Appendix F5: Baseline Load Study, 2016

City and County of Honolulu
National Pollutant Discharge Elimination System (NPDES)
Permit No. HI S000002

Trash Reduction Plan
Baseline Load Study Protocol

Final

February 2016

By:
City and County of Honolulu
Department of Facility Maintenance
Kapolei, Hawaii

E Mālama I Ka Wai Ola
Protect our waters...
FOR LIFE

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1. INTRODUCTION

The City was first required under the City and County of Honolulu (City) 2011 National Pollutant Discharge Elimination System (NPDES) Permit No. HI S000002 (Permit) to develop a Trash Reduction Plan. In February 2015 the Permit was revised and Part D.1.f.(1) now specifies:

> *"(vii) Trash Reduction Plan. The Permittee shall continue to implement its Trash Reduction Plan, dated June2012 unless required to be revised by DOH. The Trash Reduction Plan shall be included in the SWMP and any revisions reported in the Annual Report. Trash means all improperly discarded waste material, excluding vegetation, except for yard/landscaping waste that is illegally disposed of in the storm drain system. Examples of trash include, nut are not limited to, convenience food, beverage, and other product packages or containers constructed of aluminum, steel, glass, paper, and other natural and synthetic materials. The Trash Reduction Plan shall assess the issues and identify control measures to bee implemented and monitoring activities to determine compliance with this permit, including, at a minimum the following:*
>
> - *Plan to determine a quantitative estimate of the debris currently being discharged (baseline load) from the MS4, including methodology used to determine the load.*
> - *Description of control measures currently being implemented as well as those needed to reduce debris discharges from the MS4 consistent with short-term and long-term reduction targets.*
> - *A short-term plan and proposed compliance deadline for reducing debris discharges from the MS4 by 50% from the baseline load.*
> - *A long-term plan and proposed compliance deadline for reducing debris discharges from the MS4 to zero.*
> - *Geographical targets for trash reduction activities with priority on waterbodies listed as impaired for trash on the State's CWA Section 303(d) list.*
> - *Trash reduction-related education activities as a component of Part D.1.a.*
> - *Integration of control measures, education and monitoring to measure progress toward reducing trash discharges.*
> - *An implementation schedule for compliance with the short-term and long-term discharge limits in the shortest practicable timeframe*
> - *Monitoring plan to aid with source identification and loading patterns as well as measuring progress in reducing the debris discharges from the MS4.*
> - *The Annual Report shall include a summary of its trash load reduction actions (control measures and best management practices) including the types of actions and levels of implementation, the total trash loads and dominant types of trash removed by its actions, and the total trash loads and dominant types of trash for each type of action."*

This document presents the City's proposed plan and methodology for determining the baseline load, which is defined as a quantitative estimate of the trash currently being discharged from the MS4. The baseline load will be used to determine the City's 50% and 100% reduction goals.

For purposes of the baseline load study, trash will initially be considered analogous to litter as defined in the Revised Ordinances of Honolulu (ROH), with the clarification that trash does not include non-man made materials (such as branches, leaves, and other vegetation) deposited in the waterbodies naturally. As defined in Section 29-4.1 of the ROH: "Litter" means rubbish, waste material, garbage, trash, offal or any debris of whatever kind or description, whether or not it is of value, and include improperly discarded

paper, metal, plastic, glass or solid waste. Litter also includes "refuse" as defined in Section 29-1.1. Litter may include derelict vehicles. Additionally, Section 29-1.1 specifies: "Refuse" means all putrescible (or capable of decaying) and nonputrescible solid wastes, including animal body wastes, garbage, rubbish, ashes, street cleanings, dead animals, abandoned automobiles, and solid market and industrial wastes.

Through this study, the City will evaluate and quantify the baseline trash load in the MS4 using different methods of trash assessment, including direct sampling of trash, visual assessment of trash available to the MS4, and analysis of catch basin inspection data. The City plans to compare the various assessment methods throughout this study period to determine the most effective methods of trash assessment to use throughout the life of the program.

2. TRASH SAMPLING

2.1 SITE SELECTION

Selection of sampling sites will be based on four criteria:

a. Land Use. The land use data will be obtained from The City's Honolulu Land Information System (HoLIS) which already includes a zoning layer with the following zoning districts:

HoLIS Zoning Districts

District	Description
A-1	Apartment (Low-density)
A-2	Apartment (Medium-density)
A-3	Apartment (High-density)
AG-1	Agricultural (Restricted)
AG-2	Agricultural (General)
AMX-1	Apt Mixed Use (Low-density)
AMX-2	Apt Mixed Use (Medium-density)
AMX-3	Apt Mixed Use (High-density)
B-1	Business (Neighborhood)
B-2	Business (Community)
BMX-3	Business Mixed Use (Community)
BMX-4	Business Mixed Use (Central)
C	Country
F-1	Preservation (Military and Federal)
I-1	Industrial (Limited)
I-2	Industrial (Intensive)
I-3	Industrial (Waterfront)
IMX-1	Industrial-Commercial Mixed Use

District	Description
P-1	Preservation (Restricted)
P-2	Preservation (General)
R-3.5	Residential
R-5	Residential
R-7.5	Residential
R-10	Residential
R-20	Residential
Resort	Resort
n/a	Apt Mixed Use Sub-precinct
n/a	Apt Precinct
n/a	Aloha Towers Project
n/a	Kakaako Comm. Dev. District
n/a	Mixed Use Precinct
n/a	Public Precinct
n/a	Public Use Precinct
n/a	Resort Coml. Precinct
n/a	Resort Mixed Use Precinct
n/a	Waterfront Industrial Precinct

It is impractical to develop baseline loads for all 36 zoning districts, so the following group of six (6) general categories will be used:

Group	ID	Included Zoning Districts
Apartment	A	A-1, A-2, A-3, Apt Precinct
Business	B	B-1, B-2, Aloha Towers Project
Country	C	Country

Industrial	I	I-1, I-2, I-3, IMX-1, Waterfront Industrial Precinct
Mixed Use	M	AMX-1, AMX-2, AMX-3, BMX-3, BMX-4, Apt Mixed Use Sub-precinct, Kakaako Comm. Dev. District, Mixed Use Precinct, Resort Mixed Use Precinct
Residential	R	R-3.5, R-5, R-7.5, R-10, R-20

The agricultural districts (AG-1 and AG-2) and preservation districts (F-1, P-1, and P-2) are not included as they are not within the City's jurisdictional area. The public precinct and public use precinct are not included because they make up a very small percentage of the City's jurisdictional area and the amount of trash in the municipal separate storm sewer system (MS4) from these areas is likely negligible. The resort and resort commercial precinct are not included because they are either not connected to the MS4 or contribute negligible amounts of trash. In order to facilitate accurate baseline loads for each group, the sampling site's contributing drainage area should be a homogeneous land use (i.e., composed of a single general land use category). If this is not possible, at least 75% of the sampling site's contributing drainage area should be one general land use category.

b. Drainage Area. Sampling sites should have a contributing drainage area of at least one acre. The location of City catch basins and outfalls is included in HoLIS, and contributing drainage areas will be added to the system.

c. Access. Sampling sites, especially outfalls, must be publicly accessible for best management practice (BMP) installation, inspection, and maintenance.

d. Trash Loads. Sampling sites within watersheds of public concern (identified by the Department of Facility Maintenance-Division of Road Maintenance, or part of the City's Adopt-A-Stream program, or have been reported as a trash hotspot by the public through the City's Environmental Concern Line) or within watersheds on the 303(d) list for trash, are preferred.

At least two (2) sites in each general land use category will be chosen. This redundancy will allow comparison and verification of trash deposition rates within land use categories. Sites that have been selected are presented at the end of this protocol and in Figure 1.

2.2 BMPs SELECTION

The following criteria will be used to select an appropriate BMP for each baseline load study (BLS) site:

BLS Site	**BMPs**
Box Drain	End-of-pipe Net/Debris Boom
Open Channel	Debris Boom or Compost Socks
Conduit	Connector Pipe Screens (CPS)
Existing Detention Basins	None

Existing BMPs that are selected as BLS sites will be cleaned approximately one (1) month prior to the monitoring phase. BLS sites without BMPs will have a new BMP installed approximately one (1) month prior to the monitoring phase.

2.3 MONITORING

BLS sites with existing BMPs will be cleaned prior to the start of the monitoring phase. BLS sites with new BMPs will be cleaned either as part of the installation or prior to the start of the monitoring phase.

BLS sites will be monitored according to the following protocol, which may be refined based of field experience:

1. The nearest rainfall station to each BLS site will be monitored daily.

2. BLS sites whose rainfall station recorded at least 1.0 inches of rainfall in the last 24 hours will be inspected one week after the rain event to check the amount of material in the BMP. In the event that a series of rain events triggers an inspection within the one week period, an inspection will be perform approximately one week following the last rain event. If the BMP appears to be at least 50% full, the BMP will be cleaned one week after the inspection according to the procedures listed in Section 2.4.
3. Each BMP will also be cleaned at least 4 times a year (approximately every 90 calendar days), regardless of the site's rainfall and amount of material in the BMP, it will be cleaned according to the procedures listed in Section 2.4.

Monitoring will be performed for a minimum of 24 months to accurately account for any seasonal variability. The amount of rainfall triggering an inspection may change as individual site conditions are better understood throughout the study period.

2.4 TRASH COLLECTION AND CHARACTERIZATION

Trash characterization activities will be conducted as follows:

1. Using appropriate equipment, tools, and safety measures, remove all material from BMP.
2. Separate the material into the following seven (7) categories:
   a. Polystyrene foam (Styrofoam)
   b. Metal
   c. Paper
   d. Recyclable beverage containers
   e. Other plastic material
   f. Miscellaneous
   g. Vegetative Debris (not trash)
3. Using appropriate containers, measure the volume of material in each category, and then sum up the volumes in the first six (6) categories to obtain the total volume of trash collected.
4. Take photographs of collected material, collection device, and nearby streets and streams, as appropriate.
5. Fill out the worksheet (see Appendix B).
6. Clean/replace the collection device (as necessary).
7. Properly dispose of all collected material.

2.5 DATA ANALYSIS

The baseline trash load for sampling sites will be calculated from the monitoring data as follows (adapted from the Preliminary Baseline Trash Generation Rates for San Francisco Bay Area MS4s, 2012):

1. Calculate the daily trash load for each site:

$$\boldsymbol{T_{d-i} = V_i / P_i}$$

Where: T_{d-i} = Daily trash load for site i (cubic yard/day)
i = site ID (eg, 1-30)
V_i = Total volume of trash collected at site i (cubic yard)
P_i = Accumulation period for site i (days)

2. Calculate the daily trash load for each land use by summing up the daily trash loads for all sites that correspond to the particular land use, and dividing the result by the total drainage area servicing the individual sites:

$$T_{d-j} = \sum_{i=1}^{n} T_{d-i} \Big/ \sum_{i=1}^{n} A_i$$

Where: T_{d-j} = Daily trash load for land use j (cubic yard/ac-day)
j = land use category (A, B, C, I, M, R)
i = site ID
n = number of sites in land use category j
T_{d-i} = Daily trash load for site i (cubic yard/day)
A_i = Tributary drainage area of site i (ac)

3. Calculate the annual trash load for each land use by multiplying the land uses' daily trash load by 365:

$$T_{a-j} = T_{d-j} \times 365$$

Where: T_{a-j} = Annual trash load for land use j (cubic yard/ac-yr)
T_{d-j} = Daily trash load for land use j (cubic yard/ac-day)
j = land use category (A, B, C, I, M, R)

4. Following the completion of the monitoring period, calculate the final average annual trash load for each land use:

$$T_{f-j} = \sum_{k=1}^{m} T_{a-j} / m$$

Where: T_{f-j} = Annual final trash load for land use j (cubic yard/ac-yr)
j = land use category
m = number of annual trash loads for land use j
T_{a-i} = Annual trash load for land use j (cubic yard/ac-yr)

5. Calculate the baseline trash load summing up the products of the average annual trash load for each land use and the total drainage area of the land use:

$$B = \sum_{j=1}^{n} T_{f-j} \times A_j$$

Where: B = Baseline trash load (cubic yard/yr)
j = land use category
n = number of land use categories
T_{f-i} = Annual final trash load for land use j (cubic yard/ac-yr)
A_j = Total area for land use category j (ac)

3. VISUAL ASSESSMENTS

Visual assessments will be performed quarterly for each monitoring location for one year of the sampling period and compared to sampling data. Each monitoring location assessed will be assigned a trash rating category based on the level of trash on the street that has the potential of entering the storm drain system, as defined below.

Trash Rate Category	Definition
Low	No trash to a few small pieces of trash observed at first glance.
Medium	Few easily observed pieces of trash evenly distributed/small accumulations of trash observed at first glance.
High	Trash widely disturbed/medium accumulations of trash are observed at first glance.
Hot Spot	Areas that are historically known for having trash problems,

Visual assessments will be conducted as follows:

1. Identify segment of the area to assess.
2. Walk the segment and identify the level of trash in the streets, sidewalks and adjacent areas that have the potential to discharge to the storm drain system. Look in the storm drains inlet to see if there is any accumulation of trash.
3. Determine which category the segment falls under low, medium, high or hot spot (example of sites that fall in these categories is provided in Appendix C[1]) based on visual assessment of the level of trash found on the street and in the storm drain inlet.
4. Complete Visual Assessment Worksheet (see Appendix C).
5. Take photographs of the street, storm drains inlets and the surrounding areas.

4. DESKTOP ANALYSIS OF CATCH BASIN INSPECTION RESULTS

Field inspections are performed to identify inlets and catch basins that are filled with sediment, debris and trash and are given Severity Group Ratings including: empty, quarter, half, three quarters and full. Using the data collected, a desktop analysis will be performed to identify potential areas with/without trash problems. This data will also be compared to visual assessment data to confirm accuracy of visual assessments.

5. TRASH RATINGS AND MAPS

Based on the trash loading rate, each land use will be assigned a trash rating category. It is anticipated that the categories will include Low, Medium, and High and that there will be a special category for Hot Spots.

A series of maps will be created to indicate where the Low, Medium, High, and Hot Spots areas are located throughout the MS4 for the baseline conditions. An example of these maps are located in Appendix D. Visual assessments will be used to verify trash rating in representative locations and to further refine the map where no direct sampling occurred.

[1] Visual Assessment examples were taken from the Watershed Monitoring and Assessment Program: Pilot Trash Assessment Strategy developed by EOA, INC. on behalf of SCVURPPP. http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/stormwater/MRP/C10/2014/Santa_Clara_County/SCVURPPP.pdf

6. IMPLEMENTATION SCHEDULE

The proposed implementation schedule for the City's Trash Reduction Baseline Load Study is presented below.

Task	Start	End	Fiscal Year																					
			13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Short-Term Plan																								
Baseline Load Study	07/01/12	12/30/17																						
Selection of Monitoring Sites	07/01/12	06/30/14																						
Develop BLS Protocol	07/01/12	06/30/14																						
Install BMPs	04/01/14	12/30/15																						
Sampling period	07/01/14	12/30/17																						
Data Analysis and Reduction Strategy	7/1/16	6/30/19																						
Short Term Reductions (50%)	07/01/12	06/30/23																						
Long Term Implementation & Monitoring Strategy	07/01/23	06/30/24																						
Long Term Reduction (100%)	07/01/25	6/30/34																						

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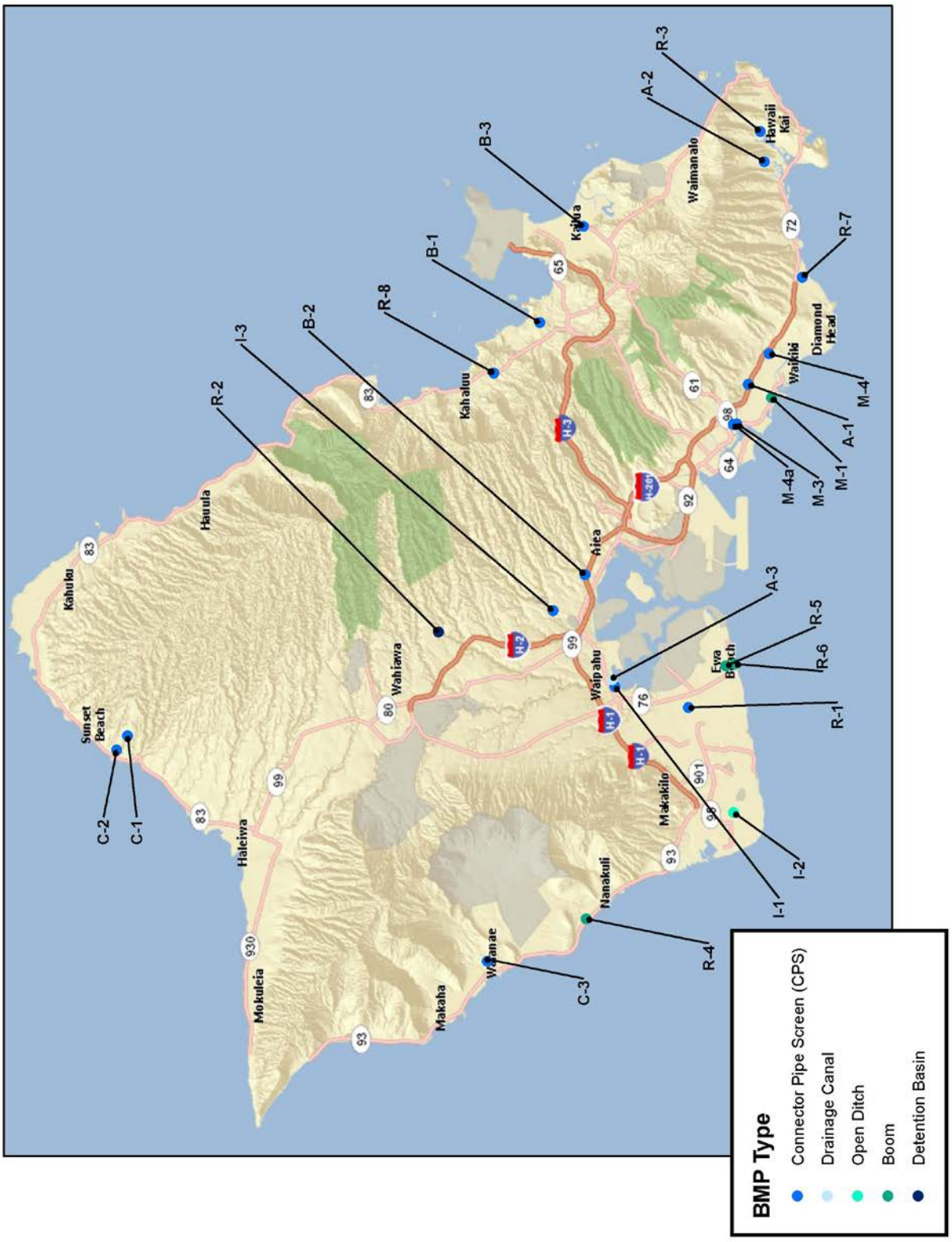
Figure 1: Baseline Load Proposed Monitoring Sites



Appendix A: Monitoring Sites

	Site ID	General Monitoring Location	Apparent Hot Spot	Site Type	Storm Water Outfall ID/ Node ID	% Land Use	Drainage Area (Acres)	GPS Coordinates	Receiving Water	Proposed BMP
1	**A-1**	Makiki: Kewalo St		RCP (34")	HAML 9/54898	100% Apartment	9.9	N21° 18' 12.4" W157° 50' 24.0"	Pearl Harbor	Connector pipe Screen inside of catch basin
2	**A-2**	Hawaii Kai: Hahaione St.		RCP (18")	HKPM 10/19929	75% Apartment 25% Business	7.48	N21° 17'40.3" W157° 42'29.2"	Kuapa Pond	Connector pipe Screen inside of catch basin
3	**A-3**	Waipahu: Pupuole Mini Pupuole Park Drainage Canal	✸	Drainage Ditch (96"x48")	LPHW 3 / 4692	45% Urban Residential, 40% Apartment, 15% Business	7.4	N21° 22' 43.7" W158° 0' 53.7”	Pearl Harbor	None (utilize DFM cleaning data)
4	**B-1**	Kaneohe (Windward Mall Drainage Canal)		RCP (36")	WKNB 7 / 27072	100% Business	2.8	N21° 25' 6.4" W157° 48' 12.3"	Keaahala Stream	Connector Pipe Screen inside of catch basin
5	**B-2**	Pearl City: Kaahumanu st		RCP (30")	LPHE 5/12688	100% Business	16.61	N21° 23' 36.6" W157° 57' 10.0"	Pearl Harbor	Connector Pipe Screen inside of catch basin
6	**B-3**	Kailua: Kihapai St.		RCP (36")	WKWS 15 / 17267	70% Business, 30%MixUse	13.95	N21° 23' 40.2" W157° 44' 47.3"	Kawanui Stream	Connector Pipe Screen inside of catch basin
7	**C-1**	North Shore (Sunset), Haleiwa: Pupukea Rd.- Alapio Rd.		RCP (40")	NHG 2/51341	100% Country	8.34	N21° 38' 45.2" W158° 2' 53.0"	Hakuola Gl Stream	Connector pipe Screen inside of manhole
8	**C-2**	North Shore (Sunset), Haleiwa: Wilinau Rd.- Makana Rd.		RCP (24")	NPS 2/903	100% Country	14.69	N 21° 39'6.8" W158 3' 23.7"	Hakuola Gl Stream	Connector pipe Screen inside of manhole
9	**C-3**	Waianae: Momona Pl and Waianae Valley Road		RCP (18")	WCKI 11-64913	100% County	2.95	N 21° 26'52.9" W158 10'48.5"	Kaupuni Stream	Connector Pipe Screen inside of catch basin
10	**I-1**	Waipahu: Pupuole St. Cul-De-Sac off Leokane St.	✸	RCP (48")	LPHW 4 / 4888	100% Industrial	8.6	N21° 22' 37.9" W158° 1' 8.2"	Pearl Harbor	Connector Pipe Screen inside of catch basin
11	**I-2**	Campbell Industrial: Komohana Rd.		Open Ditch	LWMB 12 / 64738	100% Industrial	45.56	N21° 18'41.8" W158° 05'37.4"	Pacific Ocean	None (existing culvert under roadway from ditch is raised and limits trash from discharging)

	Site ID	General Monitoring Location	Apparent Hot Spot	Site Type	Storm Water Outfall ID/ Node ID	% Land Use	Drainage Area (Acres)	GPS Coordinates	Receiving Water	Proposed BMP
12	**I-3**	Pearl City (Pearl City Industrial Park):: Waihona Pl. Cul-De-Sac		RCP (18")	LWAS 5 / 11571	100% Industrial	10.68	N21° 24' 39.9", W157° 58' 26.3"	Waiawa Stream	Connector Pipe Screen inside of catch basin
13	**M-1**	Honolulu: Ala Moana Beach Park Drainage Canal		96" x 48" Box Culvert	HAML 6 / 37396	90% Mixed Use	98.83	N21° 17' 26.5", W157° 50' 52.3"	Ala Moana Drainage Canal	New 40' X 3' boom
14	**M-3**	Honolulu: Bethel St.- Merchant St.		RCP (18")	HHB 20/ 35005	100% Mixed Use	1.64	N21° 18' 34.9" W157° 51' 48.5"	Honolulu Harbor	Connector Pipe Screen inside of catch basin
15	**M-4**	Honolulu: University Ave.- S. King St.		RCP (24")	HAWC 32/ 36436	100% Mixed Use	4.59	N21° 17' 30.8" W157° 49' 18.2"	Ala Wai Canal	Connector Pipe Screen inside of manhole
16	**M-4a**	Honolulu (Downtown) : Maunakea St and North King St	✸	RCP (18")	HHB 24-32927	100 Mixed Use	1.65	N21° 18' 42.7" W157° 51' 49.2"	Honolulu Harbor	Connector Pipe Screen inside of manhole
17	**R-1**	Ewa Gentry: Kuhialoko St cul-de-sac		RCP (18")	LEGA 11/47393	100% Urban Residential	1.42	N21° 20' 11.3", W158° 1' 53.3"	None (Coral Creek Golf Course)	Connector Pipe Screen inside of catch basin
18	**R-2**	Mililani Mauka Detention Basin Between End of Pikokea St. and Lehiwa St.		Detention Basin	CKIS 18/ 56247	100% Urban Residential	36.94	N21° 28' 28.1" W157° 59' 12.5"	None	Existing Detention Basin
19	**R-3**	Hawaii Kai: Waioli St.- Maniniholo St. leading into lined channel		RCP (24")	HKPE 25/ 18443	100% Urban Residential	3.01	N21° 17' 48.9" W157° 41' 24.4"	Kuapa Pond	Connector Pipe Screen inside of catch basin
20	**R-4**	Nanakuli-Maili: Ulehawa Stream, Est branch West of U3 channel bridge at mohihi st.	✸	Lined Channel	WCUS/ 64823	95% Urban Residential, 3% Business, 2% County	136.48	N21° 23' 34.3" W158° 9' 24.2"	Ulehawa Stream/ Pacific Ocean	New 25'x 3' boom
21	**R-5**	Ewa Channel at North Road	✸	Lined Channel (24')	LWMB 1 / 66559	100% Urban Residential	176.87	N21° 18' 56.7" W158°0' 24.7"	Ewa Channel/Pacific Ocean	Existing boom
22	**R-6**	Ewa Channel at Fort Weaver Road	✸	Lined Channel (24')	LWMB 1 / 39880	95% Urban Residential	55.01	N21° 18' 39.6" W158° 0' 20.3"	Ewa Channel/ Pacific Ocean	Existing Boom
23	**R-7**	Waialae-Kahala: Waialae Nui Stream at Waiiki Street		RCP (36")	HWS 25 / 22856	98% Rural Residential	13.53	N21° 16' 25.1" W157° 46' 35.6"	Wailae Nui stream	Connector Pipe Screen inside catch basin
24	**R-8**	Kaneohe: Ahuimanu stream at Hui Koloa Pl.		RCP (36")	WAUS 27 / 15540	95% Urban Residential	5.07	N21° 26' 38.2" W157° 49' 59.5"	Ahuimanu Stream	Connector Pipe Screen inside of catch basin

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Appendix B: Baseline Load Study Worksheet

Date: _____ Time: _____

Survey Team: _____

Site Location / ID: _____

Category	Vol (gal)	Vol (cubic yards*)
Polystyrene Foam (Styrofoam)		
Metal		
Paper		
Recyclable Beverage Containers		
Other Plastic Material		
Miscellaneous (note below)		
Total Trash		
Vegetative Debris (not trash)		
Other		

*1 cubic yard = 202 gallons

Notes: _____

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Appendix C: Visual Assessment Worksheet

Date: _____ Time: _____

Survey Team: _____

Site Location / ID: _____

1. Trash Rating Categories

☐ LOW ☐ MEDIUM ☐ HIGH ☐ HOTSPOT

Trash Rating Category	Visual Observation
Low	No trash to a few small pieces of trash observed at first glance.
Medium	Few easily observed pieces of trash to evenly distributed/small accumulations of trash observed at first glance
High	Trash widely distributed/ medium accumulations of trash are observed at first glance.
Hot Spots	Areas that are historically known for having trash problems.

2. Potential Sources of Trash (check all that apply):

- □ Pedestrian litter
- □ Bus stops
- □ Moving vehicles
- □ Uncovered loads
- □ Special events
- □ Uncovered/overflowing dumpsters
- □ Illegal dumping
- □ Homeless encampments

Notes: _____

CONDITION A - LOW TRASH LEVEL

Description of a Grade A: Effectively no trash can be observed on a city block or the equivalent. There may be some small pieces in the area, but they are not obvious at first glance and one individual could quickly pick them up.

CONDITION B – MODERATE TRASH LEVEL

Predominantly free of trash except for a few pieces that are easily observed along a city block, or the equivalent. The trash could be collected by one or two individuals in a short period of time.

CONDITION C: HIGH TRASH LEVEL

Trash is widely/evenly distributed and/or small accumulations are visible on the street, sidewalks, or inlets. It would take a more organized effort to remove the litter.

CONDITION D: VERY HIGH TRASH LEVEL

Trash is continuously seen throughout the area, with large piles and a strong impression of lack of concern for litter in the area. There is often significant litter even along gutters that are swept.

Appendix D: Example Trash Generation Map

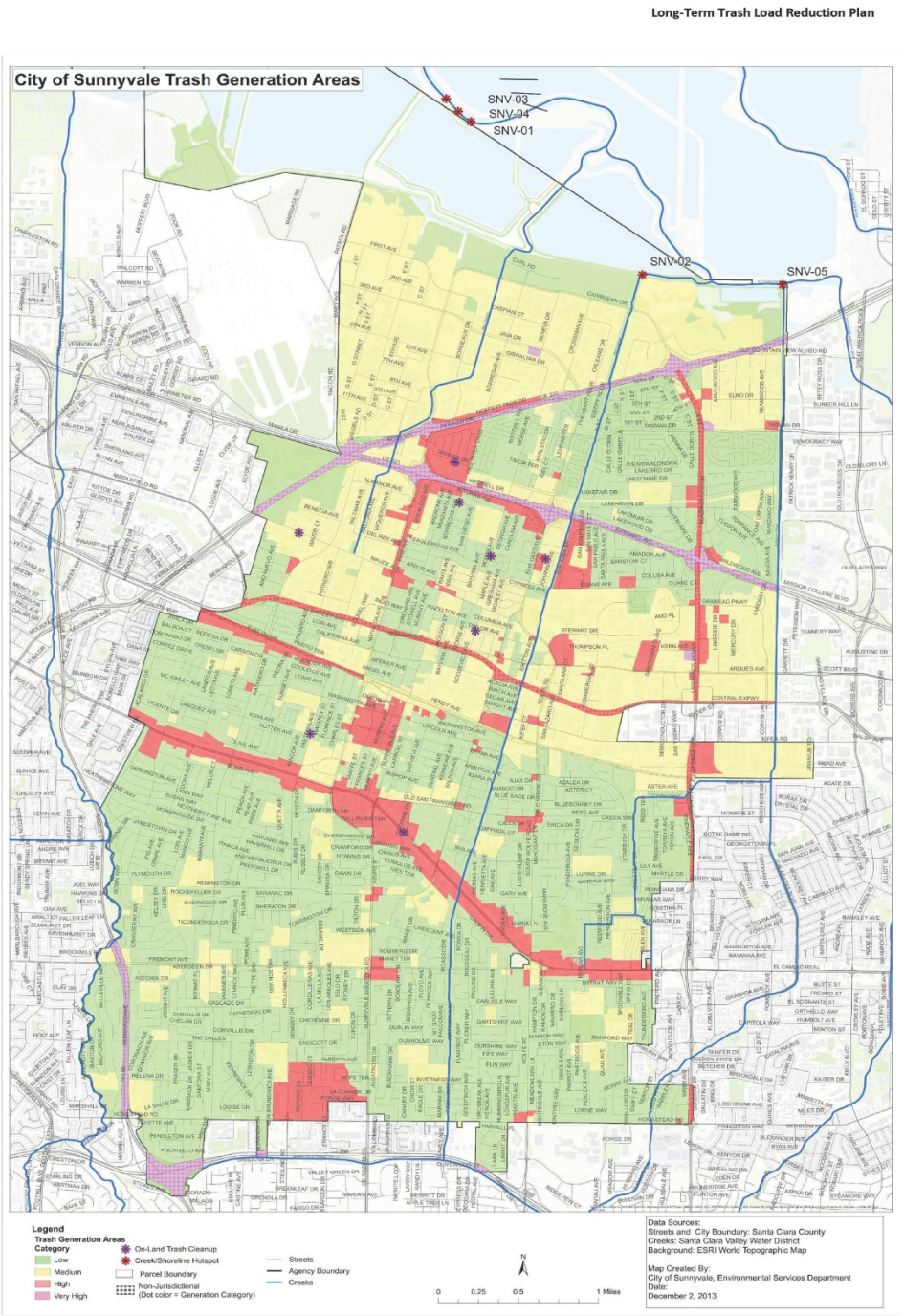

Figure 5. Final Trash Generation Map for the City of Sunnyvale

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