Comment
AC-OUTBK	Event 1	11/13/23 | 15:35	11/21/23 | 09:05	185	8	9.0	0.4	0.07	First significant storm
AC-OUTBK	Event 2	01/30/24 | 14:35	02/02/24 | 08:10	66	14	6.0	1.2	0.2	Forecast exceeded design storm
AC-OUTBK	Event 3	02/14/24 | 11:20	02/21/24 | 12:25	169	20	9.0	1.9	0.37	Forecast exceeded design storm
AC-PUBSAF	Event 1	11/13/23 | 13:53	11/21/23 | 09:37	188	8	9.0	0.4	0.07	First significant storm
AC-PUBSAF	Event 2	01/18/24 | 10:45	01/23/24 | 10:30	120	15	3.0	1.5	0.23	Forecast exceeded design storm
AC-PUBSAF	Event 3	01/30/24 | 12:58	02/02/24 | 09:40	69	14	6.0	1.2	0.2	Forecast exceeded design storm
AC-CIVIC	Event 1	11/13/23 | 13:40	11/21/23 | 09:21	188	8	9.0	0.4	0.07	First significant storm
AC-CIVIC	Event 2	01/18/24 | 11:50	01/23/24 | 10:07	118	15	3.0	1.5	0.23	Forecast exceeded design storm
AC-CIVIC	Event 3	01/30/24 | 13:40	02/02/24 | 09:10	68	14	6.0	1.2	0.2	Forecast exceeded design storm

Table AC-2. Trash volume measured for 13 trash types identified from samples collected at Alameda County outfall trash monitoring sites in WY 2024

	Trash Type	AC-OUTBK				AC-PUBSAF				AC-CIVIC			
		Event 1	Event 2	Event 3	Total	Event 1	Event 2	Event 3	Total	Event 1	Event 2	Event 3	Total
Plastic Trash Items (oz)	Single-Use Carryout Plastic Bags	0	0	0	0	0	0	0	0	0	0	0	0
	Expanded Polystyrene (EPS) Foam	0	0	0.2	0.2	0	0	0	0	0	0	0	0
	(EPS) Foam Other	0	12	0	12	0.7	1	18.6	20.3	8.1	1.4	0	9.5
	Single Use Plastic Food / Drink Ware	0	12	84	96	0	30	11.8	41.8	0	6	0	6
	Smoking Products, Traditional	0	0	0.1	0.1	0.1	0.4	0.5	1	0.4	1.2	0.7	2.3
	Smoking Products, Other	0	0	1.7	1.7	0	0	0	0	0	2	6.8	8.8
	Other plastic Items / Pieces	0	64	20	84	10	17	22	49	16	5	25	46
Non-Plastic Trash (oz)	Organic / Paper	0	0	411.4[1]	411.4[1]	0	11.8	15.2	27	0	37.2	5.1	42.3
	Fabric	0	0	6.8	6.8	0	0	0	0	0	2	0	2
	Metal	0	1	0.2	1.2	0	0	0	0	0.7	0.5	0	1.2
	Glass	0	0	0	0	0	0	0	0	0	0	0	0
	Mixed	0	0	0.9	0.9	0	0	0	0	0	0	0	0
	Biohazard	0	0	0	0	0	0	0	0	0.6	0	0	0.6
	Total Ounces	0	89	525[1]	614[1]	11	60	68	139	26	55	38	119
	Total Gallons	0	0.7	4.1[1]	4.8[1]	0.1	0.5	0.5	1.1	0.2	0.4	0.3	0.9
	Total Gallons/acre	0	0.04	0.22[1]	0.26[1]	0.01	0.04	0.04	0.09	0.02	0.04	0.03	0.09
	Average Gallons/event				1.61				0.36				0.31

1 Includes probable outliers, discussed in detail in sections that follow

The total volume of trash collected in each sample, standardized for area, is shown in Figure AC-5. The highest trash volume per unit area observed in WY 2024 occurred at site AC-OUTBK for Event 3 (0.22 gallons per acre). This result is greatly influenced by the presence of two large, flattened cardboard boxes that were captured by the net for this storm and are thought to be outliers.[6] These two boxes contributed approximately 3.2 gallons of the total 4.1 gallons of trash measured for this event (78% by volume) and 67% of the 4.8 gallons measured at this site over the three events. Removing these outliers drops the trash generation rate from 0.22 gallons per acre to 0.05 gallons per acre for this event, which is more in line with the other two sampling events at this site. The other two ACCWP sampling sites (AC-PUBSAF and AC-CIVIC) each generated trash rates below 0.05 gallons per acre across all sampling events.

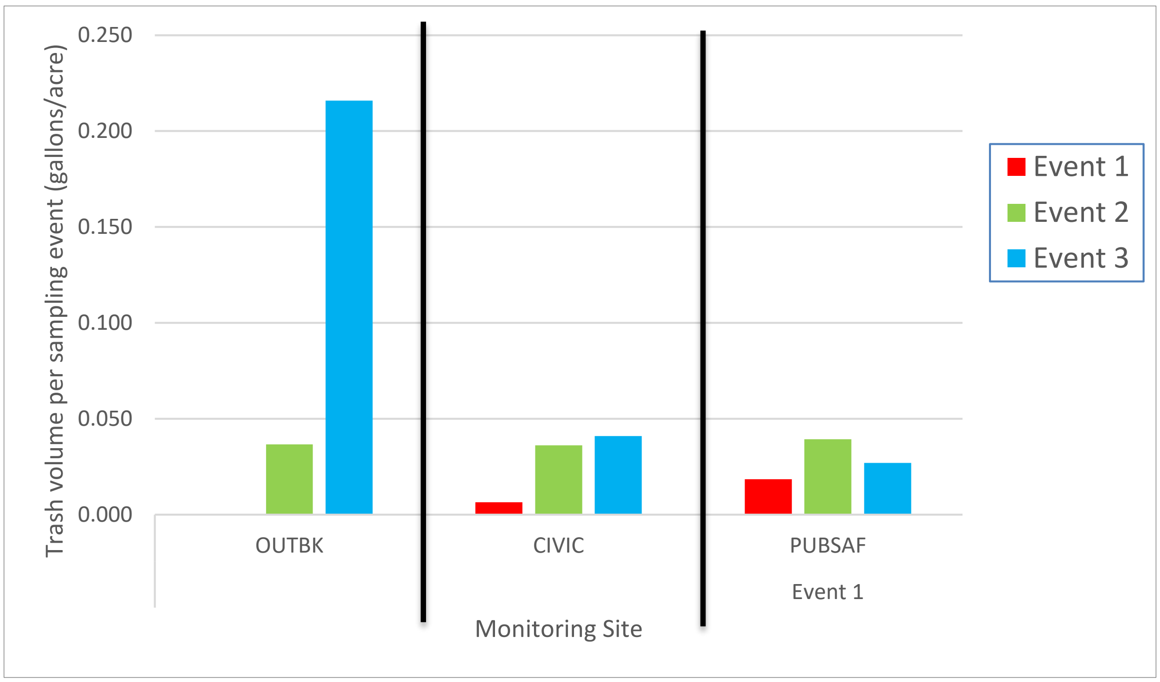


Figure AC-5. Trash volumes standardized by area for WY 2024 sample events in Alameda County

The general breakdown for trash types measured across all sampling events at all stations is greatly influenced by the potential outliers at site AC-OUTBK. The two cardboard boxes collected during Event 3 make up approximately 48% of the total volume of trash collected by ACCWP at all three sites in WY 2024. If the outliers are included, then a slight majority of trash volume collected in WY 2024 is characterized as non-plastic items (57%). If the outliers are removed, then the majority of trash (82%) shifts toward plastic items (Figure AC-6). The remaining interpretation for this report excludes these outliers from the analysis.

[6] The area in and around the monitoring location has been observed to have regular presence of unhoused persons and it is thought these boxes may have been used as sleeping pads and placed within the outfall prior to attachment of the net. The flattened boxes were found wet, but otherwise in good condition and there is no obvious way in which the boxes would have otherwise made it into the MS4.

A

B

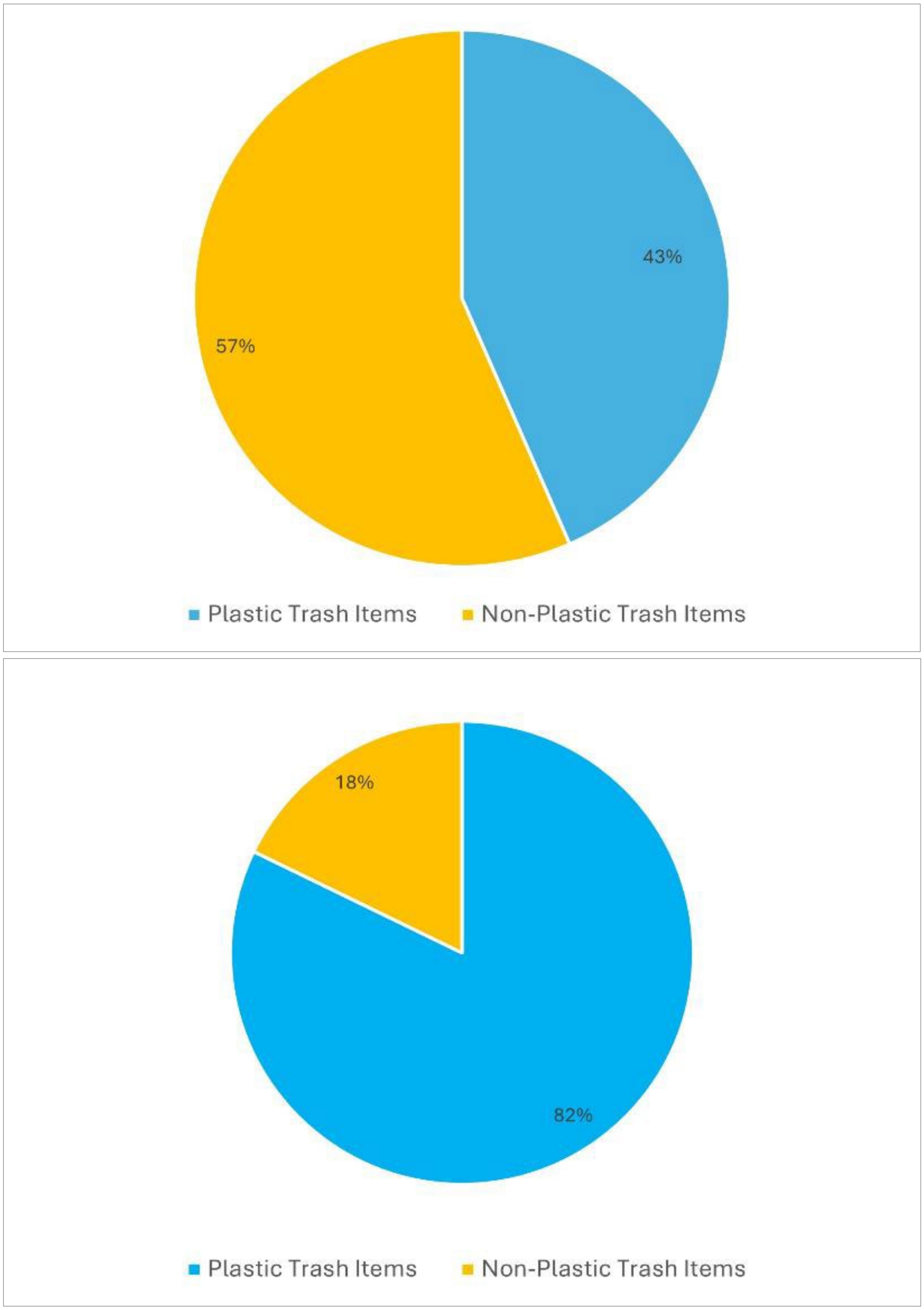


Figure AC-6. Comparison of plastic vs. non-plastic trash items measured for all WY 2024 sampling events at Alameda County sites

Figure A includes Event 3 outliers at AC-OUTBK and Figure B excludes them

Excluding outliers, the most common trash types observed in WY 2024 monitoring fall in the plastics category, of which there are seven separate subcategories (see Table AC-2). The total volume for the combined seven plastic trash subcategories accounted for between 61% and 96% of the trash collected for the combined three sample events at sites AC-OUTBK, AC-PUBSAF and AC-CIVIC (Figure AC-7).

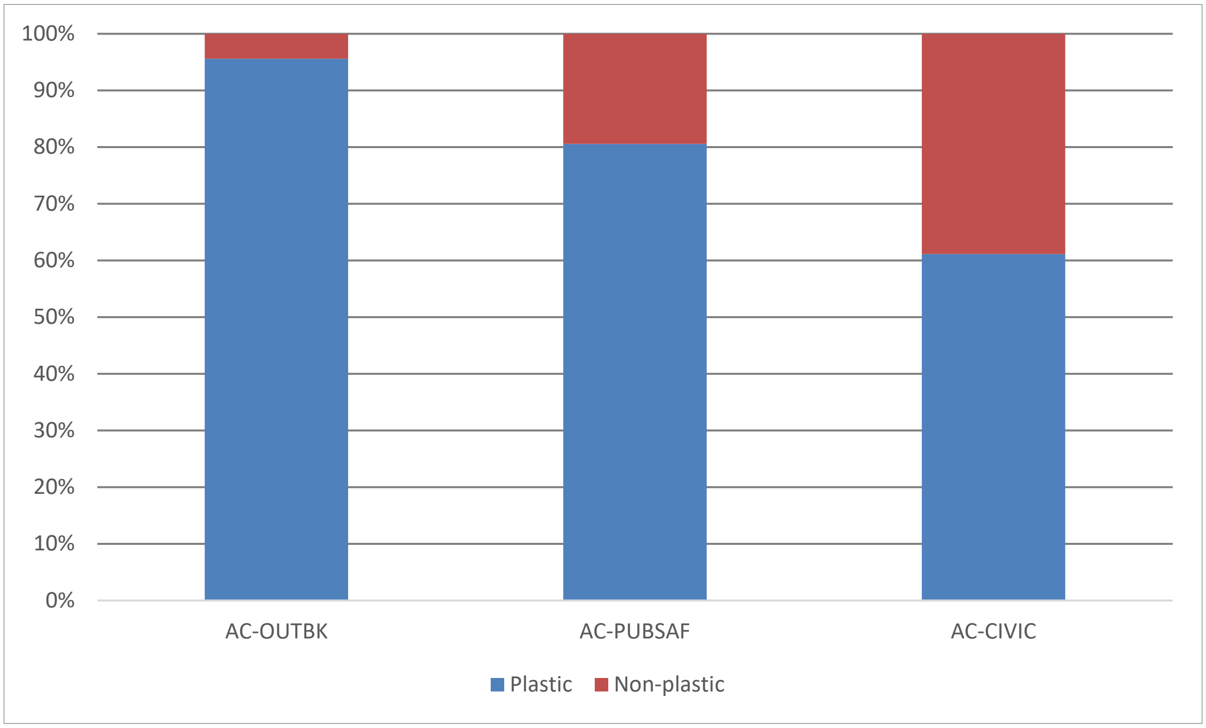


Figure AC-7. Comparison of plastic versus non-plastic trash items measured for all monitored WY 2024 storm events at sites AC-OUTBK, AC-PUBSAF, and AC-CIVIC

For the purposes of comparing different types of plastics that were identified, the plastics categories related to food ware ("*EPS Foam Food Ware*" and "*Single Use Plastic Food/Drink Ware*") and smoking products ("*Smoking Products, Traditional*" and "*Smoking Products, Other*") were combined into single categories based upon associated use, reducing the number of subcategories from seven to five.

Within these five categories, the categories of (1) ("*EPS Foam Food Ware*" and "*Single Use Plastic Food/Drink Ware*") and (2) "*Other plastic Items / Pieces*" were the most significant contributors to the overall plastic waste stream (Figure AC-8). These two categories make up approximately 93% of total plastic volume at site AC-OUTBK (50% food ware, 43% other plastic), 71% at AC-PUBSAF (8% food ware, 63% other plastic), and 82% at AC-CIVIC (38% food ware, 44% other plastic). It is perhaps not surprising that the highest levels of food ware-related plastic occurred in the catchment with multiple establishments selling food and beverages (AC-OUTBK).

The combined smoking product category formed a relatively low proportion of the waste stream collected overall. It was, however, a much larger contributor at the AC-PUBSAF catchment (15% of all trash collected by volume) relative to the other two catchments, for which smoking products made up approximately 1% of all waste collected. No single use plastic bags were identified in any of the nine total sampling events conducted during WY 2024 monitoring.

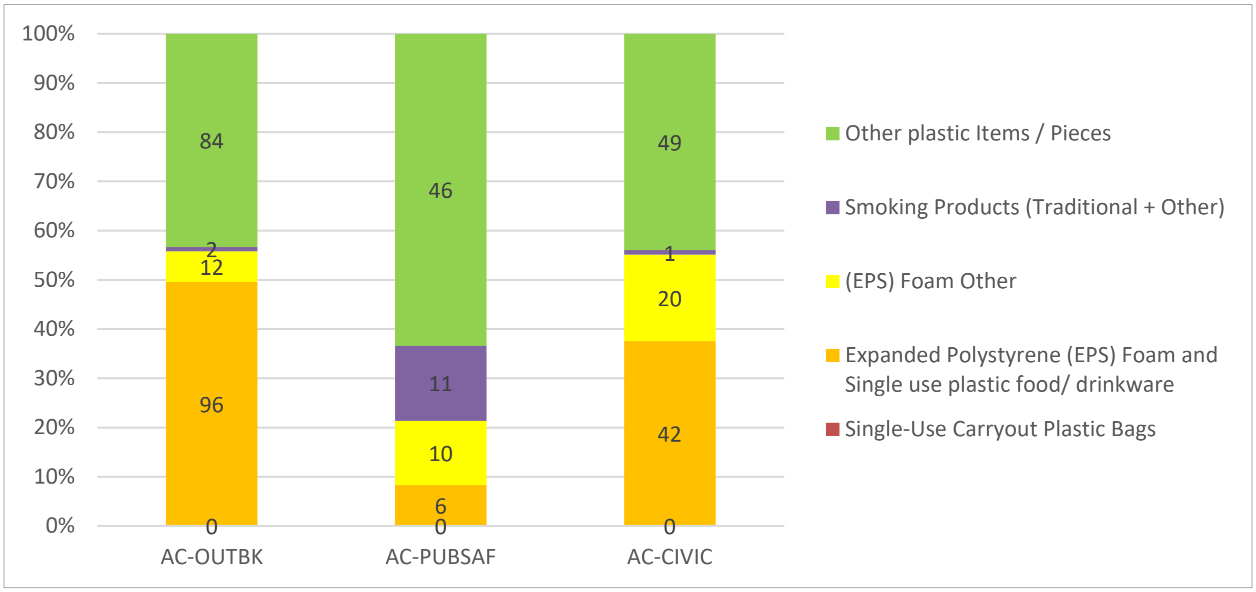


Figure AC-8. Comparison of volume (in ounces, indicated on columns) and proportion of total plastic trash items measured for all 3 WY 2024 sampling events at sites AC-OUTBK, AC-PUBSAF, and AC-CIVIC

Some characterization categories combined as identified in the legend. Single-use Carryout Plastic Bags were not observed in any of the 9 total sampling events.

B1.2.3 Rainfall and Flow

Precipitation data was obtained from a rain gauge operated by Zone 7 that is nearby to all three WY 2024 monitoring locations and identified as weather station "LJ1_BDB - Line J-1 below Dublin Blvd." The weather station is located approximately 0.5 (AC-OUTBK), 0.2 (AC-CIVIC), and 0.1 (AC-PUBSAF) miles from the three WY 2024 monitoring stations, respectively.

To estimate end-of-pipe flows for each monitoring location, ACCWP installed depth sensors in each monitored outfall prior to the start of the monitoring season. Sensors functioned well and generated a continuous record throughout the wet season. Manning's Equation was used to calculate flow from depth measurements at each 2-minute sampling interval, and to calculate total and peak volume per storm. However, for the storm events for which monitoring nets were attached, the nets along with their accumulated material (vegetation and trash) caused flow to back up into the pipes, artificially inflating depth measurements and biasing high the calculated flows.

To estimate flows for the storms when nets were deployed, total precipitation and total and peak flow data were compiled for the 21 storms occurring during WY 2024 where the trash nets were not attached. The data from those 21 storms were used in a linear regression model to estimate total and peak flow for the storm events at each site for which the nets were deployed using the lm function in R Studio 2023 (Version 6.1.524). The resulting linear equations were then used to estimate total volume and peak flow at each site with the total precipitation for a given storm (Tables AC-3 and AC-4).

Total precipitation, in situ calculated flow (when net was attached, biased high), and the linear regression estimated total flow for each affected storm event are compiled in Table AC-3. Table AC-4 compiles information on linear regression estimated peak flow for all sites.

Table AC-3. Results of linear regression model efforts to estimate total flow during monitored storm events in WY 2024

Event	Site	Dates	Total Precipitation (in.)	In Situ Calculated Total Flow, Manning (cf)	Modeled Total Flow, Linear Regression (cf)	Scaling Factor (decimal difference +1)
1	AC-PUBSAF	11/15/23 | 11/18/23	0.4	57,566	6,189	0.108
2	AC-PUBSAF	01/19/24 | 01/22/24	1.5	762,575	25,328	0.033
3	AC-PUBSAF	01/31/24 | 02/02/24	1.2	1,121,753	20,311	0.018
1	AC-CIVIC	11/15/23 | 11/18/23	0.4	7,440	4,069	0.547
2	AC-CIVIC	01/19/24 | 01/22/24	1.5	19,445	14,680	0.755
3	AC-CIVIC	01/31/24 | 02/02/24	1.2	45,254	11,899	0.263
1	AC-OUTBK	11/15/23 | 11/18/23	0.4	20,422	14,459	0.708
2	AC-OUTBK	01/19/24 | 01/22/24	1.5	84,220	68,424	0.812
3	AC-OUTBK	01/31/24 | 02/02/24	1.2	156,791	54,277	0.346
4	AC-OUTBK	02/14/24 | 02/20/24	1.9	463,721	90,133	0.194

Table AC-4. Results of linear regression model efforts to estimate peak flow during monitored storm events in WY 2024

Event	Site	Dates	Total Precipitation (in.)	In Situ Calculated Peak Flow, Manning (cfs)	Modeled Peak Flow, Linear Regression (cfs)
1	AC-PUBSAF	11/15/23–11/18/23	0.4	14.24	1.58
2	AC-PUBSAF	01/19/24–01/22/24	1.5	46.02	4.35
3	AC-PUBSAF	01/31/24–02/02/24	1.2	46.28	3.62
1	AC-CIVIC	11/15/23–11/18/23	0.4	0.87	0.62
2	AC-CIVIC	01/19/24–01/22/24	1.5	3.44	0.93
3	AC-CIVIC	01/31/24–02/02/24	1.2	5.75	0.85
1	AC-OUTBK	11/15/23–11/18/23	0.4	9.81	2.57
2	AC-OUTBK	01/19/24–01/22/24	1.5	10.85	5.05
3	AC-OUTBK	01/31/24–02/02/24	1.2	12.28	4.40
4	AC-OUTBK	02/14/24–02/20/24	1.9	32.14	6.04

Total precipitation and total flow were highly correlated for each of the three WY 2024 ACCWP monitoring sites (Table AC-5). The relationship between total precipitation and peak flow at site AC-CIVIC was the only one of the modeled peak flow relationships that did not exhibit a strong linear relationship. Given the slight insignificance and low adjusted R^2, the peak flow estimates at AC-CIVIC should be treated with caution. However, these modeled peak flows are comparable to the in situ measured peak flows for storms of similar total precipitation without nets deployed.

Table AC-5. Results of linear regression model efforts to estimate peak flow during monitored storm events in WY 2024

Site	Total Precipitation vs. Total Flow		Total Precipitation vs. Peak Flow	
	Correlation Coefficient	R^2	**Correlation Coefficient**	R^2
AC-OUTBK	0,84	0.68	0.60	0.32
AC-PUBSAF	0.94	0.88	0,80	0.62
AC-CIVIC	0.97	0.94	0.43	0.14

The strong linear relationships between total precipitation and total flow volume were anticipated as total precipitation and total surface runoff have been shown to have strong linear relationships worldwide (Rossi et al., 2016; Miao et al., 2020). The weaker linear relationships between total precipitation and peak flow could be due to other factors such as differing storm intensities and durations; the WY 2024 storms sampled in this analysis consisted of both short, intense storms and those with lower intensity spread over several days. These differences in intensity and duration impact peak flow volumes even if the overall total precipitation is similar.

Event Hydrographs

Measured precipitation totals and flow data calculated for each site over the wet season of WY 2024 are presented in Figure AC-9. Flows for each storm event for which trash nets were deployed have been estimated as described previously.

Plots of rainfall and flow data for each sample event are shown in Figures AC-10 (AC-OUTBK), AC-11 (AC-PUBSAF), and AC-12 (AC-CIVIC). The net deployment interval is indicated in all figures. To match the estimated total flow volumes to the 2-minute interval flows calculated using Manning's Equation, the difference between the in situ calculated total volume and the model estimated total volume were used to create a scaling factor to correct for high biased flow data when nets were attached. The difference between in situ calculated and modeled flows were estimated using the equation: (In Situ Total Flow – Modeled Total Flow) / In Situ Total Flow. The scaling factor was created by adding 1 to the decimal difference. Manning's Equation calculated flows at each timestep during a sampling event were multiplied by this site- and event-specific scaling factor to correct for high-biased measurements (Table AC-3). These scaled flows are reflected during storm events in all hydrograph Figures AC-9 through AC-12.

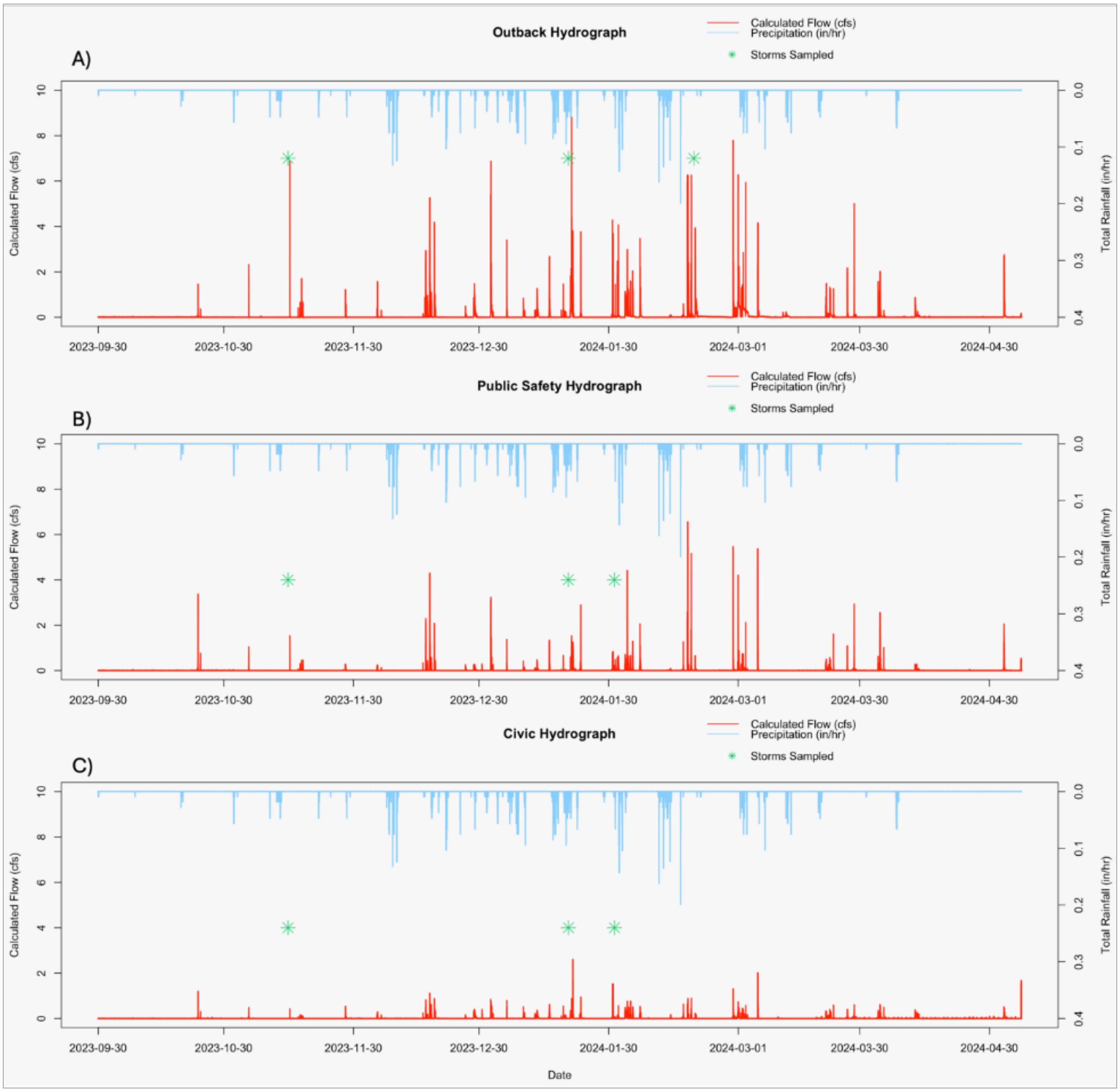


Figure AC-9. Annual hydrographs for 3 trash outfall monitoring sites in Alameda County

Top: AC-OUTBK Middle: AC-PUBSAF Bottom: AC-CIVIC

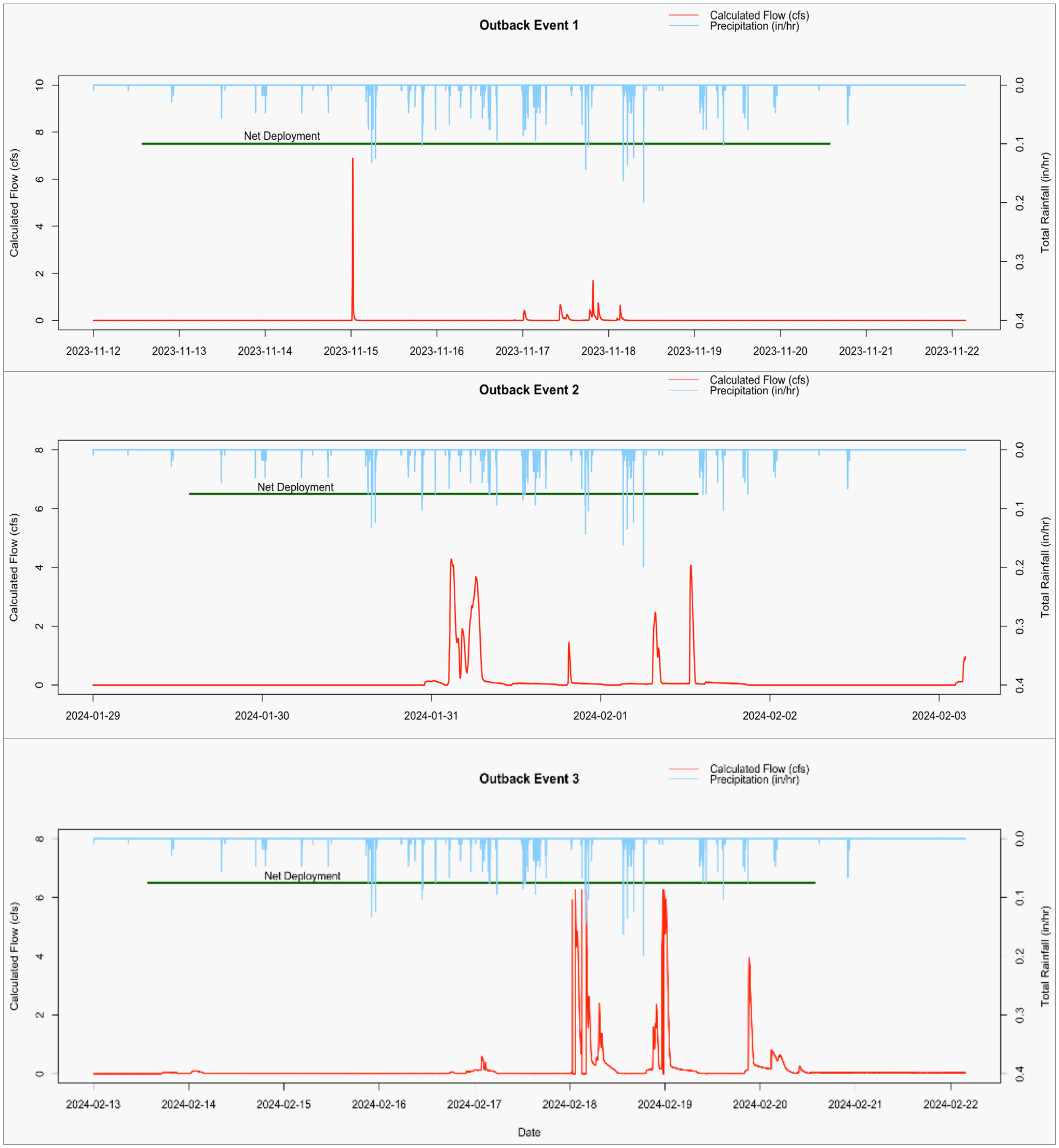


Figure AC-10. Hydrographs for 3 sampling events at site AC-OUTBK

Top: Event 1 Middle: Event 2 Bottom: Event 3

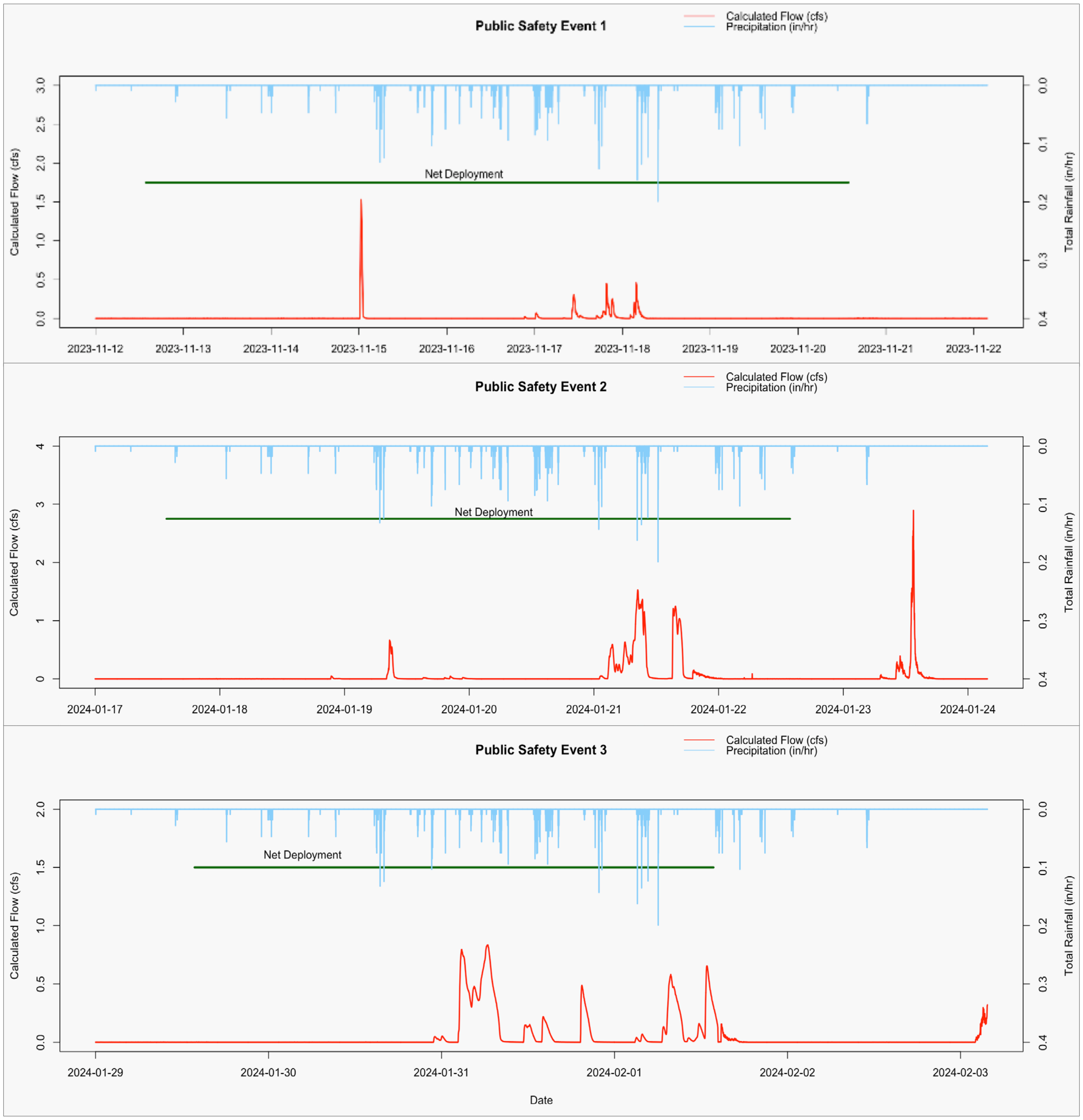


Figure AC-11. Hydrographs for 3 sample events at site AC-PUBSAF

Top: Event 1   Middle: Event 2   Bottom: Event 3

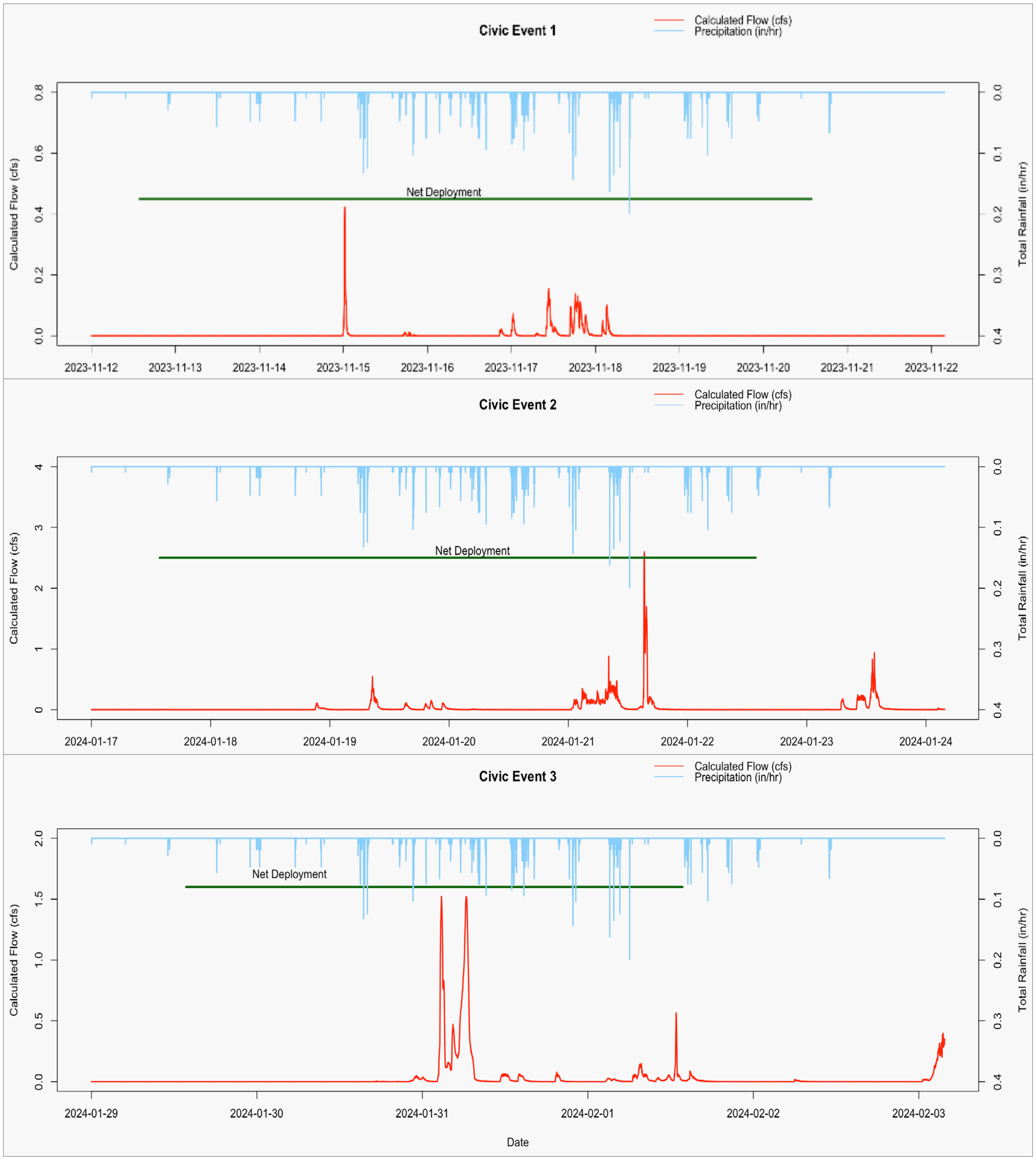


Figure AC-12. Hydrographs for 3 sample events at site AC-CIVIC

Top: Event 1 Middle: Event 2 Bottom: Event 3

B1.3 Investigation of Trash Generation

A summary of the visual observations of trash sources in the monitored catchments is provided in the section below.

B1.3.1 Catchment Assessments

Given the relatively small size of the three study catchments, ACCWP was able to conduct visual assessments of trash sources in each of the three catchment areas for each sampling event. AMS staff walked the public rights-of-way and noted the presence of trash during the dry season prior to start of WY 2024 monitoring and again during each net deployment and retrieval (Table AC-6). A description for each of the catchment areas is provided above in Section B1. A summary of the observations and known operation and maintenance records is provided for each site below.

Table AC-6. Dates of WY 2024 catchment characterizations

Site	Event #	Pre-storm Assessment Date	Post-storm Assessment Date
AC-OUTBK	Dry season	10/06/23	N/A
AC-OUTBK	1	11/13/24	11/23/24
AC-OUTBK	2	01/18/24	01/23/24
AC-OUTBK	3	01/30/24	020/2/24
AC-OUTBK	4	02/14/24	02/21/24
AC-PUBSAF	Dry season	10/06/23	N/A
AC-PUBSAF	1	11/13/24	11/23/24
AC-PUBSAF	2	01/18/24	01/23/24
AC-PUBSAF	3	01/30/24	020/2/24
AC-CIVIC	Dry season	10/06/23	N/A
AC-CIVIC	1	11/13/24	11/23/24
AC-CIVIC	2	01/18/24	01/23/24
AC-CIVIC	3	01/30/24	02/02/24

Site AC-OUTBK

Very dense littering and/or windblown trash were observed accumulating along the banks on either side of the monitored outfall. This is likely an effect of both proximity to I-580 and unhoused populations that were observed near to the outfall and within the upstream catchment periodically. There also appears to be regular illegal dumping occurring in the catchment. There are several commercial dumpsters associated with local business in the parking areas, and on multiple occasions staff observed materials left beside the dumpsters (e.g., cardboard and bags full of garbage).

Food and drink ware associated with multiple restaurants and coffee shops in the catchment were regularly observed in the parking areas around these establishments. In some cases, this litter appeared to be caught in vegetated strips adjacent to the parking areas. In other cases, the waste was observed in the paved parking areas and more likely to reach the MS4.

The curb and gutter areas around Regional Street were regularly littered with trash, including paper, glass, metal, and miscellaneous plastic items. Street sweeping did appear to be ongoing, given the presence and absence of leaf litter, but new loadings of trash appeared to be occurring on a regular basis.

The main source of trash within the catchment appeared to be associated with construction activities that were ongoing over the course of the monitoring season (Table AC-7 and Figure AC-13). There were both construction-related materials (plastic bands, tools, soil dumping) that were observed regularly, as well as food and drink ware that was deposited in two different areas that appeared to be used as break spots.

Site AC-PUBSAF

There was minimal trash observed adjacent to the outfall for any of the WY 2024 sampling events. Although access to the adjacent levee road is restricted, like that at the AC-OUTBK site, the area around the monitored outfall does not appear to be visited by members of the public, unlike AC-OUTBK.

The majority of litter observed in the AC-PUBSAF catchment during sampling events appeared to be accumulating in vegetated areas adjacent to roadways, including bioretention features (Table AC-8 and Figure AC-14). This is in comparison to both AC-OUTBK and AC-CIVIC catchments, in which litter was regularly observed in light to moderate densities on roadways and in parking areas.

Although there was no obvious construction occurring in the catchment during WY 2024 monitoring activities, AMS field staff noted multiple locations within the catchment that appeared to be used as break areas. These areas had regular and relatively dense accumulations of food and beverage waste, smoking products, and other miscellaneous trash.

The two catch basin inserts (CBIs) contained within the catchment were cleaned prior to the wet season. Upon inspection prior to the first WY 2024 sampling event here, AMS field staff observed one of these catch basins was mostly full of leaves. AMS communicated this to the City of Dublin, and the leaves were cleared prior to the next sampling event performed.

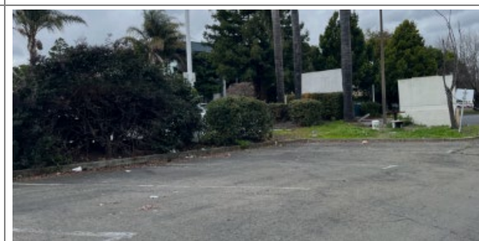
Site AC-CIVIC

The AC-CIVIC monitoring site is located along a heavily used public trail, the Alamo Canal Trail. Trash associated with trail usage appeared to be fairly low during the WY 2024 monitoring season, with the trail and banks around the monitored outfall appearing mostly devoid of obvious litter.

There were several activities occurring in the catchment that did appear to be associated with trash accumulation, however (Table AC-9 and Figure AC-15). Similar to AC-OUTBK, the catchment is located adjacent to I-580 and windblown trash was regularly observed accumulating in the nearby parking area and associated landscaping. There was also construction occurring at the Dublin Civic Center during the monitoring period. There were some construction-related materials that were observed in the adjacent parking area (mostly plastic items or pieces), but not in great densities. And possible usage by unhoused persons was observed, with several personal care products showing up in the parking areas (e.g., toothbrushes, floss picks).

The main source of trash in the catchment appears related to the public playing fields located on the east side of the catchment. Food and drink waste and smoking products were regularly observed in the landscaped areas and adjacent parking lots.

Table AC-7. Trash assessments in catchment for site AC-OUTBK during WY 2024

Observations During Survey	Latitude, Longitude	Photos
Trash likely related to construction activities. There were multiple areas that appeared to be used for work breaks and other sites where pieces of construction materials accumulated. (photo taken 02/14/24)	37.70056, -121.93251	
Food and beverage waste accumulated in parking areas near restaurants and coffee shops. (photo taken 02/14/24)	37.69989, -121.93243	
Litter associated with the use of parking areas by possible unhoused persons. (photo taken 01/18/24)	37.00781, -121.93281	
Likely dumping was observed at commercial dumpster areas on multiple occasions (full garbage bags, cardboard, etc.). (photo taken 01/30/24)	37.70188, -121.93398	
Litter accumulating on banks adjacent to the outfall; high trash density not evident from photo. (photo taken 01/18/24)	37.69957, -121.93203	

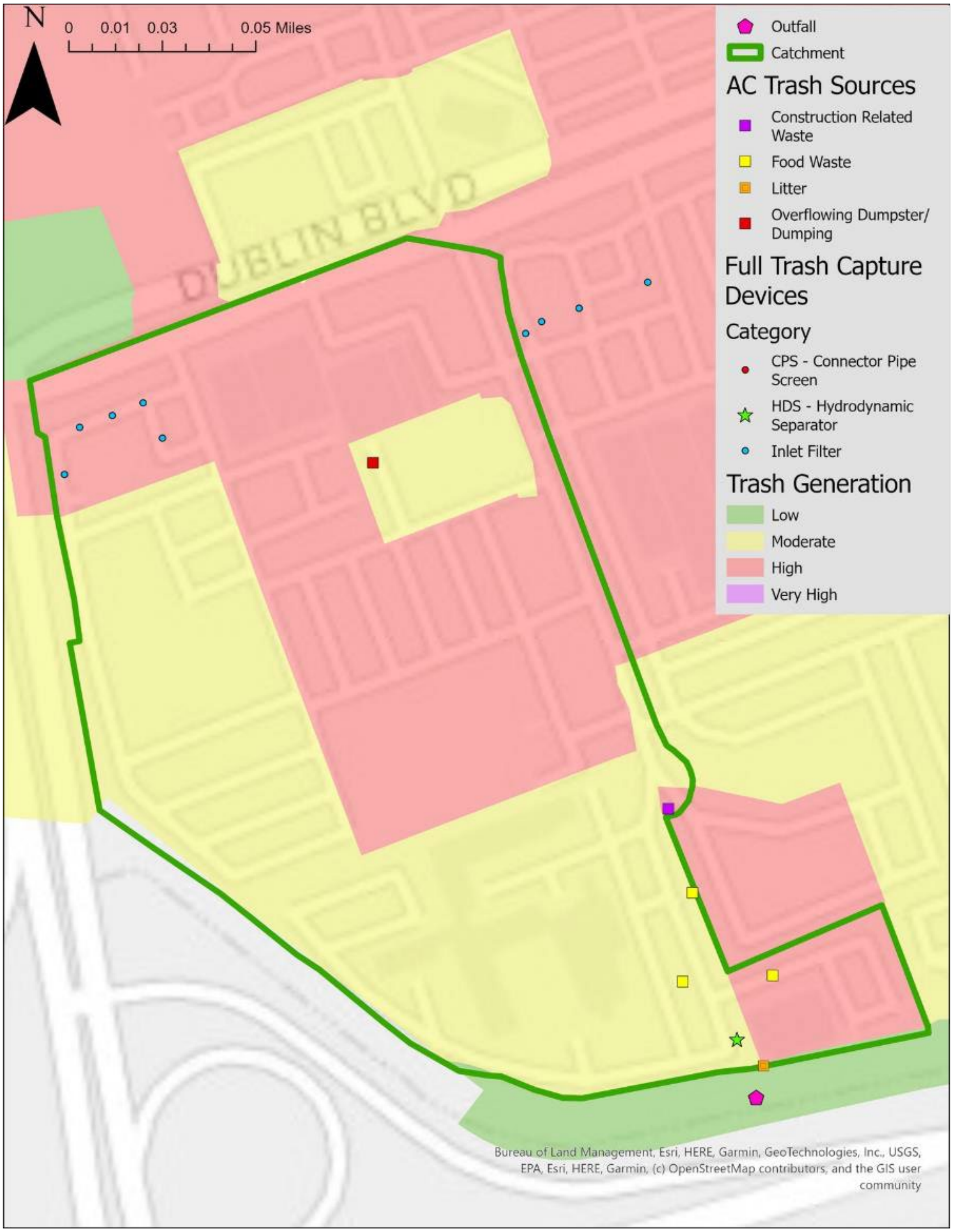


Figure AC-13. Trash sources identified in the City of Dublin during trash assessment for catchment AC-OUTBK

Table AC-8. Trash assessments in catchment for site AC-PUBSAF during WY 2024

Observations During Survey	Latitude, Longitude	Photos
Food waste, smoking products, and miscellaneous waste in areas that appear to be used for work breaks. (photo taken 10/6/23).	37.70409, -121.92188	
Multiple types of waste trapped by vegetation in bioretention features. (photo taken 1/18/24).	37.70347, -121.91992	
Vegetation in non-bioretention areas temporarily trapping blown-in waste. (photo taken 1/18/24).	37.70393, -121.92084	
CBI discovered nearly full of vegetation, communicated to City of Dublin and maintained shortly thereafter. (photo taken 10/06/23).	37.70347, -121.91992	

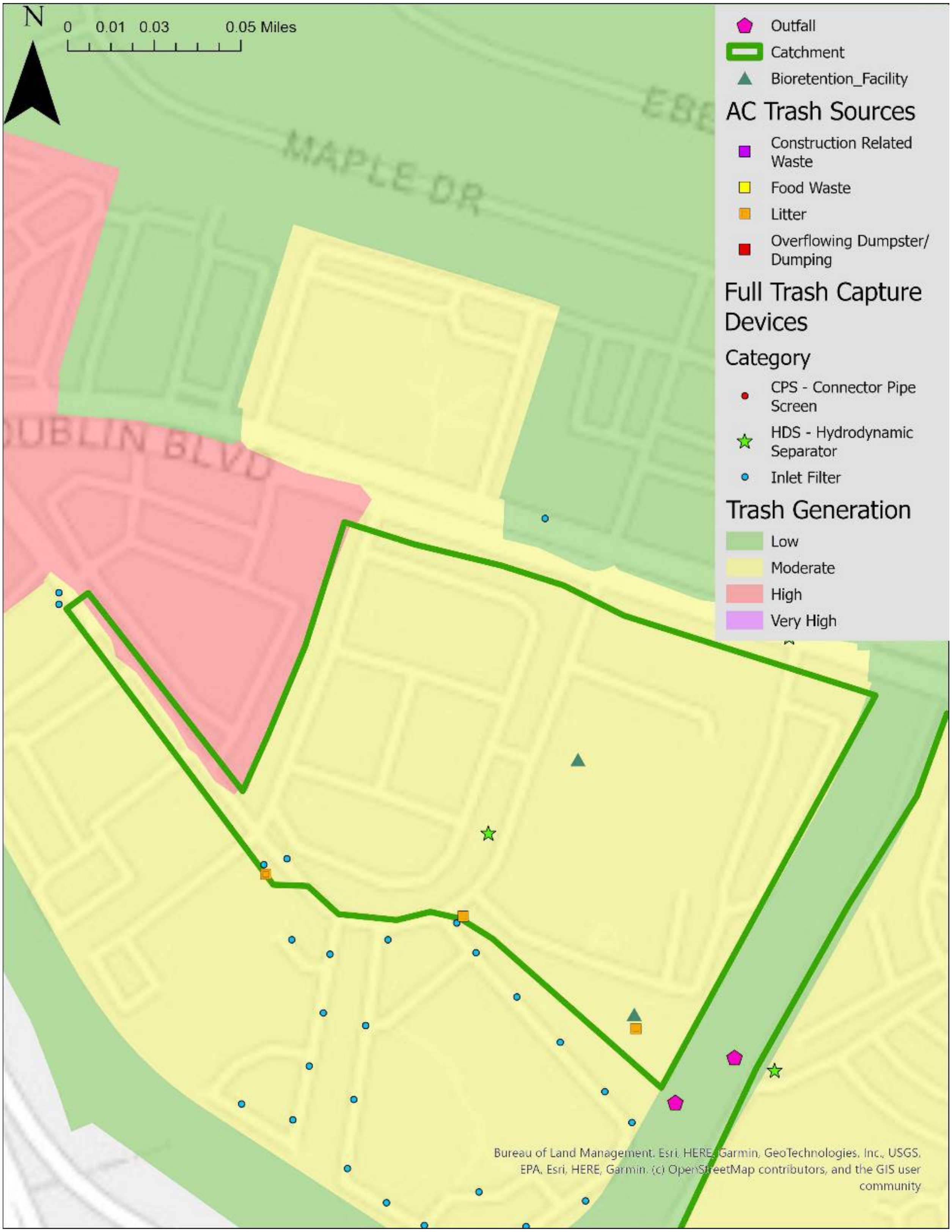
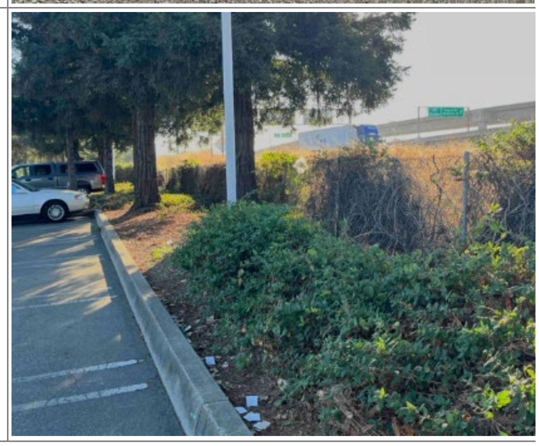


Figure AC-14. Trash sources identified in the City of Dublin, during trash assessment for catchment AC-PUBSAF

Table AC-9. Trash assessments in catchment for site AC-CIVIC during WY 2024

Location and Type of Trash	Latitude, Longitude	Photos
Food and beverage related waste in the grounds surrounding the public ballfields. (photo taken 1/18/24).	37.70298, -121.91806	
Smoking products in the parking areas surrounding the public ballfields. (photo taken 1/30/24).	37.70266, -121.91809	
Windblown litter in the vegetation and parking area adjacent to I-580. (photo taken 10/6/23).	37.70217, -121.91904	

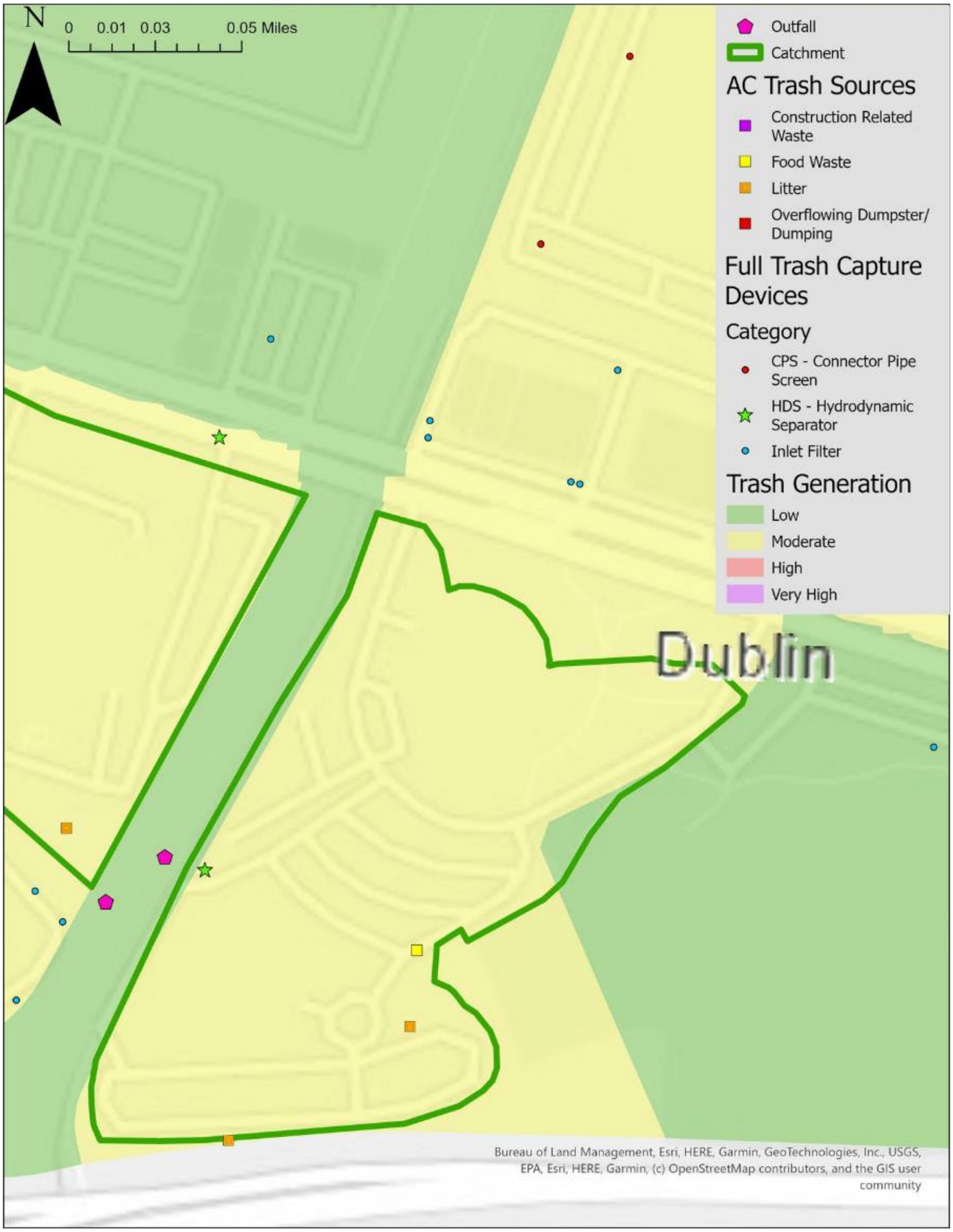


Figure AC-15. Trash sources identified in the City of Dublin, during trash assessment for catchment AC-CIVIC

B1.3.2 Trash Management Actions

Operations and maintenance records (where available) for full trash capture devices and other trash controls implemented in the monitored catchments are summarized in Table AC-10.

Table AC-10. Summary of operations and maintenance activities associated with full trash capture and other controls implemented in catchments for ACCWP outfall monitoring sites

Monitored Catchment	Full Trash Capture	Other Controls
AC-OUTBK	The City of Dublin contracts for the cleaning of publicly owned HDS units two times per year. Inspected on 10/31/23, 3/25/24, and 5/24/24; cleaned on 10/31/23 and 5/24/24.	Street sweeping (2x / month)
AC-PUBSAF	The City of Dublin requires privately-owned HDS devices to be maintained three times per year.	Street sweeping (2x / month)
	The City of Dublin contracts for cleaning of CBIs three times per year; inspected on 11/8/23, 3/27/24, and 7/30/24; cleaned on each date	
	Two bioretention features on Public Safety Complex property; these are inspected as part of overall grounds upkeep on an approximately biweekly basis and maintained as conditions indicate (vegetation management, trash removal, rodent control, etc.).	
AC-CIVIC	The City of Dublin contracts for the cleaning of publicly owned HDS units two times per year. Inspected on 8/21/23 and 3/26/24; not cleaned either date (sufficient capacity).	Street sweeping (2x / month)

B1.4 Refinements

The following refinements to trash outfall monitoring will be implemented in Alameda County for WY 2025 monitoring.

Monitoring locations

At the request of the Water Board, a replacement site for site AC-CIVIC will be installed for monitoring beginning in WY 2025. The site is located near a commercial shopping and office area in downtown Hayward. This will provide greater geographic coverage to the overall sampling scheme.

B1.5 References

Rossi, M. W., Whipple, K. X., & Vivoni, E. R. (2016). Precipitation and evapotranspiration controls on daily runoff variability in the contiguous United States and Puerto Rico. *Journal of Geophysical Research: Earth Surface*, **121**, 128–145. https://doi.org/10.1002/2015JF003446

Miao, C., Zhang, H., Jiao, J., Feng, X., Duan, Q., Mpofu, E. (2020). The changing relationship between rainfall and surface runoff on the Loess Plateau, China. *Journal of Geophysical Research: Atmospheres,* **125,** e2019JD032053**.** https://doi.org/10.1029/2019JD032053

B2 CONTRA COSTA CLEAN WATER PROGRAM (CCCWP)

B2.1 Introduction

Two locations in Contra Costa County were selected for trash outfall monitoring (Figure CC-1). The first outfall (CC-PCH) is located in the census designated place of Pacheco above Grayson Creek off Center Avenue near the intersection with Pacheco Boulevard. The second outfall (CC-WC) is located on a natural stream bank above Walnut Creek in Civic Park within the City of Walnut Creek. Characteristics of each monitoring location and corresponding drainage area are provided below.

Grayson Creek (CC-PCH)

Site CC-PCH (Figures CC-2 and CC-4) is an 18-inch diameter outfall that drains an approximately 3.9-acre catchment in the census designated place of Pacheco. This catchment consists of the following urban land uses[7]: retail centers (75%), commercial businesses (24%), and urban park (1%). Baseline (i.e., pre-trash control) trash generation rates for the catchment were identified as approximately 25% moderate and 75% high by area. The catchment area is controlled to a low trash designation by 100% treatment through use of catch basin inserts. Trash management actions in the catchment have resulted in reducing the trash generation rate[8] from 24.4 (baseline) to 2.5 (current) gallons/acre/year.

The outfall at site CC-PCH is located off Center Avenue near the intersection of Pacheco Boulevard and drains runoff from the catchment area to Grayson Creek. The outfall flows onto a concrete skirt embedded with small diameter rip rap on a bioengineered flood control levee. The surrounding banks are approximately 8 feet above the channel.

Walnut Creek (CC-WC)

Site CC-WC (Figures CC-3 and CC-5) is a 15-inch diameter outfall that drains an approximately 1-acre catchment area in the parking lot of Civic Park in Walnut Creek. Baseline trash generation rates for the catchment were identified as approximately 100% moderate. The catchment area is controlled to a low trash designation by 100% treatment through use of catch basin inserts. Trash management actions in the catchment have resulted in reducing the trash generation rate from 7.5 (baseline) to 2.5 (current) gallons/acre/year.

The outfall at site CC-WC discharges to Walnut Creek approximately 500 meters upstream of Ygnacio Valley Boulevard. The outfall pipe flows onto a small concrete skirt located on a natural stream bank on the west side of the creek. The surrounding banks are approximately 19 feet above the channel.

[7] Land use data derived from ABAG (2006).
[8] Baseline and current trash generation rates are estimated as spatially weighted averages using midpoint values of trash generation rate categories and the proportion of each catchment that is controlled to low at the time of monitoring.

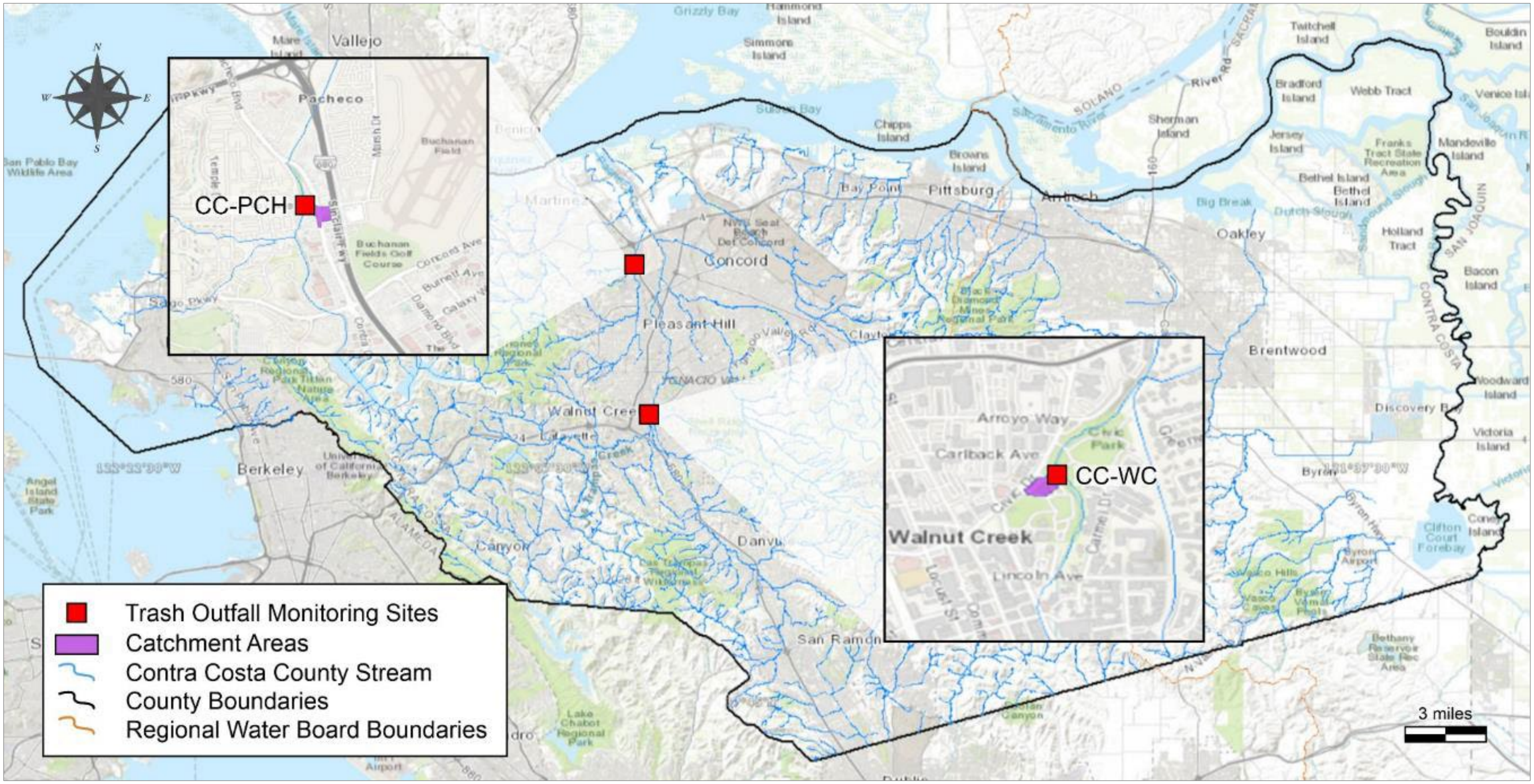


Figure CC-1. Trash outfall monitoring locations in Contra Costa County

Figure CC-2. Grayson Creek outfall site CC-PCH in Pacheco

Figure CC-3. Walnut Creek outfall site CC-WC in Civic Park, Walnut Creek

Figure CC-4. Outfall retrofit and netting device install at Grayson Creek outfall site CC-PCH

Figure CC-5. Outfall retrofit and netting device install at Walnut Creek outfall at site CC-WC

B2.2 Results

B2.2.1 Sample Events

Three storm events were sampled at each of the two trash outfall monitoring sites in Contra Costa County in WY 2024. Net deployment and retrieval dates and times for the three sample events are presented in Table CC-1. Storm event details including storm duration, antecedent dry periods, rainfall total, and maximum rainfall intensity for each sample are also presented in Table CC-1.

A brief summary of the three sample events for both Contra Costa County sites is presented below.

Event 1

During the first sample event of the season for both Contra Costa County sites, nets were deployed over a seven-day period in mid-November (Table CC-1). The predicted storm for the first sample event was delayed several days and the majority of rainfall arrived during the second half of the net deployment. Rainfall totals at sites CC-PCH and CC-WC were 0.56 and 0.59 inches, respectively. The samples at sites CC-PCH and CC-WC were collected during the first monitorable event of the season (i.e., first significant event). Maximum rainfall intensities at CC-PCH and CC-WC were 0.14 and 0.12 inches/hour, respectively. Antecedent dry conditions for sites CC-PCH and CC-WC were 170 and 11.5 days, respectively. At site CC-WC, the sample was collected 11 days after a smaller storm, when approximately 0.15 inches fell over a 6-hour period on November 5, 2023. At site CC-PCH, 0.12 inches fell over an 8-hour period, with no 6-hour period containing 0.10 inches, thereby not meeting the definition of a storm event. Field crews were not mobilized for the November 5, 2023 storm because the predicted forecast was below the mobilization criteria.

Event 2

The second sampling event at both Contra Costa County sites included a five-day sampling period in mid to late January. The second sampling event was predicted to be a long duration, high-intensity event; however, the storm produced lower rainfall totals than originally forecast. Though smaller than predicted, the second event still produced 0.94 and 1.11 inches of rainfall over a 13.25 and 16.25-hour period at sites CC-PCH and CC-WC, respectively. Maximum rainfall intensities at CC-PCH and CC-WC were 0.18 inches/hour and 0.17 inches/hour, respectively, which did not exceed the design storm at either location. Antecedent dry conditions for sites CC-PCH and CC-WC were 3.5 and 3.3 days, respectively.

Event 3

The last sample event of WY 2024 included the largest event rainfall totals (ranging from 1.23 to 1.50 inches at CC-WC and CC-PCH, respectively) and highest rainfall intensity at CC-PCH (which ranged from 0.13 to 0.34 inches/hour at CC-WC and CC-PCH, respectively. The rainfall intensity at CC-PCH exceeded the full trash capture design standard (i.e. the one-year, one-hour storm), which is 0.31 inches/hour (BAMSC 2024).[9] Rainfall intensity at CC-WC was predicted to exceed design standards but the most intense rainfall of the storm passed to the north. The one-year, one-hour storm event intensity for Walnut Creek is 0.39 inches/hour. The third event represented the longest

[9] https://hdsc.nws.noaa.gov/hdsc/pfds/

storm duration (18 and 46 hours at CC-PCH and CC-WC, respectively). Antecedent dry conditions for both sites were approximately seven days.

Table CC-1. Trash net deployment data and storm statistics for outfall sampling events conducted in Contra Costa County during WY 2024

Site	Sample	Net Deployment Date | Time	Net Retrieval Date | Time	Sampling Period (hours)	Storm Duration (hours)	Antecedent Dry Period (days)	Rainfall Total (in)	Max Rainfall Intensity (in/hr)[1]	Comment[2]
CC-PCH	Event 1	11/13/23 | 12:30	11/20/23 | 13:00	168.5	16	170	0.56	0.14	First significant event
CC-PCH	Event 2	01/18/24 | 12:45	01/23/24 | 13:15	120.5	13.25	3.5	0.94	0.18	
CC-PCH	Event 3	01/30/24 | 13:00	02/02/24 | 10:00	69	18	7.2	1.50	0.34	Exceeded the design storm
CC-WC	Event 1	11/13/23 | 11:30	11/20/23 | 11:30	168	25	11.5	0.59	0.12	First significant event
CC-WC	Event 2	01/18/24 | 11:45	01/23/24 | 12:00	120.25	16.25	3.3	1.11	0.17	
CC-WC	Event 3	01/30/24 | 12:00	02/02/24 | 11:30	71.5	46	7.1	1.23	0.13	Forecasted to exceed the design storm[3]

1 Rainfall intensity is calculated using a 60-minute integration interval.

2 The MRP identifies the requirement to monitor the first significant storm event of each water year, as well as targeting one storm per year forecast to exceed the full capture design standard storm (i.e., the one-year, one-hour storm event). These design storms include one-hour rainfall rates of 0.31 inches/hour and 0.39 inches/hour in Pacheco and Walnut Creek, respectively.

3 Event was forecasted to exceed the one-year, one-hour rate, but rainfall intensity did not exceed the full trash capture design standard

B2.2.2 Trash Characterization

Trash collected at site CC-PCH for all three storm events were sorted into 13 trash categories and measured for volume (Table CC-2). The lowest volume of trash collected at site CC-PCH was 0.23 gallons during Event 1. The highest volume of trash collected at site CC-PCH was 1.6 gallons during Event 3. Event 3 at site CC-PCH had the highest rainfall total and intensity, including a period of rainfall that exceeded the full trash capture design standard.

No trash was collected during all three storm events at CC-WC. Field crews recovered organic material (detritus, leaf matter) from the trash net, which confirmed discharge through the MS4 into the net during all events. During-storm field observations were made at CC-WC during Event 2, where field crew confirmed flow through the outfall and ensured the netting device was properly secured to the outfall. In WY 2024, site CC-WC recorded a total of 0.0 gallons of trash during all three events.

Table CC-2. Trash volume measured for 13 trash types identified from samples collected at 2 outfall monitoring locations in Contra Costa County

		CC-PCH				CC-WC			
	Trash Type	**Event 1**	**Event 2**	**Event 3**	**Total**	**Event 1**	**Event 2**	**Event 3**	**Total**
Plastic Trash Items (oz)	Single-use Plastic Bags	0	0	0	0	0	0	0	0
	EPS Foam Food and Drinkware	0	0.51	25.4	25.91	0	0	0	0
	EPS Foam, Other	0	7.61	5.1	12.71	0	0	0	0
	Single-use Plastic Food / Drinkware	12.7	29.1	28.1	69.9	0	0	0	0
	Smoking Products, Traditional	0.34	0.1	0.51	0.95	0	0	0	0
	Smoking Products, Other	0	0	27.1	27.1	0	0	0	0
	Other Plastic Items	16.1	3.4	113.8	133.3	0	0	0	0
Non-Plastic Trash (oz)	Organic / Paper	0.17	0	2.5	2.67	0	0	0	0
	Fabric	0	0.85	0	0.85	0	0	0	0
	Metal	0	0	1.0	1.0	0	0	0	0
	Glass	0	0	0.84	0.84	0	0	0	0
	Mixed	0	0	0	0	0	0	0	0
	Biohazard	0	0	0	0	0	0	0	0
	Total Ounces	29.3	41.6	204	274.9	0	0	0	0
	Total Gallons	0.23	0.32	1.60	2.15	0	0	0	0
	Total Gallons/acre	0.059	0.082	0.409	0.550	0	0	0	0
	Average Gallons/event	0.72				0			

EPS = expanded polystyrene

The total volume of trash collected in each sample, standardized for area, is shown in Table CC-2 and Figure CC-6. The highest trash volume per area occurred at site CC-PCH during Event 3, with 0.41 gallons per acre. Trash volume per area collected during Events 1 and 2 were 0.06 and 0.08 gallons per acre, respectively. No trash was collected at site CC-WC during all three sampled events. Estimated annual trash loading rates are presented in the WY 2024 Trash Outfall Monitoring Progress Report (see Table 6, Section 3.4.4).

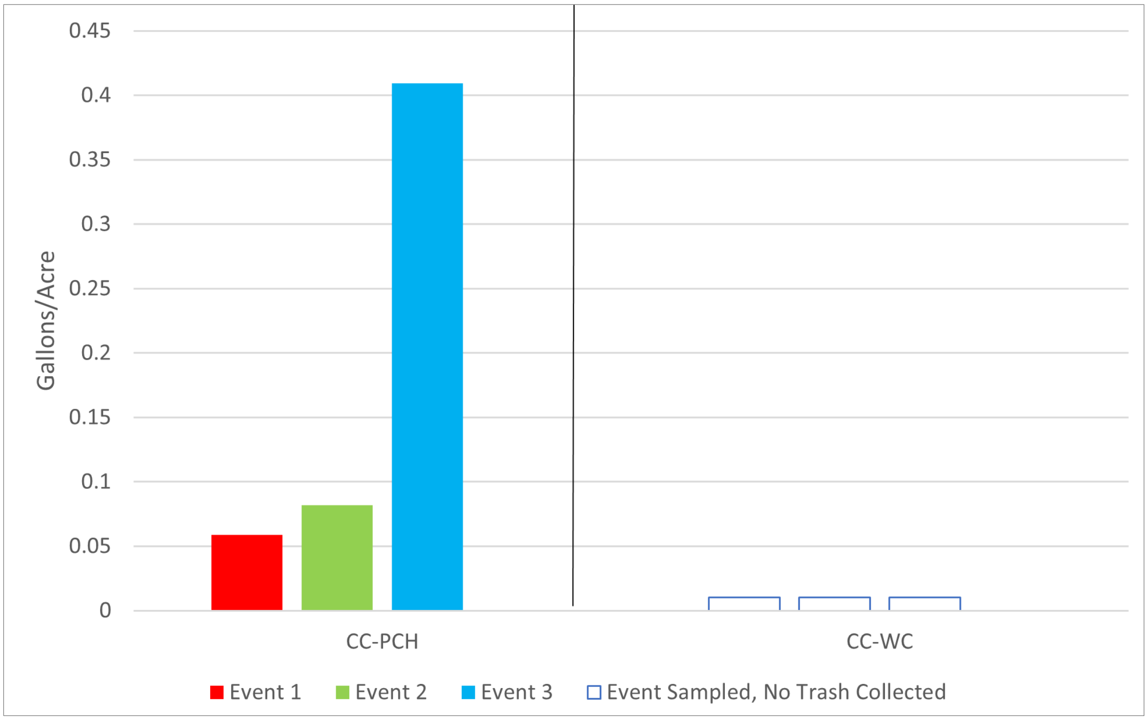


Figure CC-6. Trash volumes standardized by area for 3 sample events at 2 monitoring sites in Contra Costa County

The most common trash type was plastic, of which there are seven separate plastic type categories. The total volume for the combined seven plastic trash categories presented in Table CC-2 accounted for 98% of trash collected from three combined samples at site CC-PCH (Figure CC-7). The most common type of plastic trash was "*Other Plastic Items*" which accounted for 49% of all plastic trash items (Figure CC-8). The "*Other Plastic Items*" category consists of plastic packaging for food and beverage goods purchased at convenience and grocery stores.

The combined plastic items "*Single-use Plastic Food/Drinkware*", and "*Expanded Polystyrene (EPS) Foam Food and Drinkware*" accounted for 36% of plastic trash items. "*Single-use Plastic Bags*" accounted for 0% of plastic trash items. Existing County and State ordinances ban the distributions of these three categories of trash in the San Francisco Bay Area. "*EPS Foam, Other*" accounted for 5% of plastic trash items, while the combined "*Smoking Products, Traditional" and "Smoking Products, Other"* accounted for about 10% of plastic items at CC-PCH.

No trash was collected during all three events at site CC-WC.

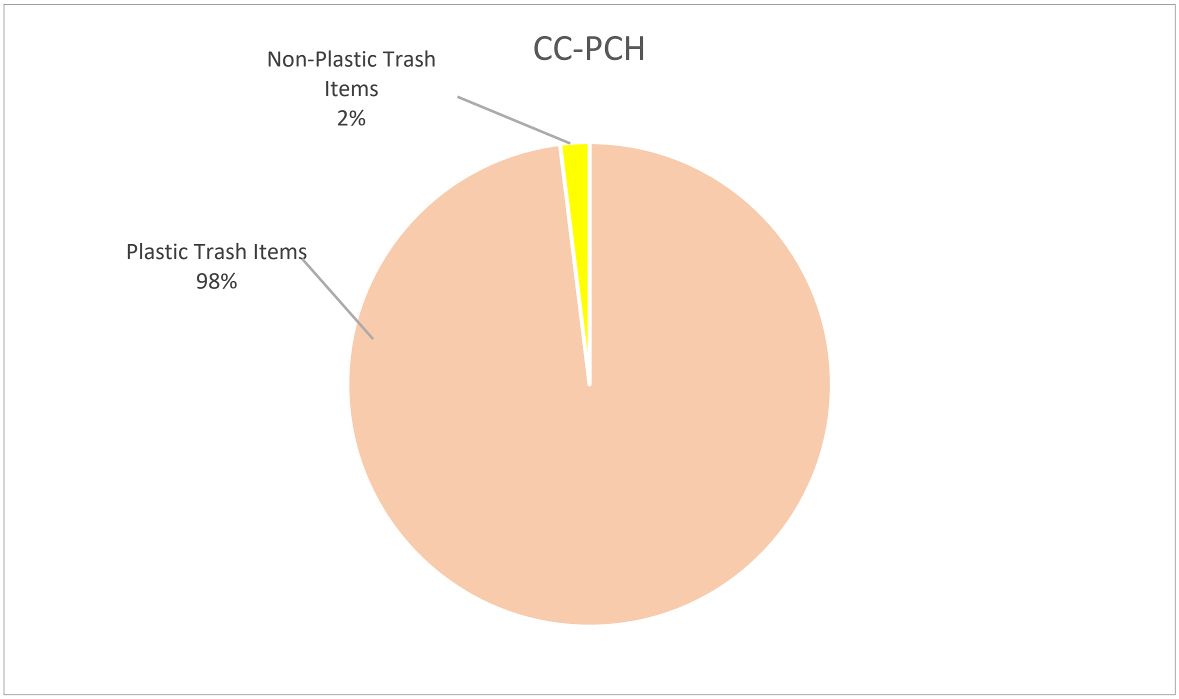


Figure CC-7. Comparison of plastic versus non-plastic trash items measured for all 3 storm events at site CC-PCH

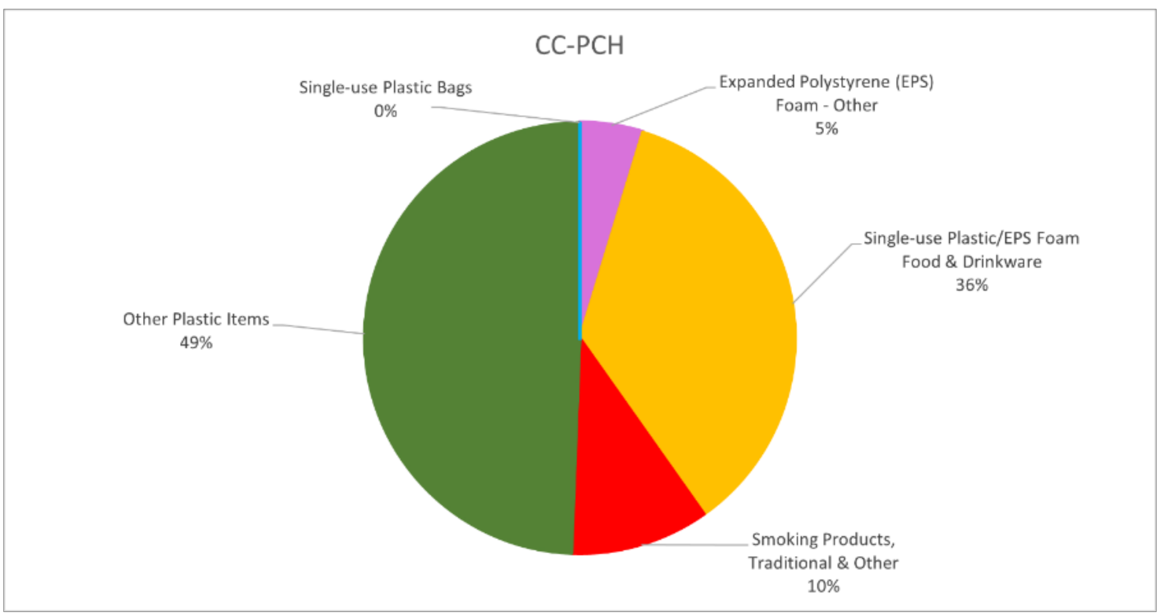


Figure CC-8. Comparison of plastic trash items measured for all 3 storm events at site CC-PCH

B2.2.3 Rainfall and Flow

Rainfall data was compiled from Weather Underground stations in proximity to catchment areas for site CC-PCH (13 stations) and site CC-WC (12 stations). Rainfall totals were calculated using an inverse distance squared weighted average from rainfall data collected at the stations listed in Table CC-3. Rainfall data and storm event details for sampled events are available in Table CC-1. WY 2024 hydrographs are presented in Figures CC-9 and CC-10.

Water level loggers were deployed in the MS4 pipe at both sites in Contra Costa County. Water level data were converted to flow data using Manning's Equation for a partially full pipe. One hundred percent of the data was collected at both sites from October 1, 2023, up to the device retrieval date of May 6, 2024. Data collected at site CC-PCH was field verified for accuracy and collected with no issue. At site CC-WC, low water levels and steep pipe gradient led to flow bypassing the depth sensor at times, causing periods of flow to not be fully measured during storm events. Multiple in-pipe deployment locations were attempted before field crews determined the most effective way to measure 100% of runoff was to install a Thel-mar weir in the pipe to prevent bypass around the sensor. A 15-inch Thel-mar weir was installed on March 28, 2024. Flow data prior to the installation of the Thel-Mar weir were modeled using USACE hydrologic modeling software. The hydrologic model and modeled data were calibrated using field collected data, which was successfully collected following installation of the Thel-mar weir in the MS4 pipe.

Event Hydrographs

Event hydrographs showing flow rate and rainfall intensity during three sample periods for events at CC-PCH and CC-WC are presented below (Figures CC-11 and CC-12, respectively). Event hydrographs begin at the start of the sampling period (net deployment date/time) and stop at the end of the sampling period (net retrieval date/time).

Table CC-3. WY 2024 weather stations

Station ID	Latitude	Longitude	Distance from Site (mi)
Pacheco (PCH)			
KCACONCO143	37.993	-122.046	0.63
KCACONCO240	37.991	-122.037	0.49
KCACONCO255	37.993	-122.047	0.65
KCAMARTI112	37.983	-122.086	0.03
KCAMARTI59	37.999	-122.085	1.07
KCAMARTI96	37.957	-122.096	1.68
KCAMARTI97	37.999	-122.088	1.05
KCAPLEAS111	37.967	-122.080	1.04
KCAPLEAS20	37.945	-122.082	2.54
KCAPLEAS263	37.951	-122.058	2.13
KCAPLEAS281	37.949	-122.070	2.26
KCAPLEAS296	37.951	-122.066	2.11
KCAPLEAS307	37.951	-122.084	2.14
Walnut Creek (WC)			
KCAWALNU114	37.891	-122.053	0.86
KCAWALNU208	37.891	-122.046	0.84
KCAWALNU211	37.909	-122.079	0.43
KCAWALNU213	37.902	-122.037	0.09
KCAWALNU248	37.890	-122.052	0.90
KCAWALNU25	37.900	-122.054	0.25
KCAWALNU261	37.908	-122.080	0.35
KCAWALNU263	37.907	-122.079	0.25
KCAWALNU267	37.906	-122.062	0.19
KCAWALNU281	37.896	-122.041	0.50
KCAWALNU35	37.904	-122.047	0.07
KCAWALNU73	37.900	-122.067	0.22

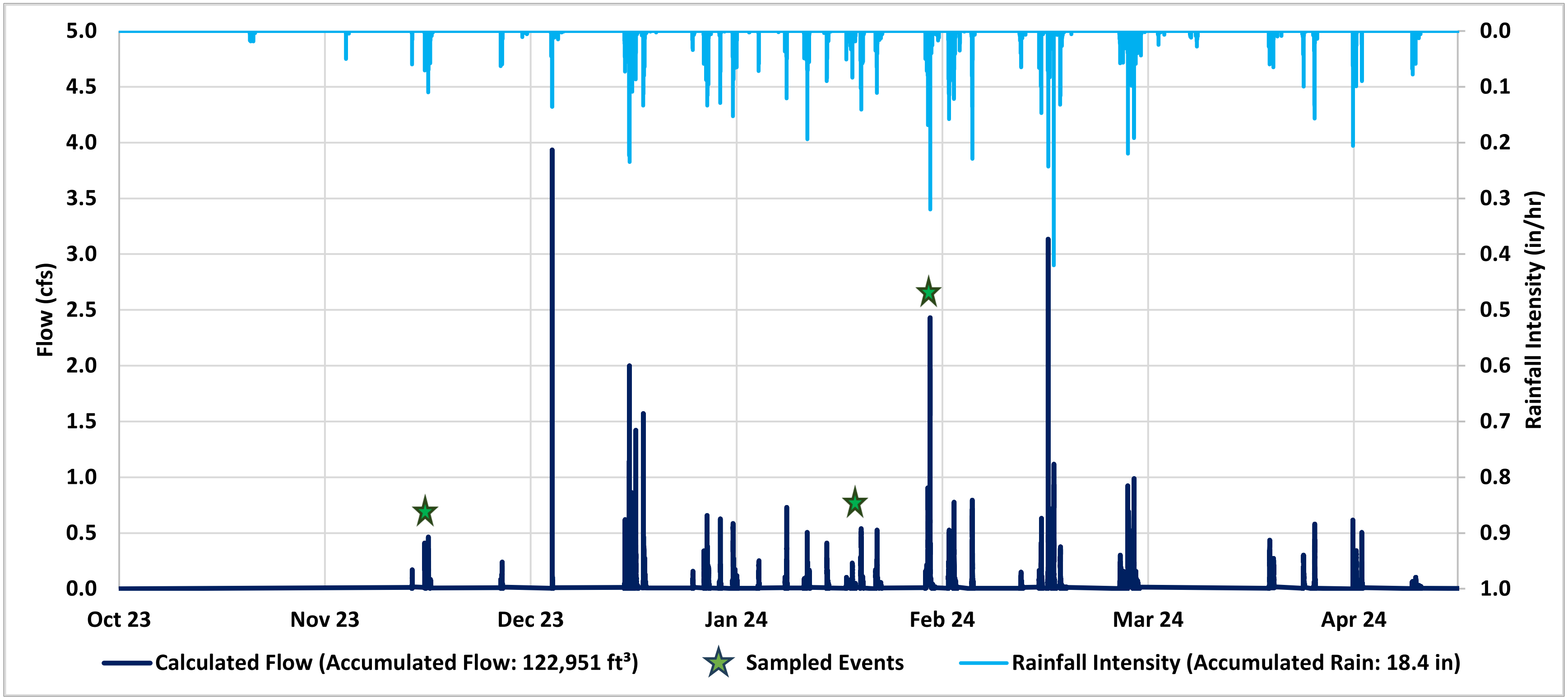


Figure CC-9. Annual hydrograph for trash outfall monitoring site CC-PCH in Contra Costa County

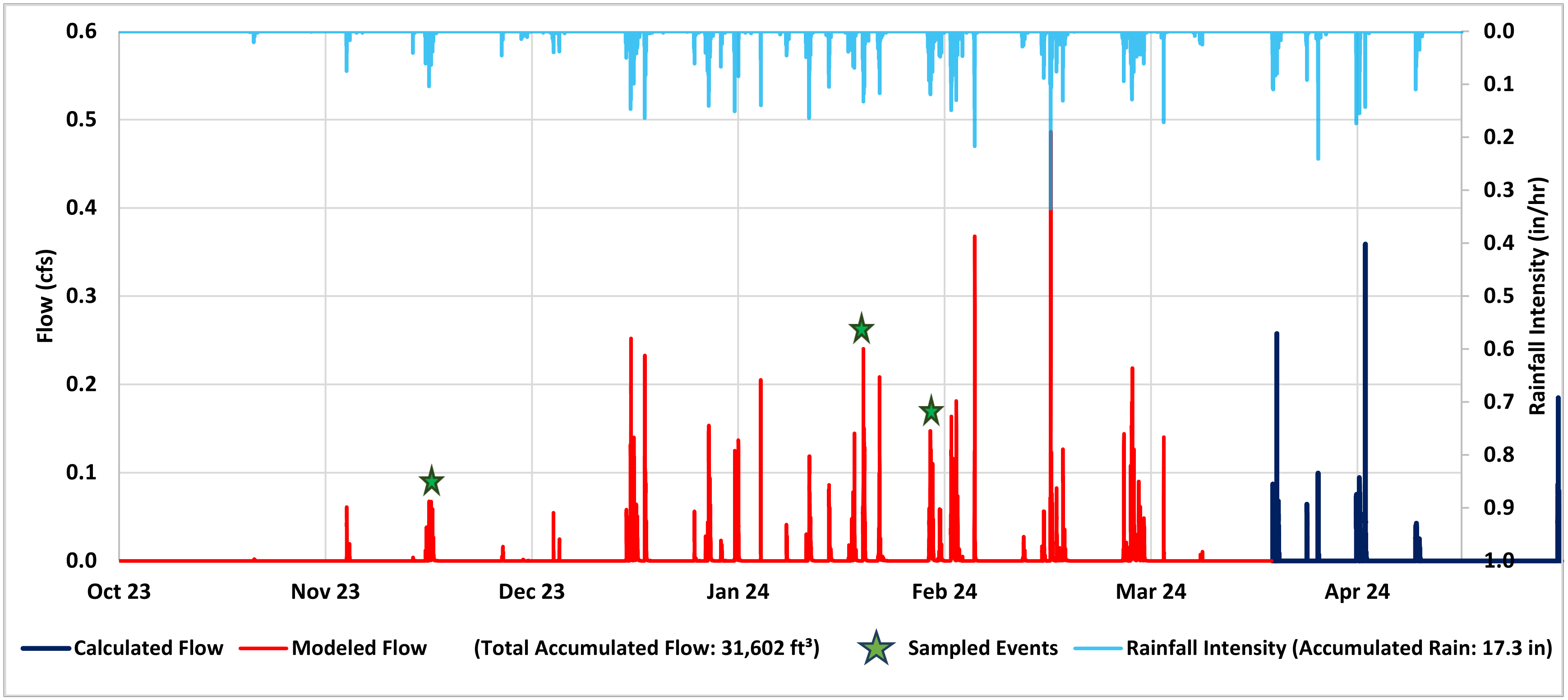


Figure CC-10. Annual hydrograph for trash outfall monitoring site CC-WC in Contra Costa County

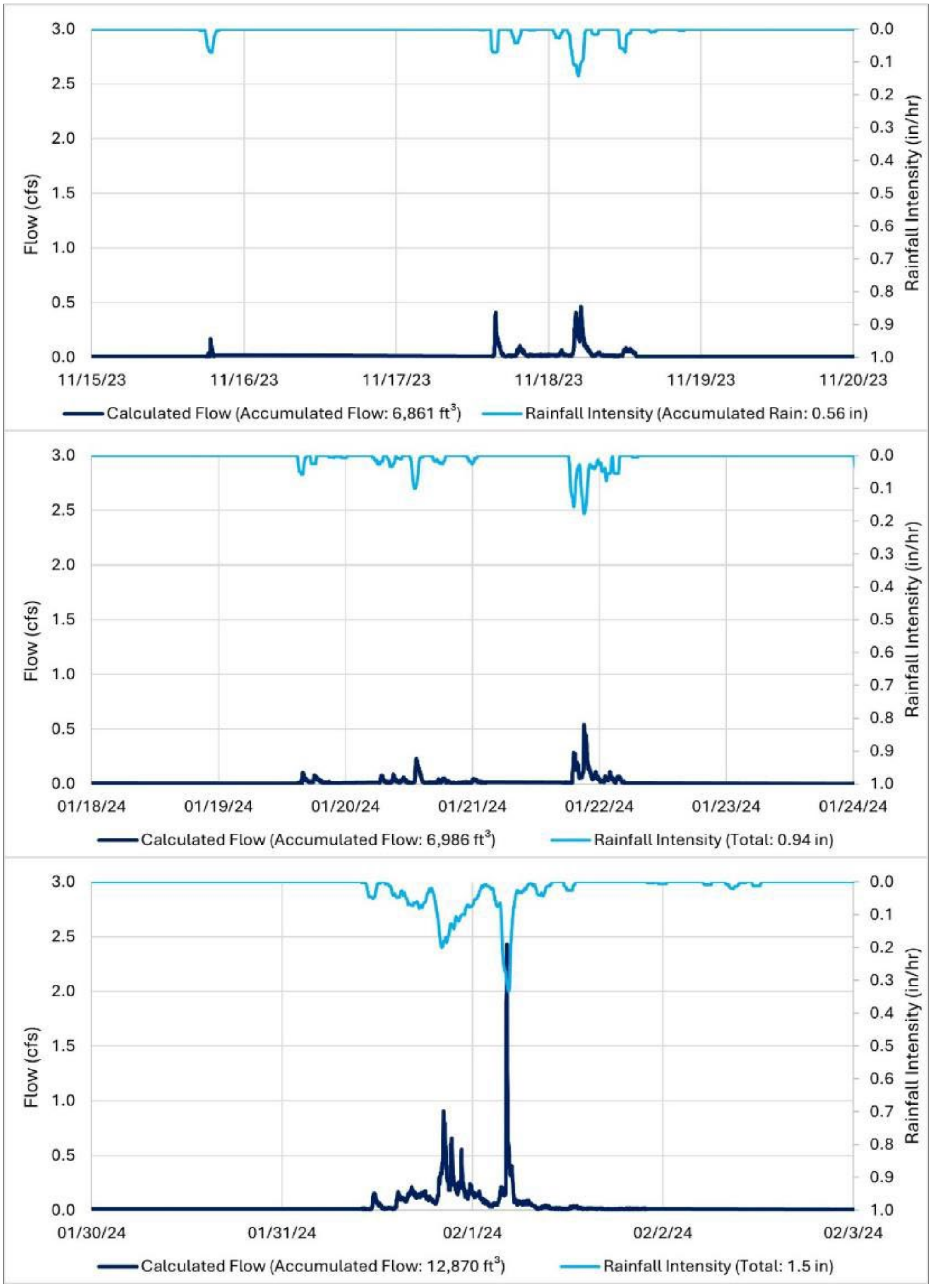


Figure CC-11. Hydrographs for 3 sample events at site CC-PCH

Top: Event 1 Middle: Event 2 Bottom: Event 3

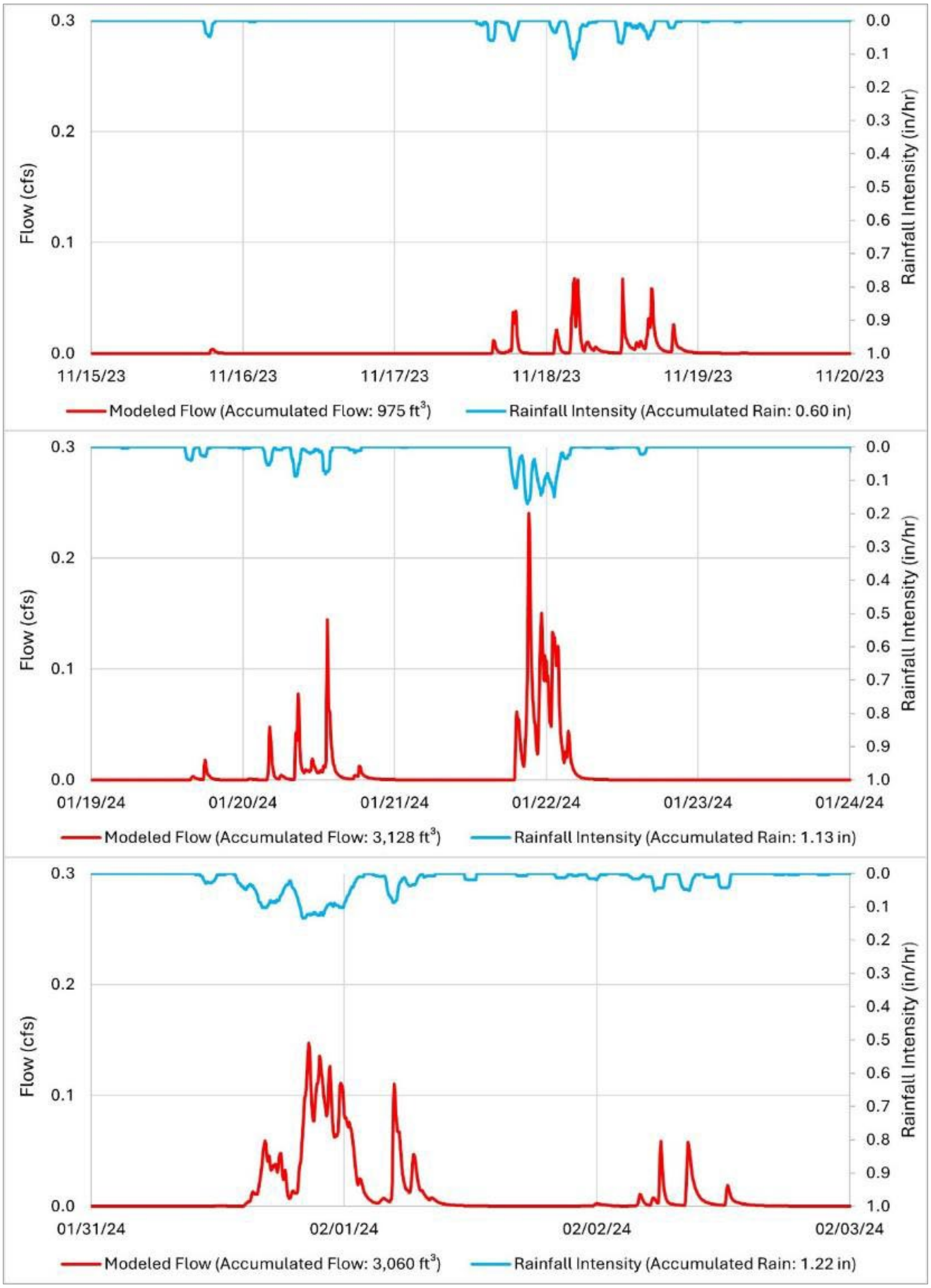


Figure CC-12. Hydrographs for 3 sample events at site CC-WC

Top: Event 1 Middle: Event 2 Bottom: Event 3

B2.3 Investigation of Trash Generation

A summary of the visual observations of trash sources in the monitored catchments is provided in the section below.

B2.3.1 Catchment Assessments

Visual observations of trash sources in the catchment areas for sites CC-PCH and CC-WC were conducted on October 30, 2023, prior to rainfall in either catchment. A description for each of the catchment areas is provided in Section B2. A summary of the observations is provided below, as well as in Tables CC-4 and CC-5 and Figures CC-11 and CC-12. Known operation and maintenance records are provided for each site in Section 3.2.

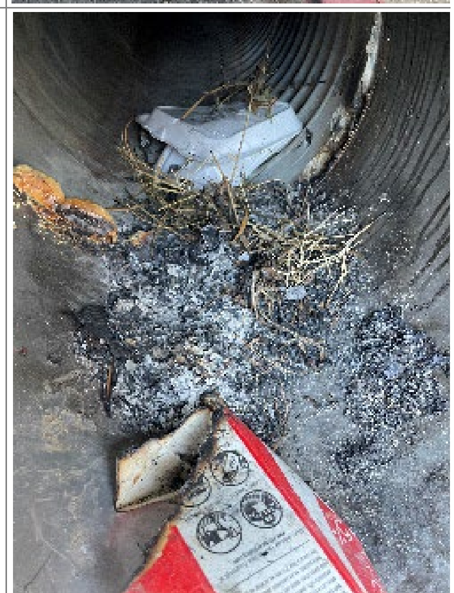
Site CC-PCH

Litter and/or windblown trash were observed in the curb and gutter of Pacheco Boulevard within the catchment area. Trash was documented next to bus stops along Pacheco Boulevard, in a manner that suggested the trash was discarded by individuals using the public transit system or using the bus stop benches. Field crews noted that no trash receptacles were available in proximity to the bus stops. Light litter was noted on occasion in parking lots or planter boxes next to a bowling alley and casino. The highest concentration of trash within the catchment area was found to be associated with loitering or encampments. While there were no encampments directly in the catchment area, there were several camps on the perimeter. Field crews noted the CC-PCH catchment area is a foot traffic corridor for encampment populations to access convenience stores.

Site CC-WC

There was minimal trash observed during the assessment conducted in the catchment area for site CC-WC. Litter was observed in the parking lot of Civic Park, but overall only a few pieces of trash were observed in the catchment area. Visual observations indicate trash receptacles and potential trash sources adjacent to the catchment area parking lot were well maintained and clean. Windblown trash was observed on the creek bank outside the catchment area near the outfall.

Table CC-4. Trash observations conducted on 10/30/23 in catchment for site CC-PCH, Pacheco

10/30/23 Observations	Latitude, Longitude	Photos
Litter in curb/gutter along Pacheco Blvd. Litter along Pacheco Blvd. was documented during pre-season and pre-storm catchment area characterizations. Litter was observed to be located next to a bus stop with no trash receptacles and was commonplace outside convenience store parking lots.	37.98298, -122.06759	
Trash in outfall. Prior to the wet season, a fire was started in the outfall selected for monitoring. Field crew adopted a common practice to inspect the outfall before monitoring and remove trash from the outfall not associated with discharge through the MS4.	37.98346, -122.06842	
Trash on banks near outfall. Single-use plastic litter was documented in the catchment during observations. Multiple convenience stores are located within the catchment.	37.98344, -122.06733	

10/30/23 Observations	Latitude, Longitude	Photos
Encampment under Center Avenue overpass next to outfall. The CC-PCH catchment area has no encampments within the drainage management area; however, there are multiple encampments on the perimeter. Litter suggests the drainage area is a corridor to and from the encampments.	37.98330, -122.06843	

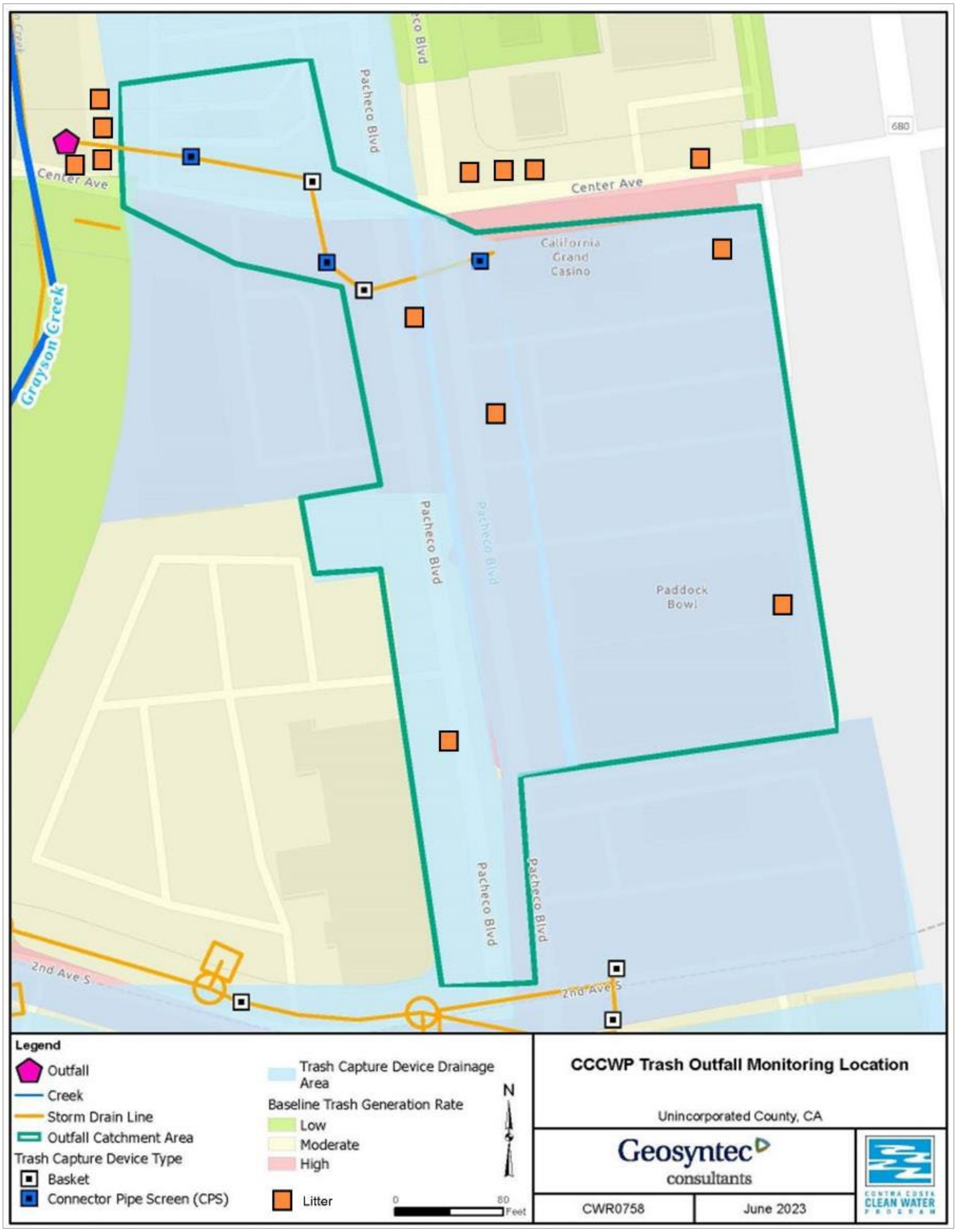


Figure CC-13. Trash locations identified in Pacheco during 10/30/23 observations for catchment CC-PCH

Table CC-5. Trash observations conducted on 10/30/23 in catchment for site CC-WC, City of Walnut Creek

10/30/23 Observations	Latitude, Longitude	Photos
Garbage bins located in the catchment area. Bins were well maintained and inspected during preseason and prestorm catchment area characterizations. Lids were secure and bins were not overflowing with trash. Correspondence with the City of Walnut Creek indicated the garbage bins are emptied at a minimum of once/week.	37.90323, -122.05961	
Catchment area and storm drain drop inlet. Litter was occasionally documented in the drainage area parking lot, curb/gutter, and on the stream banks near the outfall.	37.90333, -122.05942	
Full trash capture device maintenance. Public works department staff perform routine maintenance in drop inlet prior to the start of the WY 2024 wet season.	37.90342, -122.05941	
Drop inlet and full trash capture device after storm event. Organic material and trash are filtered out by the full trash capture device, allowing only water to discharge through the outfall until the device design standard is exceeded.	37.90342, -122.05941	

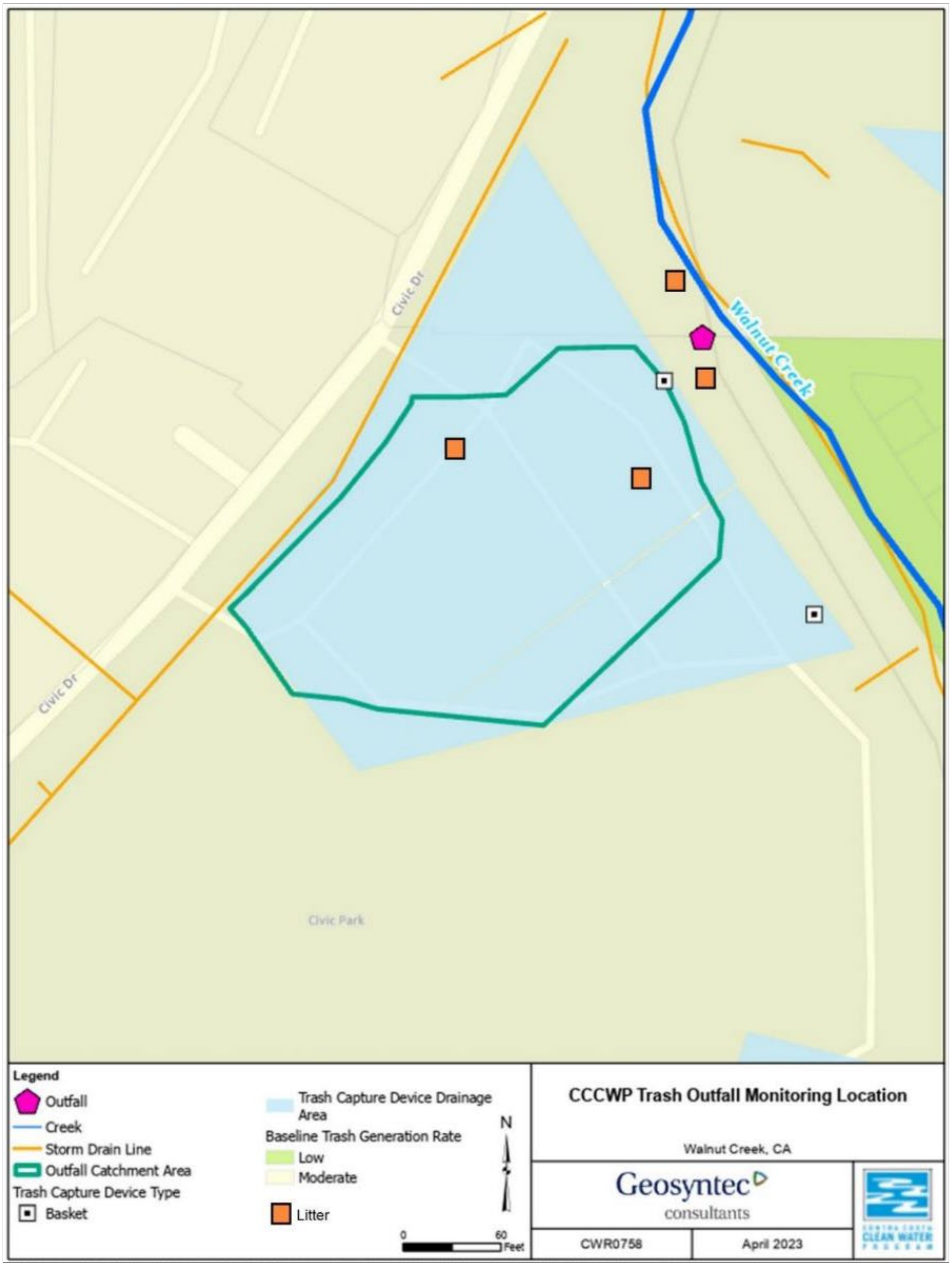


Figure CC-14. Trash locations identified in Walnut Creek during 10/30/23 observations for catchment CC-WC

B2.3.2 Trash Management Actions

Operations and maintenance records for full trash capture devices and other trash controls implemented in the monitored catchments are summarized in Table CC-6.

Table CC-6. Summary of operations and maintenance activities associated with full trash capture and other controls implemented in catchments for outfall monitoring sites

Monitored Catchment	Full Trash Capture	Other Controls
CC-PCH	Connector pipe screens and baskets are cleaned approximately once or twice a year. For WY 2024, devices were cleaned on 10/17/23 and 03/05/24.	– Improved bin container management – Enhanced street sweeping – On-land clean ups
CC-WC	Catch basin insert cleaned annually. Cleaned on 11/13/23 during WY 2024.	– Improved bin container management – On-land clean ups

CC-PCH

Email from Contra Costa County:

> *"Contra Costa County's trash management actions in the drainage area of the outfall monitoring site include street sweeping twice a month, stormwater business inspections, and servicing the full trash capture devices and auto-retractable screens that are present. As part of the stormwater business inspections, trash assessments are conducted, and notices of violations are issued for trash discharges."*

CC-WC

Email from City of Walnut Creek:

> *"The two dumpsters in the parking lot DMA are for the City Ceramics Studio building and activities. They are emptied once a week. The park is swept twice a week due to high volume of programmed Arts and Rec activities, including a senior center at the far end of the park (which has two dumpsters, serviced two times a week). The TCDs are cleaned as permit requires and as needed before storms due to the abundant tree canopy and leaf drop this time of year. The surrounding park area just outside the catchment also has separate trash and recycle bins, as well as a couple big belly solar trash/recycle compactors that hold more and keep the trash contained due to the nature of the device. Parks staff maintain the park area daily."*

B2.4 Refinements

CCCWP has no suggested refinements to trash outfall monitoring in Contra Costa County for WY 2025.

B3 SAN MATEO COUNTYWIDE CLEAN WATER PROGRAM (SMCCWP)

B3.1 Introduction

Two MS4 outfall trash monitoring locations in San Mateo County were selected for trash outfall monitoring (Figure SM-1). The first outfall location (SM-PIL) is at the upstream end of a drainage ditch adjacent to California State Route (SR) 1 that flows approximately 300 meters south to its confluence with Pilarcitos Creek in Half Moon Bay. The second outfall location (SM-SBS) is in the City of San Carlos at the upstream end of a drainage ditch that flows approximately 600 meters east, under SR 101, to its confluence at Steinberger Slough. Characteristics of each monitoring location and corresponding drainage area are provided below.

Pilarcitos Creek (SM-PIL)

Site SM-PIL is a 47-inch-diameter outfall that drains an 86-acre catchment in the City of Half Moon Bay. This catchment area consists of following urban land uses[10]: commercial (23%), K-12 schools (32%), industrial (16%); residential (12%); urban area that is not under Permittee jurisdiction (e.g., military, airports) (14%), and Caltrans Right of Way (ROW) (2%). Baseline (i.e., pre-trash control) trash generation rates for the catchment were identified as approximately 50% low, 32% moderate and 19% high/very high by area. Ninety-two percent of the catchment is treated with a High-Capacity Treatment System (CDS hydrodynamic separator). A portion of SR 1 and small area of the shopping center, both untreated, drains into the MS4 between the CDS device and the monitoring location at the outfall. Trash management actions in the catchment have resulted in reducing the trash generation rate from 8.1 (baseline) to 3.0 (current) gallons/acre/year for areas that are within Permittee jurisdiction.

The outfall at site SM-PIL is located at the north end of a narrow, manmade concrete-lined ditch that flows south along SR 1 for approximately 1,150 feet before discharging to Pilarcitos Creek (Figure SM-2). The outfall and the manmade ditch are owned by Caltrans. The outfall includes an existing concrete headwall and concrete landing area. The bottom of the ditch is concrete lined. The surrounding banks are approximately 4 feet above the channel. Sediment accumulation has allowed the channel bottom to establish dense non-native herbaceous vegetation.

Steinberger Slough (SM-SBS)

Site SM-SBS is at a 30-inch-diameter outfall that drains a 57-acre catchment area in the City of San Carlos. This catchment area consists of the following urban land uses: residential (53%), commercial/retail (18%), and industrial (24%) and urban park (5%) land uses. Less than 1% of the area is in Caltrans ROW. Baseline trash generation rates for the catchment were identified as approximately 53% low, 43% moderate and 4% high by area. A total of 31 acres (56%) is treated with Catch Basin Insert Systems (eight connector pipe screen devices) and 4 acres are treated by a private Multi-benefit Stormwater Treatment System (bioretention facility) (7%). Trash management actions in the catchment have resulted in reducing the trash generation rate from 5.7 (baseline) to 4.4 (current) gallons/acre/year.

[10] Land use data derived from ABAG (2006).

The outfall at site SM-SBS, which does not include a headwall, is located at the west end of an earthen ditch that flows approximately 1,640 feet northeast toward SR 101 (Figure SM-3). The ditch flows under the highway and continues for approximately 2,460 feet to the confluence of Steinberger Slough. The banks along the ditch are approximately 4 feet above the bottom.

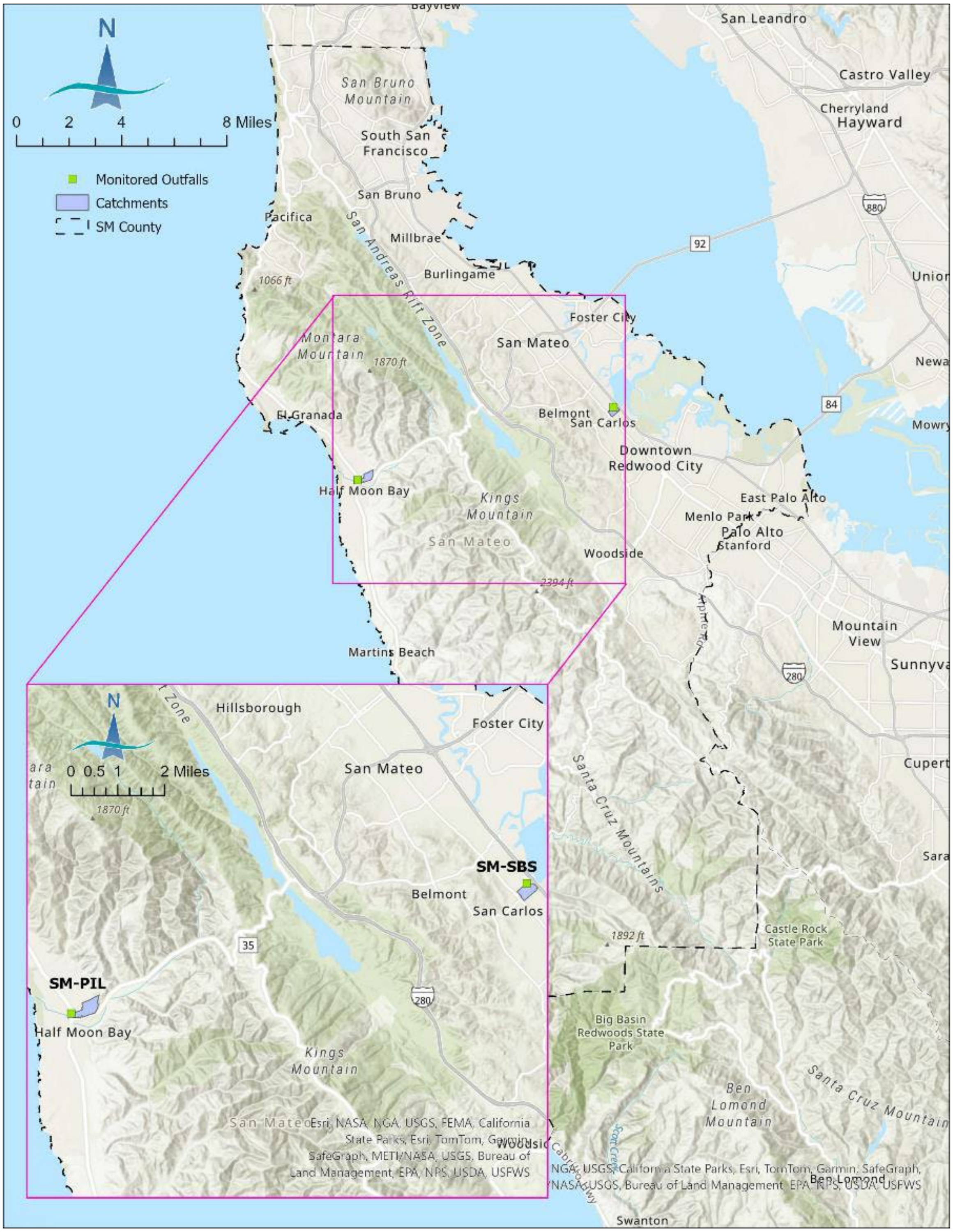


Figure SM-1. Trash outfall monitoring locations in San Mateo County

Figure SM-2. Outfall located upstream end of drainage ditch to Pilarcitos Creek, City of Half Moon Bay

Figure SM-3. Outfall located upstream of drainage ditch to Steinberger Slough, City of San Carlos

B3.2 Results

B3.2.1 Sample Events

Three sample events were conducted at the two trash outfall monitoring locations in San Mateo County during WY 2024. The sample events occurred over three different storm events. The dates and times for net deployment and retrieval and the duration of sample collection for the three sample events are presented in Table SM-1. Summary statistics for rainfall and flow for each sample event are also provided. Additional results showing rainfall totals and flow measurements for each sample event, as well as over the entire wet season, are presented in Section B3.4 below.

A summary of the three sample events for both San Mateo sites is presented below.

Storm Event 1 (November 13–20)

During the first sample event of the season for both San Mateo sites nets were deployed over a seven-day period in mid-November (Table SM-1). The predicted storm for the first sample event was delayed several days and the majority of rain arrived on the last two days of net deployment. Precipitation totals were higher at the coastal site (SM-PIL) compared to the Bay site (SM-SBS), with approximately 1.3 and 0.7 inches recorded, respectively. The sample at site SM-SBS was conducted during one of the early storms of the season (i.e., first flush). At site SM-PIL, the sample event was conducted approximately seven days after a smaller storm, when approximately 0.23 inches of rain fell over a 6-hour span on November 5, 2023. Field crews were not mobilized for this storm because the predicted forecast was below the criteria for mobilization.

Storm Event 2 (January 18–23)

Sampling Event 2 included the highest rainfall total (ranging from 2 to 3 inches) and intensity (ranging from 0.8 to 0.9 inch/hour) compared to other sample events for both sites (Table SM-1). The rainfall intensities were well above the full capture design standard storm (i.e., the one-year, one-hour storm event), which for sites SM-SBS and SM-PIL are 0.44 and 0.49 inches per hour, respectively (https://hdsc.nws.noaa.gov/hdsc/pfds/) (BAMSC 2024). Antecedent dry conditions for both sites were approximately three days. At site SM-SBS, the net was found detached from the outfall during the net retrieval visit on January 23, 2024. It is assumed that the net detached at 3:20 a.m. on January 22, based on changes in water depth measured in the pipe. As a result, the net was not attached to the outfall for the last 5.5 hours of the storm (approximately 27% of the tail end of the storm).

Storm Event 3 (January 31–February 2)

Nets were deployed at both sites for a three-day period in late-January and early-February. The third and final sample event of the season was the longest storm duration (approximately 40 hours) compared to all other sampling events (Table SM-1). The total rainfall ranged from 1.3 to 1.7 inches at sites SM-PIL and SM-SBS, respectively. Antecedent dry conditions for both sites were approximately six days.

Table SM-1. Summary of net deployment and storm period, antecedent dry period, and rainfall total and intensity for trash outfall sampling events conducted in San Mateo County during WY 2024

Site	Sample ID	Net Deploy Start Date	Net Deploy End Date	Sample Duration (Hours)	Storm Duration (Hours)	Antecedent Dry (days)	Precipitation Total (in)	Max Intensity (in/hr)
SM-PIL	Event 1	11/13/23 | 08:15	11/20/23 | 07:30	171	39	7.3	1.31	0.2
SM-PIL	Event 2	01/18/24 | 11:00	01/23/24 | 07:30	116	34	2.7	2.94	0.52
SM-PIL	Event 3	01/30/24 | 17:00	02/02/24 | 08:00	63	44	7.1	1.18	0.17
SM-SBS	Event 1	11/13/23 | 09:30	11/20/23 | 08:30	167	6	>30	0.71	0.25
SM-SBS	Event 2	01/18/24 | 10:00	01/22/24 | 03:20 [1]	89	15	3.2	2.09	0.45
SM-SBS	Event 3	01/30/24 | 16:00	02/02/24 | 09:00	65	40	6.3	1.68	0.18

1 Net was found detached on retrieval date/time (1/23 at 9:00); assume net detached on 1/22 at 03:20, based on changes in water depth measured in the pipe. If these assumptions are correct, the net was attached approximately 73% of the duration for the combined two storm peaks.

B3.2.2 Trash Characterization

Trash collected at both sites for all three sample events were sorted into 13 trash categories and measured for volume (Table SM-2). The highest volume of trash for each site was collected during Event 1 (5.7 gallons at SM-PIL; 2.9 gallons at SM-SBS). Five gallons of trash were also measured at site SM-PIL for Event 2, which was the storm with highest rainfall total and intensity. In contrast, the lowest volume of trash occurred at site SM-SBS (0.4 gallons) for Event 2. The net detached during the peak of the storm at this site, which in part may have contributed to the lower trash volume. The net was found cinched closed in the channel, suggesting that trash loss during each detachment was minimal.

Table SM-2. Trash volume measured for thirteen trash types that were identified from trash samples collected at 2 outfall monitoring locations in San Mateo County

		SM-PIL				SM-SBS			
	Trash Type	**Event 1**	**Event 2**	**Event 3**	**Total**	**Event 1**	**Event 2**	**Event 3**	**Total**
Plastic Trash Items (oz)	Single-Use Carryout Plastic Bags	0	0	0	0	0	0	0	0
	Expanded Polystyrene (EPS) Foam	0	0	0	0	0	0	0	0
	(EPS) Foam Other	14	22	28	64	40	3	4	48
	Single Use Plastic Food / Drink Ware	12	40	0	52	6	1	3	10
	Smoking Products, Traditional	6	2	2	10	1	0	0	1
	Smoking Products, Other	12	3	0	15	20	5	2	27
	Other plastic Items / Pieces	600	520	102	1,222	297	36	105	439
Non-Plastic Trash (oz)	Organic / Paper	60	24	27	111	2	0	0	2
	Fabric	12	16	5	33	9	3	2	13
	Metal	14	12	12	38	0	0	0	0
	Glass	0	0	0	0	0	0	0	0
	Mixed	0	0	0	0	0	0	0	0
	Biohazard	0	0	0	0	0	0	0	0
	Ounces	730	638	177	1,545	374	49	117	539
	Total Gallons	5.7	5.0	1.4	12.1	2.9	0.4	0.9	4.2
	Total Gallons/acre	0.08	0.07	0.02	0.14	0.05	0.01	0.02	0.07
	Average Gallons/event	4.0				1.4			

The total volume of trash collected in each sample, standardized for area, is shown in Figure SM-4. The highest trash volume per unit area occurred at site SM-PIL for Events 1 and 2, 0.08 and 0.07 gallons per acre, respectively. The highest trash volume for site SM-SBS occurred during Event 1 (0.05 gallons per acre). Estimated annual trash loading rates for both sites are presented in Table 6, Section 3.4.4.

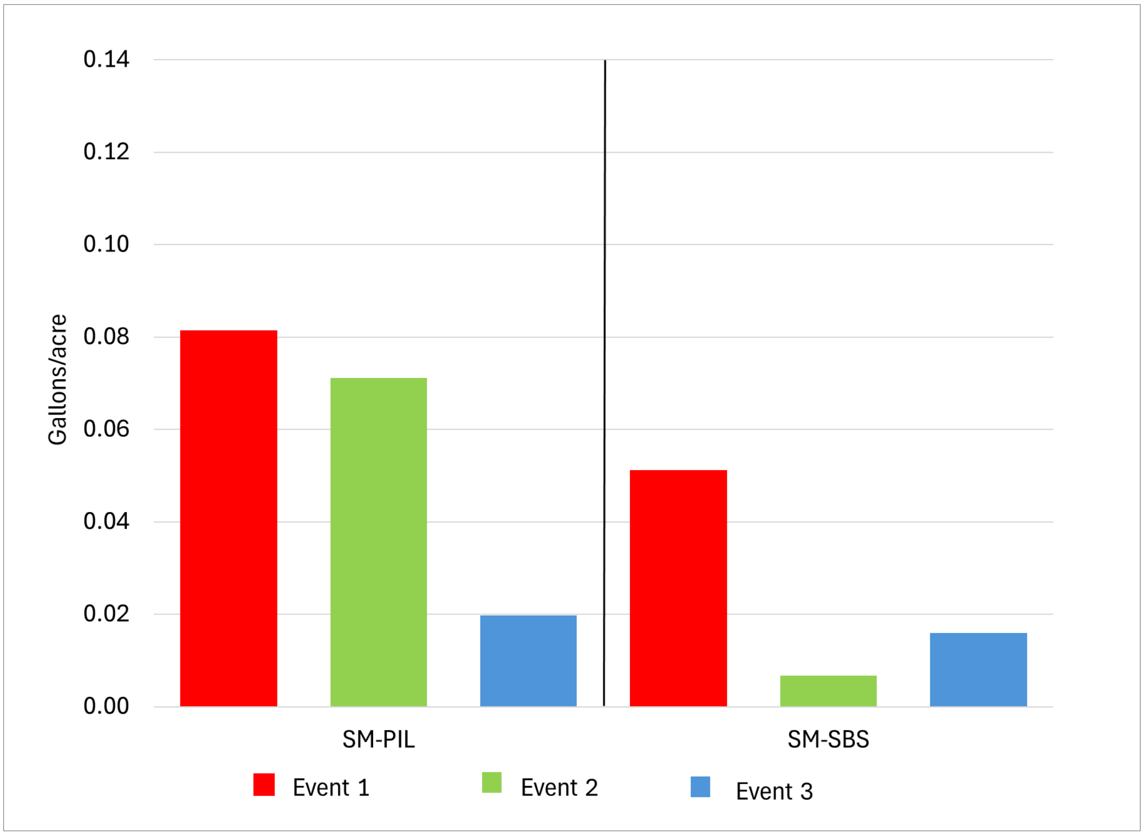


Figure SM-4. Trash volumes standardized by area for 6 sample events at 2 monitoring sites in San Mateo County

The most common trash type was plastic, of which there are six separate type categories. The total volume for the combined six plastic trash categories presented in Table SM-2 accounted for 88% and 97% of the trash collected for combined three sample events at sites SM-PIL and SM-SBS, respectively (Figure SM-5). The most common type of plastic trash was "*Other Plastic Items/Pieces*" which accounted for 93% and 82% of all plastic trash items for sites SM-PIL and SM-SBS, respectively (Figure SM-6). The "*Other Plastic Items/Pieces*" category includes plastic packaging for food and beverage goods purchased at convenience and grocery stores. The combined plastic items "*Single Use Plastic Food/Drink Ware*", "*Expanded Polystyrene* (*EPS) Foam Food Ware*" and "*Single Use Plastic Bags*" accounted for about 2% of the plastic trash items for both sites. Existing County and State ordinances ban the distribution of these three categories of trash in the San Francisco Bay Area. "*EPS Foam Other"* accounted for approximately 11% of the plastic items at site SM-SBS and 2% of plastic items at site SM-PIL. Smoking products accounted for approximately 3% to 5% of plastic items at each site.

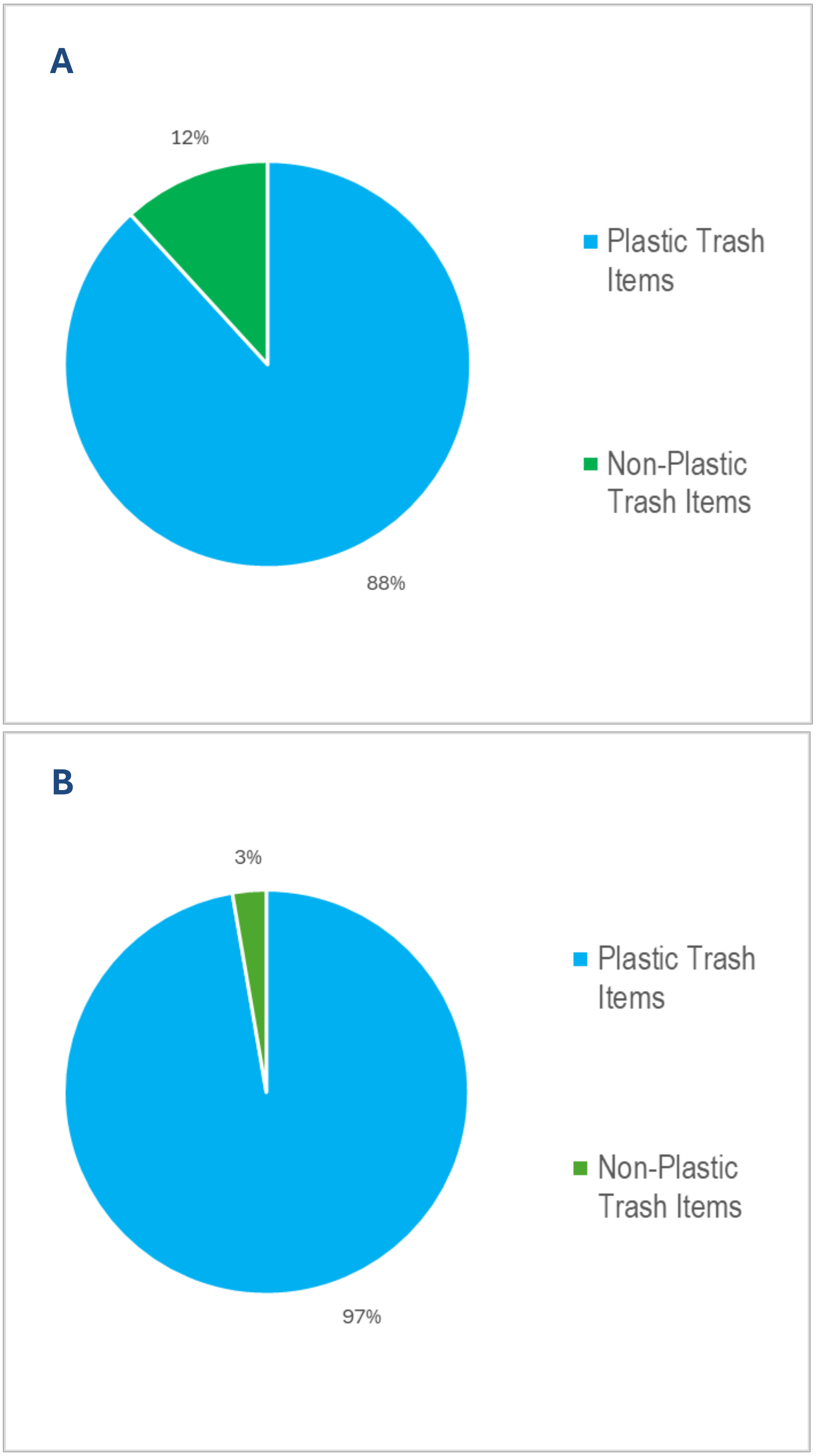
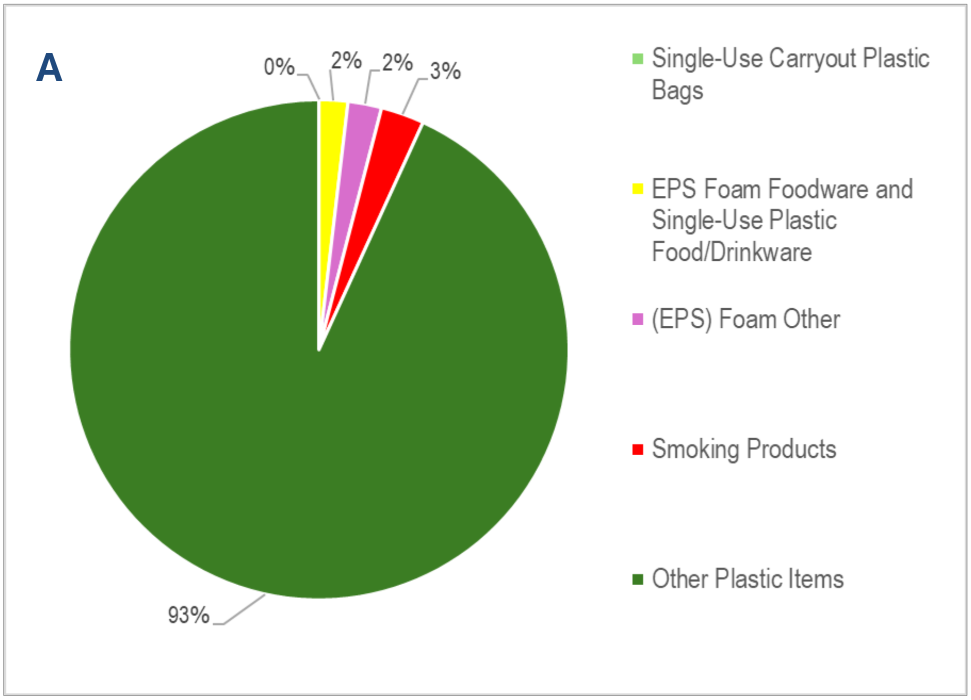


Figure SM-5. Comparison of plastic versus non-plastic trash items measured for all 3 storm events at sites A) SM-PIL and B) SM-SBS



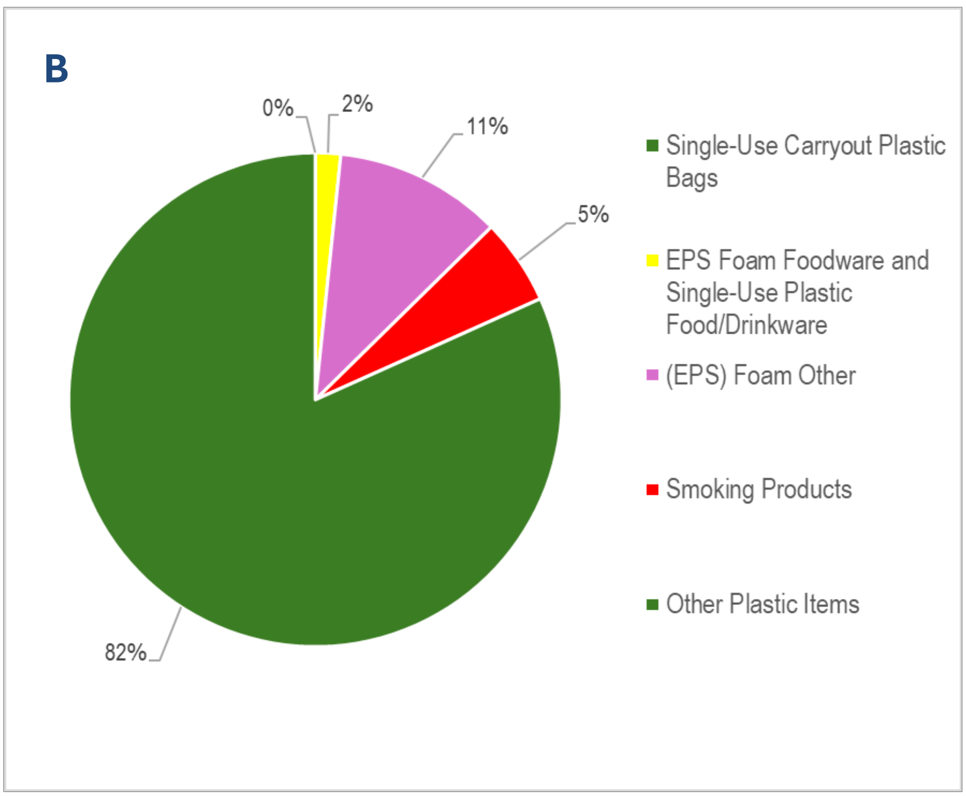


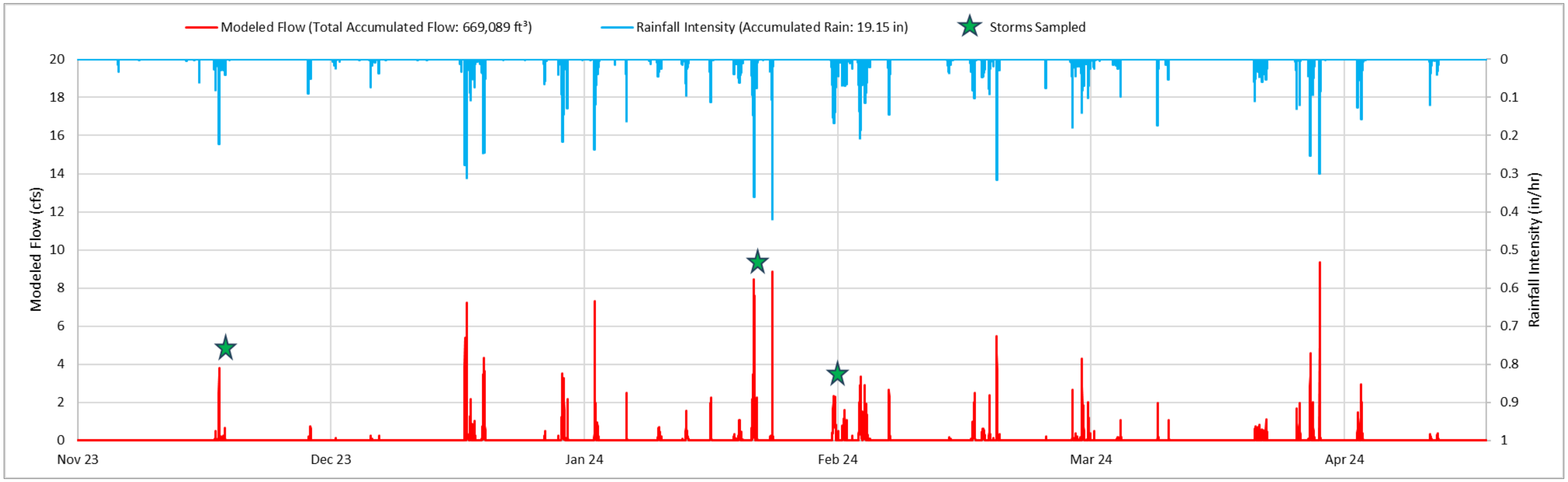
Figure SM-6. Comparison of plastic trash items measured for all 3 storm events at sites A) SM-PIL and B) SM-SBS

B3.2.3 Rainfall and Flow

Rainfall data was compiled from Weather Underground stations in proximity to catchment areas for site SM-PIL (20 stations) and site SM-SBS (12 stations). Rainfall totals were calculated using an inverse distance squared weighted average. Rainfall totals for each site over the wet season of WY 2024 are presented in Figure SM-7.

Depth sensors were deployed in the MS4 pipe at both sites in San Mateo County. However, the data from these sensors did not accurately represent flow due to channel conditions (i.e., low gradient and dense vegetation) that caused water to back up into the outfalls during storms. In addition, tidal influences significantly affected water depth at site SM-SBS. As a result, the Manning's Equation was not used to calculate flows at either station. For both sites in San Mateo County, flow rates were calculated using the rainfall-runoff model described in Section 3.2.6. Modelled flows were used to develop annual hydrographs for both sites (Figure SM-7).

Plots of rainfall and flow data for each sample event are shown in Figures SM-8 (Site SM-PIL) and SM-9 (Site SM-SBS). The sampling period is indicated in both figures.

A


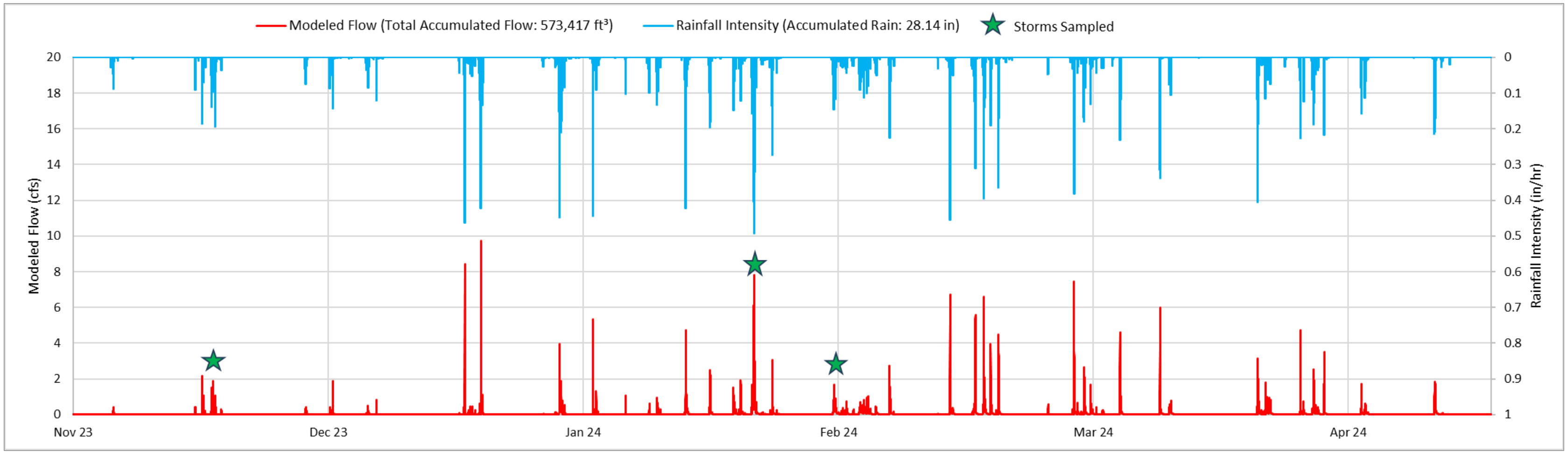
B


Figure SM-7. Annual hydrographs for 2 trash outfall monitoring sites in San Mateo County: A) SM-PIL and B) SM-SBS

Event Hydrographs

Hydrographs showing rainfall and the net deployment period for the three sample events at SM-PIL (Figure SM-8) and SM-SBS (Figure SM-9) are shown below.

Figure SM-8. Hydrographs for 3 sample events at site SM-PIL

Top: Event 1 Middle: Event 2 Bottom: Event 3

Figure SM-9. Hydrographs for 3 sample events at site SM-SBS

Top: Event 1 Middle: Event 2 Bottom: Event 3

B3.3 Investigation of Trash Generation

A summary of the visual observations of trash sources in the monitored catchments is provided in the section below.

B3.3.1 Catchment Assessments

Visual observations of trash sources in the catchment areas for sites SM-PIL and SM-SBS were conducted on September 24, 2023. A description for each of the catchment areas is provided above in Section B3.1. A summary of the observations and known operation and maintenance records is provided for each site below.

Site SM-PIL

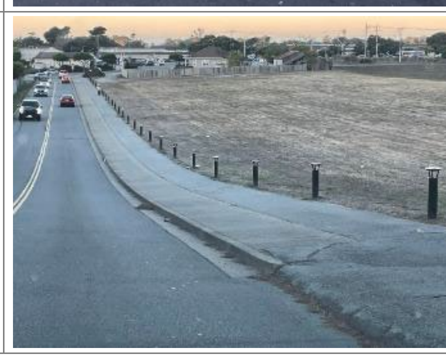
Littered and/or windblown trash were observed along the tops of the banks of the ditch adjacent to a pedestrian/bicycle pathway just downstream of the outfall (Table SM-3 and Figure SM-10). There was some larger trash items associated with dumping just below the outfall. Additional litter was observed within the catchment area along the pathway adjacent to Lewis Foster Drive between Main Street and the high school. Some trash was also observed near dumpsters behind the New Leaf Community Market.

Site SM-SBS

There was minimal trash observed during the assessment conducted in the catchment area for site SM-SBS. Litter was observed along both sides of the Caltrans ditch to which the outfall discharges. This litter appeared to have been transported by wind from the adjacent roadway and the parking lot of the nearby In-N-Out restaurant (Table SM-4 and Figure SM-11), rather than through the MS4. One of the catch basins in the catchment area located just upstream of the outfall, which contained a Connector Pipe Screen, was full of paper and plastic waste from the adjacent In-N-Out restaurant. City of San Carlos staff later reported that all catch basins in the catchment were cleaned out on November 7, 2023, about one week prior to first sampling event.

Very little litter was observed on the streets within the catchment, except for a few pieces of trash observed on the corner of Holly Street and Industrial Road, near the gas station. Some litter was observed in the parking lot of Laureola Park. Visual surveys of industrial and commercial businesses along San Carlos Way and Old County Road indicate trash dumpsters and surrounding parking lots were well maintained and clean.

Table SM-3. Trash assessment in catchment for site SM-PIL, in the City of Half Moon Bay, during WY 2024

Observations during survey	Latitude, Longitude	Photos
Dumping of trash in ditch below outfall (wooden pallet, fabric) Note: trash was removed from below outfall to prevent entanglement of net.	37.469267, -122.433784	
Litter on sides of ditch and along pedestrian footpath/Hwy 1 (plastic bags, bottles).	37.468921, -122.433804	
Trash next to dumpsters behind New Leaf Market on Main St (plastic bags, Styrofoam).	37.469097, -122.432460	
Litter along Lewis Foster Dr, between Main St and HMB high school (plastic bottles, food wrappers).	37.470279, -122.430384	

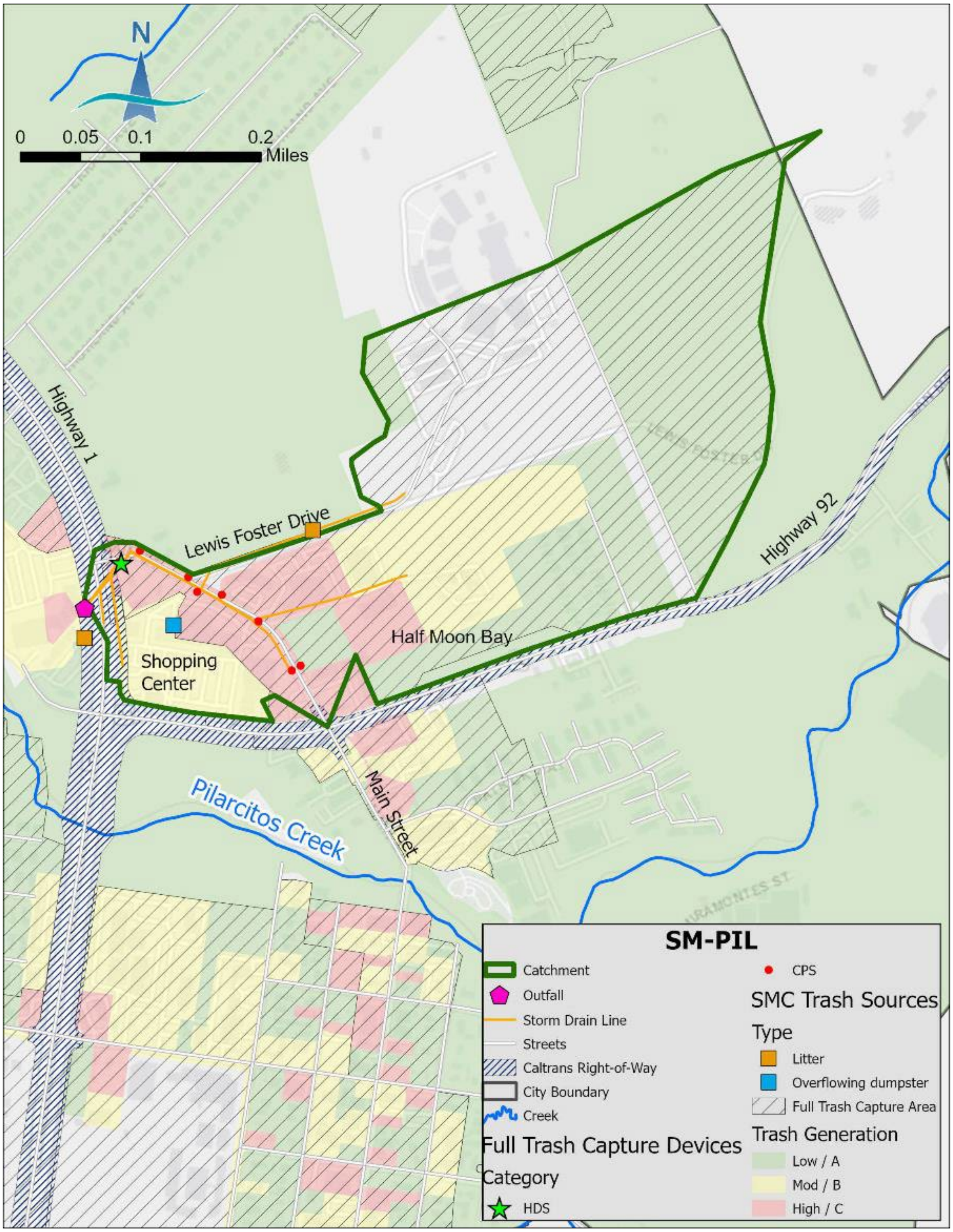


Figure SM-10. Trash sources identified in the City of Half Moon Bay during trash assessment for catchment SM-PIL

Table SM-4. Trash assessment in catchment for site SM-SBS, in the City of San Carlos, during WY 2024

Location and Type of Trash	Latitude, Longitude	Photos
Trash on sides of ditch near outfall; windblown litter from parking lot of In-N-Out restaurant and adjacent roadway.	37.512314, -122.257832	
Trash in catch basin near In-N-Out Note: inlets were cleaned out one week prior to the first monitoring event).	37.512218, -122.258016	
Litter on the corner of Holly and Industrial near 76 gas station.	37.512013, -122.258154	
Litter at the parking lot of Laureola Park.	37.509109, -122.259799	

Figure SM-11. Trash sources identified in the City of San Carlos, during trash assessment for catchment SM-SBS

B3.3.2 Trash Management Actions

Operations and maintenance records (where available) for full trash capture devices and other trash controls implemented in the monitored catchments are summarized in table SM-5.

Table SM-5. Summary of operations and maintenance activities associated with full trash capture and other controls implemented in catchments for outfall monitoring sites

Monitored Catchment	Full Trash Capture	Private Land Development Area Program – Trash Generation (acres)	Other Controls
SM-SBS	Connector Pipe Screens are cleaned annually; cleaned on 11/07/23 during WY2024 Privately owned LID; inspection records not available.	– Moderate (4.7)	– Enhanced street sweeping – On-land clean ups – Storm drain cleaning
SM-PIL	CDS hydrodynamic separator is cleaned annually; cleaned on 10/20/23 during WY2024 Connector Pipe Screens are cleaned annually; cleaned on 10/16/23 through 10/19/23 during WY2024	– Moderate (8.3) – High (0.16)	– Improved bin container management – Enhanced street sweeping – On-land clean ups

LID = low impact development

B3.4 Refinements

The following refinements to trash outfall monitoring will be implemented in San Mateo County.

Flow Measurements

An evaluation of the water level sensor records from the wet season of WY 2024 at site SM-SBS indicated that flows could not be accurately measured due to standing water conditions at the outfall. The source of the water is presumed to be combination of tidal influence and ground water seepage due to close proximity to SF Bay. There are no manholes that can be feasibly and safely accessed along the storm drain system upstream of the outfall due to busy road conditions. As a result, water depth will not be measured at this outfall location during WY 2025. Flows will be calculated using the rainfall-runoff model.

Similar standing water conditions were observed at site SM-PIL. Low gradient and a depression in the ditch below the outfall created a pool of standing water at the outfall where the water depth sensor was installed in WY 2024. The depth sensor will be relocated approximately 100 meters downstream of the outfall in the ditch to measure flow during the wet season of WY 2025.

B4 SANTA CLARA VALLEY URBAN RUNOFF POLLUTION PREVENTION PROGRAM (SCVURPPP)

B4.1 Introduction

Three MS4 outfall trash monitoring locations in Santa Clara County were selected for trash outfall monitoring (Figure SC-1). The first outfall location (SC-SFC) is in the City of Palo Alto approximately 70 meters west of El Camino Real. The outfall discharges directly into San Francisquito Creek. The second outfall location (SC-STE) is in the City of Mountain View approximately 50 meters west of El Camino Real. The outfall discharges directly into Stevens Creek. The third outfall location (SC-COY) is in the City of San Jose approximately 1 kilometer southeast of Interstate (I) 280. The outfall discharges directly into Coyote Creek. Characteristics of each monitoring location and corresponding drainage area are provided below, with photos included in Figures SC-2, SC-3, and SC-4).

San Francisquito Creek (SC-SFC)

Site SC-SFC is a 42-inch diameter outfall that drains a 60-acre catchment in the City of Palo Alto. The catchment area contains the following urban land uses[11]: commercial (91%), parks (6%) and urban areas that are not under Permittee jurisdiction (3%). The commercial area includes the Stanford Shopping Center and the Hoover Medical Campus.

Baseline (i.e., pre-trash control) trash generation rates for the catchment were identified as approximately 21% low and 79% moderate. A total of 7 acres (11%) of the catchment is treated with three Multi-benefit Stormwater Treatment System projects that provide full trash capture treatment. All three projects implement bioretention treatment measures. Trash reduction from actions equivalent to full trash capture systems have been documented at four street locations surrounding the catchment using the On-land Visual Trash Assessment (OVTA) methodology. Trash management actions in the catchment have resulted in reducing the trash generation rate from 6.6 (baseline) to 4.95 (current) gallons/acre/year for areas within Permittee jurisdiction.

The outfall at site SC-SFC is located on the eastern bank of San Francisquito Creek on land owned by Stanford University. The outfall has a concrete headwall and landing that is approximately 5 feet above the high-water mark and 15 feet below the top of the bank and discharges directly into the creek (Figure SC-2). The outfall is located within a steep embankment that is wooded and has an understory characterized by dense vegetation and non-native herbs.

Stevens Creek (SC-STE)

Site SC-STE is at a 54-inch-diameter outfall that drains a 137-acre catchment area in the City of Mountain View. This catchment area consists of the following urban land uses: residential (73%), commercial/retail (24%) and Caltrans (SR 87) (3%). Baseline trash generation rates for the catchment were identified as approximately 74% low, 13% moderate and 13% high by area. A total of 12 acres (10%) is treated with one High-Capacity Flow System (i.e., hydrodynamic separator) and one Multi-benefit Stormwater Treatment System (bioretention). Both full capture devices are on privately owned land. Trash reduction from other trash controls in the watershed has been

[11] Land use data derived from ABAG (2006).

documented using OVTA survey data. A major management action in the catchment was the relocation of a large homeless community living in recreational vehicles. Large vehicle parking restrictions were added and the MS4 system was flushed. Trash management actions in the catchment have resulted in reducing the trash generation rate from 5.7 (baseline) to 3.0 (current) gallons/acre/year for areas within Permittee jurisdiction.

The outfall at site SC-STE is located 200 meters south of El Camino Real, on land owned by the City of Mountain View. The outfall is located within concrete bank armoring but does not include an existing concrete headwall nor a concrete landing area. The outfall is approximately 2.5 meters above the channel high water mark and 3 meters below the top of the bank and discharges directly into Stevens Creek (Figure SC-3). The bottom of the creek in the surrounding area is a combination of natural and manmade structure (i.e., Sakrete). A mix of woody vegetation and non-native herbs are present at the top of the bank, adjacent to the armoring. Sediment accumulation has allowed the channel bottom to establish dense, herbaceous vegetation.

Coyote Creek (SC-COY)

Site SC-COY is at a 60-inch diameter outfall that drains a 400-acre catchment area in the City of San Jose. This catchment area consists of the following land uses: industrial (57%), commercial/retail (22%), and park land (6%) and non-urban (15%).

Baseline trash generation rates for the catchment were identified as approximately 22% low, 74% moderate and 4% high by area. A total of approximately 200 acres (51%) is treated with one High-Capacity Flow System (i.e., hydrodynamic separator) and less than 1% of the catchment area is treated by a private Multi-benefit Stormwater Treatment System (bioretention facility). Trash reduction from other trash controls for the remaining 200 acres in the catchment has been documented using OVTA survey data. Trash management actions in the catchment have resulted in reducing the trash generation rate from 7.4 (baseline) to 5.6 (current) gallons/acre/year[12].

The outfall at site SC-COY is located on the western bank of Coyote Creek, near the Japanese Gardens in Kelley Park, owned by City of San Jose. This outfall does not contain a headwall but does have a wide landing area protected with riprap. The outfall is approximately 5 feet above the channel high water mark and 5 feet below the top of the bank and discharges directly into the creek (Figure SC-4). The outfall is situated in a lower portion of the levee along Coyote Creek. Vegetation in the armoring and below the outfall is sparse, consisting of nonnative herbs, and trees at the ordinary high-water mark.

[12] During WY 2024, the City of San Jose conducted visual trash assessments in several privately owned parcels within the catchment area of site SC-COY as part of their Private Land Developed Area (PLDA) Program. The result of these assessments reduced an additional 15 acres of moderate and high trash generation to low trash generation. These actions reduced the overall trash generation rate for the entire catchment to less than 5 gallons/acre/year.

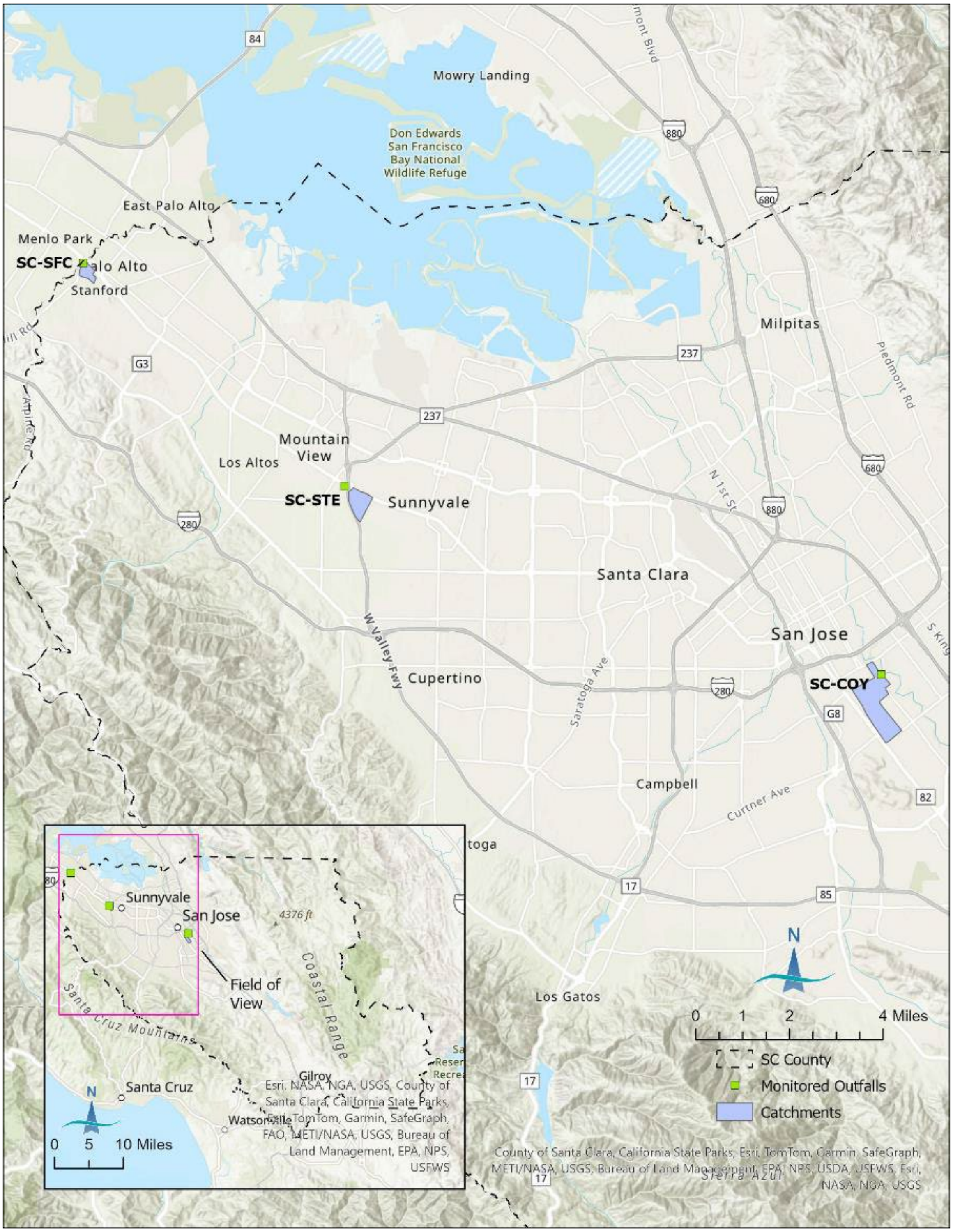


Figure SC-1. Trash outfall monitoring locations in Santa Clara County

Figure SC-2. Outfall located above San Francisquito Creek, City of Palo Alto

Figure SC-3. Outfall above Stevens Creek, City of Mountain View

Figure SC-4. Outfall above Coyote Creek, City of San Jose

B4.2 Results

B4.2.1 Sample Events

Three sample events were conducted at each of the three trash outfall monitoring locations in Santa Clara County during WY 2024. The sample events occurred over six different storm events. Three attempts to collect the samples at sites SC-COY and SC-STE were unsuccessful due to vandalism or equipment failure. The dates and times for net deployment and retrieval and the duration of sample collection for all successful sample events are presented in Table SC-1. Summary statistics for rainfall and flow for each sample event are also provided. Additional results showing rainfall totals and flow measurements for each sample event, as well as over the entire wet season, are presented in Section B4.2.3 of this attachment.

A summary of sampling efforts during each of the six targeted storm events is presented below.

Storm Event 1 (November 13–20)

Trash nets were deployed at all three sites over a seven-day period in mid-November (Table SC-1). The predicted storm was delayed over several days and the majority of rain arrived on the last two days of the net deployment. The first trash samples of the season were collected at sites SC-STE and SC-SFC, however the net was vandalized at site SC-COY, and the sample was lost. Total precipitation was about 0.55 inches at both sites SC-SFC and SC-STE. The samples collected at these two sites occurred during the first significant storm event of the season (i.e., at least 0.25 inches over 24 hours).

Storm Event 2 (December 15–18)

The first successful sample event of the season conducted at site SC-COY was during a 26-hour storm in mid-December (Table SC-1). The storm occurred after nearly one month of antecedent dry conditions. The total precipitation for the storm was approximately 0.46 inches. The storm was the second significant storm of the season at this location.

Storm Event 3 (December 29–January 2)

The second sample event for site SC-COY occurred during a short nine-hour storm at the end of December (Table SC-1). The storm was approximately nine days after the previous storm. The total precipitation for the storm was approximately 0.98 inches. A trash net was also deployed at site SC-STE during this storm; however, the net detached from the outfall early in the storm due to equipment malfunction. There was very little material captured within the net and the trash was not used as a sample.

Storm Event 4 (January 18–23)

Nets were deployed at all three sites in Santa Clara County over a six-day period in mid-January (Table SC-1). This sampling event was the second of the season for sites SC-STE and SC-SFC, and the third and final of the season for site SC-COY. The forecast predicted a storm that would exceed the design storm at all Santa Clara three sites. The sample event included one small storm followed by a much larger storm, with a combined 20 hours in duration across the sample event.

The total precipitation across the three sites ranged from 1.0 to 1.5 inches. The peak rainfall intensity was highest at site SC-SFC (0.71 inches), which exceeded the design standard storm (i.e., 0.37 inches). At sites SC-COY and SC-STE, peak rainfall intensity ranged between 0.27 to 0.3 inches/hour, both below the design standard storm. Antecedent dry conditions for all three sites were approximately three days.

The nets at sites SC-STE and SC-SFC detached during the peak intensity of the second storm peak, approximately 6 hours prior to the end of the overall storm event. As a result, nets at these two sites captured approximately 70–75% of the combined two storm peaks.

Storm Event 5 (January 31–February 2)

Nets were deployed at sites SC-SFC and SC-STE for a three-day period in late-January and early-February (Table SC-1). The storm was approximately 48 hours with a rainfall total of approximately 1.5 inches. Antecedent dry conditions for site SF-SFC were approximately seven days. The net at site SC-STE was vandalized, and as a result, no sample was collected at SC-STE during the storm event.

Storm Event 6 (February 29–March 4)

The last sample event of the season occurred at site SC-STE in late February and early March. The storm was approximately 59 hours, which was the longest compared to all other sampling events (Table SC-1). The total rainfall was 1.26 inches at the site. Antecedent dry conditions for the site were approximately nine days.

B4.2.2 Trash Characterization

Trash collected during the nine sample events across at the three outfall monitoring sites were sorted into 13 trash categories and measured for volume (Table SC-2). The highest volumes of trash for sites SC-SFC and SC-STE were collected during the first sample event, 12.7 gallons and

12.5 gallons, respectively. The two highest volumes of trash for SC-COY were collected during its first and third sample event, with approximately 12.1 gallons of trash for each event.

The three the lowest trash volumes occurred at site SC-STE (0.5 gallons, Event 2) and site SC-SFC (1.7 gallons, Event 2 and 0.6 gallons, Event 3). The net detached during the peak of the storm during Event 2 at both sites, which in part may have contributed to the lower trash volumes. However, both nets were found cinched closed in the channel, suggesting that trash loss during each detachment was minimal.

The total volume of trash collected in each sample, standardized for area, is shown in Figure SC-5. The highest trash volume per unit area occurred at site SC-SFC for Event 1 (0.21 gallons per acre). The highest trash volume for site SC-STE also occurred during Event 1 (0.09 gallons per acre). The highest trash volume for site SC-COY occurred during Event 1 and Event 3 (0.03 gallons per acre). Estimated annual trash loading rates for all three sites are presented in Table 6, Section 3.4.4 of the main *Annual Trash Outfall Monitoring Progress Report for WY 2024* (i.e., main report).

Table SC-1. Summary of net deployment and storm period, antecedent dry period, and rainfall total and intensity for trash outfall sampling events conducted in Santa Clara County during WY 2024

Site	Sample ID	Net Deploy Start Date	Net Deploy End Date	Sample Duration (hours)	Storm Duration (hours)	Antecedent Dry (days)	Precipitation Total (in)	Max Intensity (in/hr)
SC-SFC	Event 1	11/13/23 | 10:00	11/20/23 | 09:15	167	6	>43	0.54	0.20
SC-SFC	Event 2	01/18/24 | 08:45	01/22/24 | 04:30 [1]	92	16	3	1.54	0.71
SC-SFC	Event 3	01/30/24 | 15:00	02/02/24 | 10:20	67	48	7	1.55	0.19
SC-STE	Event 1	11/13/23 | 10:40	11/20/23 | 11:00	168	15	>48	.55	0.12
SC-STE	Event 2	01/18/24 | 10:00	01/23/24 | 04:00 [2]	121	14	3	1.04	0.30
SC-STE	Event 3	02/29/24 | 07:45	03/04/24 | 07:00	95	59	9	1.26	0.19
SC-COY	Event 1	12/15/23 | 09:30	12/18/23 | 12:30	75	26	29	.46	0.18
SC-COY	Event 2	12/29/23 | 08:00	01/02/24 | 07:15	95	9	9	.98	0.21
SC-COY	Event 3	01/18/24 | 06:45	01/23/24 | 11:45	125	20	4	1.52	0.27

1 Net was found detached on retrieval date/time (1/23 at 9:45); assume net detached on 1/22 at 4:30, based on changes in water depth measured in the pipe; and storm ended at 10:00 am. If these assumptions are correct, the net was attached approximately 75% of the duration for the combined two storm peaks.

2 Net was found detached on retrieval date/time (1/23 at 10:45); assume net detached on 1/22 at 4:00, based on changes in water depth measured in the pipe; and storm ended at 10:45 am. If these assumptions are correct, the net was attached approximately 70% of the duration for the combined two storm peak.

Table SC-2. Trash volume measured for 13 trash types identified from trash samples collected at 3 outfall monitoring locations in Santa Clara County

	Trash Type	SC-SFC				SC-STE				SC-COY			
		Event 1	Event 2	Event 3	Total	Event 1	Event 2	Event 3	Total	Event 1	Event 2	Event 3	Total
Plastic Trash Items (oz)	Single-Use Carryout Plastic Bags	29	0	0	29	0	0	0	0	0	0	50	50
	Expanded Polystyrene (EPS) Foam	43	0	0	43	3.4	0	24	27	16	48	32	96
	(EPS) Foam Other	58	85	0.3	144	142	1.7	32	176	78	171	256	505
	Single Use Plastic Food / Drink Ware	334	45	1.7	381	222	32	123	378	78	79	72	229
	Smoking Products, Traditional	0.5	0.2	1	1.7	3.4	0.7	1.7	5.8	2.5	1.7	1.7	6
	Smoking Products, Other	36	0.03	1.7	38	16	0	6	22	8.5	2	4.2	15
	Other plastic Items / Pieces	970	88	65	1123	973	27	371	1371	920	199	982	2101
Non-Plastic Trash (oz)	Organic / Paper	29	0.03	1.7	31	6.8	1.7	15	23.5	18	6	5	29
	Fabric	40	3.4	0	43	142	0	20	162	40	16	40	96
	Metal	55	0.7	0.3	56	100	1	17	118	363	17	96	476
	Glass	0	0	0	0	0	0	0	0	0	0	0	0
	Mixed	0	0	0	0	10	0	7	17	20	48	16	84
	Biohazard	0	0	0	0	0	0	2	2	1	0	0	1
	Ounces	1,594	222	72	1888	1,620	64	619	2303	1545	587	1555	3687
	Total Gallons	12.5	1.7	0.6	14.8	12.7	0.5	4.8	18	12.1	4.6	12.2	28.8
	Total Gallons/acre	0.21	0.03	0.01	0.25	0.09	0.004	0.035	0.13	0.03	0.01	0.03	0.06
	Average Gallons/event	4.9				6.0				9.6			

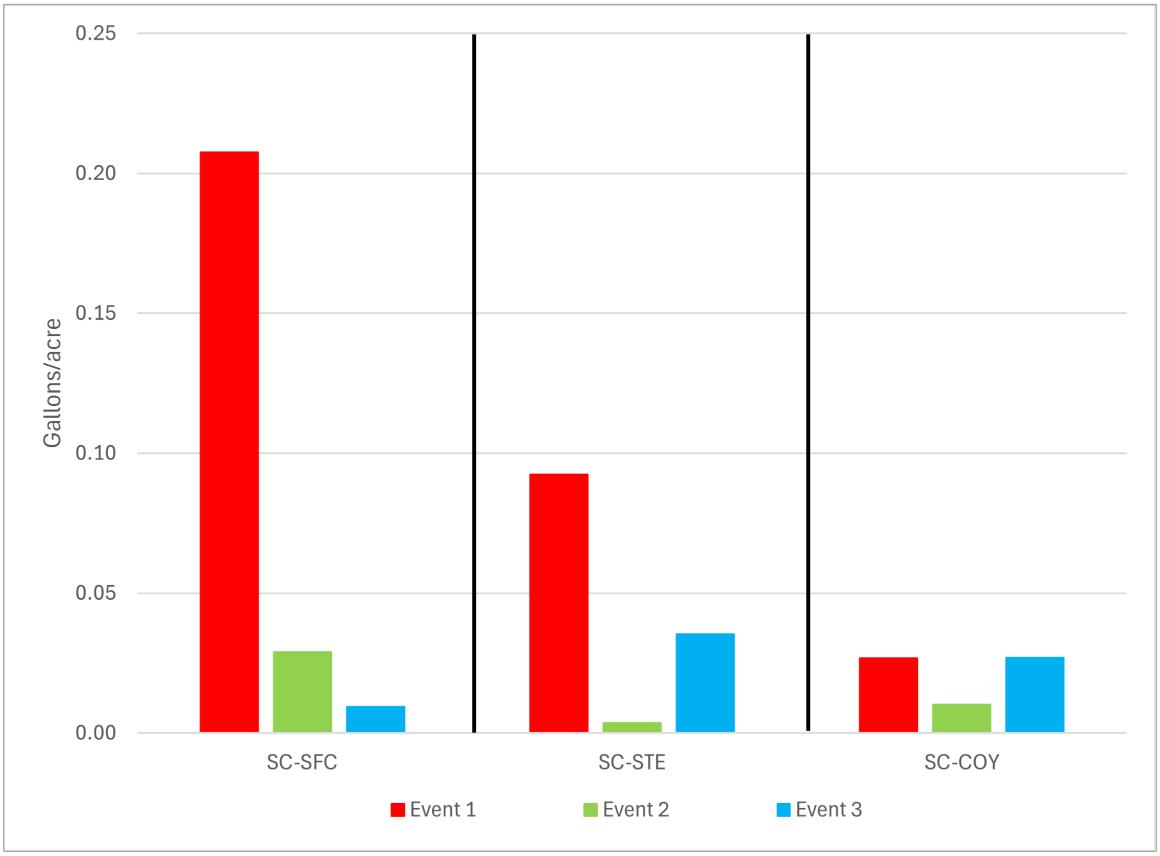


Figure SC-5. Trash volumes standardized by area for 6 sample events at 3 monitoring sites in Santa Clara County

The most common trash type was plastic, of which there are six separate type categories. The total volume for the combined six plastic trash categories presented in Table SC-2 accounted for 93%, 86%, and 81% of the trash collected for combined six sample events at sites SC-SFC, SC-STE, and SC-COY, respectively (Figure SC-6). The most common type of plastic trash was "*Other Plastic Items/Pieces*" which accounted for 64%, 69%, and 70% of all plastic trash items for sites SC-SFC, SC-STE, and SC-COY, respectively (Figure SC-7). The "*Other Plastic Items/Pieces*" category includes plastic packaging for food and beverage goods purchased at convenience and grocery stores. The combined plastic items "*Single Use Plastic Food/Drink Ware*", "*Expanded Polystyrene (EPS) Foam Food Ware*" and "*Single Use Carryout Plastic Bags*" accounted for approximately 12% of the plastic items at site SC-COY, 20% of plastic items at site SC-STE, and 25% of the plastic items SC-SFC. Existing County and State ordinances ban the distribution of these three categories of trash in the San Francisco Bay Area. "*EPS Foam Other"* accounted for approximately 8% of the plastic items at sites SC-SFC and SC-STE and 17% of plastic items at site SC-COY. Smoking products accounted for approximately 1% to 2% of plastic items at each site.

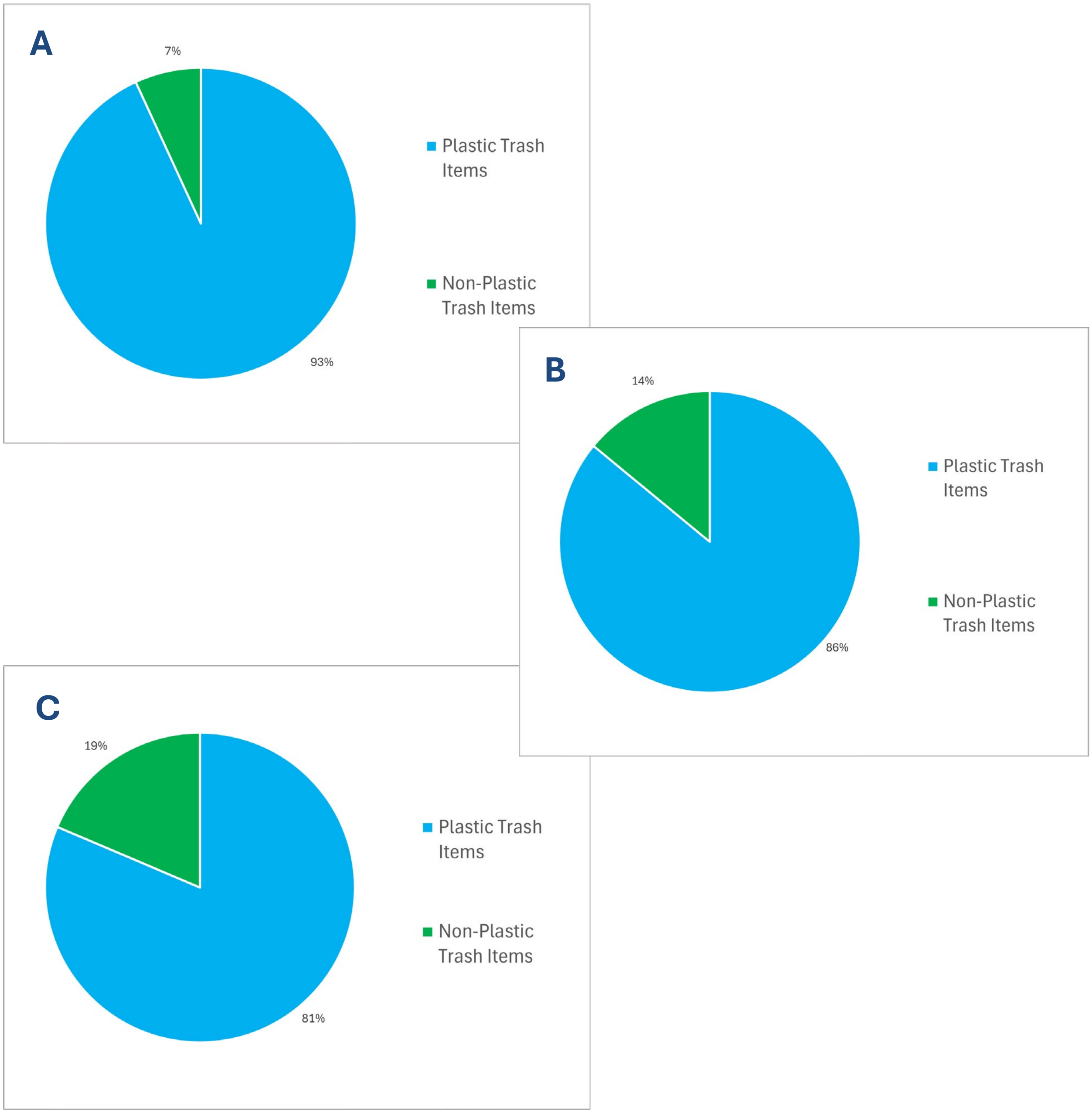


Figure SC-6. Comparison of plastic versus non-plastic trash items measured for all 3 storm events at sites A) SC-SFC, B) SC-STE, and C) SC-COY

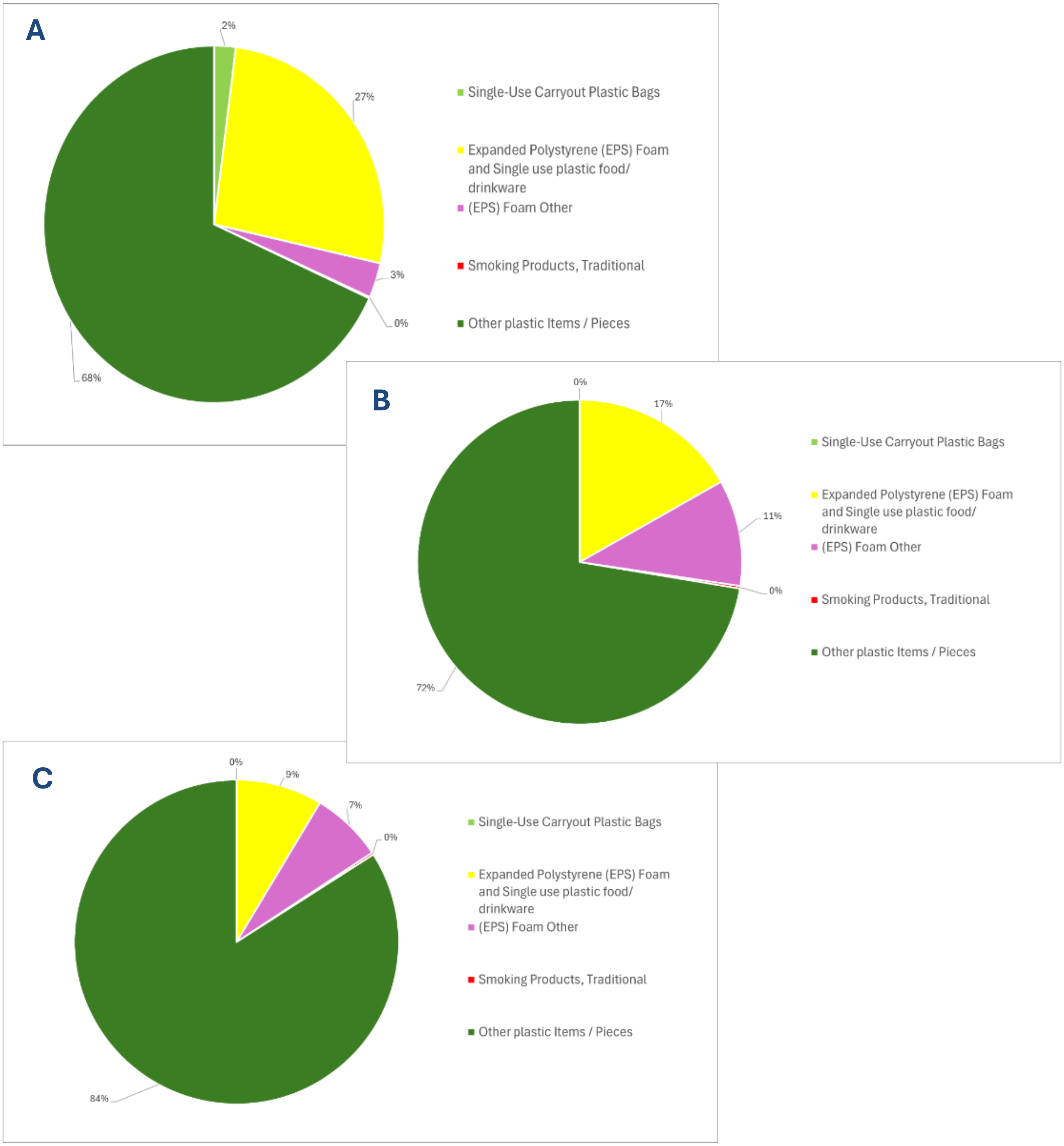


Figure SC-7. Comparison of plastic trash items measured for all 3 storm events at sites A) SC-SFC, B) SC-STE, and C) SC-COY

B4.2.3 Rainfall and Flow

Rainfall data was compiled from Weather Underground stations in proximity to catchment areas for site SC-SFC (11 stations), SC-STE (13 stations) and SC-COY (20 stations). Rainfall totals were calculated using an inverse distance squared weighted average. Rainfall totals for each site over the wet season of WY 2024 are presented in Figure SC-8.

Depth sensors were deployed in the MS4 pipe at all three sites in Santa Clara County. However, the data collected from these sensors did not accurately represent flow during any of the sample events due to the back up of water into the pipe that was caused by a clogged net. For all three sites in Santa Clara County, flow rates were calculated using the rainfall-runoff model described in Section 3.2.6 of the main report. Modelled flows were used to develop annual hydrographs for both sites (Figure SC-8).

Plots of rainfall, flow data and sampling period for each sample event for all three sites are shown in Figures SC-9 to SC-11.

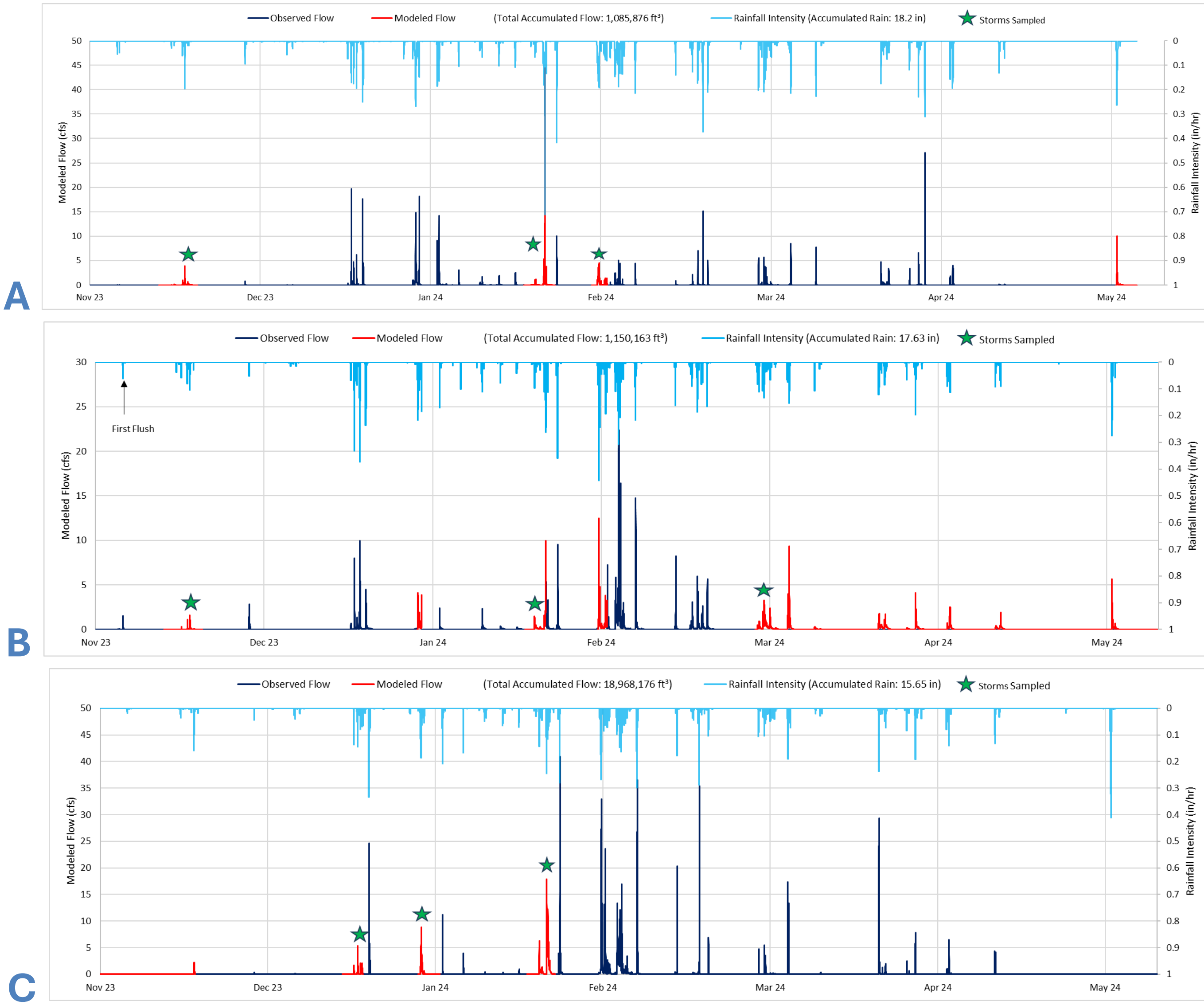


Figure SC-8. Annual hydrographs for 3 trash outfall monitoring sites in Santa Clara County

A: SC-SFC B. SC-STE C: SC-COY

Event Hydrographs

Hydrographs showing rainfall and the net deployment period for the three sample events at site SC-SFC (Figure SC-9), site SC-STE (Figure SC-10) and site SC-COY (Figure SC-11) are shown below.

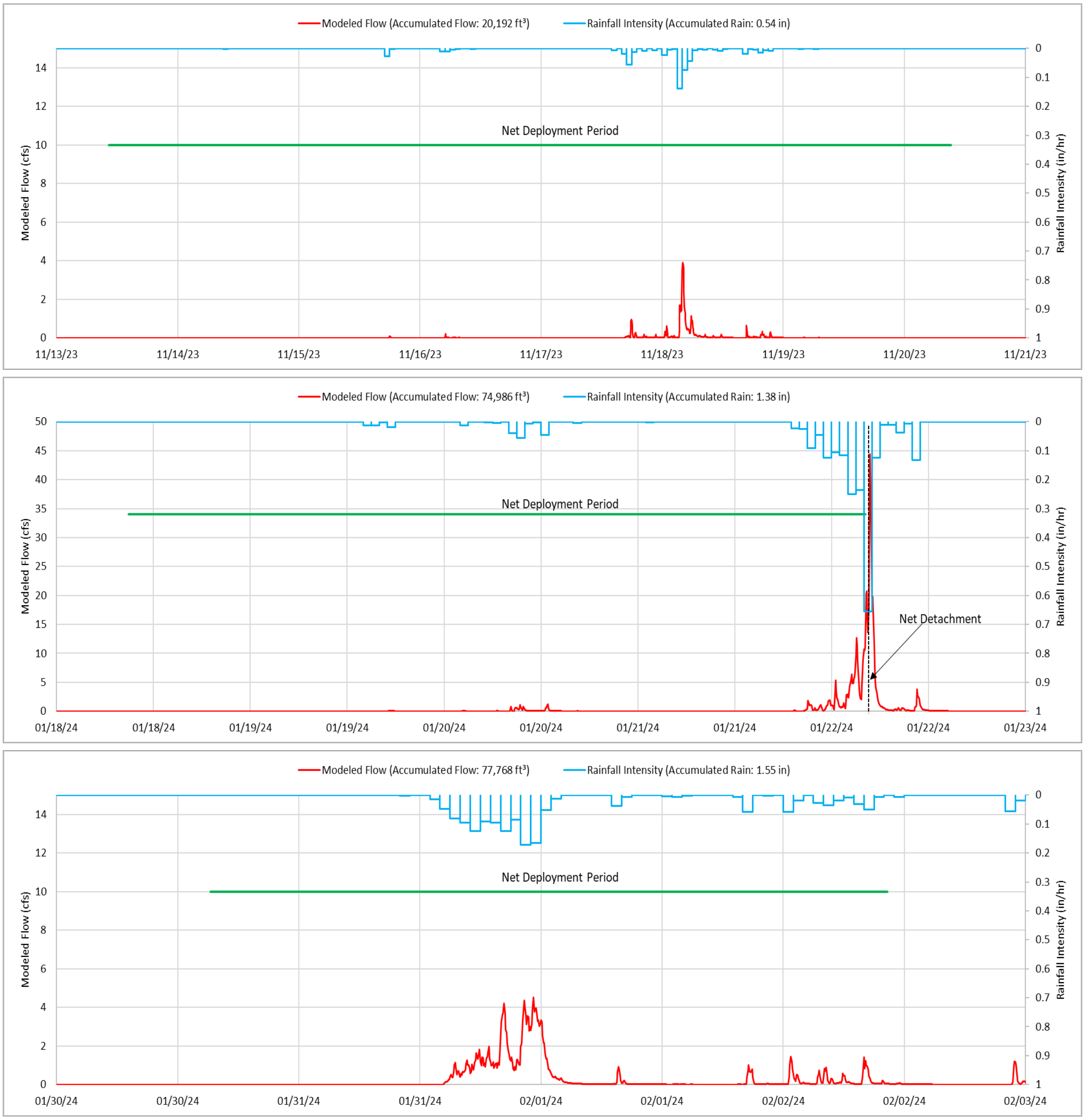


Figure SC-9. Hydrographs for 3 sample events at site SC-SFC

Top: Event 1 Middle: Event 2 Bottom: Event 3

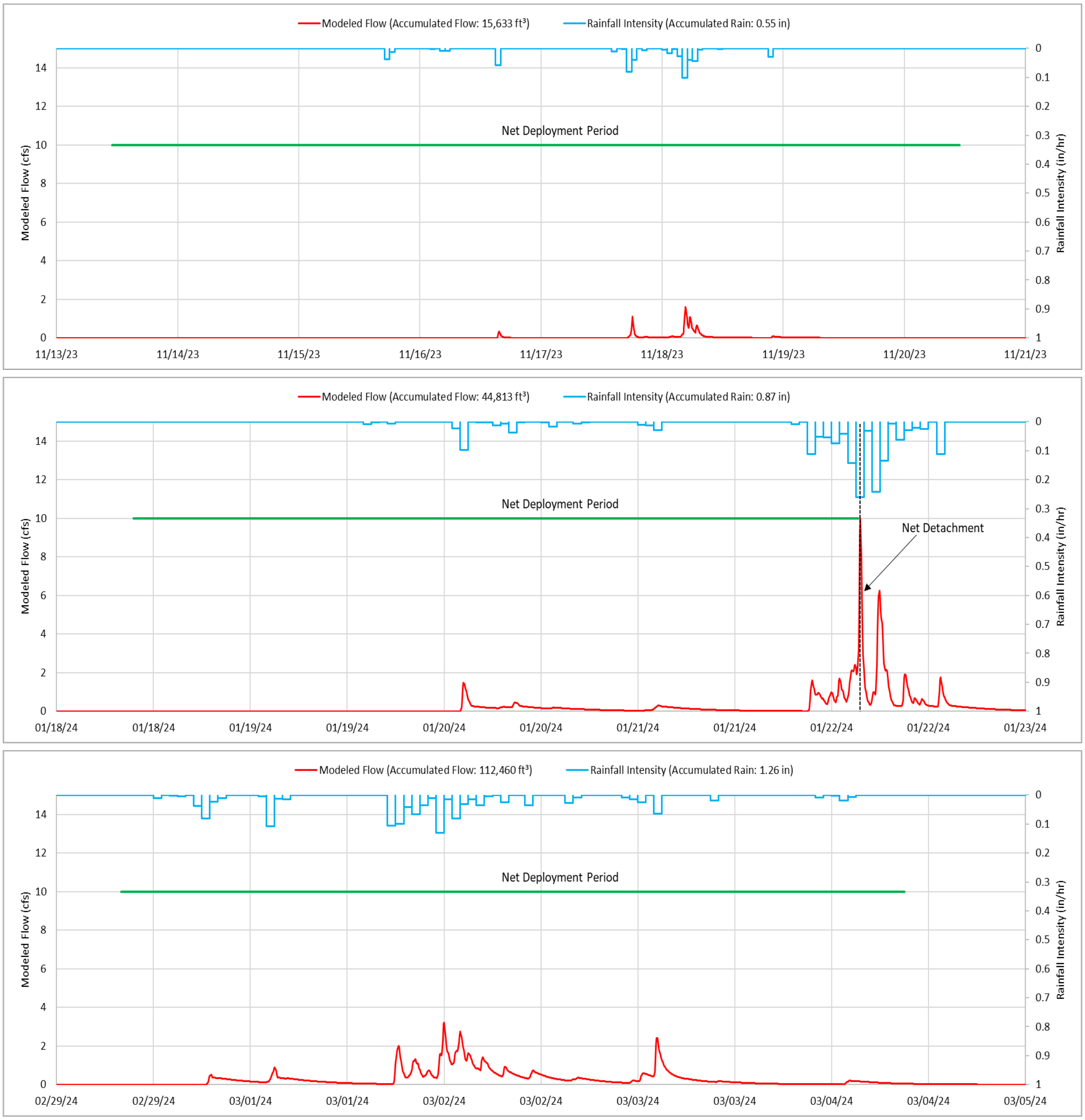


Figure SC-10. Hydrographs for 3 sample events at site SC-STE

Top: Event 1 Middle: Event 2 Bottom: Event 3.

Figure SC-11. Hydrographs for 3 sample events at site SC-COY

Top: Event 1 Middle: Event 2 Bottom: Event 3.

B4.3 Investigation of Trash Generation

A summary of the visual observations of trash sources in the monitored catchments is provided in the section below.

B4.3.1 Catchment Assessments

Visual observations of trash sources in the catchment areas for the three trash outfall monitoring sites in Santa Clara County were conducted during separate visits between September 2–17, 2023. A description for each of the catchment areas is provided above in Section B4.1. A summary of the observations and known operation and maintenance records for each catchment is provided below.

Site SC-SFC

There was minimal trash observed at the outfall for site SC-SFC. No trash was seen on the concrete pad directly below the outfall and only two pieces of trash were seen on the edge of the creek directly below the concrete landing of the outfall (Table SC-3 and Figure SC-12). Minimal trash was observed in the creek upstream or downstream of the outfall.

There was minimal trash observed during the visual survey of the catchment area. Trash was seen along fence line of a construction site at Stanford Shopping Center. A few pieces of trash were seen on the median strip of Sand Hill Road. No trash was observed during a windshield survey around the parking areas of the shopping mall. No trash was seen in the biofiltration structures in the parking lot.

Table SC-3. Trash assessment in catchment for site SC-SFC, in the City of Palo Alto, during WY 2024

Location and Type of Trash	Latitude, Longitude	Photos
No trash observed on concrete landing below outfall; few plastic pieces and metal can below the landing on bottom of creek.	37.44581, -122.17226	
Littered trash (plastic cups, bags, paper) along fence line to construction site at Stanford Shopping Center	37.445208, -122.172438	
Wind blown litter along a median strip at Sand Hill Road	37.444974, -122.172874	

Location and Type of Trash	Latitude, Longitude	Photos
Minimal to no trash observed within parking lot areas of Stanford Shopping Center	37.442308, -122.170680	
No trash observed on roadways adjacent to biofiltration areas.	37.443961, -122.168429	

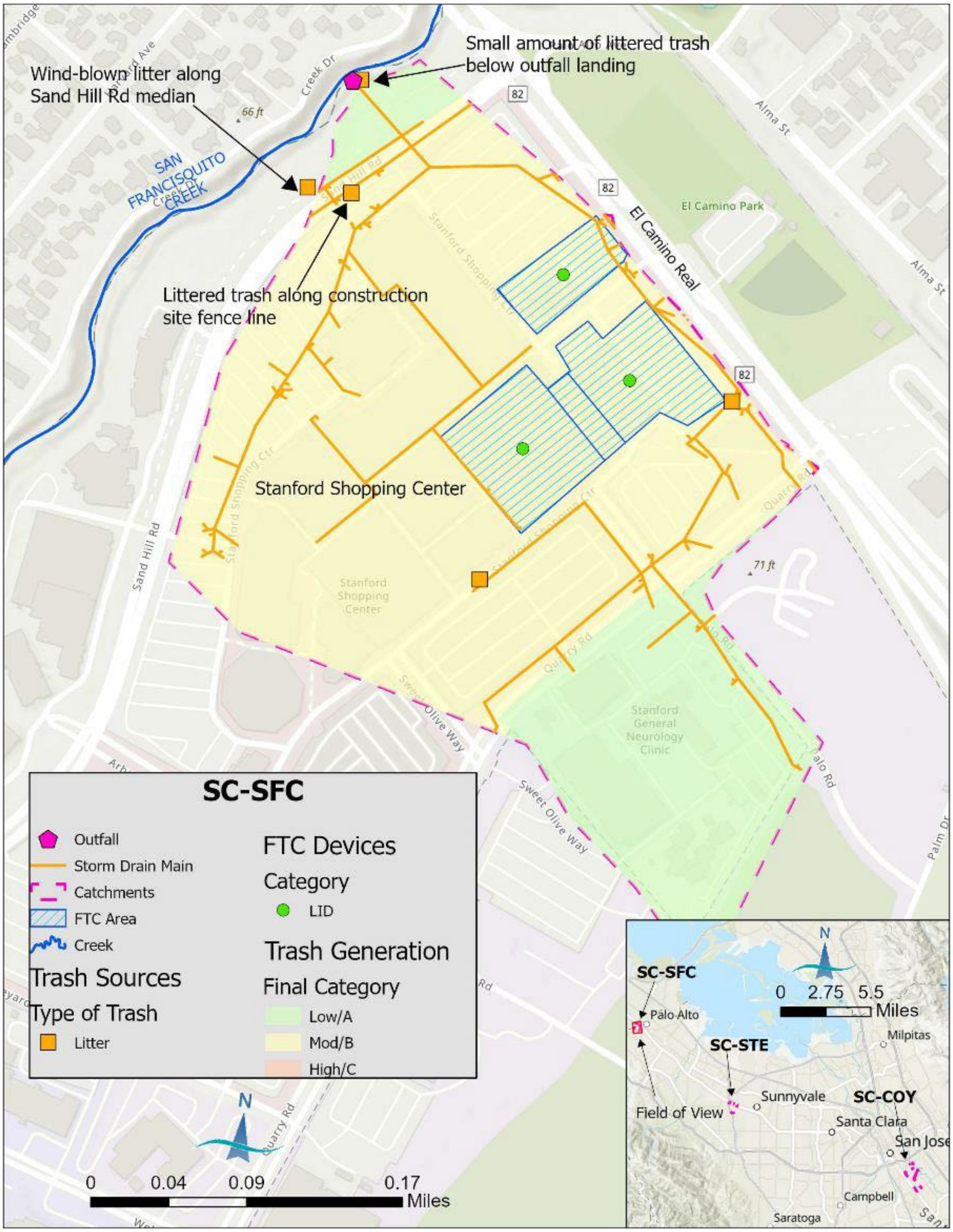


Figure SC-12. Trash sources identified in the City of Palo Alto, during trash assessment for catchment SC-SFC

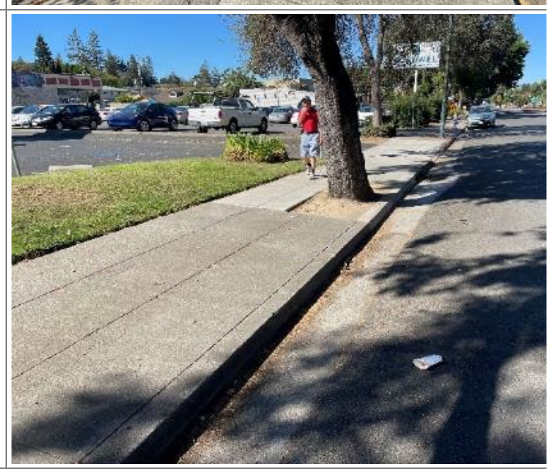
Site SC-STE

Trash was observed at the outfall location of site SC-STE (Table SC-4 and Figure SC-13) during the assessment on September 17, 2023. The majority of the trash (plastic food wrappers, plastic bottle and metal can) appeared to be unworn and clean, indicating that the source was from littering from people using the bike path at the top of bank (i.e., not transported via storm drain). Although there is a trash receptacle on the bike path close to the outfall, there were several plastic and paper cups observed along the top of bank. Larger trash items (e.g., clothing) in the dry creek bed near the outfall were documented; these trash items may have originated from people living in nearby homeless encampments under El Camino Real bridge, located about 100 meters downstream of the outfall.

There was very little trash observed during the visual survey of the catchment area for site SC-STE. The majority of the catchment is comprised of multi-family residential areas that appeared to be well maintained. Trash was observed at Continental Circle along the sound wall for SR 87. Littered trash items (e.g., plastic cups, liquor bottles and paper) were documented along the curb and landscaped area by the wall. This location was formerly occupied by occupants living in RVs, which are now absent following the adoption of a municipal ordinance prohibiting RVs parked on narrow streets. No RVs were observed during the assessment. There was also litter observed in the parking lot and sidewalk in front of the Goodwill store on the south side of El Camino Real. Paper cups were also observed in the street.

Table SC-4. Trash assessment in catchment for site SC-STE in the City of Mountain View during WY 2024

Location and Type of Trash	Latitude, Longitude	Photos
Littered trash below outfall, including food wrappers, plastic bottles and metal cans that appears to be from pedestrian pathway at top of bank. Larger trash items (e.g., clothing) were scattered on the dry channel bed, likely from nearby homeless encampments. Outfall may be pathway for homeless to access the bike trail.	37.37815, -122.06934	

Location and Type of Trash	Latitude, Longitude	Photos
Littered trash (beverage containers, plastic liquor bottles, paper) along sound wall at Continental Circle.	37.374604, -122.067643	
Some litter in the parking lot of Goodwill on El Camino Real.	37.375565, -122.061114	
Litter on the street and sidewalk of El Camino Real near Goodwill.	37.375565, -122.061114	

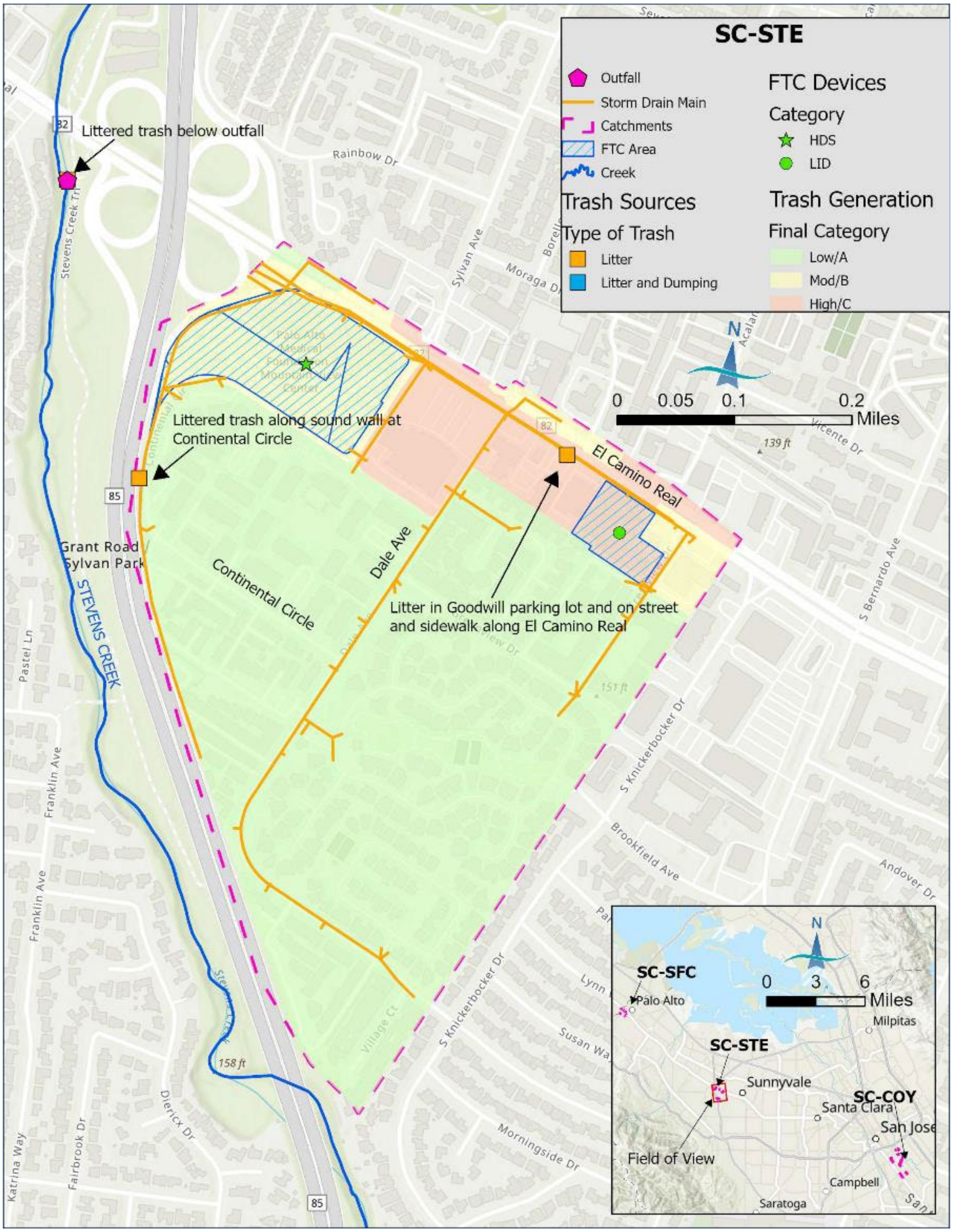


Figure SC-13. Trash sources identified in the City of Mountain View, during trash assessment for catchment SC-STE

Site SC-COY

There was a moderately high level of trash observed at the outfall location during the assessment on September 10, 2023. An accumulation of plastic trash items (e.g., food wrappers, bags and bottles) was observed within the flow path downstream of the outfall (Table SC-5 and Figure SC-14). Additional littered and dumped trash was seen scattered on the bank around the outfall. A large amount of trash (e.g., plastic bags, tarps, fabric) was observed at a homeless encampment located on the opposite bank from the outfall. Despite the presence of a chain link fence at the top of the bank, the outfall appears to provide access for people travelling between the encampment and nearby park facilities (e.g., picnic tables, bathrooms).

Within the catchment area, litter and dumped trash items were documented at several locations along the west side of South 7th Street, between East Alma Avenue and Phelan Avenue (Table SC-5 and Figure SC-14). Plastic and paper items, as well as several full trash bags, were observed between the fence and parking barricades at 155 South 7th Street, just north of Valley Recycling. Litter and dumped trash (e.g., fast food waste, plastic bags and bottles and metal cans) were also observed near parked cars and bushes at 1695 South 7th Street, just north of Phelan Avenue. There is no sidewalk or curb along the west side of South 7th Street, so trash removal by street sweeping does not appear to be possible. Littered trash (e.g., fast food containers) was also observed at the corner of South 10th Street and Phelan Avenue, between the building and sidewalk.

Table SC-5. Trash assessment in catchment for site SC-COY, in the City of San Jose, during WY 2024

Observations during survey	Latitude, Longitude	Photos
Accumulation of plastic trash items (food wrappers, bags and bottles) and Styrofoam in the flow path below the outfall.	37. 32246, -121.86009	
Litter and dumped trash items (fabric, tarps, bags) on opposite bank at illegal encampment. Littered and dumped trash items (food wrappers, paper, fabric) on bank around outfall.	37. 32246, -121.86009	

Observations during survey	Latitude, Longitude	Photos
Litter and dumping of trash at 1555 South 7th Street (facing north); trash mostly between fence and barricades	37.316568, -121.867499	
Litter and dumping of trash at 1555 South 7th Street (facing south); trash mostly between fence and barricades	37.316568, -121.867499	
Litter at 1695 South 7th Street (north of Phelan Avenue); litter along parked cars/food truck	37.313962, -121.865639	

Observations during survey	Latitude, Longitude	Photos
Litter and dumping at 1695 South 7th Street (north of Phelan Avenue); fast food waste, plastic bags between parked cars and bushes.	37.313962, -121.865639	
Litter at 1699 South 10th Street (north of Phelan Avenue); fast food containers, plastic bags between building and sidewalk	37.315943, -121.862776	

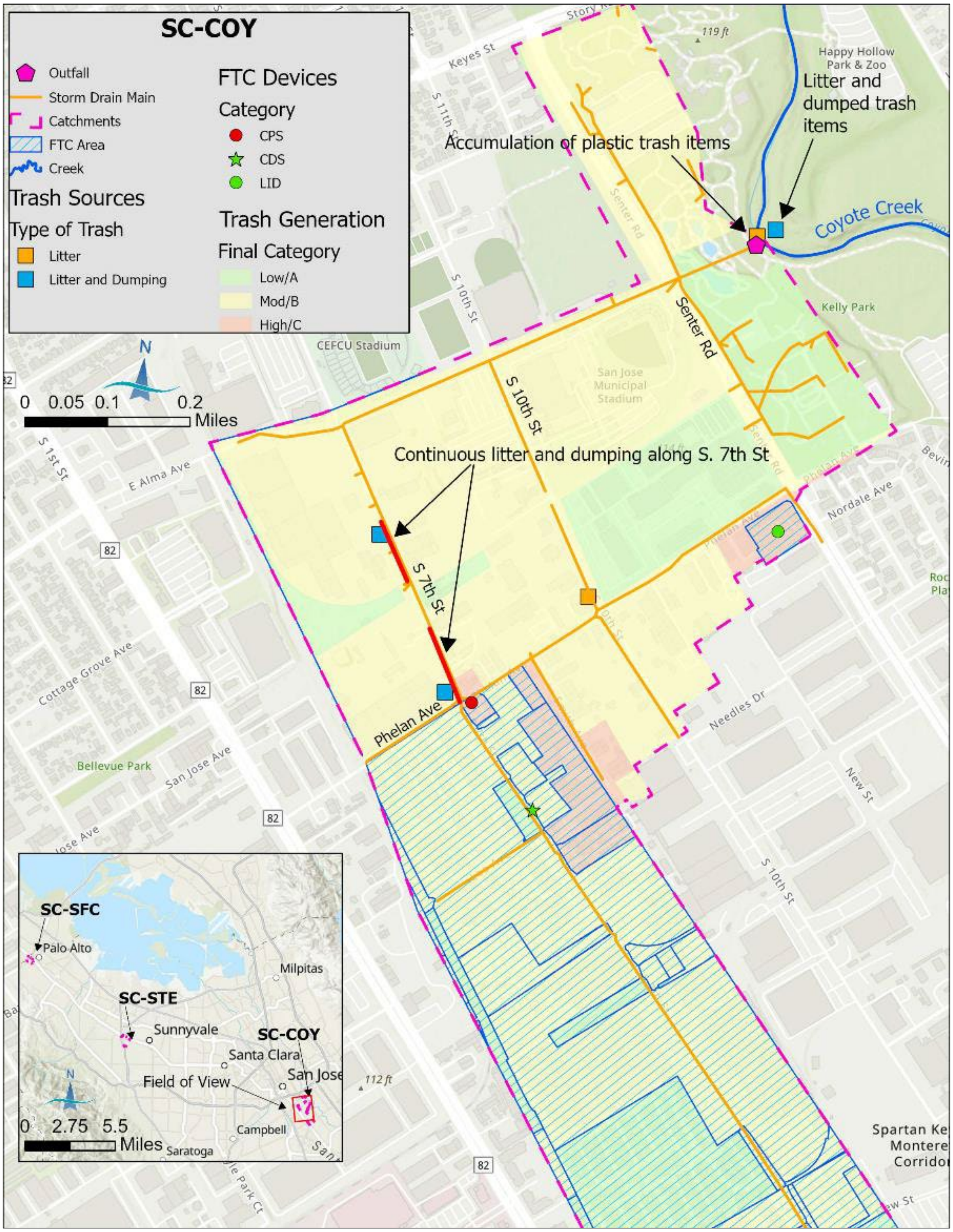


Figure SC-14. Trash sources identified in the City of San Jose during trash assessment for catchment SC-COY

B4.3.2 Trash Management Actions

Operations and maintenance records (where available) for full trash capture devices and other trash controls implemented in the monitored catchments are summarized in Table SC-6.

Table SC-6. Summary of operations and maintenance activities associated with full trash capture and other controls implemented in catchments for outfall monitoring sites

Monitored Catchment	Full Trash Capture	Private Land Development Area Program – Trash Generation (Acres)	Other controls
SC-COY	CDS cleaned twice annually; inspected monthly. Cleaned on 02/23/24. Estimated 16.2 cu yd removed; 60% of debris was trash. CPS inspected on 6/21 and 8/2 in 2023; cleaned on 7/7/2023 and 10/11/2024. LID is included in City of San Jose's Postconstruction compliance inspection program (Provision C.3). Maintenance activities include periodical removal of trash, sediment, and debris in bioretention basin.	– Moderate (104) – High (1.1)	– Improved bin container management – Enhanced street sweeping – On-land clean ups – Public Education – Trash Inspection Program – Smoking Ordinance – Encampment Management – Park Ranger Patrol – Free Junk Pickup
SC-STE	Private CDS and DVS systems (Palo Alto Medical Foundation) inspected and cleaned on 8/22/2023 and 8/14/2024. Private LID (M Residences) – no inspection records available for WY 2024.	– Moderate (1.8) – High (8.3)	– Improved bin container management – Enhanced street sweeping – On-land clean ups – Partial Capture
SC-SFC	The City of Palo Alto completed multiple C.3 inspections at four biofiltration facilities (Stanford Mall). Inspections were conducted at one or more facilities on 11/21/2023, 2/7/2024 and 3/29/2024. No trash was observed at any of the LID facilities.	– Moderate (35)	– Improved bin container management – Trash Inspection Program – On-land clean ups

LID = low impact development

B4.4 Refinements

The following refinements to trash outfall monitoring will be implemented in Santa Clara County in WY 2025.

Flow Measurements

- Field measurements will be collected at each of the three trash outfall sites to verify pipe dimensions and slope data obtained from construction drawings. Field measurements will include measuring water depths at depth sensor location in the pipe during a storm event. Field data will be used to calibrate water depths measured using the sensor. Water velocities will also be measured synoptically with depth measurements.
- Larger trash nets will be procured and installed at sites SC-STE and SC-COY to increase surface area for flow to pass through net during each sampling event. Increased flow

through the net should help to reduce the amount of water that is backed up into the pipe when the net is attached to the outfall.

B5 SOLANO STORMWATER ALLIANCE (SSA)

B5.1 Introduction

One monitoring location in Solano County was selected in WY 2023 for trash outfall monitoring beginning in WY 2024 (Figure SSA-1). The monitoring site (identified as SSA-LOTZ) is located at an Amtrak Park & Ride lot in Suisun City.

This facility was envisioned to manage trash at what was identified as a high trash generating location but was also designed to incorporate green stormwater infrastructure components for the hydrological and water quality benefits. The proposed treatment retrofit is associated with an existing parking lot located between Lotz Way and SR 12 in Suisun City. The Amtrak Park & Ride lot is located within a Caltrans right-of-way, and the project is being implemented in partnership with Caltrans District 4 through a cooperative implementation agreement.

The overall retrofit project design incorporates approximately 4,856 square feet of a Multi-benefit Treatment System (MBTS) at the eastern edge of the parking lot. The upstream catchment to the monitoring location is approximately 4.3 acres and includes an asphalt parking lot, landscaping, and highway roadway, as shown in Figure SSA-2. The parking lot includes narrow landscaped islands between the parking bays and conventional drainage infrastructure, including curbs, gutters, and curb inlets, which will allow the runoff to flow into the MBTS. The parking lot slopes towards a drainage ditch on the eastern perimeter of the parking lot, with pre-project coverage of non-native grasses, bare earth, and rock, which will be retrofitted with a bioretention swale to slow and treat runoff from the parking lot and the offramp. The bioretention feature design is sized to meet both the full trash capture (1-hour, 1-year storm event) and water quality (85% annual flow volume).

The trash monitoring device will be located within the bioretention overflow, a 36-inch pipe situated at a low point near the eastern end of the MBTS. The monitoring device will be used to evaluate the effectiveness of both a new trash capture device, a catch basin insert (CBI) to be installed at a drop inlet capturing highway runoff entering the bioswale, and the bioretention feature itself to prevent trash from entering downstream waterways up to and including the 1-hour, 1-year storm event (0.395 inches/hour[13]). A filter bag (Fabco Industries design[14] or equivalent) will be placed within the bioretention overflow pipe to capture any trash that bypasses the bioretention feature during monitored storm events.

Land use in the catchment area is identified as 75% commercial and 25% highway, though in practice the area comprises entirely transportation-related uses. Baseline trash generation rates are approximately 25% low and 75% high by area. There are no long-term homeless encampments identified within the catchment, although unhoused persons have been observed in the parking area and behind fencing (both areas drain to the MBTS) on a consistent basis.

[13] NOAA Atlas. https://hdsc.nws.noaa.gov/pfds/pfds_map_cont.html?bkmrk=ca. Accessed Dec. 13, 2024.

[14] https://fabco-industries.com/beehive-rain-garden-overflow-filter/

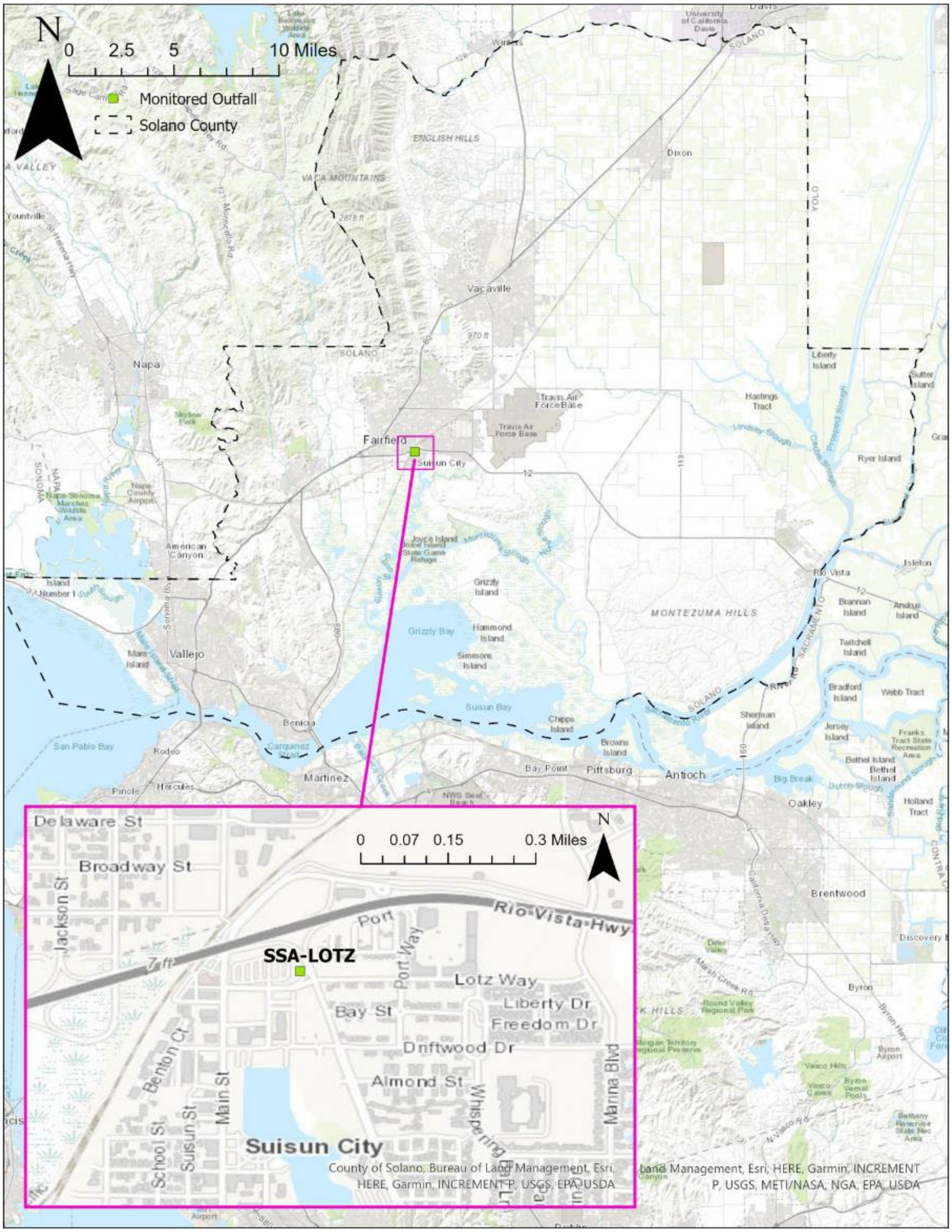


Figure SSA-1. Trash outfall monitoring location SSA-LOTZ in Suisun County

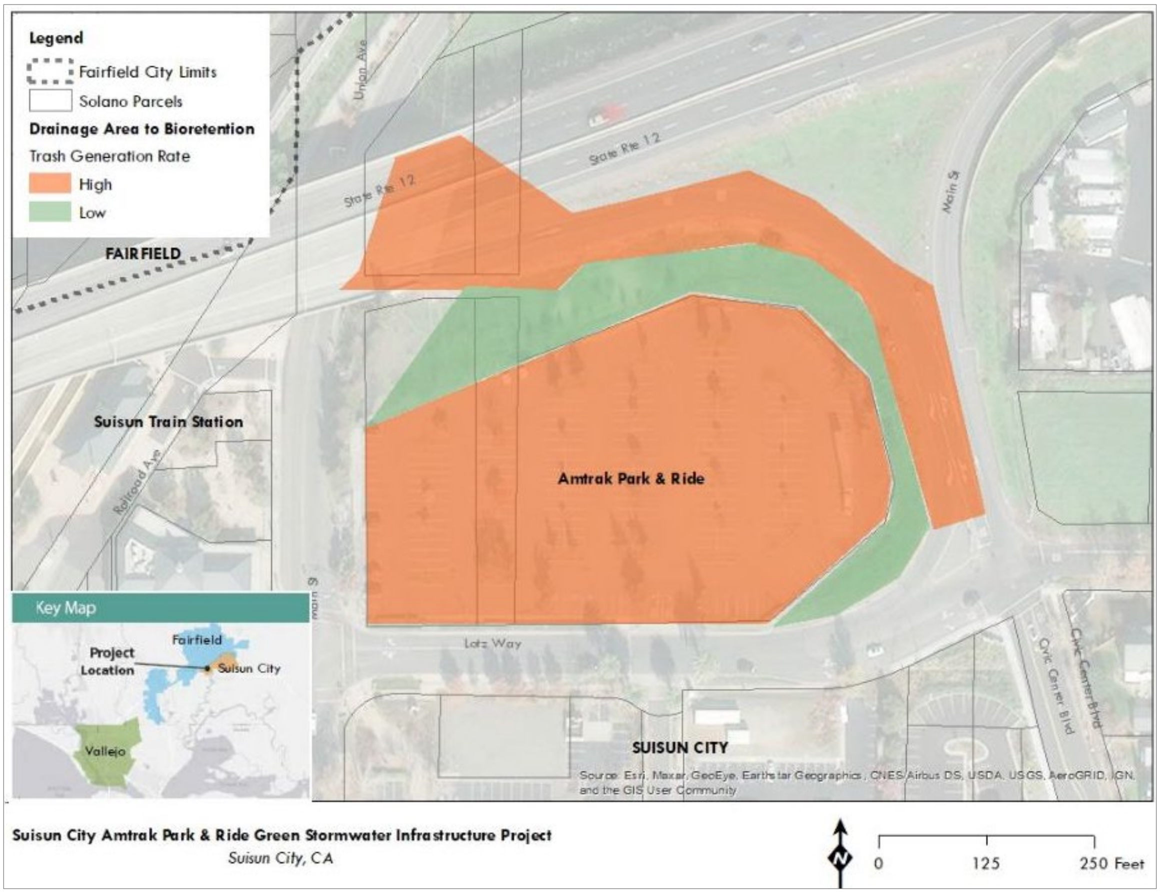


Figure SSA-2. Amtrak Park & Ride development located upstream of Suisun Slough, City of Suisun with associated trash generation rates

B5.2 Results

B5.2.1 Sample Events

Due to contracting and permitting delays, the construction of the proposed MBTS was unable to be completed during the WY 2024 monitoring window. Construction is anticipated to be completed in time to support WY 2025 monitoring.

B5.3 Investigation of Trash Generation

Not applicable

B5.4 Refinements

The following refinements to trash outfall monitoring will be implemented in Solano County.

Monitoring Locations

A monitoring station will be developed to reflect final MBTS construction details. The monitoring station will include the filter bag, level sensor adjacent to overflow pipe (to inform determinations of when overflow occurs), and on-site rain gauge. Construction was nearing completion at the conclusion of WY 2024 (Figure SSA-3).

Monitoring Effort

SSA will attempt collection of up to six sample events. It is anticipated that monitoring will target larger storms with greatest potential for overflow but will also include storms less than design storm intensity to help assess any magnitude of loadings that may be occurring at times with no overflow.

Figure SSA-3. Bioswale overflow pipe in construction (monitoring basket not shown)

Attachment C

Corrective and Preventative Action Report

BAMSC Trash Monitoring
Corrective and Preventative Action Report

Stormwater Program: SMC	Date: 6/1/2024
Reporting Party: EOA	Date: 6/1/2024

Non-conformance Type

- [x] Sample collection / handling
- Laboratory analysis / characterization
- [ ] QA
- [ ] Data mgmt. / reporting
- [ ] Other

Subject: Discrepancy between original and replicated SMC-PIL trash sample.
Description of Problem: A relatively large difference in the total volume measured between the original and replicate sample collected at site SM-PIL. The original total sample volume was measured at 177 ounces, while the replicate total sample volume was measured at 141 ounces. The difference in volume was mostly attributed to a lower estimate in the volume (28 ounces) for Other Plastic Trash Items in the replicate sample. There were smaller discrepancies in volumes reported in replicate sample for foam trash item (lower) and fabric and metal trash items (higher).
Proposed Corrective / Preventative Action: The difference in volume between original and duplicate sample appears to be associated with different sized containers used for measuring volumes of trash items. Larger sized containers were used to measure volume for replicate sample, which resulted in smaller estimates of trash volumes. To reduce potential for error, the same sized containers, preferably the smallest size as possible, should be used for both original and duplicate samples. In addition, more training of sorting and measuring protocols will be conducted to the staff who will measure trash volumes. Two of the same field staff will be used so trash measurement protocols will be consistently be applied.
Affected Data (if applicable): SMC-PIL Event 3 1/30/2024
Dispensation of Data (if applicable): Only the original field sample results from this replicate pair will be used for all Program and regional data analyses.
Follow up: Training
Responsible Party: EOA
Additional Comments: NA

Paul Randall Digitally signed by Paul Randall Date: 2024.10.08 16:55:33 -07'00'

Program Mgr / Date

Bay Area Municipal Stormwater Collaborative

BAMSC Trash Monitoring
Corrective and Preventative Action Report

Stormwater Program: All	Date: NA
Reporting Party: AMS	Date: 10/17/24

Non-conformance Type

- ☐ Sample collection / handling
- ☒ Laboratory analysis / characterization
- ☐ QA
- ☐ Data mgmt. / reporting
- ☐ Other

Subject: Replicate characterizations
Description of Problem: Characterization team completed duplicate analysis of only two of four targeted samples for the year (1 per Program).
Proposed Corrective / Preventative Action: Characterization teams will be reminded of the QAPP required duplicate frequency before WY25 characterization efforts.
Affected Data (if applicable): WY24 outfall trash characterization data
Dispensation of Data (if applicable): OK to use as is. Duplicate analyses are intended to inform assessments of characterization process and understanding of uncertainty associated with characterization results. WY24 data do not require censoring.
Follow up: QAO will attend a minimum of one characterization event for WY25 data (outfall, receiving water, or both)
Responsible Party: Paul Randall, Paul Salop
Additional Comments:

Paul Salop Digitally signed by Paul Salop
Date: 2024.10.17 10:18:21 -07'00'

Program Mgr / Date