Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Storm Drain Trash Monitoring and Characterization Project

Technical Report

September 2016

This report was developed by the agencies participating in the

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

City of Campbell	City of Milpitas	City of Santa Clara
City of Cupertino	City of Monte Sereno	City of Saratoga
City of Los Altos	City of Mountain View	City of Sunnyvale
Town of Los Altos Hills	City of Palo Alto	County of Santa Clara
Town of Los Gatos	City of San Jose	Santa Clara Valley Water District

Prepared for:

Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP)

Prepared by:

EOA, Inc.
1410 Jackson St., Oakland, CA 94612

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LIST OF ABBREVIATIONS

ARS	Automated Retractable Screen
BASMAA	Bay Area Stormwater Management Agencies Association
CRV	California Redemption Value
EPS	Expanded Polystyrene
gal	Gallon
MDL	Method detection limit
mL	milliliter
mm	millimeter
MRP	San Francisco Bay Area Municipal Regional Stormwater NPDES Permit
MS4s	Municipal Separate Storm Sewer Systems
NPDES	National Pollutant Discharge Elimination System
SAP	Sampling and Analysis Plan
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
QA/QC	Quality Assurance/Quality Control
yr	Year

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1.0 INTRODUCTION

High levels of trash (i.e., litter, floatables, gross pollutants, or solid waste) in local watersheds can present an aesthetic nuisance to communities, and pose a serious threat to surface water quality if transported to local creeks, the San Francisco Bay, or the Pacific Ocean. Data suggest that plastic trash in particular persists for hundreds of years in the environment and can pose a threat to wildlife through ingestion, entrapment, as well as harboring chemicals potentially harmful to the aquatic environment (Bjorndal et al. 1994; Islam and Tanaka 2004; Moore 2008; von Saal et al. 2008). Types of trash commonly observed in watersheds and water bodies include food and beverage containers (e.g., plastic bags and bottles), food packaging, cigarette butts, food waste, construction and landscaping materials, furniture, electronics, tires, and hazardous materials (e.g., paint and batteries).

In response to concerns about urban trash impacts on receiving water bodies in the San Francisco Bay Area, the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB or Water Board) included trash reduction requirements in the Municipal Regional Stormwater NPDES Permit for Phase I communities in the Bay Area (Order No. R2-2009-0074), referred to as MRP 1.0, and in the recently reissued Permit (Order No. R2-2015-0049), also known as MRP 2.0. These provisions require applicable Bay Area municipalities (i.e., Permittees) to reduce trash from their Municipal Separate Storm Sewer Systems (MS4s) by 70 percent by July 1, 2017, 80 percent by July 1, 2019, and 100 percent or "no adverse impacts" to water bodies by July 1, 2022 (SFBRWQCB 2015). To establish a baseline, each Permittee was also required to develop an estimate of the amount of trash discharged from its stormwater conveyance system circa 2011, and develop and implement an assessment strategy used to account for trash load reduction actions and to demonstrate progress and attainment of trash load reduction targets.

Permittees participated in a regional trash characterization and generation rate study through Bay Area Stormwater Management Agencies Association (BASMAA), with the goal of developing first-order estimates of trash generation in Bay Area urban areas. As part the BASMAA Study, a total of 154 trash full-capture devices located in Bay Area storm drain inlets were monitored for trash. Trash and debris was intercepted and collected during four different time periods, and subsequently sorted and characterized. Monitoring sites represented seven different land use classes and a range of household income levels. Of the 154 inlets, 87 were located in Santa Clara County.

The BASMAA Study resulted in trash generation rates for each inlet monitored in the Bay Area. Best estimates for trash generation in the Bay Area ranged from 0.5 to 150 gallons/acre per year, depending on the land use and the median household income level in the area surrounding monitored sites. These rates along with additional field observations were used to develop maps illustrating trash generation for each Permittee. Additionally, data generated from the BASMAA Study included the number and volume of single-use plastic bags and expanded polystyrene foam (EPS) food service ware found in stormwater conveyances. This information was collected prior to the implementation of many trash control measures, including most product-related ordinances in Santa Clara County. The results of the project are presented in the *San Francisco Bay Area Stormwater Trash Generation Rates* Final Technical Report (BASMAA 2014).

The assessment strategy used by Co-permittees in Santa Clara County to demonstrate progress and attainment of trash reduction targets is described in Co-Permittee *Long-Term Trash Load Reduction Plans* (Long-Term Plans) and the *Pilot Assessment Strategy* (Strategy) developed by the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP 2014). SCVURPPP includes fourteen population-based Co-Permittees within Santa Clara County (13 cities and the unincorporated area) and the Santa Clara Valley Water District that collaborate to protect water quality in Santa Clara County creeks, wetlands and

the San Francisco Bay. With regard to trash reduction, each population-based Co-permittee was required by provision C.10 of the Municipal Regional Stormwater NPDES Permit (MRP) to submit a Long-Term Plan by February 1, 2014. The Long-Term Plans outline how each Co-permittee will achieve MRP trash reduction goals. Trash control measures and implementation schedules are described in each Long-Term Plan. In their Long-Term Plans, some Co-permittees included the adoption of ordinances that prohibit the distribution of litter-prone products (e.g., single-use plastic bags and expanded polystyrene food service ware) in their jurisdictions. Section 4.0 of the Long-Term Plan describes each Co-permittee's approach to assessment and includes a reference to the Strategy, which was submitted on behalf of the Co-permittees and describes a number of indicators that Co-permittees plan to use to assess progress towards trash reduction goals. These indicators are either outcome-based or output-based. Outcome-based indicators measure the results or environmental outcomes of litter reduction efforts and are used to assess the effectiveness of trash control measures.

This report describes the results of *SCVURPPP Storm Drain Trash Monitoring and Characterization Project* (Project). The main goal of this Project was to measure trends in one outcome-based indicator described in the Strategy, the amount of litter-prone products (i.e., single-use plastic bags and expanded polystyrene food service ware) and other litter in storm drains and hydrodynamic separators.

1.1 Trash Control Measures

1.1.2 Product-based Ordinances

In an effort to reduce the environmental impacts of single-use plastic bags, eleven Co-Permittees have adopted ordinances prohibiting their distribution at the point-of-sale within their jurisdictions. In addition to adopting single-use bag ordinances, eleven Co-Permittees have also prohibited the distribution of expanded polystyrene (EPS) food service ware by restaurants, food vendors, and/or retailers. A list of Co-Permittees with single-use plastic bag and EPS food service ware ordinances (with their effective date) are provided in Table 1.1. Ordinances were developed due to potential impacts of single-use plastic bags and EPS food service ware to aquatic life and wildlife; persistence of these material within the environment; and for overall sustainability and zero waste reasons. The Cities of Monte Sereno, and Saratoga, and the Town of Los Altos Hills have not instituted single-use plastic bag ordinances and the Cities of Milpitas, Monte Sereno, and Saratoga have not adopted EPS food service ware ordinances. The Town of Los Altos Hills and City of Monte Sereno, however, do not have retail land uses within their jurisdictions and therefore there is no need to adopt the ordinances. Due to limited information on the levels of single-use plastic bags and EPS food service ware currently observed in the environment within Santa Clara County, there was an interest in characterizing the magnitude and extent of these materials to determine if they continue to be present in the environment and if so, at what levels.

Table 1.1. Effective dates of single-use plastic bag and EPS food service ware ordinances in Santa Clara County.

Co-Permittee	Date of Single-use Plastic Bag Ordinance	Date of Expanded Polystyrene (EPS) Food Service Ware Ordinance
Campbell	1/27/2014	6/1/2015
Cupertino	10/1/2013	7/1/2014
Los Altos	7/4/2013	7/4/2014
Los Altos Hills	NA	6/15/2012
Los Gatos	2/3/2014	6/1/2015
Milpitas	1/1/2016	NA
Monte Sereno	NA	NA
Mountain View	4/22/2013	7/1/2014
Palo Alto	9/18/2009[a]	4/22/2010[a]
San Jose	1/1/2012	1/1/2014[b]
Santa Clara	12/1/2014	9/1/2014
Santa Clara County	1/1/2012	2/1/2013
Saratoga	NA	NA
Sunnyvale	6/20/2012	4/22/2014[c]

[a] Palo Alto's single-use plastic bag ordinance requiring compliance from grocery stores became effective on September 18, 2009. This ordinance was expanded to include retail stores on July 1, 2013 and restaurants on November 1, 2013. Palo Alto's EPS food service ware ordinance requiring compliance from food vendors became effective on April 22, 2010. The ordinance was expanded to prohibit the retail sale or distribution of plastic foam ice chests, foam egg cartons, foam food service ware and foam packaging materials on March 1, 2016.

[b] San José's EPS food service ware ordinance requiring compliance from multi-state restaurant chains became effective on January 1, 2014. The second phase of the ordinance went into effect at all other restaurants, including mobile and street vendors, on January 1, 2015.

[c] Sunnyvale's EPS food service ware ordinance requiring compliance from food providers became effective on April 22, 2014. The second phase of the ordinance went into effect at all other vendors who sell or provide EPS containers and EPS food service ware, on April 22, 2015.

1.1.3 Other Trash Control Measures

Enhanced or new trash control measures presented within the Long-Term Plan are based on the Co-permittees' current understanding of trash problems within its jurisdiction and the effectiveness of control measures designed to reduce trash impacts associated with MS4 discharges. The Long-Term Plans build upon trash control measures implemented by Co-permittees prior to the adoption of the MRP and during the implementation of Short-Term Trash Load Reduction Plans submitted to the Water Board on February 1, 2012. With the implementation of the Long-Term Plan, trash reductions should be observable on streets, public right-of-ways, and in stormwater conveyances. Trash control measures that may be implemented by Co-permittees include, but not limited to the following:

- Enhanced Street Sweeping
- Public Education and Outreach Programs
- Anti-Littering and Illegal Dumping Enforcement Activities
- Improved Trash Bin/Container Management
- Enhanced On-land Trash Cleanups

- Curb Inlet Screens
- Enhanced Storm Drain Inlet Maintenance
- Full-Capture Treatment Devices
- Creek/Channel/Shoreline Cleanups

1.2 Management Questions

With increased levels of control measures implementation, Co-permittees are assessing progress toward trash reduction goals and evaluating the effectiveness of specific control measures that are designed to reduce the generation of trash. In particular, SCVURPPP is interested in determining whether the effects of municipal product-based ordinances that prohibit litter-prone items are detectable in stormwater conveyances or in other locations in the environment. Additionally, SCVURPPP was interested in evaluating whether reductions in the overall level of trash in stormwater conveyances in Santa Clara County are observable from the time of the previous monitoring and characterization project that occurred from December 2010 to April 2012 (BASMAA 2014).

The following management questions were developed to evaluate environmental outcomes associated with product-based ordinances and trash levels in Santa Clara County:

1. To what degree are single-use plastic bags present in stormwater drainage systems?
2. Have single use plastic bag ordinances substantially reduced the level of bags observed in the environment?
3. To what degree is EPS food service ware present in stormwater drainage systems?
4. Have municipal ordinances substantially reduced the level of EPS food service ware found in the environment?
5. Are trash control measures implemented by Co-Permittees effectively reducing trash in municipal stormwater conveyances in Santa Clara County?

2.0 MONITORING DESIGN AND METHODS

Site selection and monitoring procedures used during the Project are fully described in the Project's Sampling and Analysis Plan (SAP; SCVURPPP 2015) included in Appendix A. The SAP describes the assessment methods outlined in Long-Term Plans and the Strategy that Co-Permittees are using to evaluate progress towards overall trash reduction goals and assist SCVURPPP in assessing the effects of specific trash control measures designed to reduce the generation and impacts of litter-prone products and materials.

The monitoring design employed during this Project consisted of re-sampling the majority of the storm drain inlets in Santa Clara County monitored during the previous BASMAA Study (BASMAA 2014), in addition to other previously unmonitored inlets in Co-permittee jurisdictional areas. Data on single-use plastic bags and EPS food service ware, which were collected during the BASMAA Study and prior to the implementation of many product-related ordinances in Santa Clara County, were compared to data collected via this Project. This Project was designed in December 2014/January 2015 and conducted between March 2015 and February 2016.

2.1 Monitoring Sites

2.1.1 Site Selection Criteria

In an effort to select previously unmonitored sites and assess the level of specific trash items potentially present in different land uses, data generated via the BASMAA Study were compiled and evaluated. Based on the analysis of single-use plastic bag data specific to different land uses, the current and planned locations of many enhanced control measures, and experience in conducting trash characterization studies; monitoring sites included in this Project met the following selection criteria, which were applied in the following order:

1. Sites (inlets) that are equipped with properly functioning small trash full-capture[1] devices or systems meeting the full-capture standard;
2. Sites that are not equipped with curb inlet screens that block trash from entering the storm drain inlet;
3. Sites with properly functioning devices that were previously sampled during the BASMAA Study;
4. Previously unmonitored sites that drain predominately retail land use areas associated with moderate, high or very high trash generation rates[2]; and,
5. A minimum of two monitoring sites equipped with small trash full-capture devices or one large full-capture device were selected within each Co-permittee's jurisdiction.

2.1.2 Selected Monitoring Sites – Small Full-Capture Devices

A total of 125 monitoring sites (Figure 2.1) were selected from a pool of nearly 423 available sites equipped with small full-capture devices. Prior to commencing the SCVURPPP Project, each monitoring site was reviewed to determine if it met the site selection criteria described above. A total of 56 of the 87 sites previously monitored during the BASMAA Study were selected for re-sampling. Previously monitored sites not selected for this Project were either located in areas with low trash generation rates or in very close proximity to other sites selected for the Project. Since the main goal of the Project was to measure the quantity of single-use plastic bags and EPS food service ware in the environment, sites with low trash generation rates were seen as less beneficial due to the unlikelihood of both products being observed in these inlets.

Table 2.1 summarizes the small device sites available in Santa Clara County and the 125 monitoring sites selected for the Project. The monitoring sites were distributed approximately proportional to Co-Permittee populations. The previously monitored sites represent a larger variety of land uses, with most of the newer sites being in retail land uses. The land uses associated with the selected monitoring sites are provided in Table 2.2. Details on each of the selected monitoring sites is available in Appendix B.

All 125 small full-capture devices located in inlets monitored during the Project were Connector Pipe Screens (CPS) manufactured by Stormtek or United Stormwater, Inc. An example small full-capture device used as a monitoring site is provided as Figure 2.2.

[1] A full capture system or device has the ability to trap all particles retained by a 5 mm mesh screen and has a design treatment capacity of at least the peak flow rate resulting from a one-year, one-hour, storm in the sub-drainage area.

[2] The City of Monte Sereno and Town of Los Altos Hills do not have devices in retail land use areas. The City of Santa Clara did not have any small full-capture devices yet installed when the SAP was being developed.

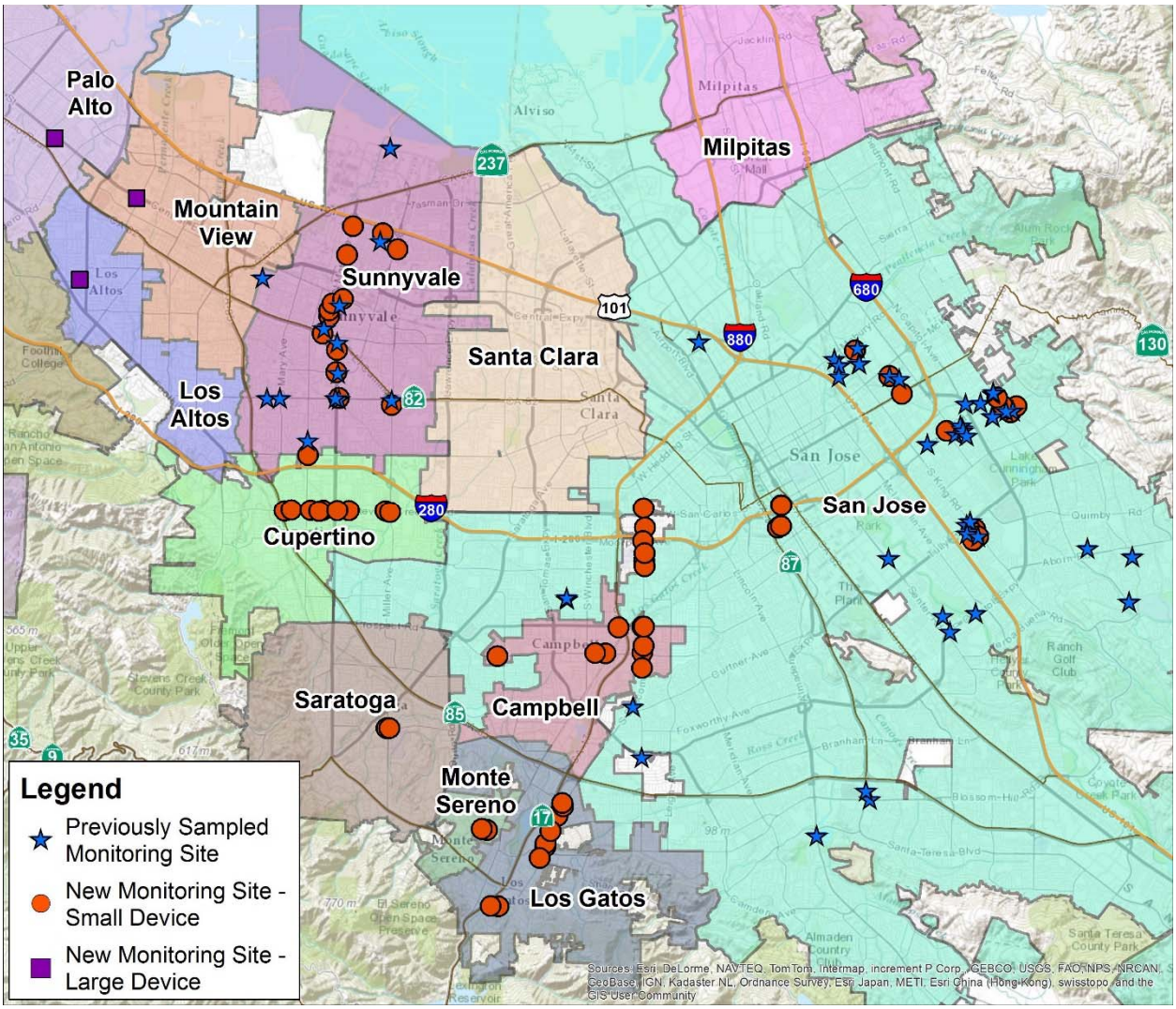

Figure 2.1. Monitoring sites included in the SCVURPPP Storm Drain Trash Monitoring and Characterization Project.

Table 2.1. Summary of available and selected monitoring sites with small full-capture devices by Co-permittee.

Co-permittee	# Available Sites[1]	# Sites Monitored in BASMAA Study	# BASMAA Study Sites Monitored via SCVURPPP Project	# Previously Unmonitored Sites Selected for SCVURPPP Project	Total # Sites Selected for SCVURPPP Project
Campbell	28	0	0	9	**9**
Cupertino	107	0	0	10	**10**
Los Gatos	30	0	0	9	**9**
Monte Sereno	4	0	0	2	**2**
San Jose	145	71	42	19	**61**
Santa Clara County	26	0	0	6	**6**
Saratoga	4	0	0	2	**2**
Sunnyvale	77	16	14	12	**26**
Total	**423**	**87**	**56**	**69**	**125**

[1] Includes those inlets equipped with small full-capture devices that are owned and operated by Co-permittees at the time of the development of the SAP (January 2015). Many Co-Permittees have additional devices within their jurisdictional boundaries that are owned and operated by private entities.

Table 2.2. Land uses associated with selected monitoring sites with small full-capture devices .

Land Use	# of Sites
Colleges and Universities	2
Commercial	12
Industrial	7
Residential	33
Retail	65
Roadway[3]	2
School	3
Urban Park	1
Total	**125**

[3] These sites are along roadways that are significantly separated from adjacent land uses.

Figure 2.2. Example small full-capture device used as a monitoring site.

2.1.3 Selected Monitoring Sites – Large Full-Capture Devices

Small full-capture devices typically drain smaller areas that are depictive of a homogeneous land use (e.g., retail) and are relatively easy to clean/maintain. Therefore, inlets equipped with these devices were identified as the ideal monitoring locations. At the time of this Project, however, five Co-Permittees (i.e., Los Altos, Milpitas, Mountain View, Palo Alto and Santa Clara) had only large full-capture devices within their jurisdictions. Large devices are equally effective at capturing trash in debris, however they typically treat larger less homogenous land areas. Due to their ease of sampling, hydrodynamic separators (i.e., HDS) large devices installed in Los Altos (1), Mountain View (1) and Palo Alto (2) were used as monitoring sites for these Co-permittees, as alternatives to small inlet-based devices. The locations of HDS units used as monitoring sites (n=4) are presented in Table 2.1 and illustrated in Figure 2.1.

Table 2.3. Location of HDS units used as monitoring site.

Co-permittee	Location
Los Altos	On View St, 180’ N of the intersection with Edith Ave.
Mountain View	Intersection of Leland Ave. and Fair Oaks St.
Palo Alto	Intersection of Park Blvd. and Ventura Ave **AND** On Park Blvd., 60’ SE of the intersection with Maclane St.

2.2 Sampling and Characterization Methodology

2.2.1 Sampling Procedure

Small Full-Capture Devices

Prior to the start of the Project in March 2015, a total of 122 of the 125 monitoring sites equipped with small full-capture devices were cleaned to provide a start date for the trash accumulation period. Of the three sites not cleaned, one site in San Jose and one site in Cupertino had Automatic Retractable Screens (ARS) installed, and one site in San Jose was blocked by a construction fence. As a result, these three sites were removed from the Project.

All trash and debris was removed during the March 2015 cleanouts and the screens on the devices were cleaned to provide for proper device operation during the first accumulation period. Trash and debris from this cleanout was not saved for characterization. In July and August 2015, a total of 119 of the 122 remaining monitoring sites were again cleaned. Of the three sites not cleaned, two sites in Sunnyvale and one site in San Jose were blocked by cars, and therefore removed from the Project. The cleanout date for each of the 119 sites was recorded to calculate the number of days during the first accumulation period. In January and February 2016, a total of 117 of the 119 remaining were again cleaned. The date was recorded to calculate the number of days during the second accumulation period. The two sites not cleaned were both located in San Jose and blocked by cars. It was decided to not remove these sites from the Project, but to use only the first accumulation period to determine trash generation rates for these sites.

All trash and debris (e.g., sediment, vegetation, rocks, bugs, etc.) removed from inlets during the second and third cleanouts were placed in large, plastic garbage bags and transported to the Palo Alto Regional Water Quality Control Plant for characterization. All cleaning events were performed by Revel Environmental Manufacturing, Inc. (REM), a contractor that has extensive experience with small full-capture device maintenance that was hired specifically for the Project. The contractor followed procedures in accordance with the *Standard Operating Procedure for Storm Drain Insert Trash Removal* (see Project SAP in Appendix A).

Site information was recorded by the contractor on field forms, including exact cleanout dates and any issues associated with the devices or monitoring site (e.g., damaged screens, presence of ARSs, observations of flows bypassing devices, cars blocking site, other issues) that were observed. The total accumulation period for all monitoring sites for the second cleanout was between 122 and 175 days, and between 159 and 220 days for the third cleanout. This report includes data analysis for a total of 119 monitoring sites equipped with small full-capture devices. Of the six sites that were removed from the SCVURPPP Project because of the above mentioned reasons, three had been previously monitored and three were new to the Project. In the end, data from 53 previously monitored sites and 66 previously unmonitored were analyzed and used to address the management questions for the Project.

Large Full Capture Devices

Monitoring sites with large full-capture devices (i.e., HDS units) were cleaned once by Co-Permittees during the 2015 dry season. The removal of trash and debris from HDS units followed procedures described within the SCVURPPP document entitled *Hydrodynamic Separator Operation and Maintenance: Standard Operating Procedures* (see Project SAP in Appendix A). Cleanouts consisted of removing the top floatable fraction within the HDS chamber and solids from the HDS sump. Cleanouts occurred during dry weather conditions on a designated date determined by Program staff and Co-Permittees.

HDS units were cleaned during May 2015 (Palo Alto), September 2015 (Los Altos) and October 2015 (Mountain View). Prior to each cleanout, Co-Permittees provided the exact date when the HDS unit was last cleaned. Trash and debris removed from HDS units represents accumulation during the FY 14-15 wet weather season. All collected trash and debris from cleanouts was saved and transported to a designated location (i.e., drying pads operated by each Co-permittee) for trash and debris characterization. The total accumulation period for monitored HDS units was 145 days (Palo Alto), 218 days (Los Altos) and 286 days (Mountain View).

2.2.2 Characterization Procedure

Trash Classification System

Once the material cleaned from monitoring sites was received at the centralized characterization location (Palo Alto Regional Water Quality Control Plant or Co-permittee drying pads), trash was separated from other debris using procedures described in the *Standard Operating Procedure for Trash and Debris Evaluation* (see Project SAP in Appendix A). Program staff conducted all trash characterization activities using the trash classification system presented in Table 2.4.

Table 2.4 . Trash characterization classification system used during the project.

Main Categories	Subcategories	Description and Examples
Plastic	Recyclable beverage containers	Recyclable beverage containers labeled with a California Redemption Value (CRV). Includes all plastic and glass redeemable water, soda and juice bottles.
	Single-use plastic bags	Includes all single use plastic bags that have handles and are typically distributed at point-of-sale. Single use plastic bags used to distribute or hold produce, newspapers, sandwiches and parking tickets were not included in this category.
	Expanded polystyrene (EPS) food service ware	Expanded polystyrene (EPS) food and beverage service ware includes all disposable containers, bowls, plates, trays, cartons, cups, and other items made of expanded polystyrene designated for one-time use for prepared foods. Food and beverage ware includes service ware distributed for takeout foods and leftovers from partially consumed meals prepared by food providers.
	Rigid plastic disposable food and beverage ware	Rigid plastic disposable food and beverage ware includes non-EPS plastic, fiber-based, and compostable plastic containers, bowls, plates, trays, cartons, cups, and other items designated for one-time use for prepared foods. These products are typically distributed by food vendors in jurisdictions with EPS prohibitions.
	Other plastic materials/items	Includes all other trash items made of any type of plastic, including but not limited to food and candy packaging, straws, lids, and bottle tops. Includes hard plastic and plastic film.
Cigarette Butts	Cigarette Butts	Cellulose cigarette butts
All Other Trash	All Other Trash	Any other item or fragment of an item that does not fit into one of the categories listed above. Includes but is not limited to, paper, metal, and items made of rubber, fabric or other hybrid materials.
Debris	NA	All material not characterized as trash. Includes sand, sediment and vegetation.

Trash Measurement

Trash and debris removed from each storm drain inlet during the July/August 2015 and January/February 2016 cleanout events, and HDS units in May 2015 (Palo Alto), September 2015 (Los Altos) and October 2015 (Mountain View) was sorted based on the Project's trash classification system and placed into containers between 50 milliliters (mL) and 5 gallons in size (depending on the volume of the material). All items identified as recyclable beverage containers, single-use plastic bags, EPS food service ware, and rigid plastic disposable food and beverage ware was also counted and recorded. Measurement procedures generally included the following steps:

- Volume: The appropriate size of container was used to measure and record the total un-compacted volume of each of the trash categories and debris for each site. If a bucket of trash or debris was partially full, a ruler was used to measure the average depth, which is then converted to a volume in gallons in the Project database. The lowest reporting limit for total volume determination for trash or debris was 5 mL for samples less than 50 mL but greater than zero. Sites that did not contain one or more trash categories or debris were recorded as zero.
- Item Count: The number of recyclable beverage containers (plastic and glass counted separately), single-use plastic bags, polystyrene foam food ware items, and rigid plastic disposable food and beverage ware were counted and recorded.
- Disposal: After all measurements and records were completed, all trash and debris was placed in plastic trash bags and properly disposed.

All data recorded on field data sheets were transferred into the Project database. To ensure that all data were transferred correctly, quality assurance and control checks were performed during and following data entry.

3.0 MONITORING RESULTS AND DISCUSSION

3.1 Statement of Data Quality

A comprehensive quality assurance and control (QA/QC) program was implemented, covering all aspects of trash monitoring and characterization. All data and associated information on trash captured via monitored full capture treatment devices at sampling sites were compiled into a Project database. Data underwent quality assurance checks prior to being used to calculate total volumes or numbers of specific items (i.e., single-use plastic bags or EPS food service ware).

With regard to assessing the precision of the trash characterization methods that were used as part of the Project, trash and debris samples from 34 sites/events (14%) were re-measured. In comparison to the volume of samples originally measured, all samples that were re-measured except for one were within 20% of original results, with one having a volume of 40% more trash the second time measured.[4] The average relative percent difference between the first measurement and the second was 7.2%, and the net difference between the total measured trash quantities was only 1.1%. The level of precision was considered adequate for the characterization of this material and therefore, no samples characterized during the Project were discarded. All results of QA/QC assessments used to evaluate precision are included in Appendix C.

[4] This 40% increase in volume is most likely due to a large item being more compacted the first time it was sorted from the material and then becoming less compacted during the second sort. Discrepancies may also occur for large items that do not fit well into buckets (e.g. hub caps, clothes hangers, etc.), and are difficult to measure their volume or if different size buckets (i.e., 2-gallon vs. 5-gallon bucket) are used.

3.2 Overview of Results

3.2.1 Summary of Characterization Results

A total of 119 small full-capture devices throughout Santa Clara County and four HDS units in Palo Alto, Los Altos and Mountain View were sampled as part of the Project. The period of trash accumulation occurred from March 2015 to February 2016 and ranged from 124 to 350 days for the sites monitored. Approximately 4,178 gallons of material (i.e., trash and debris) was collected and characterized from both small and large full-capture devices. A total of 3,822 gallons (91.5%) was debris (i.e., sediment and vegetation), with the remainder (8.5%) identified as trash (Table 3.1 and Figure 3.1). Trash volumes for each monitoring site are provided in Appendix D.

A total of 57 single-use plastic bags were observed, with 43 collected from 119 small full-capture devices and 14 from 4 large full-capture devices. This compares to 539 single-use bags observed at the 154 small devices during the BASMAA Study. No single-use plastic bags observed during the SCVURPPP Project could be clearly identified as originating from food vendors. Specifically, all single-use plastic bags identified were either clearly associated with (i.e., branded) non-food vendors or very small bags (e.g., ~6"x9") that are typically distributed by convenience stores or non-food vendor types of retail businesses. A total of 8.8 gallons of expanded polystyrene (EPS) foam food service ware and 7.2 gallons of cigarette butts were observed during the Project.

CRV-labeled plastic and glass containers accounted for 6.1% of trash characterized. Approximately 64.1% of the trash characterized was other plastic and 23.5% was all other trash (e.g. paper, rubber, metal, mixed materials). Only 0.8 gallons of disposable rigid or paper food or beverage ware products were observed at the 119 monitoring sites, indicating that EPS food service ware replacement products are not consistently observed in the storm drain conveyance system in Santa Clara County. A possible explanation may be that either these products are littered at a lower frequency than other items, or that they are too large to easily fit in the curb opening or grate of a storm drain inlet.

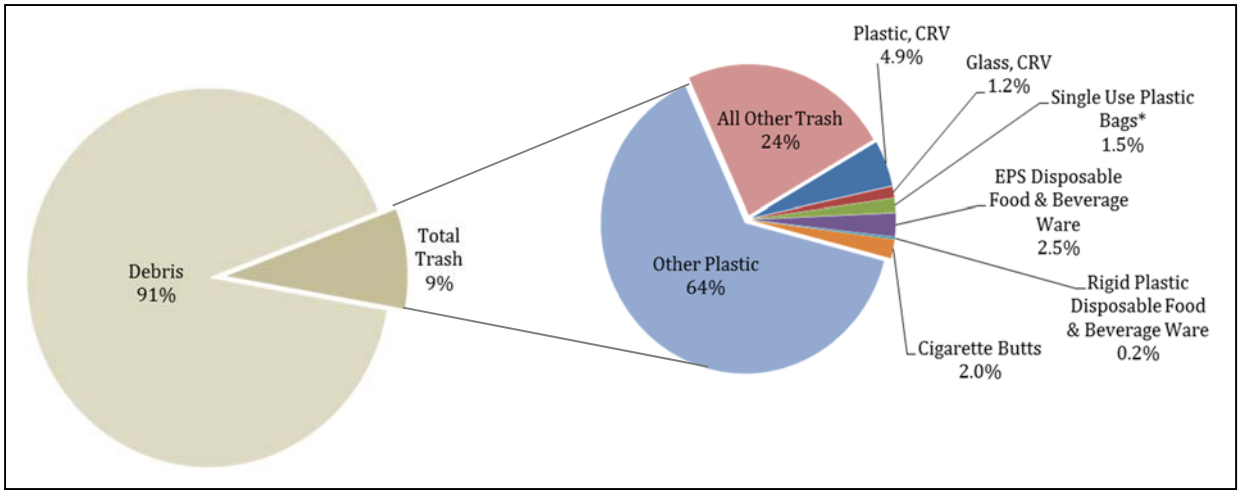

Figure 3.1. Percent of trash and debris (by volume) that was characterized during the SCVURPPP Project (*Assumes an average volume of 12 ounces per bag).

Table 3.1. Total amount and percentage of material removed and characterized from SCVURPPP monitoring sites.

Material Type	# Counted	Volume (gallons)	% of All Material Type	% of Trash
Debris (e.g., Sediment, sand and vegetation)	--	**3,822.3**	**91.5%**	--
Trash	--	**355.3**	**8.5%**	--
1. Plastic - Recyclable Beverage Containers (CRV-labeled)	142	17.5	0.4%	4.9%
2. Glass - Recyclable Beverage Containers (CRV labeled)	44	4.3	0.1%	1.2%
3. Single Use Plastic Bags	57	5.3*	0.1%*	1.5%*
4. EPS Disposable Food & Beverage Ware	394	8.8	0.2%	2.5%
5. Rigid Plastic Disposable Food and Beverage Ware	--	0.8	0.0%	0.2%
6. Cigarette Butts	--	7.2	0.2%	2.0%
7. Other Plastic	--	227.9	5.5%	64.1%
8. All Other Trash	--	83.5	2.0%	23.5%
9. **Total**	--	4,178	--	--

*Assumes 12 oz/bag

3.2.2 Trash Rates by Co-permittee for Small Full-Capture Devices

The results of the BASMAA Study are presented as annual trash rates (gallons/year). The accumulation period during the SCVURPPP Project, however, was roughly ten to eleven months for small full-capture devices and five to nine months for large full-capture devices (i.e., HDS units). For comparison purposes, normalizing the volumes of trash removed and characterized from the 119 monitoring sites equipped with small full-capture devices and 4 monitoring sites with HDS units into annual rates was therefore necessary. For each Project monitoring site, normalization was done by multiplying the daily trash rates observed during the Project (i.e., volume of trash observed divided by the number of accumulation days) by 365 days.

The results of the trash rates by Co-permittee are presented in Table 3.2. Co-permittees with the highest trash rates were the City of San Jose and unincorporated Santa Clara County. The Cities of Cupertino, Monte Sereno, and Saratoga had the lowest trash rates. The Cities of Campbell, Los Gatos, and Sunnyvale had relatively moderate levels of trash.

Table 3.2. Average trash rates (gallons/year) by Co-permittee for small full-capture devices.

Co-permittee	Number of Sites	Average Trash Rate (gal/yr)	Average Bag Rate (bags/yr)	Average EPS Rate (gal/yr)
Campbell	9	2.43	0.88	0.03
Cupertino	9	0.85	0	0.07
Los Gatos	9	2.15	0	0
Monte Sereno	2	0.46	0	0
San Jose	58	4.13	0.6	0.13
Santa Clara County	6	4.11	0.37	0.2
Saratoga	2	0.34	0	0
Sunnyvale	24	1.61	0.14	0.01
Total/Average	**119**	**2.97**	**0.41**	**0.09**

3.2.3 Trash Rates by Land Use

As in the BAASMA Study, Project monitoring sites were also classified by land use to determine if trash rates varied among land use types. In the BASMAA Study and SCVURPPP Project, the six common land use categories included commercial, industrial, schools (kindergarten through 12th grade), residential, retail and urban parks. Additionally, the SCVURPPP Project also included the land use categories of colleges and universities and roadways. Calculated annual average trash rates for each land use class monitored during the BASMAA Study and SCVURPPP Project are presented in Table 3.3. The HDS units contain a variety of land uses within their catchment and are therefore not included.

Trash rates were generally lower in the SCVURPPP Project, with the average trash rate being less than half of what was observed in the BASMAA Study. However, caution should be taken when comparing trash rates since only 53 of the sites are in common between the data sets. Commercial trash rates are higher in the SCVURPPP Project due to many of the inlets in low trash generating areas not being included. Trash rates in retail and school land uses were less than those observed in the BASMAA Study.

Table 3.3. Average trash rates (gallons/year) by land use for BASMAA Study and SCVURPPP Project monitoring sites.

Land Use	BASMAA Study (2011-12)		SCVURPPP Project (2015-16)	
	# of Sites	Average Trash Rate (gallons/year)[a]	# of Sites	Average Trash Rate (gallons/year)[a]
Colleges and Universities	0	--	2	0.86
Commercial	18	1.33	11	2.32
Industrial	13	7.41	7	3.92
Residential	49	4.66	32	3.42
Retail	61	8.66	62	2.76
Roadway	0	--	2	7.52
School	10	5.08	2	0.85
Urban Park	3	1.27	1	1.32
All Land Uses	**154**	**6.13**	**119**	**2.97**

[a] Trash rates presented in the table were not normalized for the effects of existing trash control measures (e.g., street sweeping) or area draining to each monitoring site as was done to develop trash generation rates presented in BASMAA (2014).

3.3 Evaluation of Management Questions

The SCVURPPP Project was designed to answer the five management questions listed in Section 1.2. These questions were evaluated using the data collected during the SCVURPPP Project and BASMAA Study. A discussion of the preliminary results of the evaluations is presented for each management questions in the following sections.

3.3.1 Presence of Single-Use Plastic Bags and Effectiveness Ordinances

The first two management questions relate to the presence of single-use plastic bags in the environment and effectiveness of single-use plastic bag ordinances adopted in Santa Clara County. The goal of single-use plastic bag ordinances is to substantially reduce the level of bags observed in the environment and associated adverse environmental impacts. Of the 119 monitoring sites equipped with small-full capture devices that were sampled as part of the SCVURPPP Project, 53 sites (i.e., 40 sites in San Jose and 13 sites in Sunnyvale) were also part of the BASMAA Study and were used to evaluate the rate at which bags were observed prior to, and after ordinances went into effect.

Single-use plastic bags removed from each monitoring site were counted during both the BASMAA Study and SCVURPPP Project. The numbers of bags observed at the 53 sites common to both the Study and Project are presented in Table 3.4.

Table 3.4. Number of single-use plastic bags observed pre-ordinance (BASMAA Study) and post-ordinance (SCVURPPP Project) at 53 monitoring sites in Cities of San Jose and Sunnyvale.

Permittee	Site ID	Land Use	BASMAA Study (2011-12)		SCVURPPP Project (2014-2015)	
			Accumulation Period (Days)	# Single-Use Plastic Bags	Accumulation Period (Days)	# Single-Use Plastic Bags
San Jose (n=40)	SJC-044	Commercial	324	2	336	0
	SJC-007	Industrial	303	0	334	0
	SJC-045	Industrial	411	1	337	0
	SJC-046	Industrial	319	5	337	0
	SJC-048	Industrial	321	0	337	0
	SJC-107	Industrial	409	1	350	3
	SJC-002	Residential	270	1	348	0
	SJC-006	Residential	274	2	330	1
	SJC-010	Residential	299	1	331	0
	SJC-055	Residential	411	7	331	0
	SJC-056	Residential	411	5	331	3
	SJC-060	Residential	401	2	343	4
	SJC-073	Residential	167	0	345	0
	SJC-076	Residential	419	6	346	4
	SJC-077	Residential	419	5	345	0
	SJC-079	Residential	167	1	345	0
	SJC-085	Residential	401	3	126	0
	SJC-086	Residential	401	6	172	0
	SJC-093	Residential	420	2	345	0
	SJC-102	Residential	419	8	346	0
	SJC-104	Residential	419	2	346	1
	SJC-110	Residential	269	0	350	0
	SJC-112	Residential	305	1	345	0
	SJC-113	Residential	419	6	126	1
	SJC-003	Retail	263	0	334	0
	SJC-004	Retail	235	0	334	0
	SJC-016	Retail	260	0	336	0
	SJC-018	Retail	287	1	335	0
	SJC-027	Retail	235	0	336	0
	SJC-032	Retail	435	3	335	0
	SJC-033	Retail	435	6	335	3
	SJC-036	Retail	432	1	336	2
	SJC-038	Retail	432	9	349	1
	SJC-080	Retail	419	1	350	0
	SJC-081	Retail	419	2	350	1
	SJC-082	Retail	419	3	350	1
	SJC-142	Retail	295	2	350	1
	SJC-008	Roadway	298	5	335	0
	SJC-021	Roadway	235	0	335	0
	SJC-019	Urban Park	287	1	335	0
Sunnyvale (n=13)	SNV-097	Commercial	238	0	327	0
	SNV-098	Commercial	239	0	327	0
	SNV-137	Commercial	236	0	325	0
	SNV-166	Commercial	546	0	329	0
	SNV-122	Residential	238	0	328	0
	SNV-165	Residential	585	5	329	0
	SNV-092	Retail	237	0	327	0
	SNV-112	Retail	238	0	327	0
	SNV-117	Retail	238	0	328	0
	SNV-129	Retail	238	0	329	0
	SNV-150	Retail	236	2	325	0
	SNV-114	School	238	0	327	0
	SNV-163	School	565	3	329	0
Totals			-	**111**	-	**26**

Using similar methods to those described for calculating annual trash rates by volume, the number of bags observed and the associated accumulation period for each of the 53 sites were used to calculate the average annual number of single-use plastic bags in the stormwater conveyance system during the BASMAA Study (pre-ordinance) and the SCVURPPP Project (post-ordinance). The average number of single-use plastic bags (i.e., bags/year) collected at all sites in San Jose (n=40) and Sunnyvale (n=13) during the Study and Project are shown in Table 3.5. Average rates for retail sites and non-retail sites monitored in San Jose and Sunnyvale are also presented separately.

Table 3.5. Average annual number[a] of single-use plastic bags pre-ordinance (BASMAA Study) and post-ordinance (SCVURPPP Project) at 53 monitoring sites in the Cities of San Jose and Sunnyvale.

Co-permittee	Land Use	# Sites	BASMAA Study (Pre-Ordinance) (bags/yr)	SCVURPPP Project (Post-Ordinance) (bags/yr)	Percent Reduction
San Jose	Retail Sites	13	1.92	0.74	61%
	Non-Retail Sites	27	2.66	0.74	72%
	All Sites	40	2.42	0.74	69%
Sunnyvale	Retail Sites	5	0.62	0	100%
	Non-Retail Sites	8	0.63	0	100%
	All Sites	13	0.63	0	100%
San Jose and Sunnyvale	**All Sites**	53	1.98	0.56	72%

[a] Because there were different accumulation periods during the BASMAA Study and SCVURPPP Project, the numbers of bags observed in storm drains during the Study and Project were normalized to an average annual rate for comparison purposes.

Average rates were significantly lower during the SCVURPPP Project compared to the BASMAA Study. The average rate of single-use plastic bags decreased by 69% at the 40 monitoring sites in San Jose, compared to pre-ordinance data from the 2011 BASMAA Study. Average rates for single-use plastic bags at San Jose retail land use sites decreased by 61% and by 72% at non-retail sites. Only 13 of the 40 San Jose sites contained a plastic bag, a large drop compared to the BASMAA Study where 29 of the 40 sites contained a plastic bag. There were no bags found at any of the 13 Sunnyvale monitoring sites during the SCVURPPP Project. Therefore, the number of single-use plastic bags decreased by 100% when compared to pre-ordinance data from the 2011 BASMAA Study. Although the data set is limited, these results appear to indicate that the level of single-use plastic bags observed in stormwater conveyances has substantially decreased at the San Jose and Sunnyvale sites, regardless of land use. Overall, there was a 72% reduction in the number of bags between the Study and Project.

A statistical comparison[5] of single-use plastic bags annual rates for the BASMAA Study and SCVURPPP Project was performed to further evaluate the statistical significance of the reduction. The results indicate that there is greater than a 95% chance that a statistically significant difference ($p < 0.001$, $\alpha = 0.05$) exists between the data collected at the 53 sites pre- and post-ordinance adoption.

[5] The two data sets were first assessed for normality using the Shapiro-Wilk test and found not to follow a normal distribution. A Mann-Whitney Rank Sum Test was therefore used rather than a paired t-test.

3.3.2 Presence of EPS Food Service Ware in the Environment and Effectiveness of Ordinances

The third and fourth management questions relate to the presence of EPS food service ware in the environment and effectiveness of EPS food service ware ordinances adopted in Santa Clara County. The goal of EPS food service ware ordinances is to substantially reduce the level of EPS food service ware observed in the environment and associated adverse environmental impacts. To assess potential trends in the presence of EPS food service ware in the environment over time, the volumes of EPS food service ware removed from the 53 monitoring sites (i.e., 40 sites in San Jose and 13 sites in Sunnyvale) in both the BASMAA Study (pre-ordinance) and SCVURPPP Project (post-ordinance) were compared. Using similar methods to those described for calculating annual rates (by volume) for all trash, annual rates of EPS food service ware were calculated for the 53 sites. Volume was used to compare the EPS service ware data rather than item count because EPS commonly breaks into smaller pieces, making item counts difficult to interpret.

The average EPS food service ware rates (i.e., gallons/year) collected at all sites in San Jose and Sunnyvale during the BASMAA Study and SCVURPPP Project are shown in Table 3.6. Average rates for retail sites and non-retail sites monitored in San Jose and Sunnyvale are also presented separately. Out of the 53 monitoring sites common to both the BASMAA Study and SCVURPPP Project (Table 3.7), EPS food service ware was observed at 48 sites (39 in San Jose and 9 in Sunnyvale) during the BASMAA Study (pre-ordinance). During the SCVURPPP Project, EPS food service ware was observed at 35 sites (32 in San Jose and 3 in Sunnyvale).

Table 3.6. Average annual volume (gallons/yr) of EPS food service ware based on data collected during the BASMAA Study and SCVURPPP Project at 53 monitoring sites in in the Cities of San Jose and Sunnyvale.

Co-permittee	Land Use	# Sites	BASMAA Study (Pre-Ordinance)	SCVURPPP Project (Post-Ordinance)	Percent Reduction
San Jose	Retail Sites	13	0.42	0.18	57%
	Non-Retail Sites	27	0.61	0.13	79%
	All Sites	40	0.55	0.15	73%
Sunnyvale	Retail Sites	5	0.35	0	100%
	Non-Retail Sites	8	0.08	0.02	75%
	All Sites	13	0.19	0.01	95%
San Jose and Sunnyvale	**All Sites**	53	0.46	0.12	74%

Table 3.7. Volume (gallons) of EPS food service ware observed pre-ordinance (BASMAA Study) and post-ordinance (SCVURPPP Study) at 53 monitoring sites in the Cities of San Jose and Sunnyvale.

Co-Permittee	Site ID	Land Use	BASMAA Study (2011-12)		SCVURPPP Project (2015-2016)	
			Accumulation Period (Days)	EPS Food Ware (gal)	Accumulation Period (Days)	EPS Food Ware (gal)
San Jose (n=40)	SJC-044	Commercial	324	0.29	336	0.02
	SJC-007	Industrial	303	0.38	334	0.00
	SJC-045	Industrial	411	0.67	337	0.30
	SJC-046	Industrial	319	1.11	337	0.67
	SJC-048	Industrial	321	0.17	337	0.03
	SJC-107	Industrial	409	1.56	350	0.00
	SJC-002	Residential	270	0.00	348	0.15
	SJC-006	Residential	274	0.11	330	0.13
	SJC-010	Residential	299	0.56	331	0.06
	SJC-055	Residential	411	1.11	331	0.30
	SJC-056	Residential	411	0.19	331	0.20
	SJC-060	Residential	401	1.56	343	0.07
	SJC-073	Residential	167	0.44	345	0.00
	SJC-076	Residential	419	0.73	346	0.48
	SJC-077	Residential	419	0.89	345	0.04
	SJC-079	Residential	167	1.56	345	0.08
	SJC-085	Residential	401	0.39	126	0.00
	SJC-086	Residential	401	0.02	172	0.01
	SJC-093	Residential	420	0.37	345	0.24
	SJC-102	Residential	419	0.60	346	0.15
	SJC-104	Residential	419	0.38	346	0.02
	SJC-110	Residential	269	0.02	350	0.05
	SJC-112	Residential	305	0.03	345	0.08
	SJC-113	Residential	419	1.28	126	0.07
	SJC-003	Retail	263	0.11	334	0.10
	SJC-004	Retail	235	0.09	334	0.00
	SJC-016	Retail	260	0.11	336	0.00
	SJC-018	Retail	287	0.11	335	0.00
	SJC-027	Retail	235	0.11	336	0.15
	SJC-032	Retail	435	0.83	335	0.08
	SJC-033	Retail	435	0.56	335	0.34
	SJC-036	Retail	432	0.94	336	0.37
	SJC-038	Retail	432	0.75	349	0.19
	SJC-080	Retail	419	0.78	350	0.61
	SJC-081	Retail	419	0.72	350	0.11
	SJC-082	Retail	419	0.11	350	0.15
	SJC-142	Retail	295	0.56	350	0.15
	SJC-008	Roadway	298	0.22	335	0.09
	SJC-021	Roadway	235	0.11	335	0.02
	SJC-019	Urban Park	287	0.02	335	0.00
Sunnyvale (n=13)	SNV-097	Commercial	238	0.11	327	0.00
	SNV-098	Commercial	239	0.00	327	0.05
	SNV-137	Commercial	236	0.00	325	0.00
	SNV-166	Commercial	546	0.02	329	0.00
	SNV-122	Residential	238	0.07	328	0.08
	SNV-165	Residential	585	0.44	329	0.00
	SNV-092	Retail	237	0.17	327	0.00
	SNV-112	Retail	238	0.00	327	0.00
	SNV-117	Retail	238	0.56	328	0.00
	SNV-129	Retail	238	0.42	329	0.01
	SNV-150	Retail	236	0.00	325	0.00
	SNV-114	School	238	0.01	327	0.00
	SNV-163	School	565	0.11	329	0.00
Totals			-	**22.44**	-	**5.61**

After normalizing the volumes of EPS food service ware observed during the BASMAA Study and the SCVURPPP Project into annual averages, a comparison between the two data sets was made. The percent reduction in both San Jose and Sunnyvale was over 70%, with an overall reduction of 74%. Furthermore, statistical analysis indicates that there is a 95% chance ($p < 0.001$, $\alpha = 0.05$)[6] that the annual volume of EPS food service ware has significantly decreased since the adoption of ordinances. These results suggest that although EPS food service ware ordinances have not eliminated EPS food service ware from the environment, they are having a significant effect on the volume of this material observed.

Eleven of the fourteen Co-Permittees in Santa Clara County have adopted ordinances prohibiting the distribution of EPS food service ware by restaurants, food vendors and/or retailers. For those Co-Permittees with ordinances, the year of the adoption (see Table 1.1) and scope of the ordinance vary. All but one Co-permittee (i.e., City of Palo Alto) adopted their EPS food service ware ordinance after the BASMAA Study was completed. However, Palo Alto did not have any monitored sites in the BASMAA Study. Of the 119 monitoring sites equipped with small-full capture devices that were sampled as part of the SCVURPPP Project, 66 sites were not part of the BASMAA Study and therefore did not have any pre-ordinance data sets. Information presented in Table 3.1 presents the average EPS rate (gallons/year) observed at the 119 sites post-ordinance. Similar to the results of the BASMAA Study and SCVURPPP Project for the common monitoring sites in San Jose and Sunnyvale, it is also likely that the average EPS rate observed during the SCVURPPP Project for the 66 sites not included in the BASMAA Project has significantly decreased post-ordinance.

Therefore, unlike the comparison of pre- and post-ordinance datasets for single-use plastic bags, comparisons presented in this section are not linked to EPS ordinance adoption timeframes. Information presented is only focused on evaluating the extent and magnitude of EPS food ware observed in the environment over time. Of all the trash characterized, EPS was only 2.5% of the total volume, indicating that it is entering the MS4 at a much lower rate than other trash types.

3.4 Effectiveness of All Trash Control Measures

The trash management question--*Are trash control measures implemented by Co-Permittees effectively reducing the overall level of trash in municipal stormwater conveyances in Santa Clara County*?-- was addressed by comparing trash rates measured during the SCVURPPP Project to those measured during the BASMAA Study for the same 53 sites. As a first step, trash volumes observed during the Study and Project were normalized to annual rates (gallons/year), which were then used to develop box plots which illustrate the range and distribution of annual trash rates for both the BASMAA Study and SCVURPPP Project (Figure 3.2). Box plots are typically used to visualize and compare data sets to better understand the level of data variability within and between categories (e.g., land use). Box plots have three parts: 1) the "box", which represents the 25th percentile (lower edge), 50th percentile (horizontal line), and 75th percentile (upper edge) of the dataset; 2) the "whiskers", which represent the 10th percentile and 90th percentile of the dataset; and 3) the "dots", which represent the statistical outliers in the dataset. Visual observations of the box plots suggest that trash rates observed in different land uses during the SCVURPPP Project are consistently lower than those observed by the BASMAA Study.

[6] The Shapiro-Wilk test determined that the two groups did not follow a normal distribution, resulting in the use of the Mann-Whitney Rank Sum Test to evaluate statistical differences between the two datasets.

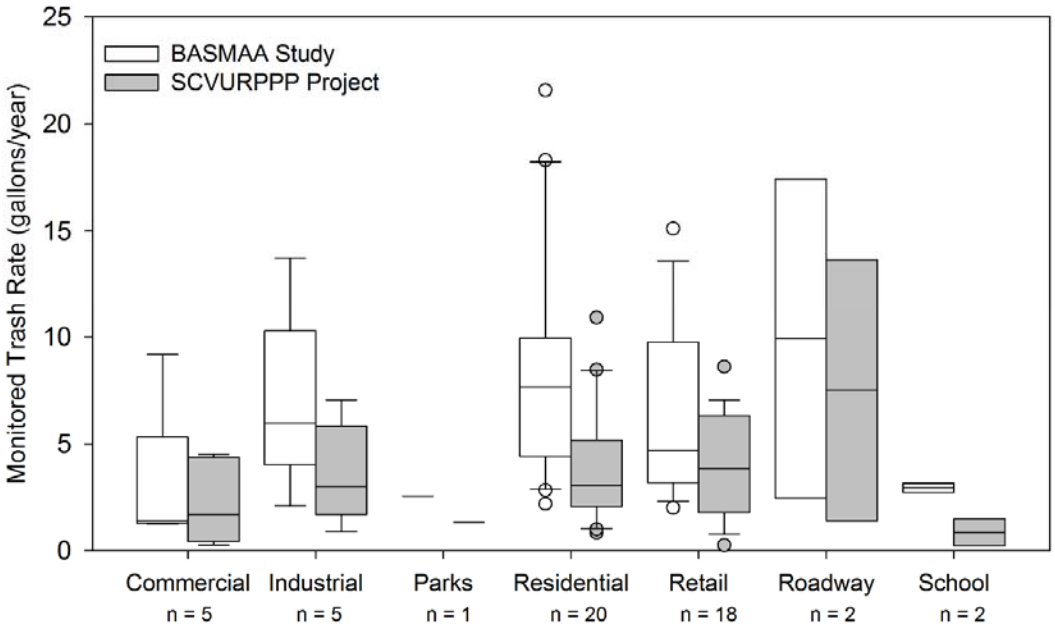

Figure 3.2. Comparison of trash rates by land use observed during the BASMAA Study and SCVURPPP Project (n= 53).

The average trash rates (i.e., gallons/year) collected at all sites in San Jose and Sunnyvale during the BASMAA Study and SCVURPPP Project are shown in Table 3.8. Average rates for retail sites and non-retail sites monitored in San Jose and Sunnyvale are also presented separately.

Table 3.8. Average annual volume (gallons/yr) of trash based on data collected during the BASMAA Study and SCVURPPP Project at 53 monitoring sites in in the Cities of San Jose and Sunnyvale.

Co-permittee	Land Use	# Sites	BASMAA Study (Pre-Ordinance) (gal/yr)	SCVURPPP Project (Post-Ordinance) (gal/yr)	Percent Reduction
San Jose	Retail Sites	13	8.1	4.83	40%
	Non-Retail Sites	27	8.35	4.12	51%
	All Sites	40	8.27	4.35	47%
Sunnyvale	Retail Sites	5	2.73	1.86	32%
	Non-Retail Sites	8	2.68	1.56	42%
	All Sites	13	2.7	1.67	38%
Total	**All Sites**	53	6.9	3.69	47%

Compared to the BASMAA Study, average trash rates were significantly lower during the SCVURPPP Project. The average trash rate decreased by 47% at the 40 monitoring sites in San Jose and by 38% at the 13 monitoring sites in Sunnyvale. Average trash rates at Sunnyvale retail land use sites decreased by 32% and by 42% at non-retail sites. Although the data set is limited, these results appear to indicate that the level of trash observed in stormwater conveyances has substantially decreased in San Jose and Sunnyvale, regardless of land use. Overall, there was a 47% reduction in trash observed at sites monitored both during the BASMAA Study and Project.

Statistical comparisons[7] were made to further evaluate whether there are significant differences between the BASMAA and SCVURPPP data sets, possibly indicating a reduction in trash between 2011/12 and 2015/2016. Like the single-use plastic bag and EPS food service ware reductions, statistically speaking there is a greater than 95% probability ($p < 0.001$, $\alpha = 0.05$) that the observed reduction is significant.

3.5 Trash Rates from Hydrodynamic Separators

The Project also included the characterization of trash and debris from four hydrodynamic separators (HDS) located in the Cities of Palo Alto (two), Los Altos (one) and Mountain View (one). The two units in Palo Alto are in very close proximity of each other and were grouped together for the purposes of this Project. For the Palo Alto and Mountain View HDS units, the majority of material removed from the HDS unit was characterized and the volume of each trash item was extrapolated to the portion of trash and debris not characterized. To ensure that a representative sample of trash and debris was characterized, a random grab sample was collected from the entire amount of trash and debris removed from the HDS unit. The volume of each fraction (i.e., characterized vs. non-characterized) was measured to ensure an accurate extrapolation. All material removed from the Los Altos HDS unit was characterized.

The catchment areas for each of the HDS units range from a low of 106 acres in Los Altos to a high of 168 acres for the combined Palo Alto HDS units. As a comparison, the average small full capture device in the Project had a catchment area of 1.76 acres, with a summed total of 207 acres for all 119 small full-capture devices. This Project and the BASMAA Study did not find a correlation with catchment area and quantity of trash. Therefore, trash rates were not normalized by catchment area. However, to be comparable to HDS units, the rates must be normalized to catchment area. This was only done by using the averages and not the catchment area specific to each small full-capture device.

Table 3.9 shows that the normalized rates for total trash, single-use plastic bags, and EPS food service ware were much lower in the HDS units than the small full-capture devices. However, none of the cleanout periods for the HDS units included the "first flush" event in fall 2015, which occurred on November 2, 2015. As a result, the actual trash rate may be higher. In addition to missing the first flush, HDS units only capture trash and debris during storm flows. Therefore, the last day of accumulation was the last storm event before the cleanouts. The last rain of any significance in spring 2015 occurred on May 14, 2015, so there would not be any trash accumulation expected in the HDS units after this day. When the accumulation period is ended on May 14, 2015, the Los Altos trash rate would increase by a multiplier of 2.7 and the Mountain View rates by a multiplier of 2.3. The Palo Alto rates would not change.

[7] A Shapiro-Wilk test of normality determined that none of the data sets were normally distributed and therefore a Mann-Whitney Rank Sum Test (non-parametric) test was used.

Table 3.9. Annual rate of total trash, single-use plastic bags, and EPS normalized to drainage area.

Trash Full Capture System	Area (acres)	Trash Rate Total (gal/yr/ac)	Plastic Bags Rate (bags/yr/ac)	EPS Rate (gal/yr/ac)
CPS (All 119)	207	1.69	0.23	0.049
Los Altos (HDS)	106	0.08	0.06	0.000
Mountain View (HDS)	126	0.33	0.03	0.004
Palo Alto (2 HDS)	168	0.23	0.10	0.003

4.0 CONCLUSIONS AND UNCERTAINTIES

Data collected as part of the *Santa Clara Countywide Storm Drain Trash Monitoring and Characterization Project* and the previously conducted BASMAA Study assisted in beginning to answer questions related to reductions in single-use plastic bags, EPS food service ware, and overall levels of trash observed in stormwater conveyance systems in Santa Clara County. The 119 sites monitored during the SCVURPPP Project (including 53 previously monitored BASMAA sites) served as sites representative of high and moderate trash generation in Santa Clara County. Based on the limited data available as part of the SCVURPPP Project and the BASMAA Study, the following preliminary conclusions can be made with reference to the five management questions developed to guide this Project:

- Trash Characteristics – Roughly 9% (by volume) of the material removed and characterized from storm drain inlets meets the definition of trash. This is compared to 17% observed during the BASMAA study. The types of trash observed are dominated by plastic film, food and candy packaging, straws, lids, and bottle tops (i.e., Other Plastic Category); and paper napkins, newspapers, cardboard, sports balls, and other non-plastic trash (i.e., All Other Trash Category). CRV-labeled plastic and glass recyclable bottles, cigarette butts, single-use plastic bags, and EPS food ware comprise a smaller portion of the trash characterized (~12% combined). Rigid plastic and paper disposable food and beverage ware are not consistently observed in material removed from storm drains.

- Single-Use Plastic Bags – The number of single-use plastic bags observed in Santa Clara County storm drains appears to have decreased significantly since the adoption of single-use bag ordinances. In the 53 sites common to both the BASMAA Study (pre-ordinance) and this Project (post-ordinance), the number of bags observed decreased by 72%. This decrease was seen in both San Jose and Sunnyvale sites, and in both retail and non-retail land uses. This decrease coincides with the adoption and implementation of ordinances prohibiting the distribution of single-use plastic bags at many stores/businesses in Santa Clara County. This result suggests that although ordinances have not eliminated single-use plastic bags in the environment, they are having a significant effect on the number of bags observed in stormwater conveyance systems in the Santa Clara Valley.

- EPS Food Service Ware – Similar to single-use plastic bags, there was a 74% decrease in the volume of EPS food service ware observed in the 53 sites in common between this Project and the BASMAA Study. Like single-use plastic bags, this large decrease coincides with ordinances that have been adopted throughout most of the Santa Clara Valley. This result also suggests that although ordinances have not eliminated EPS food service ware in the environment, they are

having a significant effect on the volume of this type of trash in storm stormwater conveyance systems in the Santa Clara Valley.

- Effectiveness of All Trash Control Measures – Consistent with methods outlined in the MRP, Co-permittees perform on-land visual assessments to quantify long term reductions in trash observed on-land and available to the stormwater conveyance system. Results from over 500 visual assessments conducted in 2015 suggest that countywide at least 25% of the trash entering the storm drainage system in 2009 has been reduced as a result of ordinances and control measures other than full capture devices (SCVURPPP 2016). This compares to the data collected via this Project, where the overall amount of trash observed at 53 sites common to the BASMAA Study and SCVURPPP Project has decreased by approximately 47%.

5.0 REFERENCES

Bay Area Stormwater Management Agencies Association (BASMAA) (2014). San Francisco Bay Area Stormwater Trash Generation Rates - Final Technical Report. Prepared for the Bay Area Stormwater Management Agencies Association (BASMAA). Oakland. Prepared by Eisenberg, Olivieri and Associates (EOA). June 20.

Bjorndal K.A., A.B. Bolten, C.J. Lagueux. 1994. Ingestion of marine debris by juvenile sea turtles in coastal Florida habitats. Marine Pollution Bulletin. Volume 28, Issue 3, Pages 154–158. March.

Islam, M. S. and M. Tanaka. 2004. Impacts of pollution on coastal and marine ecosystems including coastal and marine fisheries and approach for management: a review and synthesis. Marine Pollution Bulletin. Volume 48, Issues 7–8, Pages 624–649.

Moore, C.J. 2008. Synthetic polymers in the marine environment: A rapidly increasing, long-term threat. Environmental Research. Volume 108, Issue 2, Pages 131–139. October.

Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) (2014). Pilot Trash Assessment Strategy. February 1.

Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) (2015). Storm Drain Trash Characterization Project. Sampling and Analysis Plan. January.

Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) (2016). 2015 Program Summary. May.

SFBRWQCB. 2009. Municipal Regional NPDES Permit. Order R2-2015-0049. NPDES Permit No CAS612008. San Francisco Bay Regional Water Quality Control Board.

von Saal. F.S., S. Parmigiani, P.L. Palanza, L.G. Everett, R. Ragaini. 2008. The plastic world: Sources, amounts, ecological impacts and effects on development, reproduction, brain and behavior in aquatic and terrestrial animals and humans. Environmental Research. Volume 108, Issue 2, Pages 127–130. October.

APPENDIX A

SCVURPPP PROJECT
SAMPLING AND ANALYSIS PLAN (SAP)

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Storm Drain Trash Characterization Project

Sampling and Analysis Plan

January 13, 2015

EOA inc.

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TERMINOLOGY

Control Measure: Any activity, technology, process, operational method or measure, or engineered system, which when implemented prevents, controls, removes, or reduces pollution. A control measure is also referred to as a best management practice (BMP).

Full Capture Device: A single device or series of devices that can trap all particles retained by a 5 mm mesh screen, and has a treatment capacity that exceeds the peak flow rate resulting from a one-year, one-hour storm in the subdrainage area treated by the BMP.

Litter: As defined by California Code Section 68055.1(g), litter means all improperly discarded waste material, including, but not limited to, convenience food, beverage, and other product packages or containers constructed of steel, aluminum, glass, paper, plastic, and other natural and synthetic materials, thrown or deposited on the lands and water.

Municipal Separate Storm Sewer System (MS4): "a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains): (i) Owned or operated by a state, city, town, borough, county, parish, district, association, or other public body (created to or pursuant to state law) including special districts under state law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the Clean Water Act that discharges into waters of the United States. (ii) Designed or used for collecting or conveying stormwater; (iii) Which is not a combined sewer; and (iv) Which is not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.2." (40 CFR 122.26(b)(8))

Receiving Waters: Natural water bodies receiving discharges from municipal stormwater drainage systems.

Stormwater: Runoff from roofs, roads and other surfaces that is generated during rainfall and snow events and flows into a stormwater drainage system.

Storm Drain Inlet: Part of the stormwater drainage system where surface runoff enters the underground conveyance system. Includes side inlets located adjacent to curbs and grate inlets located on the surface of a street or parking lot.

Storm Drain Insert: A device (e.g., screen) designed to capture trash capture within a storm drain inlet.

Trash: Man-made litter (as defined by California Code Section 68055.1g) that cannot pass through a 5 mm mesh screen. Excludes sediments, sand, vegetation, oil and grease, and exotic species.

Urban Runoff: All flows in a MS4 and consists stormwater (wet weather flows) and non-storm water illicit discharges (dry weather flows).

1.0 PROJECT PURPOSE AND BACKGROUND

Trash (i.e., litter, floatables, gross pollutants, or solid waste) is a serious problem for watersheds where it presents an aesthetic nuisance, and a serious threat to aquatic life in creeks, San Francisco Bay, and the Pacific Ocean. Data suggest that plastic trash in particular persists for hundreds of years in the environment and can pose a threat to wildlife through ingestion, entrapment, as well as harboring chemicals potentially harmful to the aquatic environment. Types of trash commonly observed in watersheds and water bodies include food and beverage containers (e.g., plastic bags and bottles) and packaging, cigarette butts, food waste, construction and landscaping materials, furniture, electronics, tires, and hazardous materials (e.g., paint and batteries).

In response to concerns about urban trash impacts on receiving water bodies in the San Francisco Bay area, the San Francisco Bay Regional Water Quality Control Board (Water Board) included trash reduction requirements in the Municipal Regional Stormwater NPDES Permit for Phase I communities in the Bay area (Order R2-2009-0074), also known as the Municipal Regional Permit (MRP). These provisions require applicable Bay Area municipalities (Permittees) to reduce trash from their Municipal Separate Storm Sewer Systems (MS4s) by 40 percent before July 1, 2014, 70 percent by 2017, and to a point of “no adverse impacts” to water bodies by 2022. To establish a baseline, each Permittee was also required to develop an estimate of the amount of trash discharged from its stormwater conveyance system circa 2011, and develop and implement a trash load reduction tracking method that will be used to account for trash load reduction actions and to demonstrate progress and attainment of trash load reduction targets.

The assessment strategy used by Co-permittees is described in their Long-Term Trash Load Reduction Plan (Long-Term Plan) and the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) Pilot Assessment Strategy. This sampling and analysis plan (SAP) was developed to assist Co-permittees in assessing the effects of specific trash control measures designed to reduce the generation and impacts of persistent and problematic types of trash.

1.1 Background

1.1.1 Stormwater Trash Management within Santa Clara County

Co-permittees in Santa Clara County collaborate through SCVURPPP to protect creeks, wetlands and San Francisco Bay. With regard to trash reduction, each Co-permittee was required by the MRP to submit a Long-Term Plan by February 1, 2014. Long-Term Plans outline how each Co-permittee will achieve MRP trash reduction goals. Trash control measures and implementation schedules are provided in each Plan.

Leading up to Long-Term Plan submittal, Co-permittees participated in the BASMAA San Francisco Bay Area Stormwater Trash Generation Rates Project (BASMAA Project). As part of the BASMAA Project, trash was trapped and removed during four different time periods from a total of154 storm drain inlets equipped with full trash capture devices. Trash and debris removed was then sorted and characterized. Of the 154 inlets, 87 were located within Santa Clara County. The BASMAA Project resulted in trash generation rates for each inlet monitored in the Bay area. These rates along with additional field observations were then used to develop maps illustrating trash generation. Additionally, data generated from the BASMAA Project included the number and volume of single-use carryout plastic bags and expanded polystyrene

(EPS) food service ware, as well as the total volume of trash generated from the land area draining to each inlet. This information was collected prior to the implementation of many trash control measures, including product-based ordinances designed to reduce the environmental impacts of litter-prone trash items.

1.1.2 Product-based Ordinances

Ten SCVURPPP Co-permittees have adopted ordinances prohibiting the distribution of single-use carryout plastic bags at the point of sale within their jurisdictions. Eleven Co-permittees have also prohibited the distribution of EPS food service ware at restaurants, food vendors and/or retailers (Table 1). Ordinances were adopted to reduce the potential impacts of single-use carryout plastic bags and EPS food ware on aquatic life and wildlife, and the presence of these persistent materials in the environment. Limited information on the levels of single-use carryout plastic bags and EPS food service ware currently observed in the environment is available for SCVURPPP Co-permittees. Therefore, there is an interest in characterizing the magnitude and extent of these materials to determine if they continue to be present in the environment and if so, at what levels.

Table 1. SCVURPPP Co-permittees that have adopted single-use carryout plastic bag or expanded polystyrene (EPS) food service ware ordinances[a].

Co-permittee	Single-use Carryout Plastic Bag Ordinance	EPS Food Service Ware Ordinance
Campbell	X	X
Cupertino	X	X
Los Altos	X	X
Los Altos Hills		X
Los Gatos	X	X
Mountain View	X	X
Palo Alto	X	X
San Jose	X	X
Santa Clara	X	X
Santa Clara County	X	X
Sunnyvale	X	X

[a] The Cities of Milpitas, Monte Sereno and Saratoga have not adopted single-use carryout plastic bag or expanded polystyrene (EPS) food service ware ordinances.

1.2 Management Questions

SCVURPPP Co-permittees subject to trash reduction requirements described in Permit Provision C.10 of the MRP have implemented a variety of enhanced or new trash control measures since the BASMAA regional trash generation study was conducted in 2011. As a result, trash reductions are observable on streets, public right-of-ways, and in stormwater conveyances as control measures are implemented. At a minimum, the effects of municipal ordinances that prohibit the distribution of trash items frequently observed in stormwater conveyances (i.e., single-use carryout plastic bags and EPS food service ware) should be detectable.

With increased levels of control measures being implemented, Co-permittees have started assessing the effectiveness of specific control measures designed to reduce the generation of trash and determining the progress toward trash reduction goals. This Sampling and Analysis Plan (SAP) describes the methods that will be used to assist Co-permittees in answering the following management questions:

1. Single-use Carryout Plastic Bags:
    a. To what degree are single-use plastic carryout bags present in MS4s?
    b. Have single use carryout plastic bag ordinances substantially reduced the level of bags observed in the environment?
2. EPS Food Service Ware
    a. To what degree is EPS Food Service Ware present in MS4s?
    b. Have municipal ordinances substantially reduced the level of EPS Food Service Ware found in the environment?

2.0 MONITORING DESIGN

The following section describes the monitoring design that will be used to answer the management questions presented within Section 1. The monitoring design consists of re-sampling all or most storm drain inlets in Santa Clara County monitored during the BASMAA Project, in addition to a number of other inlets that have not been previously monitored. Data on single-use carryout plastic bags and EPS food service ware, which was collected during the BASMAA Project and prior to the implementation of many product-based ordinances in Santa Clara County, will be compared to data collected via this stormwater trash characterization project. Additionally, data generated through monitoring of new sites located in high and medium trash generating areas throughout the County will be compared to data from similar sites previously sampled in other Bay Area locations during the BASMAA Project.

2.1 Monitoring Sites

2.1.1 Trash Full Capture Devices

Small full-capture devices (e.g., storm drain inserts) provide optimal sampling locations to establish trash generation/loading rates and have been used extensively in previous trash loading studies. Storm drain inserts will be the primary device used in this assessment study because they generally drain a relatively small drainage area with a homogenous land use (e.g., retail) and are easy to clean/maintain. SCVURPPP Co-permittees have installed nearly 420 storm drain inserts to-date, creating an adequate pool for the selection of 124 sites that will be monitored during this project in an attempt to adequately represent the levels of trash in Santa Clara County MS4s. Five Co-permittees (i.e., Los Altos, Milpitas, Mountain View, Palo Alto and Santa Clara), however, have opted to install large full-capture devices rather than small full-capture devices. Therefore, large devices installed within these jurisdictions will be used as monitoring sites, as alternatives to small inlet-based devices.

2.1.2 Considerations of Land Use

In an effort to adequately represent the level of single-use carryout plastic bags, EPS food service ware, and other trash types that will be characterized during the project and to inform the selection of new monitoring sites, data generated via the BASMAA Project was compiled

and evaluated. During the BASMAA Project, a total of 154 sites located throughout the Bay area (87 in Santa Clara County) were monitored up to four times each and the material removed was characterized into eight trash and debris categories: 1) debris (vegetation and sediment); 2) recyclable beverage containers (i.e., CRV); 3) single-use carryout plastic bags; 4) EPS food service ware; 5) other plastic; 6) paper; 7) metal; and 8) miscellaneous (rubber, items of mixed material, etc). For each category, both volume and weight were measured. For single-use carry plastic bags and EPS food service ware, individual items were also counted. An average of 1.09 single-use plastic bags was observed per year during the BASMAA Project. Although the number of bags observed at any one site varied greatly, no particular land use type was identified as contributing significantly more bags than others (Figure 1 and Table 1).

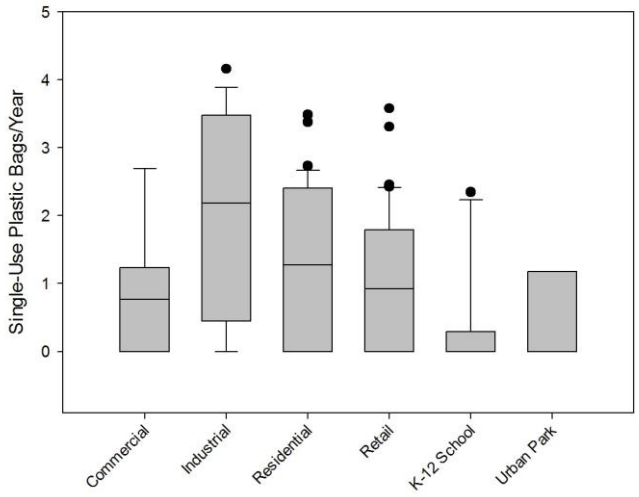

Figure 1. Number of single-use plastic bags observed in 154 San Francisco Bay area storm drains in 2011-12.

Table 2. Descriptive statistics for the number of single-use carryout plastic bags observed in 154 San Francisco Bay area storm drains in 2011-12.

	Commercial	Industrial	Residential	Retail	School	Urban Park
Max	2.7	4.2	3.5	3.6	2.3	1.2
75%	1.0	3.5	2.3	1.8	0	0.6
Mean	**0.8**	**2.0**	**1.3**	**0.9**	**0.4**	**0.4**
Median	**0.8**	**2.2**	**1.3**	**0.9**	**0**	**0**
25%	0	0.9	0	0	0	0
Min	0	0	0	0	0	0
N	18	13	49	61	10	3

2.1.3 Site Selection Criteria

Based on the analysis of single-use carryout plastic bag data with regard to land uses, the current and planned locations of many control measures, and experience in conducting trash characterization studies, monitoring sites that will be included in this stormwater trash characterization project were selected based on the following selection criteria, which were applied in the following order:

1. All sites selected must be equipped with a properly functioning system or device that meets the full-capture standard (i.e., a full capture system or device has the ability to trap all particles retained by a 5 mm mesh screen and has a design treatment capacity of at least the peak flow rate resulting from a one-year, one-hour, storm in the sub-drainage area);
2. Monitoring sites with small full-capture devices cannot also be equipped with curb inlet screens that block trash from entering the storm drain inlet;
3. To the extent possible, all properly functioning sites that were sampled during the BASMAA Project will be re-sampled to assess spatial and temporal trends;
4. Most new sites will drain predominately retail land use areas associated with moderate, high or very high trash generation rates to assess the level of specific items currently in storm drain conveyance systems;
5. A minimum of two sites equipped with small full-capture devices or one large full-capture device will be selected within each Co-permittee's jurisdictional area.

2.1.4 Proposed Monitoring Sites – Small Full-Capture Devices

Trash and debris from a total of 124 monitoring sites equipped with small full-capture devices will be removed and characterized during the project. Although locations of proposed monitoring sites equipped with small devices are presented in this section, field verification is required to ensure that each small device is still in-place, operational and meets the criteria described above. Therefore, the total number of sites equipped with small devices may slightly differ.

A total of 87 monitoring sites within the Cities of San Jose and Sunnyvale were part of the BASMAA Study. Of these 87 previously monitored sites, 52 are proposed for re-sampling during the project. Of the 35 sites (i.e., 33 in San Jose and 2 in Sunnyvale) not recommended for re-sampling, 28 sites (i.e., 26 in San Jose and 2 in Sunnyvale) are not ideal monitoring locations due to the very limited volume of trash observed during previous monitoring events. Of the remaining 7 San Jose sites not recommended for re-sampling, 3 sites are equipped with curb screen inlets, 3 sites are directly adjacent to sites which will be resampled, and one site is located on an expressway. All proposed monitoring sites equipped with small devices are listed in Table 3. A total of 26 monitoring sites proposed for the City of Sunnyvale are equipped with curb screen inlets. To be included as a monitoring site in this project, all curb screen inlets must be removed prior to the study beginning and remain off for the duration of the study.

Table 3. Proposed monitoring sites equipped with small full-capture devices in SCVURPPP Project

Permittee	Site ID	Latitude	Longitude	Land Use	Trash Rate (gal/year)	# of Bags Observed	Accumulation Period (days)	Bag Rate (bags/yr)	Proposed for Re-sampling	Proposed New Site
San Jose	SJ01	37.36731	-121.86344	Industrial	5.95	1	409	0.9	X	
San Jose	SJ06	37.36482	-121.86716	Industrial	10.35	0	411	0.0	X	
San Jose	SJ07	37.36436	-121.87085	Industrial	6.83	1	411	0.9	X	
San Jose	SJ08	37.36275	-121.86927	Industrial	13.75	5	319	5.7	X	
San Jose	SJ11	37.36332	-121.86295	Residential	9.54	7	411	6.2	X	
San Jose	SJ12	37.36331	-121.86278	Residential	9.96	5	411	4.4	X	
San Jose	SJ13	37.35593	-121.84917	Retail	11.69	3	435	2.5	X	
San Jose	SJ15	37.34759	-121.82962	Residential	10.30	6	419	5.2	X	
San Jose	SJ16	37.34690	-121.82910	Residential	17.53	6	419	5.2	X	
San Jose	SJ17	37.34649	-121.82871	Residential	9.19	5	419	4.4	X	
San Jose	SJ18	37.34502	-121.82759	Residential	18.31	1	167	2.2	X	
San Jose	SJ19	37.35354	-121.82326	Retail	9.53	1	419	0.9	X	
San Jose	SJ20	37.35593	-121.81928	Retail	15.12	2	419	1.7	X	
San Jose	SJ21	37.35634	-121.81906	Retail	9.55	3	419	2.6	X	
San Jose	SJ22	37.35015	-121.81948	Residential	21.58	8	419	7.0	X	
San Jose	SJ23	37.35009	-121.81919	Residential	9.11	2	419	1.7	X	
San Jose	SJ24	37.35158	-121.81480	Residential	9.93	2	420	1.7	X	
San Jose	SJ25	37.35165	-121.81287	Residential	7.33	3	401	2.7	X	
San Jose	SJ26	37.35169	-121.81273	Residential	5.00	6	401	5.5	X	
San Jose	SJ27	37.31965	-121.82803	Retail	9.94	4	432	3.4	X	
San Jose	SJ28	37.31951	-121.82705	Retail	9.35	1	432	0.8	X	
San Jose	SJ29	37.31884	-121.82336	Retail	11.63	9	432	7.6	X	
San Jose	SJ30	37.32170	-121.82714	Retail	10.41	3	435	2.5	X	
San Jose	SJ31	37.32269	-121.82603	Retail	13.43	6	435	5.0	X	
San Jose	SJ35	37.31279	-121.85240	Industrial	5.94	0	303	0.0	X	
San Jose	SJ37	37.29903	-121.82384	Retail	4.59	2	295	2.5	X	
San Jose	SJ38	37.29408	-121.83206	Roadway	17.42	5	298	6.1	X	
San Jose	SJ39	37.31617	-121.78789	Residential	4.39	2	274	2.7	X	
San Jose	SJ40	37.31412	-121.77330	Retail	4.11	1	287	1.3	X	
San Jose	SJ52	37.25049	-121.85737	Retail	3.30	0	235	0.0	X	
San Jose	SJ53	37.25258	-121.85862	Retail	5.16	0	235	0.0	X	
San Jose	SJ55	37.26037	-121.93147	Retail	4.79	0	260	0.0	X	

Permittee	Site ID	Latitude	Longitude	Land Use	Trash Rate (gal/year)	# of Bags Observed	Accumulation Period (days)	Bag Rate (bags/yr)	Proposed for Re-sampling	Proposed New Site
San Jose	SJ56	37.27349	-121.93459	Retail	4.34	0	263	0.0	X	
San Jose	SJ58	37.30136	-121.95666	Residential	4.06	0	269	0.0	X	
San Jose	SJ59	37.30103	-121.95653	Residential	4.51	1	270	1.4	X	
San Jose	SJ64	37.34275	-121.84024	Residential	6.29	1	305	1.2	X	
San Jose	SJ73	37.34534	-121.83120	Residential	3.35	0	167	0.0	X	
San Jose	SJ76	37.35942	-121.84977	Residential	6.16	2	401	1.8	X	
Sunnyvale	SU01	37.41717	-122.01626	Commercial	1.25	0	546	0.0	X	
Sunnyvale	SU02	37.38304	-122.05706	Residential	7.94	5	585	3.1	X	
Sunnyvale	SU03	37.39502	-122.01828	School	3.89	4	565	2.6	X	
Sunnyvale	SU04	37.39299	-122.01896	School	2.73	3	565	1.9	X	
Sunnyvale	SU05	37.37628	-122.03185	Retail	2.80	2	236	3.1	X	
Sunnyvale	SU07	37.36660	-122.03245	Retail	3.83	0	238	0.0	X	
Sunnyvale	SU08	37.35874	-122.03210	Residential	2.19	0	238	0.0	X	
Sunnyvale	SU09	37.35198	-122.01442	Retail	2.65	0	238	0.0	X	
Sunnyvale	SU10	37.35199	-122.03154	Retail	2.01	0	238	0.0	X	
Sunnyvale	SU11	37.35225	-122.03270	School	3.16	0	238	0.0	X	
Sunnyvale	SU13	37.35199	-122.05075	Commercial	1.41	0	239	0.0	X	
Sunnyvale	SU14	37.35194	-122.05494	Commercial	1.44	0	238	0.0	X	
Sunnyvale	SU15	37.34118	-122.04155	Retail	2.34	0	237	0.0	X	
Sunnyvale	SU16	37.37025	-122.03685	Commercial	1.30	0	236	0.0	X	
Campbell	CM01	37.29413	-121.93146	Retail						X
Campbell	CM02	37.29012	-121.93157	Retail						X
Campbell	CM03	37.28734	-121.93182	Retail						X
Campbell	CM04	37.28340	-121.93182	Retail						X
Campbell	CM05	37.29387	-121.93969	Retail						X
Campbell	CM06	37.28701	-121.94376	Retail						X
Campbell	CM07	37.28712	-121.94709	Retail						X
Campbell	CM08	37.28587	-121.97886	Retail						X
Campbell	CM09	37.29414	-121.93197	Retail						X
Cupertino	CP01	37.33737	-122.04128	Retail						X
Cupertino	CP02	37.32275	-122.01519	Retail						X
Cupertino	CP03	37.32309	-122.01458	Retail						X
Cupertino	CP04	37.32841	-122.01457	Retail						X
Cupertino	CP05	37.32288	-122.00661	Retail						X

Permittee	Site ID	Latitude	Longitude	Land Use	Trash Rate (gal/year)	# of Bags Observed	Accumulation Period (days)	Bag Rate (bags/yr)	Proposed for Re-sampling	Proposed New Site
Cupertino	CP06	37.32300	-122.04644	Retail						X
Cupertino	CP07	37.32303	-122.04018	Retail						X
Cupertino	CP08	37.32270	-122.04871	Colleges and Universities						X
Cupertino	CP09	37.32276	-122.03744	Retail						X
Cupertino	CP10	37.32274	-122.03267	Retail						X
Los Gatos	LG01	37.24093	-121.96077	Retail						X
Los Gatos	LG02	37.24491	-121.95842	Retail						X
Los Gatos	LG03	37.24726	-121.95673	Retail						X
Los Gatos	LG04	37.24817	-121.95702	Retail						X
Los Gatos	LG05	37.23674	-121.96235	Retail						X
Los Gatos	LG06	37.23769	-121.96227	Retail						X
Los Gatos	LG07	37.23385	-121.96410	Retail						X
Los Gatos	LG08	37.22120	-121.97726	Retail						X
Los Gatos	LG09	37.22128	-121.97972	Retail						X
Monte Sereno	MS01	37.24093	-121.98136	Residential						X
Monte Sereno	MS02	37.24123	-121.98301	Residential						X
Saratoga	SA01	37.26680	-122.01442	Commercial						X
Saratoga	SA02	37.26679	-122.01355	Colleges and Universities						X
Santa Clara County	SC01	37.32497	-121.93202	Retail						X
Santa Clara County	SC02	37.31979	-121.93167	Retail						X
Santa Clara County	SC03	37.31625	-121.93214	Retail						X
Santa Clara County	SC04	37.30975	-121.93155	Retail						X
Santa Clara County	SC05	37.31317	-121.93153	Retail						X
Santa Clara County	SC06	37.31113	-121.93156	Retail						X
San Jose	SJ77	37.31785	-121.82466	Residential						X
San Jose	SJ78	37.34815	-121.83049	Retail						X
San Jose	SJ79	37.35782	-121.84524	Retail						X
San Jose	SJ80	37.34613	-121.83417	Retail						X
San Jose	SJ81	37.34589	-121.83384	Retail						X
San Jose	SJ82	37.35275	-121.81586	Residential						X
San Jose	SJ83	37.35497	-121.81789	Residential						X
San Jose	SJ84	37.35556	-121.84888	Retail						X
San Jose	SJ85	37.31383	-121.86502	Industrial						X
San Jose	SJ86	37.32616	-121.88749	Retail						X

Permittee	Site ID	Latitude	Longitude	Land Use	Trash Rate (gal/year)	# of Bags Observed	Accumulation Period (days)	Bag Rate (bags/yr)	Proposed for Re-sampling	Proposed New Site
San Jose	SJ87	37.32020	-121.88847	Other - Urban Open						X
San Jose	SJ88	37.32077	-121.88757	Residential						X
San Jose	SJ89	37.32011	-121.82553	Commercial						X
San Jose	SJ90	37.31873	-121.82335	Commercial						X
San Jose	SJ91	37.31766	-121.82494	Residential						X
San Jose	SJ92	37.35770	-121.84550	Retail						X
San Jose	SJ93	37.34582	-121.83393	Retail						X
San Jose	SJ94	37.35277	-121.81163	Residential						X
San Jose	SJ95	37.35232	-121.81547	Residential						X
San Jose	SJ96	37.35330	-121.81637	Residential						X
San Jose	SJ97	37.32626	-121.88758	Retail						X
San Jose	SJ98	37.32067	-121.88749	Residential						X
Sunnyvale	SU17	37.35060	-122.01440	Retail						X
Sunnyvale	SU18	37.35889	-122.03260	Retail						X
Sunnyvale	SU19	37.36459	-122.03249	Retail						X
Sunnyvale	SU20	37.36887	-122.03719	Retail						X
Sunnyvale	SU21	37.37150	-122.03596	Commercial						X
Sunnyvale	SU22	37.37335	-122.03519	Commercial						X
Sunnyvale	SU23	37.37492	-122.03520	Retail						X
Sunnyvale	SU24	37.37664	-122.03427	Commercial						X
Sunnyvale	SU25	37.37786	-122.03080	Retail						X
Sunnyvale	SU26	37.39099	-122.01335	Retail						X
Sunnyvale	SU27	37.38933	-122.02979	Retail						X
Sunnyvale	SU28	37.39671	-122.02795	Commercial						X

The remaining 72 monitoring sites have not been previously sampled. Sites were selected from nearly 420 small full-trash capture devices installed by municipalities in Santa Clara County. A total of 119 of the nearly 420 sites have retail land uses within a 200 foot radius surrounding each site. Of the 119 potential retail land use sites, a total of 50 sites were selected for this project. Sites depicting retail land uses were emphasized and selected because they are the focused area of implementation for single-use carryout plastic bag bans. Additionally, these areas generally have a higher potential for trash generation. The new sites were selected consistent with the monitoring site selection criteria. The remaining 22 new monitoring sites consist of the following land uses: residential, industrial, commercial and colleges/universities. All proposed new sites are listed in Table 3.

2.1.5 Proposed Monitoring Sites – Large Full-Capture Devices

Trash and debris from a total of five full-capture devices will be removed and characterized during the project. The jurisdiction and type of each large full-capture device is presented in Table 4. These large full-capture devices were selected in jurisdictions that opted not to install small full-capture devices.

Table 4. Type and location of large full-capture device proposed for SCVURPPP Project (by jurisdiction)

Co-permittee	Device Type	Location
Los Altos	Hydrodynamic Separator	On View St, 180' N of the intersection with Edith Ave.
Milpitas	Gross Solids Removal Device	Wrigley-Ford pump station
Mountain View	Hydrodynamic Separator	Intersection of Leland Ave. and Fair Oaks St.
Palo Alto	Hydrodynamic Separator	Intersection of Park Blvd. and Ventura Ave **OR** On Park Blvd., 60' SE of the intersection with Maclane St.
Santa Clara	Netting Device	Westside Storm Station

2.1.6 Proposed Monitoring Sites – Summary

Table 5 presents a summary of the sites in each Co-permittee's jurisdictional area that are proposed for monitoring. Figure 2 illustrates the location of each proposed monitoring site. The following provides additional information on the site selection process:

- A total of 52 sites (i.e., 38 sites in San Jose and 14 sites in Sunnyvale) previously monitored during the BASMAA Project are planned for re-sampling.
- Each Co-permittee was assigned an allotment of new monitoring locations to best distribute the total sites equally among all jurisdictions.
- Monte Sereno and Saratoga do not have devices in retail sites and therefore did not receive more than two monitoring locations.
- Mostly retail sites were proposed for Campbell, Cupertino, Los Gatos and Santa Clara County.

- New sites in San Jose and Sunnyvale were chosen from all available retail and commercial locations.

Each site planned for re- or new sampling will be field verified. Alternate monitoring sites will be chosen within the Co-permittee jurisdictional area if the originally selected site does not meet the monitoring site criteria.

Table 5. Proposed number of monitoring sites in SCVURPPP Project

Co-permittee	# Large Devices	Small Devices [a]		Estimated # in SCVURPPP Study	
		Total #	# in BASMAA Study	Small Devices [b]	Large Devices
Campbell	0	28	-	9	-
Cupertino	0	107	-	10	-
Los Altos	1	0	-	-	1
Los Altos Hills	0	0	-	-	-
Los Gatos	0	30	-	9	-
Milpitas	1	0	-	-	1
Monte Sereno	0	4	-	2	-
Mountain View	1	0	-	-	1
Palo Alto	2	0	-	-	1
San Jose	9	143	71	60	-
Santa Clara	2	0	-	-	1
Santa Clara County	2	26	-	6	-
Saratoga	0	4	-	2	-
Sunnyvale	1	75	16	26	-
Total	**19**	**417**	**87**	**124**	**5**

[a] Numbers only include those devices owned and operated by Co-permittees. Many Co-permittees have additional devices within their jurisdictional boundaries that are owned and operated by Private entities.
[b] Includes sites in San Jose (38) and Sunnyvale (14) previously monitored during the BASMAA Project

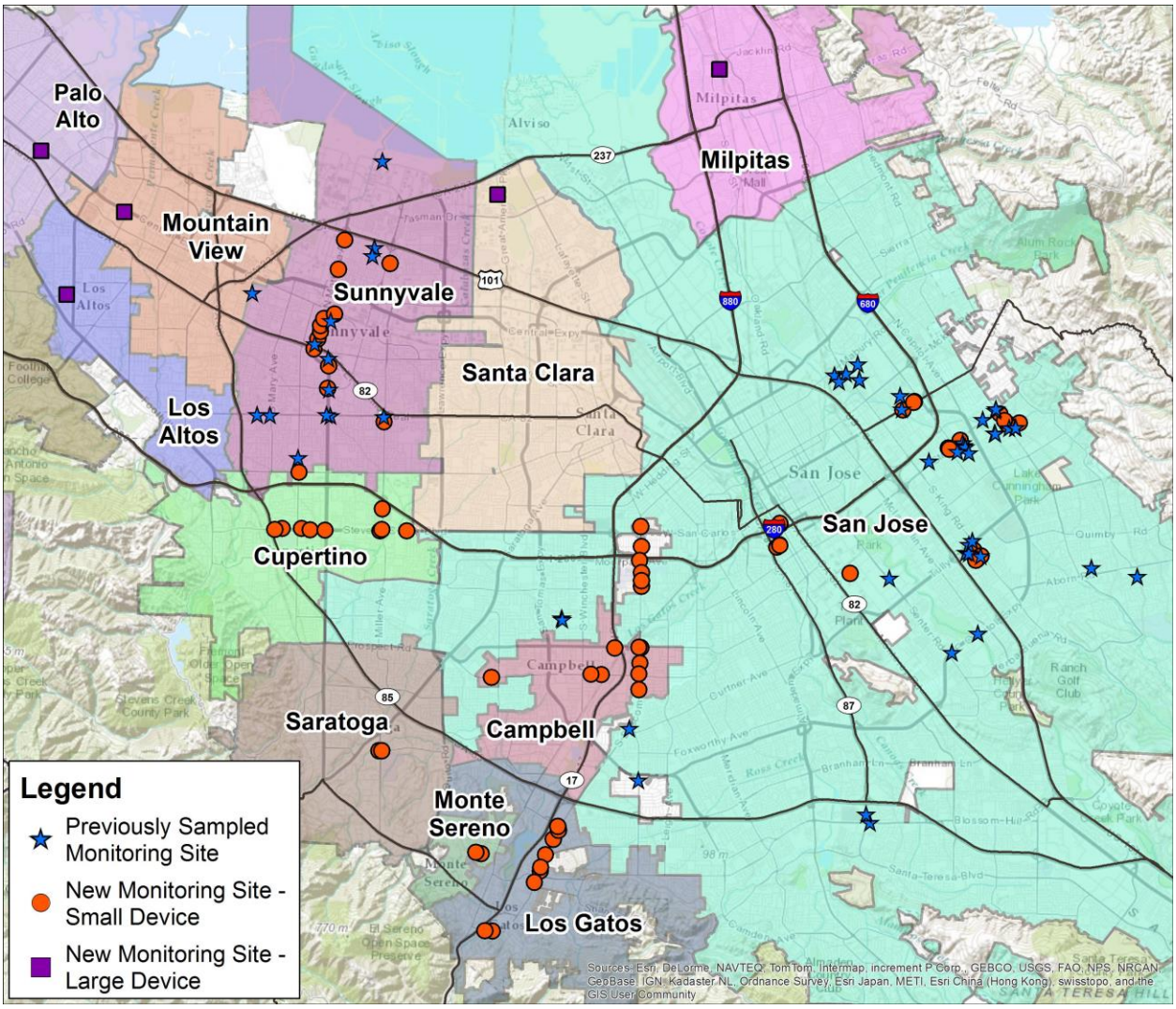

Figure 2. Location of 129 monitoring sites in SCVURPPP Study.

2.2 Device Cleanouts

Small Full Capture Devices

Monitoring sites equipped with only small full-capture devices will be cleaned three times during 2015. The removal of trash and debris will follow procedures described within the BASMAA document entitled *Standard Operating Procedures Storm Drain Insert Trash Removal* (January 2011) included in Appendix A. Prior to the start of the project, each monitoring site equipped with a small full-capture device will be cleaned during dry weather conditions to provide an accurate start date for the first trash and debris accumulation period. The cleanout will be documented with a Storm Drain Inlet Cleanout Form (Cleanout Form) that includes a map of the verified site location. The Cleanout Form will be used at each monitoring site when conducting a cleanout. The first cleanout will consist of cleaning each storm drain inlet equipped with trash full-capture devices. Trash and debris collected from this cleanout will not be saved for characterization. Collected trash and debris will be properly disposed of in accordance with all federal, state and local regulations.

The second and third cleanouts will consist of cleaning each monitoring site equipped with trash full- capture devices during dry weather conditions in accordance with a prescribed accumulation period. The cleanouts will occur on a designated date determined by Program staff, in coordination with Co-permittees. Trash and debris collected from the second and third cleanouts will be saved, placed in garbage bags and transported to a designated location for trash and debris characterization. Trash and debris removed during the second and third cleanouts will be characterized in accordance with the SAP. If unexpected cleanouts occur during the project other than at times identified (either due to flooding issues or other unforeseen events), a record of the cleanout will need to be taken, including the date of cleanout and the estimated amount of material removed.

Large Full Capture Devices

Monitoring sites with large full-capture devices will be cleaned once by Co-permittees during or following the FY 14-15 wet weather season. The removal of trash and debris from hydrodynamic separators (HDS) will follow procedures described within the SCVURPPP document entitled *Hydrodynamic Separator Operation and Maintenance: Standard Operating Procedures* included in Appendix B. The removal of trash and debris from all other large full-capture device types will follow existing maintenance procedures. The cleanout will be documented with a Large Device Cleanout Form (Cleanout Form) that will be used at each applicable monitoring site when conducting a cleanout. For HDS units, the cleanout will consist of removing the top floatable fraction within the HDS chamber. For gross solids removal devices and netting systems, all trash and debris collected within the unit will be removed for characterization.

The cleanout will occur during dry weather conditions on a designated date determined by Program staff and Co-permittees. Prior to the cleanout, it is requested that Co-permittees provide the exact date when the large device was last cleaned. All collected trash (and debris) from the cleanout will be saved and transported to a designated location for trash and debris characterization.

2.2.1 Sample Identification

In order to standardize small device cleanout reporting, field staff will identify the cleanout and site/device using the following code MMDDYY-XX-NN-#, where MMDDYY is the month, date and year; XX is the city, NN is the device number, and # is the cleanout number. For example, if device number SJ027 is cleaned out for the first time on January 15, 2015, its code would be 011515-SJ-027-1. The contractor responsible for cleanouts will maintain a list of device numbers and corresponding locations.

2.2.2 Documentation

Field forms illustrated in Appendix A will be completed at the time of the cleanout. Specifically, the date, location and personnel conducting the cleanout will be noted. If possible, personnel will photograph the full-capture device prior to and after cleaning. Photographs will be stored for future use.

2.3 Trash and Debris Characterization

Trash with at least one dimension measuring greater than 5 mm (0.2 inches) will be sorted from debris. Using best professional judgment, the field crew will not sort trash smaller than 5 mm

(0.2 inches) from the debris. All trash characterization will be conducted consistent with the *Standard Operating Procedure* for *Trash and Debris Evaluation* included as Appendix . The *Trash and Debris Evaluation Data Collection Form* included in Appendix D will be used to record the item counts and volumes. Recorded information will then be entered into a simple data management system to allow data analysis to occur efficiently.

In summary, there are three evaluation steps that field crews will conduct as part of the characterization portion of the project. They include:

1. Sorting trash from debris,
2. Counting the number of specific trash items (as applicable); and,
3. Measuring the volume of sorted trash and debris.

Categories of trash that will be counted and/or measured are presented in Table 6. The *Trash and Debris Evaluation Data Collection Form* included in Appendix D will be used to record the item counts and volumes. Recorded information will then be entered into a simple data management system to allow data analysis to occur efficiently.

Table 6. Trash sort and characterization categories for SCVURPPP Project

	Trash Category/Type	Item Count	Volume
1	Recyclable Beverage Containers (CRV labeled)	Yes	Yes
2	Single-use Carryout Plastic Bags	Yes	Yes
3	Expanded Polystyrene (EPS) Food and Beverage Ware	Yes	Yes
4	Rigid Plastic Disposable Food and Beverage Ware (includes Non-EPS plastic, fiber-based, and compostable plastic)	Yes	Yes
5	Cigarette Butts	Yes	Yes
6	Other Plastic	No	Yes
7	All Other Trash	No	Yes

2.4 Data Analysis

All data collected through the project will be managed, analyzed and reported. Program staff will conduct statistical analyses to evaluate whether single use carryout bag ordinances, applicable EPS ordinances, and other trash control measures have substantially reduced the environmental impacts of trash. All data will be compiled into a simple Microsoft Excel or Access database.

3.0 PROJECT SCHEDULE

The project is scheduled to begin in early 2015 and continue through the fall 2015. Data analysis is planned in late 2015. A project report is scheduled for completion by winter 2015/2016. Additional monitoring may be conducted in 2016 and/or subsequent years if deemed necessary. Based on previous experience and the results of other studies, variability at a given site can be high and may require sampling sites multiple times to best characterize the types and levels of trash in stormwater conveyances. Monitoring priority is typically given to the wet season due to high likelihood that precipitation runoff is the main mode of transport of trash from streets to storm drains.

APPENDIX A

Standard Operating Procedure for
Storm Drain Insert Trash Removal

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Storm Drain Trash Characterization Project

Standard Operating Procedures: Storm Drain Insert Trash Removal

January 9, 2015

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1.0 PURPOSE AND APPLICABILITY

The purpose of this Standard Operating Procedure is to detail all steps for removing trash and debris from storm drains sited with storm drain inserts. Trash and debris removed during cleanout activities will be transported to a designated location for evaluation. Trash and debris evaluation is an important step in the development of baseline trash loading rates in accordance with Permit Provision C.10.a.ii of the Municipal Regional Permit.

2.0 ACRONYMS AND DEFINITIONS

2.1 ACRONYMS

SOP: Standard Operating Procedures

2.2 DEFINITIONS

Debris: Natural, not man-made, material, including vegetation and sediment. This does not include trash.

Hydrodynamic Separator: Devices which use the tangential forces created by the incoming flow of water to separate trash, debris, oil and other pollutants from stormwater. Hydrodynamic Separators (HDSs) are also known as vortex separators or swirl concentrators.

Litter: According to the California Government Code Section 68055.1(g), "Litter" means all improperly discarded waste material, including, but not limited to, convenience food, beverage, and other product packages or containers constructed of steel, aluminum, glass, paper, plastic, and other natural and synthetic materials, thrown or deposited on the lands and waters of the state, but not including the properly discarded waste of the primary processing of agriculture, mining, logging, sawmilling, or manufacturing" (CA State 2011).

Storm Drain Insert: A full-capture treatment device sited in a storm drain to prevent trash and debris from entering receiving waters.

Trash: Man-made litter.

3.0 HEALTH AND SAFETY WARNINGS

3.1 HEALTH

3.1.1 HEAVY LIFTING

Acute back injuries can be the immediate result of improper lifting techniques and/or lifting loads that are too heavy for the back to support. When lifting a heavy storm drain grate, avoid lifting the grate alone, if possible. Lift with the legs, not the back, by bending at the knees, not at the waist. While carrying the grate, avoid twisting. Instead, turn the entire body. If necessary, ensure that proper back support is worn during the lifting process.

3.1.2 PATHOGENS AND TOXIC CHEMICALS

Because pathogens and toxic chemicals in stormwater pose a health risk, puncture and cut-resistant gloves should be worn at all times. Avoid contact with skin, mouth, eyes and nose. After completion of work, immediately wash hands with soap and hot water.

3.1.3 SHARPS

There is a risk of injury due to sharp objects that may have been collected by storm drain inserts. Pay close attention and handle trash and debris carefully to prevent accidental cuts and scrapes. If accidental cuts and scrapes do occur, ensure that tetanus shots are up-to-date to prevent infection.

The negligent handling of trash and debris could lead to infection or other serious ailments.

3.2 SAFETY

Because storm drain inserts may be sited in heavily trafficked areas, ensure that a traffic control program is in place during cleanouts. At a minimum, orange safety cones should be placed around the cleanout site and individuals conducting cleanouts should wear safety vests.

4.0 PERSONNEL QUALIFICATIONS/RESPONSIBILITIES

At least one person who has prior experience cleaning a storm drain insert should be present during the cleanout. Inexperienced field staff may assist experienced staff, but may not clean the device without supervision.

5.0 EQUIPMENT AND SUPPLIES

To remove trash and debris from storm drains sited with storm drain inserts, the following equipment and supplies will be required:

- Grate tool to remove storm drain grate or storm drain cover. A sledge hammer may be needed to loosen grates which have fine debris sealing the grate and metal channel holding it in place. A hydraulic lift may be needed to lift grates that are jammed.
- Digging tools (e.g., clam shell or flathead shovel, broad head scoop shovel);
- Broom and stiff wire brush to clean materials off or out of the catch basin insert, grate surfaces and street gutters;
- Black, super-heavy duty plastic garbage bags (e.g., contractor bags) with a minimum film thickness of 3 mil (mm) for storage of collected material;
- Gray duct tape to close and label bags;
- Permanent marker to label gray duct tape with Device ID# and cleanout date; and
- *Storm Drain Insert Cleanout Field Form* (to be provided by project manager prior to cleanout event).

6.0 PROCEDURES

Storm drain insert cleanouts should be performed during periods of low flow through the storm drain, ideally during dry weather days. The following steps should be conducted when cleaning a storm drain insert:

1) To prevent injury and possible death, individuals conducting storm drains cleanouts must institute safety measures prior to starting the cleanout process. Recommended safety measures include using arrow boards or channelizing devices (e.g., drums, cones, tabular markers, vertical panels, etc.) to visually alert the public to stay clear of a section of street or road. Guidance provided in the *California Manual on Uniform Traffic Control Devices: 2014 Edition* (see Appendix A) is the standard. It is recommended that individuals conducting cleanouts wear safety vests.
2) Remove or sweep away all material (e.g., trash, vegetation and debris) that is present on top of the storm drain grate or storm drain cover; and all material that is in close proximity to the grate or cover. This material WILL NOT be collected and bagged. Leave material in street or gutter so it may be removed by street sweeping practices.
3) Remove the storm drain grate or storm drain cover and place it out of the way.
4) ONLY clean storm drains which have storm drain inserts. If the storm drain does not have a storm drain insert, note in *Storm Drain Insert Cleanout Field Form(s)*.
5) DO NOT clean storm drains which have physical barriers (i.e., automated retractable screens, fixed screens and/or siltation sacks).
6) If the storm drain is not affixed (i.e., not screwed or bolted in place), remove the storm drain insert from the storm drain. If affixed (i.e. screwed or bolted in place and requires the use of tools to remove), keep storm drain insert in place.
7) Remove all material from the storm drain using a digging tool.
8) Place all material into black, super-heavy duty plastic garbage bag(s). Do not fill garbage bags with more than 40 to 50 pounds of material. If material contains sharp or large objects, “double bag” the material, as necessary. Use multiple garbage bags per storm drain cleanout, if needed.

9) Use a wire brush or broom to ensure that all material is removed from the storm drain insert (e.g. removed from the screen of the device).
10) Twist the black, super-heavy duty plastic garbage bag(s) closed when finished filling with material.
11) Place gray duct tape around twisted end of the black, super-heavy duty plastic garbage bag(s). Ensure that garbage bag(s) are securely closed.
12) Label duct tape with pre-assigned device ID#, date of cleanout (i.e., MMDDYY) and total number of bags using a permanent marker. Example label: SJ04-010315-1 of 3, SU01-010315-1 of 1, etc.
13) If the storm drain insert was removed, place it back in storm drain.
14) Replace the storm drain grate or storm drain cover.
15) Prior to departing cleanout site, fill-out *Storm Drain Insert Cleanout Field Form* with all requested information (e.g., date, total number of bags of material collected, moisture content, comments and staff performing cleaning). A blank and filled-out *Storm Drain Insert Cleanout Field Form* is provided in Appendix B.
16) Provide, by electronic mail or facsimile, *Storm Drain Insert Cleanout Field Form(s)* to BASMAA project team leader or other project manager within three working days of cleanout.
17) Transport bag(s) of material to designated location for storage and evaluation. The designated location and desired receiving date will be provided by the BASMAA project team leader or other project manager.

7.0 Quality Control and Quality Assurance

To accurately determine volumes of trash and debris collected for other characterization projects or analyses, follow this SOP, if possible. If collection is not possible in accordance with this SOP, at a minimum, record the date of the cleanout.

8.0 References

California State (2011). California codes. Government Code Section 68055-68055.9. Available at http://www.leginfo.ca.gov/ (Accessed January 2011).

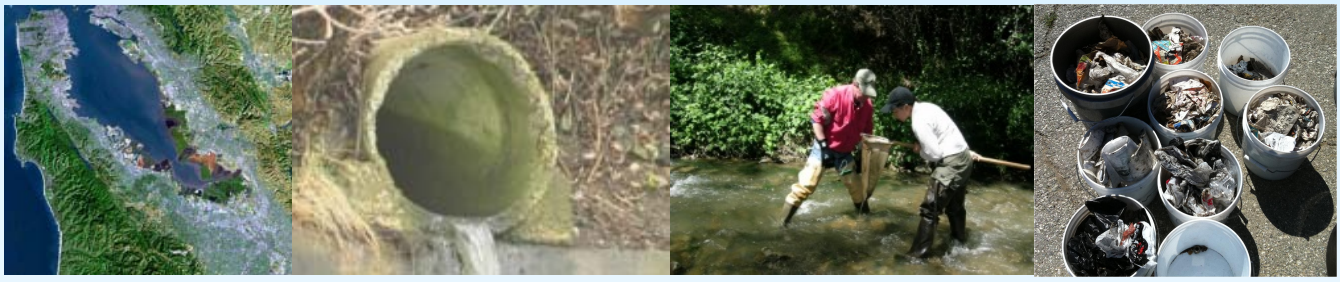
Occupational Safety & Health Administration (1999). Section VII: Chapter 1, Back Disorders and Injuries*. OSHA Technical Manual*. TED 01-00-015

APPENDIX B

Hydrodynamic Separator Operation and
Maintenance Standard Operating Procedures

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Storm Drain Trash Characterization Project



Standard Operating Procedures: Hydrodynamic Separator Trash Removal and Processing

January 9, 2015

EOA inc.

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1.0 PURPOSE AND APPLICABILITY

The purpose of this Standard Operating Procedure is to detail all steps for removing and processing (i.e., drying and sub-sampling) trash and debris from hydrodynamic separators (HDSs). Trash and debris removed from HDSs will be subsequently processed and characterized. Trash and debris characterization is an important step in the development of baseline trash generation rates in accordance with Permit Provision C.10.a.ii of the Municipal Regional Permit.

2.0 DEFINITIONS AND ACRONYMS

2.1 ACRONYMS

HDS: Hydrodynamic Separator
SOP: Standard Operating Procedures

2.2 DEFINITIONS

Debris: Natural, not man-made, material, including vegetation and sediment. This does not include trash.
Hydrodynamic Separator: Devices which use the tangential forces created by the incoming flow of water to separate trash, debris, oil and other pollutants from stormwater. Hydrodynamic Separators are also known as vortex separators or swirl concentrators.
Litter: According to the California Government Code Section 68055.1(g), "Litter" means all improperly discarded waste material, including, but not limited to, convenience food, beverage, and other product packages or containers constructed of steel, aluminum, glass, paper, plastic, and other natural and synthetic materials, thrown or deposited on the lands and waters of the state, but not including the properly discarded waste of the primary processing of agriculture, mining, logging, sawmilling, or manufacturing" (CA State 2011).
Sample: A specimen collected for inspection or analysis; or the process of collecting a specimen.
Storm Drain Insert: A full-capture treatment device sited in a storm drain to prevent trash and debris from entering receiving waters.
Sub-sample: A smaller portion of an original sample, created by trimming, subdividing, splitting or discrete collection of the original sample; or the process of collecting sub-samples from the original sample.
Trash: Man-made litter.

3.0 HEALTH AND SAFETY WARNINGS

3.1 HEALTH

3.1.1 HEAVY LIFTING

Acute back injuries can be the immediate result of improper lifting techniques and/or lifting loads that are too heavy for the back to support. When lifting a heavy access cover, plastic bag or bulk container, avoid lifting each alone, if possible. Lift with the legs, not the back, by

bending at the knees, not at the waist. Avoid twisting while carrying the cover; and instead turn the entire body. If necessary, ensure that proper back support is worn during the lifting process.

3.1.2 PATHOGENS AND TOXIC CHEMICALS

Because pathogens and toxic chemicals in stormwater pose a health risk, gloves should be worn at all times. Avoid contact with skin, mouth, eyes and nose. After completion of work, immediately wash hands with soap and hot water.

3.1.3 SHARPS

Sharp objects that may have collected in hydrodynamic separators pose an injury risk. Pay close attention and handle trash and debris carefully to prevent accidental cuts and scrapes. If accidental cuts and scrapes do occur, ensure that tetanus shots are up-to-date to prevent infection.
The negligent handling of trash and debris could lead to infection or other serious ailments.

3.2 SAFETY

Since hydrodynamic separators may be sited within active streets, roads or parking lots, individuals conducting cleanouts must institute safety measures prior to starting the cleanout process. Recommended safety measures include using arrow boards or channelizing devices to visually alert the public to stay clear of a section of roadway or parking lot where the cleanout is occurring.

4.0 PERSONNEL QUALIFICATIONS/RESPONSIBILITIES

At least one person who has prior experience cleaning hydrodynamic separators should be present during the cleanout. Inexperienced field staff may assist experienced staff, but may not clean the device without supervision.

It is <u>not necessary</u> to enter the hydrodynamic separator since cleaning can be done entirely from street or parking lot level. Anyone who enters a hydrodynamic separator must have attended OSHA Confined Space Entry training and have current certification.

5.0 EQUIPMENT AND SUPPLIES

To remove trash and debris from hydrodynamic separators, the following equipment will be needed:

- Empty vacuum truck (i.e., holding tank is free of liquid and solids);
- Arrow boards or channelizing devices (e.g., drums, cones, tabular markers, vertical panels, etc.) to visually alert the public of area where the cleanout is occurring;
- Broom to clean materials off and around access cover;
- Tool to remove access cover;
- Scraping tool with long handle to remove trash and debris from HDS separation screen;

- Scoop or shovel (e.g., plastic scoop, small plastic bucket, garden shovel, flathead shovel) to sub-sample trash and debris;
- Black, super-heavy duty plastic garbage bags (e.g., contractor bags) with a minimum film thickness of 3 mil (mm) for storage of sub-samples;
- 32-gallon garbage containers or bulk containers for storage of sub-samples;
- Gray duct tape to close and label plastic bags;
- Permanent marker to label gray duct tape with HDS location, cleanout date and total number of bags; and
- *Hydrodynamic Separator Cleanout Field Form* (to be provided by project manager prior to cleanout event).

6.0 PROCEDURES

HDS Cleanout

Hydrodynamic separators should be cleaned during dry weather conditions to ensure that no flow is entering the unit. The following steps should be conducted when cleaning HDSs:

1) If HDS access cover (i.e., manhole cover) is within an active street, road or parking lot, individuals conducting HDS cleanouts must institute safety measures prior to starting the cleanout process. Recommended safety measures include using arrow boards or channelizing devices (e.g., drums, cones, tabular markers, vertical panels, etc.) to visually alert the public to stay clear of a section of roadway or parking lot where the cleanout is occurring. Guidance provided in the *California Manual on Uniform Traffic Control Devices: 2014 Edition* (see Appendix A) is the standard. It is recommended that individuals conducting cleanouts wear safety vests.
2) Remove or sweep away all material (e.g., trash and debris) that is present on top or in close proximity to the HDS access cover. This material will not be collected and/or bagged. Leave material in street or gutter so it may be removed by street sweeping practices.
3) Open the access cover. If the cover can be held open, ensure that it is locked. If not, remove the cover and set it aside.
4) Insert a vacuum hose from an industrial vacuum truck into the sump and remove all floating trash and debris from the surface. The area outside the separation screen should also be cleaned with the vacuum if trash and debris is present. Manually remove all material from the separation screen with a scraping tool or power wash the separation screen if it cannot be removed by vacuum. Trash and debris which was manually removed from the separation screen should be removed with the vacuum.
5) After removing all floating trash and debris and material present outside the separation screen area, lower the vacuum hose into the HDS storage sump. Completely remove all trash and debris within the HDS storage sump.
6) If practical, decant the liquids from the vacuum truck back into the HDS unit to minimize the transport of liquids. Do not discharge trash and debris back into the HDS unit during the decanting process.

7) If liquids cannot be returned to the HDS unit, transport liquid off-site for disposal. Additional steps are provided below.
8) Once the HDS cleaning process is complete, replace the cover and secure it in place to prevent leakage of runoff into the HDS.
9) Prior to departing the HDS cleanout site, fill-out the form entitled *Trash Capture Device Maintenance Report - Hydrodynamic Separator (Maintenance Report)* with all requested information. An equivalent form which contains similar information may be used in lieu of the *Maintenance Report.* A blank *Maintenance Report* is provided in Appendix B.
10) Deliver all collected trash and debris to a designated facility for processing.
11) If liquids were not returned to the HDS unit, decant liquid to the sanitary sewer or designated holding ponds prior to removing collected trash and debris from the vacuum truck.

HDS Trash and Debris Drying

1) A secure area must be designated for drying trash and debris. The drying area must be flat in nature and on a vegetative surface or within an area where leachate may drain to the sanitary sewer. At a minimum, the designated drying area should be at least 20 feet by 20 feet.
2) When arriving at the designated drying area, remove all trash and debris from the vacuum truck. Place trash and debris on top of tarps and allow it to dry for a minimum of 96 hours.
3) Depending on the total volume of trash and debris removed from the HDS storage sump, it may be necessary to collect sub-samples of the entire volume once it is dried. This determination will occur on a case-by-case basis.
4) If the entire volume will be sub-sampled and characterization will occur at a designated drying area, proceed to the steps provided in the section entitled *HDS Trash and Debris Sub-Sampling* below.
5) If the entire volume will not be sub-sampled and characterization will occur at a designated drying area, proceed to the steps provided in the document entitled *Standard Operation Procedures for Trash Debris Evaluation and Characterization*.
6) If the entire volume will not be sub-sampled and characterization will not occur at the designated drying area, conduct the following:
    a) Place the dry material into black, super-heavy duty plastic garbage bags (e.g., contractor bags) with a minimum film thickness of 3 mm for storage.
    b) Twist the garbage bag(s) closed when finished filling the bag with trash and debris.
    c) Place gray duct tape around the twisted end of the garbage bag(s). Ensure that garbage bag(s) are securely closed.
    d) Label duct tape with HDS location, date of cleanout (i.e., MMDDYY) and total number of bags using a permanent marker. Example label: Main Street, 010315-1 of 10, etc.
    e) Transport bags to a designated facility for characterization.

HDS Trash and Debris Sub-Sampling

1) If necessary, sub-samples will be collected from a systematic grid system. Develop the grid by arranging the entire volume of dried trash and debris to a uniform depth. Once uniformly arranged, use a chalk line (i.e., tool for marking long, straight lines on relatively flat surfaces) to define blocks within the grid. The number of blocks will be determined based on the total volume of trash and debris.
2) Randomly select a block through a blind draw process. This block will be sampled.
3) Collect sub-samples from the grid by sampling at least half the defined blocks. A maximum of 400 gallons of trash and debris should be sub-sampled. The remaining volume of trash and debris not sub-sampled will be estimated to determine the total volume of trash and debris removed from the HDS unit. Sub-samples will be collected by scooping material with a scoop or shovel. Place sub-samples into black, super-heavy duty plastic bag(s), 32-gallon garbage containers or bulk containers depending on where characterization will occur.
4) Do not use plastic bags if characterization will occur on-site. Only use 32-gallon garbage containers or bulk containers. Transfer 32-gallon garbage containers or bulk containers to the designated characterization area.
5) Do not use 32-gallon garbage containers or bulk containers if sub-samples will be transported off-site for characterization.
6) If characterization will occur off-site, conduct the following:
    a) Place sub-samples into black, super-heavy duty plastic garbage bags (e.g., contractor bags) with a minimum film thickness of 3 mm for storage.
    b) Twist the garbage bag(s) closed when finished filling the bag with trash and debris.
    c) Place gray duct tape around the twisted end of the garbage bag(s). Ensure that garbage bag(s) are securely closed.
    d) Label duct tape with HDS location, date of cleanout (i.e., MMDDYY) and total number of bags using a permanent marker. Example label: Main Street, 010315-1 of 10, etc.
    e) Transport bags to a designated facility for characterization.

7.0 QUALITY CONTROL AND QUALITY ASSURANCE

To accurately determine volumes of trash and debris collected for other characterization projects or analyses, follow this SOP, if possible.

8.0 REFERENCES

California State (2011). California codes. Government Code Section 68055-68055.9. Available at http://www.leginfo.ca.gov/ (Accessed January 2011).

Office of Safety & Health Administration (1999). Permit-Required Confined Spaces, Title OSHA 29 CFR 1910.146.

Attachment A

California Manual on Uniform Traffic Control Devices: 2014 Edition

Guidance on Arrow Boards and Channelizing Devices

30 *Portable changeable message signs should be placed off the shoulder of the roadway and behind a traffic barrier, if practical. Where a traffic barrier is not available to shield the portable changeable message sign, it should be placed off the shoulder and outside of the clear zone. If a portable changeable message sign has to be placed on the shoulder of the roadway or within the clear zone, it should be delineated with retroreflective TTC devices. When used, advanced warning delineation is not needed if the portable changeable message sign is behind a barrier, more than 2 feet behind the curb, or 15 feet or more from the edge of the traveled way (see Section 6C.04). If the portable changeable message sign is placed on shoulder or partially blocking the shoulder (including overhangs), the shoulder should be closed off by a taper of channelizing devices with a length of 1/3 L using the formulas in Tables 6C-3, 6C-3(CA) and 6C-4 (see Section 6C.08). See Figure 6F-104(CA) for typical layout using channelizing devices to delineate a portable changeable message sign on shoulder.*

Option:

30a For incident management before additional resources are available or for short duration use (see Section 6G.02) or when portable changeable message sign is placed well beyond the shoulder but partially within 15 feet from the edge of the traveled way it may be delineated with a minimum of a 30 feet taper formed by three traffic cones.

Guidance:

31 *When portable changeable message signs are used in TTC zones, they should display only TTC messages.*

32 *When portable changeable message signs are not being used to display TTC messages, they should be relocated such that they are outside of the clear zone or shielded behind a traffic barrier and turned away from traffic. If relocation or shielding is not practical, they should be delineated with retroreflective TTC devices. If the portable changeable message sign is stored within a shoulder or partially blocking a shoulder, the shoulder should be closed according to Section 6G.07. If the portable changeable message sign is stored well beyond the shoulder but within the clear zone, it should be delineated by a taper of channelizing devices with a length of 1/3 L using the formulas in Tables 6C-3, 6C-3(CA) and 6C-4 (see Section 6C.08). Clear zone is defined by AASHTO's "Roadside Design Guide" (see Section 1A.11). See Figure 6F-104(CA) for typical layout using channelizing devices to delineate a portable changeable message sign on a shoulder.*

33 *Portable changeable message sign trailers should be delineated on a permanent basis by affixing retroreflective material, known as conspicuity material, in a continuous line on the face of the trailer as seen by oncoming road users.*

Standard:

34 On State highways, the message displayed on Portable Changeable Message signs shall be visible from a distance of 1500 feet and shall be legible from a distance of 750 feet, at noon on a cloudless day, by persons with vision of or corrected to 20/20.

Guidance:

35 *On local roads, the message displayed on Portable Changeable Message signs should be visible from a distance of 1500 feet and shall be legible from a distance of 750 feet, at noon on a cloudless day, by persons with vision of or corrected to 20/20.*

Support:

36 Refer to Caltrans' Standard Specifications Section 12-3.12 for visibility criteria cited. See Section 1A.11 for information regarding this publication.

37 Refer to Section 2B.13 for Vehicle Speed Feedback Signs.

Section 6F.61 Arrow Boards

Standard:

01 **An arrow board shall be a sign with a matrix of elements capable of either flashing or sequential displays. This sign shall provide additional warning and directional information to assist in merging and controlling road users through or around a TTC zone.**

Guidance:

02 *An arrow board in the arrow or chevron mode should be used to advise approaching traffic of a lane closure along major multi-lane roadways in situations involving heavy traffic volumes, high speeds, and/or limited sight distances, or at other locations and under other conditions where road users are less likely to expect such lane closures.*

03 *If used, an arrow board should be used in combination with appropriate signs, channelizing devices, or other TTC devices.*

04 *An arrow board should be placed on the shoulder of the roadway or, if practical, farther from the traveled lane. It should be delineated with retroreflective TTC devices. When an arrow board is not being used, it should be removed; if not removed, it should be shielded; or if the previous two options are not feasible, it should be delineated with retroreflective TTC devices.*

04a *If the arrow board is stored within a shoulder or partially blocking a shoulder, the shoulder should be closed according to Section 6G.07. If the arrow board is stored well beyond the shoulder but within the clear zone, it should be delineated by a taper of channelizing devices with a length of 1/3 L using the formulas in Tables 6C-3, 6C-3(CA) and 6C-4 (see Section 6C.08). Clear zone is defined by AASHTO's "Roadside Design Guide" (see Section 1A.11). See Figure 6F-104(CA) for typical layout using channelizing devices to delineate an arrow board on a shoulder.*

Standard:

05 **Arrow boards shall meet the minimum size, legibility distance, number of elements, and other specifications shown in Figure 6F-6.**

Support:

06 Type A arrow boards are appropriate for use on low-speed urban streets. Type B or II arrow boards are appropriate for intermediate-speed facilities and for maintenance or mobile operations on high-speed roadways. Type C or I arrow boards are intended to be used on high-speed, high-volume motor vehicle traffic control projects. Type D arrow boards are intended for use on vehicles authorized by the State or local agency.

Standard:

07 **Type A, B or II, and C or I arrow boards shall have solid rectangular appearances. A Type D arrow board shall conform to the shape of the arrow.**

08 **All arrow boards shall be finished in non-reflective black. The arrow board shall be mounted on a vehicle, a trailer, or other suitable support.**

Guidance:

09 *The minimum mounting height, measured vertically from the bottom of the board to the roadway below it or to the elevation of the near edge of the roadway, of an arrow board should be 7 feet , except on vehicle-mounted arrow boards, which should be as high as practical.*

10 *A vehicle-mounted arrow board should be provided with remote controls.*

Standard:

11 **Arrow board elements shall be capable of at least a 50 percent dimming from full brilliance. The dimmed mode shall be used for nighttime operation of arrow boards.**

Guidance:

12 *Full brilliance should be used for daytime operation of arrow boards.*

Standard:

13 **The arrow board shall have suitable elements capable of the various operating modes. The color presented by the elements shall be yellow.**

Guidance:

14 *If an arrow board consisting of a bulb matrix is used, the elements should be recess-mounted or equipped with an upper hood of not less than 180 degrees.*

Standard:

15 **The minimum element on-time shall be 50 percent for the flashing mode, with equal intervals of 25 percent for each sequential phase. The flashing rate shall be not less than 25 or more than 40 flashes per minute.**

16 **An arrow board shall have the following three mode selections:**

A. A Flashing Arrow, Sequential Arrow, or Sequential Chevron mode;

B. A flashing Double Arrow mode; and

C. A flashing Caution or Alternating Diamond mode.

17 **An arrow board in the arrow or chevron mode shall be used only for stationary or moving lane closures on multi-lane roadways.**

18 **For shoulder work, blocking the shoulder, for roadside work near the shoulder, or for temporarily closing one lane on a two-lane, two-way roadway, an arrow board shall be used only in the caution mode.**

Guidance:

19 *For a stationary lane closure, the arrow board should be located on the shoulder at the beginning of the merging taper.*

20 *Where the shoulder is narrow, the arrow board should be located in the closed lane.*

Standard:

20a The arrow board shall be located behind channelizing devices used to transition traffic from the closed lane.

Support:

20b Caltrans' Standard Specifications for flashing arrow boards are in Section 12-3.03. See Section 1A.11 for information regarding this publication.

Standard:

21 **When arrow boards are used to close multiple lanes, a separate arrow board shall be used for each closed lane.**

Guidance:

22 *When arrow boards are used to close multiple lanes, if the first arrow board is placed on the shoulder, the second arrow board should be placed in the first closed lane at the upstream end of the second merging taper (see Figure 6H-37). When the first arrow board is placed in the first closed lane, the second arrow board should be placed in the second closed lane at the downstream end of the second merging taper.*

23 *For mobile operations where a lane is closed, the arrow board should be located to provide adequate separation from the work operation to allow for appropriate reaction by approaching drivers.*

Standard:

24 **A vehicle displaying an arrow board shall be equipped with high-intensity rotating, flashing, oscillating, or strobe lights.**

25 **Arrow boards shall only be used to indicate a lane closure. Arrow boards shall not be used to indicate a lane shift.**

Option:

26 A portable changeable message sign may be used to simulate an arrow board display.

Standard:

27 The minimum legibility distance is the distance at which flashing arrow boards shall be legible at noon on a cloudless day and at night by persons with vision of or corrected to 20/20.

Support:

28 The minimum legibility distance for each arrow board type is shown in Figure 6F-6.

29 Refer to Caltrans' Standard Specifications Section 12-3.03 for visibility criteria cited. See Section 1A.11 for information regarding this publication.

Section 6F.62 High-Level Warning Devices (Flag Trees)

Option:

01 A high-level warning device (flag tree) may supplement other TTC devices in TTC zones.

Support:

02 A high-level warning device is designed to be seen over the top of typical passenger cars. A typical high-level warning device is shown in Figure 6F-2.

Standard:

03 **A high-level warning device shall consist of a minimum of two flags with or without a Type B high-intensity flashing warning light. The distance from the roadway to the bottom of the lens of the light and to the lowest point of the flag material shall be not less than 8 feet. The flag shall be 16 inches square or larger and shall be orange or fluorescent red-orange in color.**

Option:

04 An appropriate warning sign may be mounted below the flags.

Support:

05 High-level warning devices are most commonly used in high-density road user situations to warn road users of short-term operations.

Standard:

16 **The letters and numbers of the name and telephone number shall be non-retroreflective and not over 2 inches in height.**

Guidance:

17 *Particular attention should be given to maintaining the channelizing devices to keep them clean, visible, and properly positioned at all times.*

Standard:

18 **Devices that are damaged or have lost a significant amount of their retroreflectivity and effectiveness shall be replaced.**

Section 6F.64 Cones

Standard:

01 **Cones (see Figure 6F-7) shall be predominantly orange and shall be made of a material that can be struck without causing damage to the impacting vehicle. For daytime and low-speed roadways, cones shall be not less than 18 inches in height. When cones are used on freeways and other high-speed highways or at night on all highways, or when more conspicuous guidance is needed, cones shall be a minimum of 28 inches in height.**

02 **For nighttime use, cones shall be retroreflectorized or equipped with lighting devices for maximum visibility. Retroreflectorization of cones that are 28 to 36 inches in height shall be provided by a 6-inch wide white band located 3 to 4 inches from the top of the cone and an additional 4-inch wide white band located approximately 2 inches below the 6-inch band.**

03 **Retroreflectorization of cones that are more than 36 inches in height shall be provided by horizontal, circumferential, alternating orange and white retroreflective stripes that are 4 to 6 inches wide. Each cone shall have a minimum of two orange and two white stripes with the top stripe being orange. Any non-retroreflective spaces between the orange and white stripes shall not exceed 3 inches in width.**

Support:

03a The 36 inch and 42 inch high cones provide additional conspicuity in visually complex environments and for older road users.

Option:

04 Traffic cones may be used to channelize road users, divide opposing vehicular traffic lanes, divide lanes when two or more lanes are kept open in the same direction, and delineate short duration maintenance and utility work.

Guidance:

05 *Steps should be taken to minimize the possibility of cones being blown over or displaced by wind or moving vehicular traffic.*

Option:

06 Cones may be doubled up to increase their weight.

Support:

07 Some cones are constructed with bases that can be filled with ballast. Others have specially weighted bases, or weight such as sandbag rings that can be dropped over the cones and onto the base to provide added stability.

Guidance:

08 *Ballast should be kept to the minimum amount needed.*

Option:

09 Retroreflectorization of 28 inch in height or higher cones may be provided by a 13 inch band (sleeve).

Standard:

10 On State highways, the retroreflectorized bands shall be visible at 1000 feet at night under illumination of legal high beam headlights, by persons with vision of or corrected to 20/20.

Guidance:

11 *On local roads, the retroreflectorized bands should be visible at 1000 feet at night under illumination of legal high beam headlights, by persons with vision of or corrected to 20/20.*

Support:

12 Refer to Caltrans' Standard Specifications Section 12-3.01A(4) for visibility criteria cited. See Section 1A.11 for information regarding this publication.

Section 6F.65 Tubular Markers

Support:

00a Tubular markers are used to guide and channelize traffic for temporary traffic control. Tubular markers generally have the same circular cross-section throughout their length. Tubular markers may be affixed to the ground or may be portable. There are three types of tubular markers and they are defined as following:

00b The term "tubular marker" is used for a tubular marker that is affixed to the pavement and is cylindrical from top to bottom

00c The term "channelizer (CA)" is a special type of tubular marker that is affixed to the pavement and has a cylindrical lower portion and a flattened upper portion. This term "channelizer (CA)" is not to be confused with the term "channelizing device(s)" in Section 6F.63. Although it is similar to the channelizer for permanent use, as discussed in Section 3H.01 and shown in Figure 3H-101(CA), there are differences. The channelizer (CA) is used for temporary traffic control.

00d The term "portable delineator" is used to describe a tubular marker that is not affixed to the pavement but stabilized by using a weighted base or weights, and is cylindrical from top to bottom. This term "portable delineator" is not to be confused with the term "delineator " in Section 6F.80.

Standard:

00e The retroreflectorized bands for tubular markers, channelizers (CA), and portable delineators shall be visible at 1000 feet during night under illumination of legal high beam headlights, by persons with vision of or corrected to 20/20.

Support:

00f Refer to Caltrans' Standard Specifications Section 12-3.01A(4) for visibility criteria cited. See Section 1A.11 for information regarding this publication.

Tubular Marker

Standard:

01 **Tubular markers (see Figure 6F-7) shall be predominantly orange and shall be not less than 18 inches high and 2 inches wide facing road users. They shall be made of a material that can be struck without causing damage to the impacting vehicle.**

02 **Tubular markers shall be a minimum of 28 inches in height when they are used on freeways and other high-speed highways, on all highways during nighttime, or whenever more conspicuous guidance is needed.**

03 **For nighttime use, tubular markers shall be retroreflectorized. Retroreflectorization of tubular markers that have a height of less than 42 inches shall be provided by two 3-inch wide white bands placed a maximum of 2 inches from the top with a maximum of 6 inches between the bands. Retroreflectorization of tubular markers that have a height of 42 inches or more shall be provided by four 4- to 6-inch wide alternating orange and white stripes with the top stripe being orange.**

Support:

03a The 42 inch high tubular markers provide additional conspicuity in visually complex environments and for older road users.

Guidance:

04 *Tubular markers have less visible area than other devices and should be used only where space restrictions do not allow for the use of other more visible devices.*

05 *Tubular markers should be stabilized by affixing them to the pavement.*

Option:

06 Tubular markers may be used effectively to divide opposing lanes of road users, divide vehicular traffic lanes when two or more lanes of moving vehicular traffic are kept open in the same direction, and to delineate the edge of a pavement drop off where space limitations do not allow the use of larger devices.

Standard:

07 **A tubular marker shall be attached to the pavement to display the minimum 2-inch width to the approaching road users.**

Portable Delineator

Standard:

08 The design of a portable delineator shall be as shown in Figure 6F-102(CA). 09 Portable delineators shall be a minimum of 36 inches in height. The vertical portion of portable delineators shall be fluorescent orange or predominantly orange. The posts shall be not less than 3 inches in width or diameter. Retroreflectorization of portable delineators that have a height of less than 42 inches shall be provided by two 3-inch wide white bands placed a maximum of 2 inches from the top with a maximum of 6 inches between the bands. Retroreflectorization of portable delineators that have a height of 42 inches or more shall be provided by four 4-inch to 6-inch wide alternating orange and white stripes with the top stripe being orange.

Support:

10 The 42 inch or higher portable delineators provide additional conspicuity in visually complex environments and for older road users.

Guidance:

11 Portable delineators have less visible area than other devices and should be used only where space restrictions do not allow for the use of other more visible devices.

12 Portable delineators should be stabilized by using weighted bases, or weights such as sandbag rings that can be dropped over the portable delineators and onto the base to provide added stability. Ballast should be kept to the minimum amount needed.

Option:

13 Portable delineators may be used effectively to divide opposing lanes of road users, divide vehicular traffic lanes when two or more lanes of moving vehicular traffic are kept open in the same direction, and to delineate the edge of a pavement drop off where space limitations do not allow the use of larger devices.

Channelizer(CA)

Standard:

14 When a channelizer (CA) is used, it shall be attached to the pavement in a manner such that the retroreflectorized bands facing road users meet the minimum visibility requirements.

15 The design of a channelizer (CA) shall be as shown in Figure 6F-102(CA). The height shall be 36 inch minimum where speeds are above 40 mph. The height shall be 28 inch minimum where speeds are 40 mph or less. The width of the post shall be 2 ¼ inch minimum and the color predominantly orange. Channelizers (CA) shall be affixed with retroreflective white sheeting, 3 by 12 inches in size.

Support:

16 Channelizers (CA) are implanted in the ground or affixed to the pavement, and are not susceptible to displacement, and are capable of normally withstanding numerous vehicular impacts.

17 Channelizers (CA) are generally used in series to create a visual fence/barrier, to provide additional guidance and/or restriction to traffic.

Option:

18 Channelizers (CA) may be used in lieu of cones, portable delineators, or drums, to channelize traffic or divide opposing lanes of traffic.

Section 6F.66 Vertical Panels

Standard:

01 **Vertical panels (see Figure 6F-7) shall have retroreflective striped material that is 8 to 12 inches in width and at least 24 inches in height. They shall have alternating diagonal orange and white retroreflective stripes sloping downward at an angle of 45 degrees in the direction vehicular traffic is to pass.**

02 **Where the height of the retroreflective material on the vertical panel is 36 inches or more, a stripe width of 6 inches shall be used.**

Guidance:

02a Vertical panels should be a minimum of 12 inch in width.

Option:

03 Where the height of the retroreflective material on the vertical panel is less than 36 inches, a stripe width of 4 inches may be used.

04 Where space is limited, vertical panels may be used to channelize vehicular traffic, divide opposing lanes, or replace barricades.

Section 6F.67 Drums

Standard:

01 **Drums (see Figure 6F-7) used for road user warning or channelization shall be constructed of lightweight, deformable materials. They shall be a minimum of 36 inches in height and have at least an 18-inch minimum width regardless of orientation. Metal drums shall not be used. The markings on drums shall be horizontal, circumferential, alternating orange and white retroreflective stripes 4 to 6 inches wide. Each drum shall have a minimum of two orange and two white stripes with the top stripe being orange. Any non-retroreflectorized spaces between the horizontal orange and white stripes shall not exceed 3 inches wide. Drums shall have closed tops that will not allow collection of construction debris or other debris.**

Support:

02 Drums are highly visible, have good target value, give the appearance of being formidable obstacles and, therefore, command the respect of road users. They are portable enough to be shifted from place to place within a TTC zone in order to accommodate changing conditions, but are generally used in situations where they will remain in place for a prolonged period of time.

Option:

03 Although drums are most commonly used to channelize or delineate road user flow, they may also be used alone or in groups to mark specific locations.

Guidance:

04 *Drums should not be weighted with sand, water, or any material to the extent that would make them hazardous to road users or workers when struck. Drums used in regions susceptible to freezing should have drain holes in the bottom so that water will not accumulate and freeze causing a hazard if struck by a road user.*

Standard:

05 **Ballast shall not be placed on the top of a drum.**

06 On State highways, the retroreflectorized bands shall be maintained at or above minimum levels in Table 2A-3.

Guidance:

07 *On local roads, the retroreflectorized bands should be maintained at or above minimum levels in Table 2A-3.*

Support:

08 Refer to Caltrans' Standard Specifications Section 12-3.01A(4) for visibility criteria cited. See Section 1A.11 for information regarding this publication.

Section 6F.68 Type 1, 2, or 3 Barricades

Support:

01 A barricade is a portable or fixed device having from one to three rails with appropriate markings and is used to control road users by closing, restricting, or delineating all or a portion of the right-of-way.

02 As shown in Figure 6F-7, barricades are classified as Type 1, Type 2, or Type 3.

Standard:

03 **Stripes on barricade rails shall be alternating orange and white retroreflective stripes sloping downward at an angle of 45 degrees in the direction road users are to pass. Except as provided in Paragraph 4, the stripes shall be 6 inches wide.**

Option:

04 When rail lengths are less than 36 inches, 4-inch wide stripes may be used.

Standard:

05 **The minimum length for Type 1 and Type 2 Barricades shall be 24 inches, and the minimum length for Type 3 Barricades shall be 48 inches. Each barricade rail shall be 8 to 12 inches wide. Barricades used on freeways, expressways, and other high-speed roadways shall have a minimum of 270 square inches of retroreflective area facing road users.**

Support:

05a The Type I and Type II Barricades, 36 inch in length with each rail 12 inch wide, provide additional conspicuity in visually complex environments and for older road users.

Standard:

05b On State highways, the retroreflectorized bands shall be maintained at or above minimum levels in Table 2A-3.

Guidance:

05c *On local roads, the retroreflectorized bands should be maintained at or above minimum levels in Table 2A-3.*

Support:

05d Refer to Caltrans' Standard Specifications Section 12-3.01A(4) for visibility criteria cited. See Section 1A.11 for information regarding this publication.

Guidance:

06 *Where barricades extend entirely across a roadway, the stripes should slope downward in the direction toward which road users must turn.*

07 *Where both right and left turns are provided, the barricade stripes should slope downward in both directions from the center of the barricade or barricades.*

08 *Where no turns are intended, the stripes should be positioned to slope downward toward the center of the barricade or barricades.*

09 *Barricade rails should be supported in a manner that will allow them to be seen by the road user, and in a manner that provides a stable support that is not easily blown over or displaced.*

10 *The width of the existing pedestrian facility should be provided for the temporary facility if practical. Traffic control devices and other construction materials and features should not intrude into the usable width of the sidewalk, temporary pathway, or other pedestrian facility. When it is not possible to maintain a minimum width of 60 inches throughout the entire length of the pedestrian pathway, a 60 x 60-inch passing space should be provided at least every 200 feet to allow individuals in wheelchairs to pass.*

11 *Barricade rail supports should not project into pedestrian circulation routes more than 4 inches from the support between 27 and 80 inches from the surface as described in Section 4.4.1 of the "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)" (see Section 1A.11).*

Option:

12 For Type 1 Barricades, the support may include other unstriped horizontal rails necessary to provide stability.

Guidance:

13 *On high-speed expressways or in other situations where barricades may be susceptible to overturning in the wind, ballasting should be used.*

Option:

14 Sandbags may be placed on the lower parts of the frame or the stays of barricades to provide the required ballast.

Support:

15 Type 1 or Type 2 Barricades are intended for use in situations where road user flow is maintained through the TTC zone.

Option:

16 Barricades may be used alone or in groups to mark a specific condition or they may be used in a series for channelizing road users.

17 Type 1 Barricades may be used on conventional roads or urban streets.

Guidance:

18 *Type 2 or Type 3 Barricades should be used on freeways and expressways or other high-speed roadways. Type 3 Barricades should be used to close or partially close a road.*

Option:

19 Type 3 Barricades used at a road closure may be placed completely across a roadway or from curb to curb.

Guidance:

20 *Where provision is made for access of authorized equipment and vehicles, the responsibility for Type 3 Barricades should be assigned to a person who will provide proper closure at the end of each work day.*

Support:

21 When a highway is legally closed but access must still be allowed for local road users, barricades usually are not extended completely across the roadway.

Standard:

22 **A sign shall be installed with the appropriate legend concerning permissible use by local road users (see Section 6F.09). Adequate visibility of the barricades from both directions shall be provided.**

Option:

23 Signs may be installed on barricades (see Section 6F.03).

24 Barricades may be used as sign supports if the barricades have been successfully crash tested as one unit with a construction area sign attached.

Section 6F.69 Direction Indicator Barricades

Standard:

01 **The Direction Indicator Barricade (see Figure 6F-7) shall consist of a One-Direction Large Arrow (W1-6) sign mounted above a diagonal striped, horizontally aligned, retroreflective rail.**

02 **The One-Direction Large Arrow (W1-6) sign shall be black on an orange background. The stripes on the bottom rail shall be alternating orange and white retroreflective stripes sloping downward at an angle of 45 degrees in the direction road users are to pass. The stripes shall be 4 inches wide. The One-Direction Large Arrow (W1-6) sign shall be 24 x 12 inches. The bottom rail shall have a length of 24 inches and a height of 8 inches.**

Option:

03 The Direction Indicator Barricade may be used in tapers, transitions, and other areas where specific directional guidance to drivers is necessary.

Guidance:

04 *If used, Direction Indicator Barricades should be used in series to direct the driver through the transition and into the intended travel lane.*

Section 6F.70 Temporary Traffic Barriers as Channelizing Devices

Support:

01 Temporary traffic barriers are not TTC devices in themselves; however, when placed in a position identical to a line of channelizing devices and marked and/or equipped with appropriate channelization features to provide guidance and warning both day and night, they serve as TTC devices.

Standard:

02 **Temporary traffic barriers serving as TTC devices shall comply with requirements for such devices as set forth throughout Part 6.**

03 **Temporary traffic barriers (see Section 6F.85) shall not be used solely to channelize road users, but also to protect the work space. If used to channelize vehicular traffic, the temporary traffic barrier shall be supplemented with delineation, pavement markings, or channelizing devices for improved daytime and nighttime visibility.**

Guidance:

04 *Temporary traffic barriers should not be used for a merging taper except in low-speed urban areas.*

05 *When it is necessary to use a temporary traffic barrier for a merging taper in low-speed urban areas or for a constricted/restricted TTC zone, the taper length should be designed to optimize road user operations considering the available geometric conditions.*

Standard:

06 **When it is necessary to use a temporary traffic barrier for a merging taper in low-speed urban areas or for a constricted/restricted TTC zone, the taper shall be delineated.**

Guidance:

07 *When used for channelization, temporary traffic barriers should be of a light color for increased visibility.*

Option:

08 Side reflectors or top mounted reflectors (facing the road user) may be used on temporary traffic barriers.

Guidance:

09 *If used, the spacing of these reflectors should not exceed a distance in feet equal to 1.0 times the speed limit in mph through the TTC zone.*

Section 6F.71 Longitudinal Channelizing Devices

Support:

01 Longitudinal channelizing devices are lightweight, deformable devices that are highly visible, have good target value, and can be connected together.

Standard:

02 **If used singly as Type 1, 2, or 3 barricades, longitudinal channelizing devices shall comply with the general size, color, stripe pattern, retroreflectivity, and placement characteristics established for the devices described in this Chapter.**

Guidance:

03 *If used to channelize vehicular traffic at night, longitudinal channelizing devices should be supplemented with retroreflective material or delineation for improved nighttime visibility.*

Option:

04 Longitudinal channelizing devices may be used instead of a line of cones, drums, or barricades.

05 Longitudinal channelizing devices may be hollow and filled with water as a ballast.

06 Longitudinal channelizing devices may be used for pedestrian traffic control.

Standard:

07 **If used for pedestrian traffic control, longitudinal channelizing devices shall be interlocked to delineate or channelize flow. The interlocking devices shall not have gaps that allow pedestrians to stray from the channelizing path.**

Guidance:

08 *Longitudinal channelizing devices have not met the crashworthy requirements for temporary traffic barriers and should not be used to shield obstacles or provide positive protection for pedestrians or workers.*

Section 6F.72 Temporary Lane Separators

Option:

01 Temporary lane separators may be used to channelize road users, to divide opposing vehicular traffic lanes, to divide lanes when two or more lanes are open in the same direction, and to provide continuous pedestrian channelization.

Standard:

02 **Temporary lane separators shall be crashworthy. Temporary lane separators shall have a maximum height of 4 inches and a maximum width of 1 foot, and shall have sloping sides in order to facilitate crossover by emergency vehicles.**

Option:

03 Temporary lane separators may be supplemented with any of the approved channelizing devices contained in this Chapter, such as tubular markers, vertical panels, and opposing traffic lane dividers.

Standard:

04 **If appropriate channelizing devices are used to supplement a temporary lane separator, the channelizing devices shall be retroreflectorized to provide nighttime visibility. If channelizing devices are not used, the temporary lane separator shall contain retroreflectorization to enhance its visibility.**

Guidance:

05 *A temporary lane separator should be stabilized by affixing it to the pavement in a manner suitable to its design, while allowing the unit to be shifted from place to place within the TTC zone in order to accommodate changing conditions.*

Standard:

06 **At pedestrian crossing locations, temporary lane separators shall have an opening or be shortened to provide a pathway that is at least 60 inches wide for crossing pedestrians.**

Section 6F.73 Other Channelizing Devices

Option:

01 Channelizing devices other than those described in this Chapter may be used in special situations based on an engineering study.

Guidance:

02 *Other channelizing devices should comply with the general size, color, stripe pattern, retroreflection, and placement characteristics established for the devices described in this Chapter.*

Section 6F.74 Detectable Edging for Pedestrians

Support:

01 Individual channelizing devices, tape or rope used to connect individual devices, other discontinuous barriers and devices, and pavement markings are not detectable by persons with visual disabilities and are incapable of providing detectable path guidance on temporary or realigned sidewalks or other pedestrian facilities.

Guidance:

02 *When it is determined that a facility should be accessible to and detectable by pedestrians with visual disabilities, a continuously detectable edging should be provided throughout the length of the facility such that it can be followed by pedestrians using long canes for guidance. This edging should protrude at least 6 inches above the surface of the sidewalk or pathway, with the bottom of the edging a maximum of ~~2.5~~2.0 inches above the surface. This edging should be continuous throughout the length of the facility except for gaps at locations where pedestrians or vehicles will be turning or crossing. This edging should consist of a prefabricated or formed-in-place curbing or other continuous device that is placed along the edge of the sidewalk or walkway. This edging should be firmly attached to the ground or to other devices. Adjacent sections of this edging should be interconnected such that the edging is not displaced by pedestrian or vehicular traffic or work operations, and such that it does not constitute a hazard to pedestrians, workers, or other road users.*

Support:

03 Examples of detectable edging for pedestrians include:

A. Prefabricated lightweight sections of plastic, metal, or other suitable materials that are interconnected and fixed in place to form a continuous edge.
B. Prefabricated lightweight sections of plastic, metal, or other suitable materials that are interconnected, fixed in place, and placed at ground level to provide a continuous connection between channelizing devices located at intervals along the edge of the sidewalk or walkway.
C. Sections of lumber interconnected and fixed in place to form a continuous edge.
D. Formed-in-place asphalt or concrete curb.
E. Prefabricated concrete curb sections that are interconnected and fixed in place to form a continuous edge.
F. Continuous temporary traffic barrier or longitudinal channelizing barricades placed along the edge of the sidewalk or walkway that provides a pedestrian edging at ground level.
G. Chain link or other fencing equipped with a continuous bottom rail.

Guidance:

04 *Detectable pedestrian edging should be orange, white, or yellow and should match the color of the adjacent channelizing devices or traffic control devices, if any are present.*

05 *If prefabricated edging is used to separate pedestrians and vehicular traffic, such edging should be certified as crashworthy (see section 6F.01). If section of lumber is used to form a railing system, any part of the railing that is more than 3 feet above pavement should be treated lumber and cause no harm to bare hand touching it.*

Section 6F.75 Temporary Raised Islands

Standard:

01 **Temporary raised islands shall be used only in combination with pavement striping and other suitable channelizing devices.**

Option:

02 A temporary raised island may be used to separate vehicular traffic flows in two-lane, two-way operations on roadways having a vehicular traffic volume range of 4,000 to 15,000 average daily traffic (ADT) and on freeways having a vehicular traffic volume range of 22,000 ADT to 60,000 ADT.

03 Temporary raised islands also may be used in other than two-lane, two-way operations where physical separation of vehicular traffic from the TTC zone is not required.

Guidance:

04 *Temporary raised islands should have the basic dimensions of 4 inches high by at least 12 inches wide and have rounded or chamfered corners.*

05 *The temporary raised islands should not be designed in such a manner that they would cause a motorist to lose control of the vehicle if the vehicle inadvertently strikes the temporary raised island. If struck, pieces of the island should not be dislodged to the extent that they could penetrate the occupant compartment or involve other vehicles.*

Standard:

06 **At pedestrian crossing locations, temporary raised islands shall have an opening or be shortened to provide at least a 60-inch wide pathway for the crossing pedestrian.**

Section 6F.76 Opposing Traffic Lane Divider and Sign (W6-4)

Support:

01 Opposing traffic lane dividers are delineation devices used as center lane dividers to separate opposing vehicular traffic on a two-lane, two-way operation.

Standard:

02 **Opposing traffic lane dividers shall not be placed across pedestrian crossings.**

03 **The Opposing Traffic Lane Divider (W6-4) sign (see Figure 6F-4) shall be an upright, retroreflective orange-colored sign placed on a flexible support and sized at least 12 inches wide by 18 inches high.**

Guidance:

04 *The Opposing Traffic Lane Divider (W6-4) sign should only be used to supplement a channelizing device that is being used to separate opposing traffic in a TTC zone.*

Section 6F.77 Pavement Markings

Support:

01 Pavement markings are installed or existing markings are maintained or enhanced in TTC zones to provide road users with a clearly defined path for travel through the TTC zone in day, night, and twilight periods under both wet and dry pavement conditions.

Guidance:

02 *The work should be planned and staged to provide for the placement and removal of the pavement markings in a way that minimizes the disruption to traffic flow approaching and through the TTC zone during the placement and removal process.*

Standard:

03 **Existing pavement markings shall be maintained in all long-term stationary (see Section 6G.02) TTC zones in accordance with Chapters 3A and 3B, except as otherwise provided for temporary pavement markings in Section 6F.78. Pavement markings shall match the alignment of the markings in place at both ends of the TTC zone. Pavement markings shall be placed along the entire length of any paved detour or temporary roadway prior to the detour or roadway being opened to road users.**

04 **For long-term stationary operations, pavement markings in the temporary traveled way that are no longer applicable shall be removed or obliterated as soon as practical. Pavement marking obliteration shall remove the non-applicable pavement marking material, and the obliteration method shall minimize pavement scarring. Painting over existing pavement markings with black paint or spraying with asphalt shall not be accepted as a substitute for removal or obliteration.**

Option:

05 Removable, non-reflective, preformed tape that is approximately the same color as the pavement surface may be used where markings need to be covered temporarily.

Guidance:

06 *Centerlines and lane lines should be placed, replaced, or delineated where appropriate before the roadway is opened to traffic.*

Standard:

07 On State highways, whenever construction or maintenance work causes obliteration of center stripe, temporary or permanent center stripe shall be in place prior to opening the State highway to public traffic.

Attachment B

Trash Capture Device Maintenance Report – Hydrodynamic Separator

Blank Form

Trash Capture Device Maintenance Report — Hydrodynamic Separator

BAY AREA-WIDE TRASH CAPTURE DEMONSTRATION PROJECT

Use the municipal staff DATA login for your city/county to enter maintenance data at www.bayareatrashtracker.org

Address or intersection: _____

OPTIONAL SFEP Device ID: _____ Municipal Device ID _____

Purchase Order No.: _____ Item Line No. (from Purchase Order): _____

MAINTENANCE

Date of maintenance event: _____

Reason for inspection/maintenance: (check all that apply)

- ☐ Regular scheduled
- ☐ Repair (describe): _____
- ☐ Response to complaint (describe): _____

Is device functioning properly?

- ☐ Yes ☐ No (explain): _____
- ☐ Clogged

Condition of device

- ☐ Intact, not damaged
- ☐ Damaged or broken part (describe): _____
- ☐ Needs repair/adjustment (explain): _____

Estimate the volume of trash recovered at maintenance event. Use a tape measure or graduated probe to measure trash above the screen and in the sump basin. Volume will be calculated based on the dimensions of the device.

Volume of trash estimate: _____ cubic yards or _____ gallons

Maintenance effort:

How many staff participated in this maintenance event? _____

Equipment used for trash removal:

☐ Manual/shovels/clamshell ☐ Vactor truck ☐ Other (describe): _____

Maintenance time spent at site (excluding travel, prep, cleanup, disposal): _____hrs. /_____mins.

OPTIONAL

☐ Photos from this maintenance event to be uploaded to the TrashTracker website

Materials removed (estimated percentage/volume in cubic feet if available; use other units if necessary):

- ☐ Plastic _____% _____ cubic ft.
- ☐ Paper _____% _____ cubic ft.
- ☐ Sediment _____% _____ cubic ft.
- ☐ Metal _____% _____ cubic ft.
- ☐ Leaves/vegetation _____% _____ cubic ft.

Thank You!

San Francisco Estuary Partnership, www.sfestuary.org
Janet Cox: (510) 622-2334 jwcox@waterboards.ca.gov
Jesse Mills: (510) 622-2465 jemills@waterboards.ca.gov

APPENDIX C

Standard Operating Procedure
for Trash and Debris Characterization

Standard Operating Procedures for
Trash Debris and Characterization

The following provides procedures for removing and evaluating trash from removed from storm drain inlets equipped with small full-capture devices and large full-capture devices. Trash evaluation is an important step in in assessing the effects of specific trash control measures designed to reduce the generation and impacts of persistent and problematic types of trash.

1.0 Trash and Debris Evaluation

There are three trash and debris evaluation steps. They include:

- Step 1: Sort trash and debris;
- Step 2: Count the number of specific trash items; and
- Step 3: Measure volume of sorted trash and debris

When conducting trash and debris evaluations, the following steps should be performed in the order presented below.

1.1 Step 1: Sort Trash and Debris

Sort trash and debris on a work table (Note: avoid periods of time during the day that are susceptible to wind). Separate all trash items from debris (e.g., leaves, conifer needles, dirt, sand) into the following seven trash categories and/or types identified in the Program's *Trash Categories/Types Worksheet* (Attachment A): recyclable beverage containers, single-use carryout plastic grocery bags, expanded polystyrene (EPS) food and beverage ware, rigid plastic disposable food and beverage ware (includes Non-EPS plastic, fiber-based, and compostable plastic), cigarette butts, other plastic, and all other trash. If an observed trash item is not on the list, use best professional judgment in determining which trash category the item may be described as. While sorting, place the seven trash categories and/or types in separate buckets (1-5 gallons) and other containers (smaller than one gallon, variable sizes) for volume determination. Place all debris in a large box or container of known volume (e.g., preferably a box or container no smaller than 12 gallons). Use plastic bags inside the box or container to facilitate removal and disposal of debris during the sorting process.

1.2 Step 2: Count the Number of Specific Trash Items

After sorting is completed, individually count the **total number** of single-use carryout plastic bags, expanded polystyrene (EPS) food and beverage ware, rigid plastic disposable food and beverage ware. Use the Program's *Catch Basin Trash and Debris Evaluation Data Collection Form* (Appendix D) to record the total number of these three trash types. Once these trash items are counted place single-use carryout plastic bags, expanded polystyrene (EPS) food and beverage ware, rigid plastic disposable food and beverage ware back into their respective containers and measure the volume of trash in each of the seven categories.

1.3 Step 3: Measure Volume of Sorted Trash and Debris

Measure the total volume of each trash category using buckets and containers of known volume. Since all buckets and containers will not be full, use a ruler or yard stick to estimate total volume. For example, if a 2-gallon bucket is determined to be one-thirds full when measuring with a ruler, the estimation of the total volume of trash within the bucket would be 0.33 X 2 gallons = 0.666 gallons. When measuring total volume of trash, ensure that it is un-compacted. Use the Program's *Catch Basin Trash and Debris Evaluation Data Collection Form* (Appendix D) to record the total volume of each trash category.

Use the Program's *Catch Basin Trash and Debris Evaluation Data Collection Form* (Appendix D) to record the total number of boxes and/or containers of debris sorted. To determine the total volume of debris sorted, multiply the total number of boxes and/or containers with the known volume of the box and/or container. For example, if you filled five 12-gallon boxes and two five gallon buckets with debris, the total volume of debris sorted would be 70 gallons.

Properly dispose of all trash and debris.

APPENDIX D

Trash and Debris Characterization Data Collection Form
and Trash Categories/Types Worksheet

Debris and Trash Characterization Data Collection Form

Device ID #: _____ **Date:** _____ **Time:** _____ **Staff:** _____

Debris

Moisture Content			Number of Bucket(s)[1] (5 gal)
Dry	Damp	Wet	

Bucket #	1	2	3	4	5	6	7	8	9	10
Volume (inches)										

Trash

Trash Category/Type[2]	Number of Bucket(s)[1]						Total Number (pieces)	Total Volume (inches)
	5 gal	2 gal	1 gal	64 oz	32 oz	16 oz		
I. Recyclable Beverage Containers (CRV-labeled)								
II. Single Use Plastic Carryout Bags								
III. Expanded Polystyrene (Foam) Food and Beverage Ware								
IV. Rigid Plastic Disposable Food and Beverage Ware								
V. Cigarette butts								
VI. Other Plastic							**N/A**	
VII. All Other Trash							**N/A**	

[1] The number of buckets used to determine total weight of debris and trash.
[2] A description of each trash category/type is provided on the next page.

SCVURPPP Storm Drain Trash Characterization Project

Trash Characterization Categories/Types

Trash Category/Type		Examples of Items Included in Category
1	Recyclable Beverage Containers (CRV labeled)	Plastic Bottles
2	Recyclable Beverage Containers (CRV labeled)	Glass Bottles
3	Single-use Plastic Carryout Grocery Bags	Plastic Bags with handles
4	Expanded Polystyrene (Foam) Disposable Food and Beverage Ware	Polystyrene Foam Food Containers ("Clamshells")
		Polystyrene Foam Beverage Containers (e.g., cups)
		Polystyrene Foam Bowls
		Polystyrene Foam Plates
		Polystyrene Condiment Containers
		Polystyrene Foam Trays
5	Rigid Plastic Disposable Food and Beverage Ware (includes Non-EPS plastic, fiber-based, and compostable plastic)	Food Containers ("Clamshells")
		Beverage Containers (e.g., cups)
		Bowls
		Plates
		Condiment Containers
		Food Trays
6	Cigarette Butts	Cellulose cigarette butts
7	Other Plastic	Plastic Bags (Produce, Meat, Newspapers, Other)
		Pre-packaged Food- Polystyrene Foam Containers (Eggs Cartons, Ramen Bowls, Meat Trays)
		Cigarette packaging
		Mylar (Non-recyclable) Film Food Wrapers (e.g., chip bags, candy bar wrappers)
		Disposable Plastic Utensils (food related)
		Styrofoam Packaging (non-food related)
		Styrofoam Pieces
		Plastic Band, 6-pack ring
		Plastic Pieces
		All Other Plastic Products
8	All Other Trash	Paper Napkin
		Hybrid Materials (e.g., plastic-coated paper wrappers)
		Receipt, Bus/Train Card
		Newspaper, Magazine, Flyer
		Cardboard
		Lottery/Scratcher Card
		Other Paper Products
		Glass Bottle (non-CRV labeled)
		Glass Jar or Container
		Glass Pieces
		Other Glass
		Aluminum/Steel Can
		Bottle Cap
		Pipe, Rebar
		Wire
		Machine part
		Nail, Bolt, Screw
		Other Metal
		Rubber
		Foam
		Toy, Balloon
		Golf Ball
		Tennis Ball
		Synthetic Fabric
		Natural Fabric (cotton, wool)
		Wood Debris
		Other Wood
		Other Miscellaneous

APPENDIX B

QUALITY ASSURANCE

RELATIVE PERCENT REDUCTION CALCULATIONS

Appendix B Relative Percent Differences (<MDL = ½ MDL) between trash volumes measured in samples and duplicates collected at applicable sampling sites.

Sample ID	Sample Date	Sample Trash Volume (gal)	Duplicate Trash Volume (gal)	Percent Difference
SJC-007	2/2/2016	2.48	2.16	-14.0%
SJC-036	7/13/2015	3.55	3.10	-13.6%
SJC-082	2/18/2016	1.94	1.69	-13.5%
SJC-104	2/18/2016	1.78	1.58	-12.3%
CUO-079	1/31/2016	1.72	1.55	-10.2%
CMP-024	1/28/2016	2.27	2.05	-9.9%
SJC-006	2/2/2016	1.41	1.29	-9.1%
SCC-134	1/29/2016	2.03	1.85	-9.0%
SCC-153	1/29/2016	0.61	0.56	-8.2%
SJC-056	2/4/2016	3.62	3.35	-7.9%
SNV-150	1/25/2016	0.31	0.29	-6.7%
Los Altos HDS	9/29/2015	3.82	3.58	-6.4%
SJC-068	2/4/2016	5.52	5.21	-5.8%
SNV-112	7/10/2015	2.33	2.22	-4.8%
SJC-003	7/13/2015	2.60	2.52	-2.8%
CMP-012	1/28/2016	0.96	0.94	-2.3%
SNV-135	1/25/2016	1.02	1.00	-1.3%
SJC-077	2/17/2016	3.72	3.68	-1.3%
SCC-151	1/29/2016	1.62	1.60	-1.0%
SJC-016	7/13/2015	1.40	1.39	-0.8%
SJC-035	7/13/2015	4.09	4.06	-0.8%
SJC-142	7/13/2015	2.35	2.35	-0.2%
SNV-141	1/25/2016	0.59	0.59	0.4%
SJC-033	7/13/2015	5.39	5.44	0.9%
SJC-068	7/13/2015	3.04	3.11	2.2%
SJC-084	8/28/2015	2.15	2.21	2.5%
SJC-100	2/17/2016	3.00	3.10	3.3%
SJC-108	2/17/2016	1.84	1.94	5.2%
CMP-027	7/6/2015	1.17	1.25	6.6%
SNV-129	7/10/2015	2.51	2.69	7.0%
SNV-160	1/25/2016	0.60	0.65	8.3%
SCC-134	7/6/2015	1.90	2.10	9.9%
SJC-021	7/13/2015	0.59	0.70	16.8%
SJC-100	7/13/2015	2.71	4.07	40.3%
Total		**76.63**	**75.86**	**-1.1% (Avg.)**

APPENDIX C

MONITORING SITE DESCRIPTIONS AND TRASH VOLUMES

Appendix C. Trash Volumes (Gallons) by Monitoring Site.

SCVURPPP ID	Permittee	Latitude	Longitude	Land Use	Drainage Area (acres)	Include In this study	In Original SCVURPPP Study	# of Days Total	Debris Total (gal)	Trash Total (gal)	Plastic Bags Total	Number of EPS	EPS (gal)	Plastic Foodware (gal)	Cigarettes (gal)	Other Plastic (gal)	All Other Trash (gal)	Number of Plastic Bottles CRV	Plastic Bottles CRV (gal)	Number of Glass Bottles CRV	Glass Bottles CRV (gal)
CMP-003	Campbell	37.28916	-121.93143	Retail	6.03			331	41.79	1.25	0	1	0.00	0.00	0.026	1	0.32	0.00	0.000	0	0.00
CMP-005	Campbell	37.29413	-121.93146	Retail	6.34			320	29.82	0.74	0	1	0.00	0.00	0.037	0	0.27	1.00	0.066	0	0.00
CMP-006	Campbell	37.29414	-121.93197	Retail	3.86			126	6.43	1.05	0	1	0.00	0.00	0.141	1	0.24	0.00	0.000	1	0.09
CMP-009	Campbell	37.28734	-121.93182	Retail	6.21			125	28.75	1.57	0	4	0.05	0.00	0.020	1	0.26	0.00	0.000	0	0.00
CMP-012	Campbell	37.28340	-121.93182	Retail	2.82			320	28.39	1.67	0	0	0.00	0.00	0.055	1	0.53	0.00	0.000	0	0.00
CMP-019	Campbell	37.29387	-121.93969	Retail	3.04			320	21.34	2.79	5	2	0.00	0.00	0.073	2	0.77	0.00	0.000	0	0.00
CMP-024	Campbell	37.28710	-121.94377	Retail	0.60			331	14.46	2.63	2	0	0.00	0.00	0.028	1	0.89	2.00	0.792	1	0.09
CMP-025	Campbell	37.28712	-121.94710	Retail	0.96			331	21.34	0.55	0	0	0.00	0.00	0.071	0	0.11	0.00	0.000	0	0.00
CMP-027	Campbell	37.28587	-121.97887	Retail	9.47			320	12.68	2.33	0	4	0.05	0.00	0.082	1	0.29	3.00	0.406	0	0.00
CUO-002	Cupertino	37.33737	-122.04128	Retail	1.08	no		234	18.21	0.95	0	0	0.00	0.00	0.074	1	0.16	0.00	0.000	0	0.00
CUO-013	Cupertino	37.32310	-122.01591	Retail	0.80			260	26.34	0.19	0	1	0.00	0.00	0.025	0	0.07	0.00	0.000	0	0.00
CUO-016	Cupertino	37.32279	-122.01438	Retail	0.75			331	4.64	0.42	0	0	0.00	0.00	0.024	0	0.17	0.00	0.000	0	0.00
CUO-067	Cupertino	37.32301	-122.04644	Retail	0.42			263	9.85	0.58	0	2	0.01	0.00	0.012	0	0.17	0.00	0.000	0	0.00
CUO-071	Cupertino	37.32304	-122.04019	Retail	1.03			260	2.86	1.03	0	0	0.00	0.00	0.008	1	0.32	0.00	0.000	0	0.00
CUO-079	Cupertino	37.32270	-122.04872	Colleges and Universities	0.51			124	12.86	0.54	0	2	0.21	0.00	0.051	1	0.89	0.00	0.000	0	0.00
CUO-086	Cupertino	37.32308	-122.02770	Retail	0.42			331	5.18	0.06	0	0	0.00	0.00	0.005	0	0.04	0.00	0.000	0	0.00
CUO-088	Cupertino	37.32305	-122.03609	Retail	0.95			265	5.44	0.18	0	0	0.00	0.00	0.005	0	0.06	0.00	0.000	0	0.00
CUO-091	Cupertino	37.32276	-122.03744	Retail	0.69			262	9.11	0.95	0	2	0.00	0.00	0.017	1	0.24	0.00	0.000	0	0.00
CUO-102	Cupertino	37.32304	-122.03159	Retail	0.98			260	7.86	1.00	0	0	0.00	0.00	0.020	1	0.18	0.00	0.000	0	0.00
LGT-012	Los Gatos	37.24093	-121.96077	Retail	1.04			334	29.37	1.52	0	4	0.01	0.00	0.077	1	0.55	0.00	0.000	0	0.00
LGT-013	Los Gatos	37.24491	-121.95843	Retail	2.18			126	21.07	0.48	0	1	0.00	0.00	0.022	0	0.25	1.00	0.132	0	0.00
LGT-015	Los Gatos	37.24726	-121.95673	Retail	1.49			126	23.21	1.02	0	0	0.00	0.00	0.079	1	0.36	1.00	0.125	0	0.00
LGT-017	Los Gatos	37.24817	-121.95702	Retail	0.82			126	20.54	1.33	0	1	0.00	0.00	0.206	1	0.21	0.00	0.000	0	0.00
LGT-020	Los Gatos	37.23674	-121.96235	Retail	0.83			126	5.54	0.93	0	0	0.00	0.00	0.012	0	0.54	0.00	0.000	0	0.00
LGT-022	Los Gatos	37.23769	-121.96227	Retail	0.78			126	7.95	0.48	0	0	0.00	0.00	0.018	0	0.19	2.00	0.264	0	0.00
LGT-026	Los Gatos	37.23385	-121.96410	Retail	1.00			324	5.18	0.17	0	0	0.00	0.00	0.012	0	0.02	0.00	0.000	0	0.00
LGT-027	Los Gatos	37.22120	-121.97726	Retail	3.01			126	16.43	1.59	0	2	0.01	0.00	0.040	1	0.90	0.00	0.000	0	0.00
LGT-031	Los Gatos	37.22128	-121.97972	Retail	1.47			324	22.05	0.54	0	0	0.00	0.00	0.062	0	0.10	0.00	0.000	0	0.00
MTS-001	Monte Sereno	37.24094	-121.98136	Residential	1.41			125	11.34	0.15	0	0	0.00	0.00	0.001	0	0.00	0.00	0.000	0	0.00
MTS-028	Monte Sereno	37.24123	-121.98301	Residential	2.21			325	29.11	0.45	0	1	0.00	0.00	0.009	0	0.04	0.00	0.000	0	0.00
SAR-002	Saratoga	37.26680	-122.01442	Commercial	3.76			325	29.28	0.51	0	2	0.00	0.00	0.009	0	0.27	0.00	0.000	0	0.00
SAR-003	Saratoga	37.26679	-122.01355	Colleges and Universities	3.85			325	9.02	0.11	0	0	0.00	0.00	0.012	0	0.01	0.00	0.000	0	0.00
SCC-130	Santa Clara Co	37.32494	-121.93213	Retail	5.89			329	4.64	0.59	0	0	0.00	0.00	0.044	0	0.36	0.00	0.000	0	0.00
SCC-133	Santa Clara Co	37.31979	-121.93167	Retail	13.22			329	15.00	3.90	1	3	0.01	0.00	0.090	2	1.84	2.00	0.226	0	0.00
SCC-134	Santa Clara Co	37.31625	-121.93214	Retail	0.63			330	16.34	3.93	0	4	0.05	0.00	0.154	3	0.49	2.00	0.288	0	0.00
SCC-146	Santa Clara Co	37.30975	-121.93155	Retail	1.90			332	13.21	2.48	1	0	0.00	0.00	0.018	2	0.91	0.00	0.000	0	0.00
SCC-151	Santa Clara Co	37.31315	-121.93166	Retail	3.82			330	33.12	2.78	0	0	0.00	0.00	0.106	2	0.60	1.00	0.132	0	0.00
SCC-153	Santa Clara Co	37.31113	-121.93162	Retail	1.78			125	5.89	3.19	0	5	0.39	0.00	0.381	2	0.47	1.00	0.132	0	0.00

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SJC-002	San Jose	37.30103	-121.95653	Residential	0.67		yes	348	20.18	2.44	0	4	0.15	0.00	0.005	2	0.36	2.00	0.198	0	0.00
SJC-003	San Jose	37.27349	-121.93459	Retail	0.66		yes	334	35.36	3.54	0	3	0.10	0.00	0.191	2	1.07	1.00	0.132	0	0.00
SJC-004	San Jose	37.25049	-121.85737	Retail	0.90		yes	334	29.64	1.85	0	0	0.00	0.28	0.032	1	0.15	0.00	0.000	0	0.00
SJC-006	San Jose	37.31617	-121.78789	Residential	0.24		yes	330	20.00	2.30	1	1	0.13	0.00	0.029	2	0.21	0.00	0.000	1	0.09
SJC-007	San Jose	37.31279	-121.85240	Industrial	0.81		yes	334	8.93	2.73	0	2	0.00	0.00	0.018	2	0.53	2.00	0.288	1	0.18
SJC-008	San Jose	37.29408	-121.83206	Roadway	1.25		yes	335	29.46	12.53	0	6	0.09	0.00	0.447	7	5.47	0.00	0.000	0	0.00
SJC-010	San Jose	37.29811	-121.83448	Residential	1.06		yes	331	13.03	0.76	0	3	0.06	0.00	0.005	0	0.23	1.00	0.132	0	0.00
SJC-016	San Jose	37.26037	-121.93147	Retail	1.74		yes	336	8.21	2.07	0	1	0.00	0.00	0.139	1	0.41	0.00	0.000	1	0.11
SJC-018	San Jose	37.31412	-121.77330	Retail	0.38		yes	335	9.64	0.24	0	0	0.00	0.00	0.003	0	0.03	0.00	0.000	0	0.00
SJC-019	San Jose	37.30241	-121.77415	Urban Park	4.44		yes	335	19.11	1.21	0	1	0.00	0.00	0.045	1	0.38	1.00	0.132	0	0.00
SJC-021	San Jose	37.24084	-121.87440	Roadway	0.44		yes	335	31.52	1.29	0	2	0.02	0.00	0.024	1	0.34	0.00	0.000	0	0.00
SJC-023	San Jose	37.36836	-121.91491	Commercial	1.72	no	yes														
SJC-027	San Jose	37.25258	-121.85862	Retail	0.36		yes	336	8.57	4.15	0	7	0.15	0.00	0.058	3	1.16	0.00	0.000	0	0.00
SJC-032	San Jose	37.32170	-121.82714	Retail	1.47		yes	335	27.14	5.90	0	6	0.08	0.00	0.172	4	1.67	2.00	0.257	0	0.00
SJC-033	San Jose	37.32269	-121.82603	Retail	1.03		yes	335	11.43	6.02	3	10	0.34	0.00	0.178	4	1.84	1.00	0.132	0	0.00
SJC-035	San Jose	37.32011	-121.82554	Commercial	0.78			335	17.32	5.97	1	18	0.19	0.00	0.121	4	0.67	5.00	0.566	1	0.09
SJC-036	San Jose	37.31951	-121.82705	Retail	0.82		yes	336	29.91	4.65	2	15	0.37	0.00	0.132	4	0.38	0.00	0.000	0	0.00
SJC-038	San Jose	37.31884	-121.82336	Retail	0.59		yes	349	8.21	6.46	1	5	0.19	0.00	0.061	5	1.54	0.00	0.000	1	0.09
SJC-039	San Jose	37.31873	-121.82335	Commercial	0.46			344	11.60	2.75	0	0	0.00	0.00	0.029	2	1.21	0.00	0.000	0	0.00
SJC-041	San Jose	37.31766	-121.82494	Residential	2.02			332	32.50	4.00	0	6	0.15	0.00	0.034	2	1.88	0.00	0.000	0	0.00
SJC-042	San Jose	37.31775	-121.82504	Residential	1.02			332	6.28	1.71	0	7	0.11	0.00	0.003	1	0.24	0.00	0.000	0	0.00
SJC-044	San Jose	37.35328	-121.82804	Commercial	0.11		yes	336	20.53	4.16	0	6	0.02	0.00	0.029	3	1.50	0.00	0.000	0	0.00
SJC-045	San Jose	37.36436	-121.87085	Industrial	0.62		yes	337	24.64	4.24	0	16	0.30	0.00	0.077	3	0.81	1.00	0.132	1	0.09
SJC-046	San Jose	37.36275	-121.86927	Industrial	0.29		yes	337	16.35	6.52	0	15	0.67	0.00	0.073	5	1.14	0.00	0.000	0	0.00
SJC-048	San Jose	37.35989	-121.86932	Industrial	0.78		yes	337	4.10	0.82	0	3	0.03	0.00	0.026	1	0.13	0.00	0.000	0	0.00
SJC-051	San Jose	37.36661	-121.86423	Industrial	0.22			131	12.86	1.79	0	3	0.01	0.00	0.050	1	0.45	3.00	0.459	1	0.10
SJC-055	San Jose	37.36332	-121.86295	Residential	2.43		yes	331	12.92	4.95	0	6	0.30	0.08	0.079	3	1.39	0.00	0.000	3	0.28
SJC-056	San Jose	37.36331	-121.86278	Residential	2.05		yes	331	9.82	6.98	3	4	0.20	0.00	0.099	4	2.28	3.00	0.747	0	0.00
SJC-060	San Jose	37.35942	-121.84977	Residential	0.90		yes	343	25.22	2.67	4	6	0.07	0.00	0.028	2	0.35	1.00	0.264	0	0.00
SJC-065	San Jose	37.36015	-121.85286	Residential	0.62	no	yes														
SJC-066	San Jose	37.36017	-121.85300	Residential	0.30			344	7.18	1.16	0	1	0.09	0.00	0.008	1	0.16	0.00	0.000	1	0.19
SJC-068	San Jose	37.34614	-121.83417	Retail	4.05			337	40.71	8.47	1	5	0.46	0.00	0.304	4	3.00	5.00	0.726	3	0.38
SJC-073	San Jose	37.34534	-121.83120	Residential	2.38		yes	345	33.93	1.32	0	0	0.00	0.00	0.018	1	0.34	0.00	0.000	0	0.00
SJC-076	San Jose	37.34759	-121.82962	Residential	0.40		yes	346	7.05	9.97	4	16	0.48	0.26	0.053	7	2.05	3.00	0.420	0	0.00
SJC-077	San Jose	37.34649	-121.82871	Residential	1.60		yes	345	11.40	5.46	0	1	0.04	0.00	0.065	4	1.28	2.00	0.194	0	0.00
SJC-079	San Jose	37.34502	-121.82759	Residential	0.86		yes	345	15.27	1.80	0	2	0.08	0.00	0.022	1	0.18	1.00	0.132	0	0.00
SJC-080	San Jose	37.35354	-121.82326	Retail	0.70		yes	350	23.75	6.03	0	11	0.61	0.00	0.125	4	0.83	2.00	0.264	1	0.09
SJC-081	San Jose	37.35593	-121.81928	Retail	0.93		yes	350	60.80	8.16	1	2	0.11	0.00	0.143	6	1.72	3.00	0.420	0	0.00
SJC-082	San Jose	37.35634	-121.81906	Retail	1.17		yes	350	25.80	5.36	1	7	0.15	0.00	0.112	4	0.68	3.00	0.601	1	0.09
SJC-084	San Jose	37.35114	-121.81350	Industrial	1.39			345	5.62	4.16	0	7	0.11	0.00	0.040	3	0.94	1.00	0.188	0	0.00

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SJC-085	San Jose	37.35165	-121.81287	Residential	1.50		yes	126	5.00	1.09	0	0	0.00	0.00	0.008	1	0.08	0.00	0.000	0	0.00
SJC-086	San Jose	37.35169	-121.81273	Residential	1.85		yes	172	3.21	0.47	0	2	0.01	0.00	0.003	0	0.07	1.00	0.132	0	0.00
SJC-091	San Jose	37.35277	-121.81163	Residential	2.42			345	18.84	1.22	0	2	0.00	0.00	0.012	1	0.18	0.00	0.000	0	0.00
SJC-093	San Jose	37.35158	-121.81480	Residential	1.16		yes	345	13.21	2.84	0	1	0.24	0.00	0.055	2	0.54	0.00	0.000	0	0.00
SJC-095	San Jose	37.35232	-121.81547	Residential	2.35			345	15.00	2.34	1	1	0.03	0.00	0.026	1	0.96	2.00	0.396	0	0.00
SJC-097	San Jose	37.35287	-121.81597	Residential	3.57			345	27.50	4.55	0	4	0.05	0.00	0.037	2	1.44	4.00	0.681	0	0.00
SJC-100	San Jose	37.35497	-121.81789	Residential	2.19			345	26.60	5.70	0	10	0.29	0.00	0.077	3	1.74	1.00	0.132	3	0.25
SJC-102	San Jose	37.35015	-121.81948	Residential	0.41		yes	346	10.98	4.10	0	7	0.15	0.00	0.029	3	0.75	1.00	0.106	1	0.09
SJC-104	San Jose	37.35009	-121.81919	Residential	0.76		yes	346	15.00	2.83	1	2	0.02	0.00	0.048	2	0.77	3.00	0.330	0	0.00
SJC-107	San Jose	37.36731	-121.86344	Industrial	0.56		yes	350	1.67	2.12	3	0	0.00	0.01	0.004	1	0.35	2.00	0.264	0	0.00
SJC-108	San Jose	37.35556	-121.84888	Retail	0.55			345	29.28	3.90	2	3	0.05	0.00	0.125	2	1.67	1.00	0.156	1	0.07
SJC-110	San Jose	37.30136	-121.95666	Residential	1.78		yes	350	40.36	2.74	0	3	0.05	0.00	0.029	2	0.38	0.00	0.000	0	0.00
SJC-112	San Jose	37.34275	-121.84024	Residential	0.08		yes	345	13.39	3.55	0	1	0.08	0.00	0.008	2	0.54	1.00	0.528	2	0.28
SJC-113	San Jose	37.34690	-121.82910	Residential	0.82		yes	126	6.43	2.92	1	6	0.07	0.00	0.092	5	1.22	0.00	0.000	0	0.00
SJC-116	San Jose	37.32626	-121.88758	Retail	0.94			345	14.91	0.38	0	5	0.01	0.00	0.005	0	0.12	0.00	0.000	0	0.00
SJC-117	San Jose	37.32616	-121.88749	Retail	0.99			345	15.89	0.56	0	0	0.00	0.00	0.012	0	0.12	0.00	0.000	2	0.19
SJC-119	San Jose	37.32020	-121.88847	Residential	0.45			345	11.07	2.66	0	1	0.08	0.00	0.025	2	0.51	0.00	0.000	0	0.00
SJC-120	San Jose	37.32077	-121.88757	Residential	1.52			126	3.75	1.55	0	0	0.00	0.00	0.029	1	0.40	3.00	0.578	0	0.00
SJC-121	San Jose	37.32067	-121.88749	Residential	1.87			345	8.93	2.44	0	0	0.00	0.00	0.048	1	0.75	1.00	0.264	0	0.00
SJC-131	San Jose	37.32062	-121.82438	Retail	0.71	no		219	40.27	4.36	1	11	0.17	0.00	0.158	4	0.47	0.00	0.000	0	0.00
SJC-142	San Jose	37.29903	-121.82384	Retail	0.55		yes	350	23.93	3.58	1	12	0.15	0.08	0.028	3	0.46	3.00	0.254	0	0.00
SNV-092	Sunnyvale	37.34118	-122.04155	Retail	1.77		yes	327	37.86	0.74	0	0	0.00	0.00	0.026	0	0.13	0.00	0.000	1	0.19
SNV-097	Sunnyvale	37.35194	-122.05494	Commercial	1.07		yes	327	47.68	1.51	0	0	0.00	0.00	0.022	1	0.21	0.00	0.000	0	0.00
SNV-098	Sunnyvale	37.35199	-122.05075	Commercial	1.56		yes	327	28.57	3.79	0	1	0.05	0.00	0.017	2	1.94	0.00	0.000	0	0.00
SNV-112	Sunnyvale	37.35199	-122.03154	Retail	2.19		yes	327	25.89	2.86	0	0	0.00	0.00	0.071	1	1.65	0.00	0.000	0	0.00
SNV-113	Sunnyvale	37.35227	-122.03163	Retail	0.81			327	25.00	1.41	0	0	0.00	0.00	0.079	1	0.29	0.00	0.000	0	0.00
SNV-114	Sunnyvale	37.35225	-122.03270	School	1.50		yes	327	20.00	1.33	0	0	0.00	0.00	0.055	1	0.35	0.00	0.000	0	0.00
SNV-117	Sunnyvale	37.35198	-122.01442	Retail	1.48		yes	328	17.99	0.86	0	0	0.00	0.00	0.087	1	0.16	0.00	0.000	0	0.00
SNV-118	Sunnyvale	37.35060	-122.01440	Retail	5.03			324	11.07	1.01	1	1	0.01	0.09	0.015	1	0.34	0.00	0.000	0	0.00
SNV-121	Sunnyvale	37.35889	-122.03261	Retail	2.24			324	31.79	1.54	0	3	0.02	0.00	0.044	1	0.20	1.00	0.125	0	0.00
SNV-122	Sunnyvale	37.35874	-122.03211	Residential	1.43		yes	328	36.96	1.12	0	5	0.08	0.00	0.053	1	0.20	0.00	0.000	0	0.00
SNV-125	Sunnyvale	37.36459	-122.03249	Retail	0.51			325	57.86	1.48	1	1	0.05	0.00	0.025	1	0.41	0.00	0.000	1	0.09
SNV-129	Sunnyvale	37.36660	-122.03246	Retail	0.43		yes	329	26.07	2.88	0	2	0.01	0.00	0.024	2	1.05	0.00	0.000	0	0.00
SNV-135	Sunnyvale	37.36888	-122.03719	Retail	1.13			325	41.43	1.85	0	2	0.01	0.00	0.074	1	0.49	0.00	0.000	0	0.00
SNV-137	Sunnyvale	37.37025	-122.03685	Commercial	0.16		yes	325	16.96	0.24	0	0	0.00	0.00	0.001	0	0.01	0.00	0.000	0	0.00
SNV-141	Sunnyvale	37.37335	-122.03519	Commercial	1.72			325	51.96	1.00	0	1	0.00	0.00	0.077	1	0.16	0.00	0.000	0	0.00
SNV-144	Sunnyvale	37.37492	-122.03521	Retail	2.34			329	36.34	0.52	0	0	0.00	0.00	0.040	0	0.03	0.00	0.000	0	0.00
SNV-148	Sunnyvale	37.37664	-122.03427	Commercial	1.29			325	8.57	0.54	0	1	0.00	0.00	0.071	0	0.20	1.00	0.094	0	0.00
SNV-150	Sunnyvale	37.37628	-122.03185	Retail	0.13		yes	325	22.14	0.99	0	0	0.00	0.00	0.034	1	0.15	1.00	0.063	0	0.00
SNV-152	Sunnyvale	37.37786	-122.03080	Retail	2.61			325	26.25	2.18	1	3	0.01	0.00	0.040	2	0.54	0.00	0.000	0	0.00

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SNV-155	Sunnyvale	37.39099	-122.01335	Retail	2.74	no															
SNV-160	Sunnyvale	37.38933	-122.02979	Retail	2.53			325	28.12	0.98	0	1	0.07	0.00	0.075	0	0.40	2.00	0.250	0	0.00
SNV-161	Sunnyvale	37.39672	-122.02796	Commercial	1.65			325	9.86	2.16	0	0	0.00	0.00	0.045	1	0.99	1.00	0.132	0	0.00
SNV-162	Sunnyvale	37.39502	-122.01828	School	1.49	no															
SNV-163	Sunnyvale	37.39300	-122.01897	School	2.76		yes	329	6.61	0.20	0	0	0.00	0.00	0.001	0	0.08	0.00	0.000	0	0.00
SNV-165	Sunnyvale	37.38305	-122.05707	Residential	3.75		yes	329	40.71	2.47	0	0	0.00	0.00	0.071	2	0.60	1.00	0.132	0	0.00
SNV-166	Sunnyvale	37.41718	-122.01627	Commercial	3.35		yes	329	15.98	0.54	0	2	0.00	0.00	0.012	0	0.23	0.00	0.000	0	0.00
Los Altos (HDS)	Los Altos	37.38172	-122.11640		106.42			218	181.25	4.80	4	6	0.01	0.00	0.042	4	0.56	7.00	0.622	0	0.00
Mountain View (HDS)	Mountain View	37.40303	-122.09845		125.80			286	590.00	32.90	3	14	0.43	0.00	0.140	26	2.90	19.00	2.400	11	1.10
Palo Alto (2 HDS)	Palo Alto	37.41816	-122.12539		167.97			145	731.00	15.50	7	13	0.20	0.00	0.100	11	3.20	7.00	0.900	0	0.00