Appendix I5: Implementation and Monitoring Plan for Kapaa Stream, 2015

IMPLEMENTATION AND MONITORING PLAN FOR KAPAA STREAM WASTELOAD ALLOCATION FOR THE CITY AND COUNTY OF HONOLULU MUNICIPAL SEPARATE STORM SEWER SYSTEM NPDES PERMIT NO. HI S000002

June 2015

Prepared by
City and County of Honolulu
Department of Environmental Services
Kapolei, Hawaii

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

Transmittal Letter

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Acronyms

BMP	Best Management Practice
City/CCH	City and County of Honolulu
CN	Curve Number
CY	Calendar Year
DFM	City and County of Honolulu, Department of Facility Maintenance
DOH	State of Hawaii, Department of Health
ENV	City and County of Honolulu, Department of Environmental Services
EPA	United States Environmental Protection Agency
FY	Fiscal Year
GH	Good Housekeeping
HSG	Hydrologic Soil Group
I&M Plan	Implementation and Monitoring Plan
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NTE	Not-to-Exceed
OM	Organic Matter
Permit	NPDES Permit No. HI S000002
PM	Particulate Matter
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
WLA	Wasteload Allocation
WQS	Water Quality Standards

Executive Summary

This implementation and monitoring plan was developed to comply with the terms of the National Pollutant Discharge Elimination System Permit No. HI S000002 (Permit) for the City's municipal separate storm sewer system (MS4).

The State of Hawaii, Department of Health (DOH) developed and established Total Maximum Daily Loads (TMDLs) for Kapaa Stream. The DOH TMDL report further defined Wasteload Allocations (WLAs) for point dischargers including the City and County of Honolulu (City or CCH) and calculated reduction goals based on the City's MS4 coverage area which includes City streets, Kapaa Sanitary Landfill (closed), Kalaheo Sanitary Landfill (closed), and Kapaa Refuse Transfer Station.

Based on discussions with DOH representatives, it was determined that the City's load reduction goals shall be based on the seasonal 2% and 10% Not-to-Exceed (NTE) criteria as defined by the TMDL report. In addition, adjustments for existing land cover conditions, long-term storm runoff, and pollutant loads generated by the reclaimed landfill sites were applied to represent more accurate site conditions. Based on this methodology, the resulting load reduction goals for Total Suspended Solids (TSS), Total Nitrogen (TN) and Total Phosphorus (TP) are as follows:

Table ES-1: CCH Load Reduction Summary

	TSS (lb/season)		TN (lb/season)		TP (lb/season)	
	Wet Season	Dry Season	Wet Season	Dry Season	Wet Season	Dry Season
ENV (MS4)	0	0	0	0	1.4	0.3
Kalaheo Landfill (Closed)	0	0	0	0	0	0
Kapaa Landfill (Closed)	0	0	0	0	0	0
Kapaa Refuse Transfer Station	1,700	0	2.2	0	0.7	0
TOTAL	1,700	0	2.2	0	2.1	0.3

Based on this analysis, the City will implement Best Management Practices (BMPs) targeted at removing 1,700 lbs of TSS, 2.2 lbs of TN, and 2.1 lbs of TP in the wet season and 0.3 lbs of TP in the dry season. TSS and TN reductions in the dry season do not apply. The City intends to track maintenance activities based on the entire watershed to maximize the benefit to the receiving waters rather than track each individual entity by specific land use since the ultimate discharge location for all sub-basins is Kawainui Marsh.

The City will implement a variety of BMPs to reduce pollutant loads in the watershed. These activities include:

- Implementing a schedule for routine street sweeping along Kapaa Quarry Place;
- Tracking routine dredging of Kapaa Refuse Transfer Station sediment basin; and
- Inspection and cleaning of drainage structures and conveyances as necessary.

The combination of these efforts is expected to remove sediments from the waste stream and ultimately achieve the targeted WLA. Based on historical collections, it is anticipated that street sweeping once in the wet season and once in the dry season will collect particulate and organic matter in sufficient quantity to meet the seasonal TP reduction goals for the City, and potentially for TSS and TN for the entire area under City jurisdiction. In addition, the City proposes to dredge the sediment basin adjacent to the Refuse

Transfer Station once annually during the wet season to ensure reduction goals are being met. If additional activities (ex. additional street sweeping cycles or sediment basin dredging, drain cleaning, CIP improvement projects, and/or permanent BMPs, etc.) are required to meet the target reductions, the City will implement them in increments as described in Section 5.0. The following table provides a summary of the estimated pollutant load reductions for each of the City's BMPs.

Table ES-2: Summary of BMP Activities and Quantitative Reductions

	TSS Reduction (lbs/season)		TN Reduction (lbs/season)		TP Reduction (lbs/season)	
	Wet Season	Dry Season	Wet Season	Dry Season	Wet Season	Dry Season
Ameron Partnership	See Note 1					
Education and Outreach	See Note 2					
Street Sweeping	1,000	1,000	1.0	0.3	2.2	1.9
Sediment Basin Dredging See Note 3	957	-	96	-	48	-
Storm Drain Maintenance	See Note 4					
TOTAL REMOVED	1,957	1,000	97	0.3	50	1.9
REDUCTIONS REQUIRED	1,700	0	2.2	0	2.1	0.3

Note 1: The City will assist DOH in establishing a partnership with Ameron Hawaii to reduce sediments and fines deposited along Kapaa Quarry Road due to the quarry operations. However, due to the difficulty in quantifying future pollutant load reductions, it is assumed that over time, less street sweeping material will be collected due to Ameron's good housekeeping contribution.

Note 2: City will assist DOH in assessing the potential of existing businesses within the Kapaa Industrial Park to determine if there are outreach opportunities to educate business owners about potential pollutant reductions. However, due to the difficulty in quantifying future pollutant load reductions from this activity, no pollutant load reductions have been included for accounting purposes at this time.

Note 3: Historical maintenance records detailing the frequency, quantity, and material composition of the material removed from the sediment basin are not available. Based on the assumption made by DOH in the development of the TMDLs, the potential storage volume is in excess of 2,000 CY. For the purposes of estimating pollutant loads, it is assumed that 20 CY of material is dredged annually.

Note 4: Cleaning of storm drains and drainage structures will be implemented only if collections from other activities are less than anticipated and the City needs additional reductions to meet the load reduction goals for a particular season. Storm drain cleaning may also be done in lieu of additional street sweeping activities based on scheduling and equipment availability.

The final compliance deadline is December 31, 2018.

1.0 Introduction

The National Pollutant Discharge Elimination System (NPDES) Permit No. HI S000002 (Permit) issued by the State of Hawaii, Department of Health (DOH) to the City and County of Honolulu (City for CCH) for their municipal separate storm sewer system (MS4) became effective February 16, 2015. It stipulates that the City develop an updated Wasteload Allocation (WLA) implementation and monitoring plan (I&M Plan) for Kapaa Stream by the end of Fiscal Year 2015 (FY15). For the purpose of complying with the foregoing requirement, the City is submitting this updated I&M Plan for Kapaa Stream.

The DOH developed and established Total Maximum Daily Loads (TMDLs) for the Kapaa Stream in its technical report *Total Maximum Daily Loads (TMDLs) for Total Suspended Solids, Nitrogen, and Phosphorus in Kapaa Stream, Kailua, Hawaii* (DOH, May 2007). This I&M Plan will address specific City activities targeted to reducing Total Suspended Solids, Total Nitrogen, and Total Phosphorus discharges in the Kapaa Stream watershed as necessary to comply with the TMDLs and the City's WLA. The monitoring plan specifies activity tracking necessary to demonstrate efforts by the City to comply with the urban source WLAs.

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2.0 Kapaa Stream Watershed

The Kapaa Stream watershed, located on the windward side of Oahu, encompasses an area of approximately 1.3 square miles (825 acres) (see Figure 1). It is a subset of the much larger Kawainui watershed (9,400 acres). Kapaa Stream discharges directly to Kawainui Marsh and ultimately to Kailua Bay and the Pacific Ocean via Oneawa Canal. Kawainui Marsh (Class 1.b. State waters) is the largest freshwater wetland in Hawaii and houses significant cultural and wildlife resources.

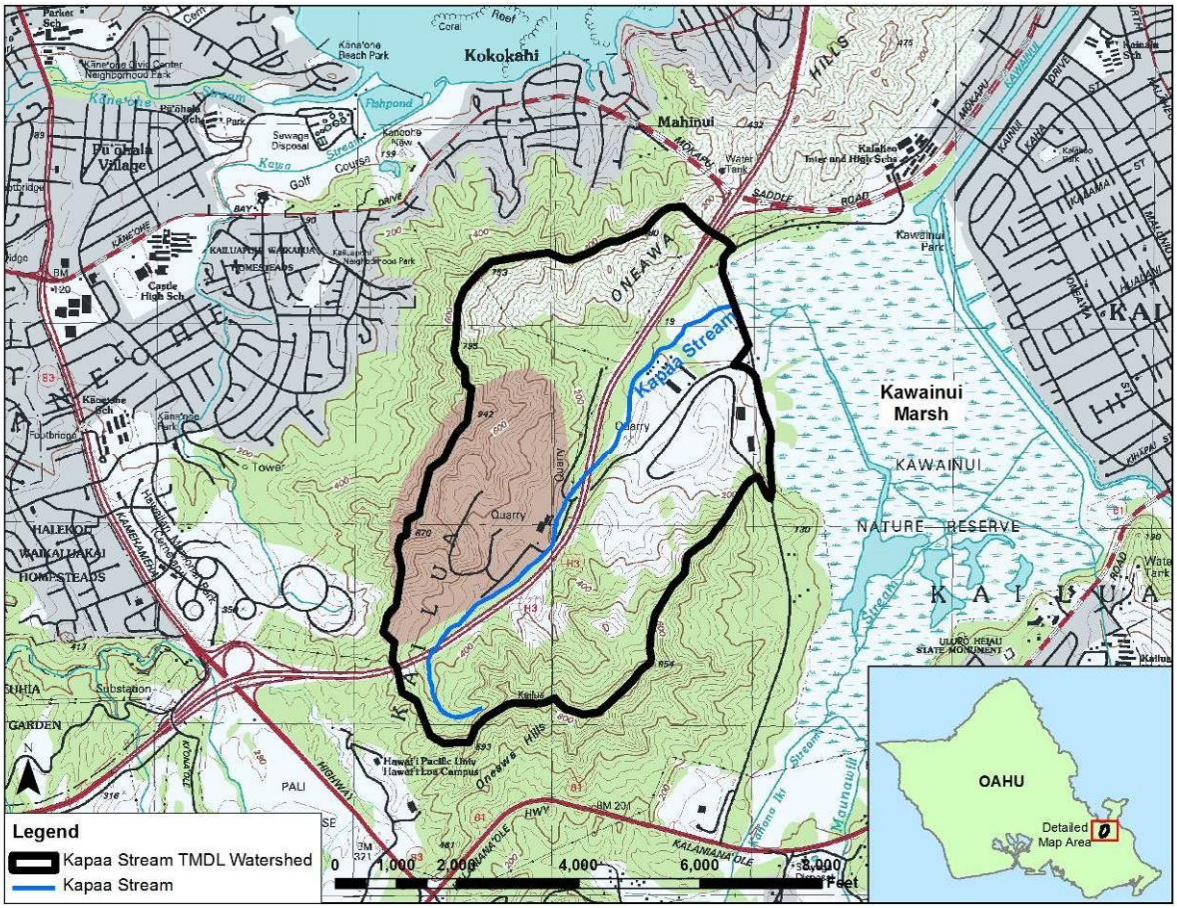

Figure 1: Kapaa Stream Watershed

Kapaa Stream, a Class 2 Inland Stream, has a total length of about 2 miles. The DOH listed Kapaa Stream on the 2004 Clean Water Act §303(d) list of impaired waters for elevated turbidity, total suspended solids, nutrients (TN and TP), and metals.

For the purposes of TMDL and WLA development, the DOH subdivided the watershed into 12 sub-basins (see Figure 2). The sub-basin boundaries were delineated based on topography and constructed drainage modifications that have substantially altered the original paths of surface water and groundwater flows. Also shown on Figure 2 are the Oceanit/AECOS stream monitoring stations that were used in the 2001-02 Kapaa Stream water quality survey which was the primary data source in the development of the TMDLs and WLAs.

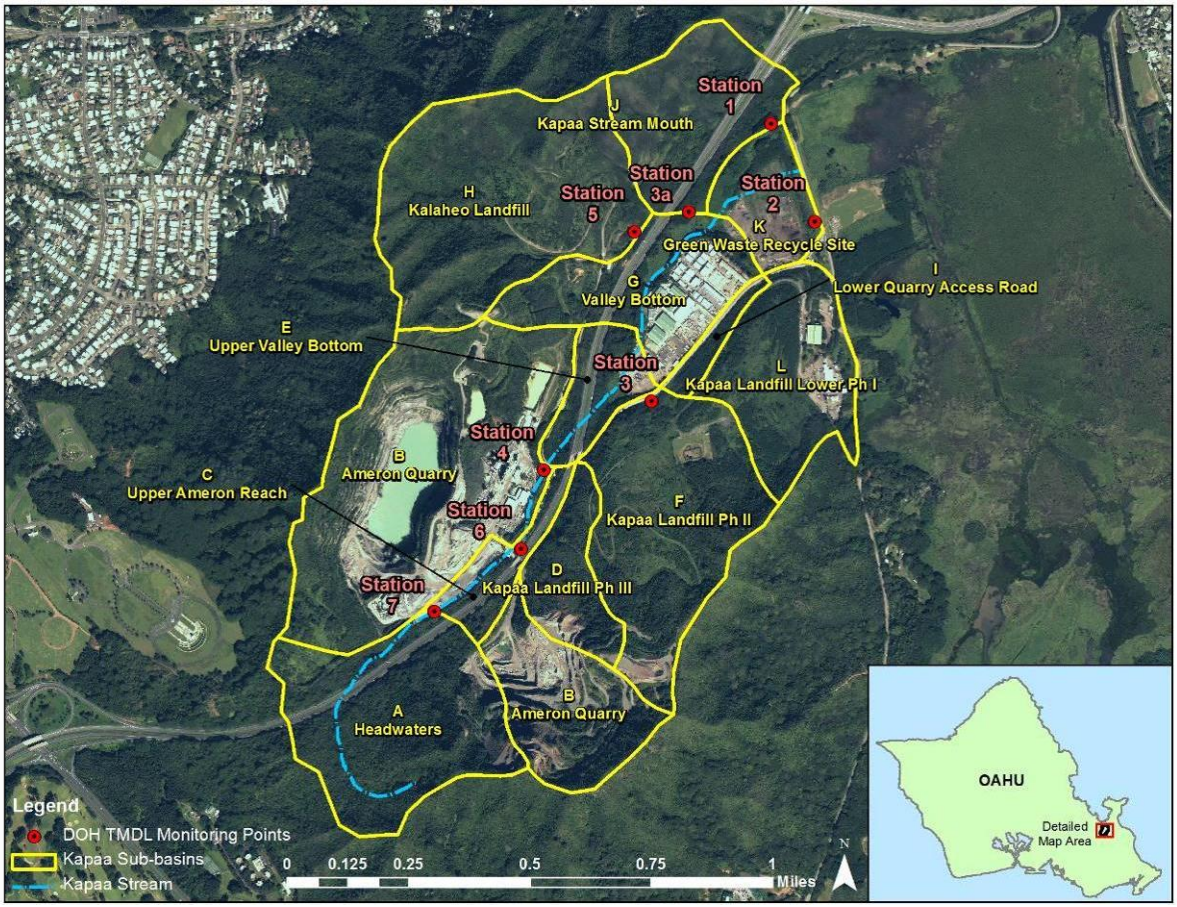

Figure 2: Kapaa Stream DOH TMDL Monitoring Stations

Primary land uses in the Kapaa watershed included forested areas, highways and roads, Ameron Hawaii Quarry operations, eroded slopes, an industrial park, and landfills (see Table 1). The City regulates sub-basins F, H, I, and L and the City roads in sub-basins E and K (see Figure 3).

Table 1: Kapaa Sub-basin Land Use and Land Cover Summary[1]

Sub-basin	Description	Forest/ Brush (acres)	Highway (acres)	Quarry (acres)	Roads (acres)	Eroded (acres)	Industrial (acres)	Landfill (acres)
A	Headwaters	90.8	5.2					
B	Ameron Quarry	31		185	2			
C	Upper Ameron Reach	13	4					
D	Kapaa Landfill Phase III		1.4			27.6		
E	Upper Valley Bottom	15	4		3.6		1.4	
F	Kapaa Landfill Phase II	40			2.7			55.3
G	Valley Bottom	28.3	3.1				28.6	
H	Kalaheo Landfill	93			2.1			30.9
I	Lower Quarry Access Road				2.4			5.6
J	Kapaa Stream Mouth	25.9	5.1					28
K	Green-Waste Recycle Site				1			27
L	Kapaa Landfill Lower Phase I				3.8		24	34.2
TOTAL (acres)		337	22.8	185	17.6	27.6	54	181

[1]Modified from DOH TMDL Report, Table 5.1 (May 2007)

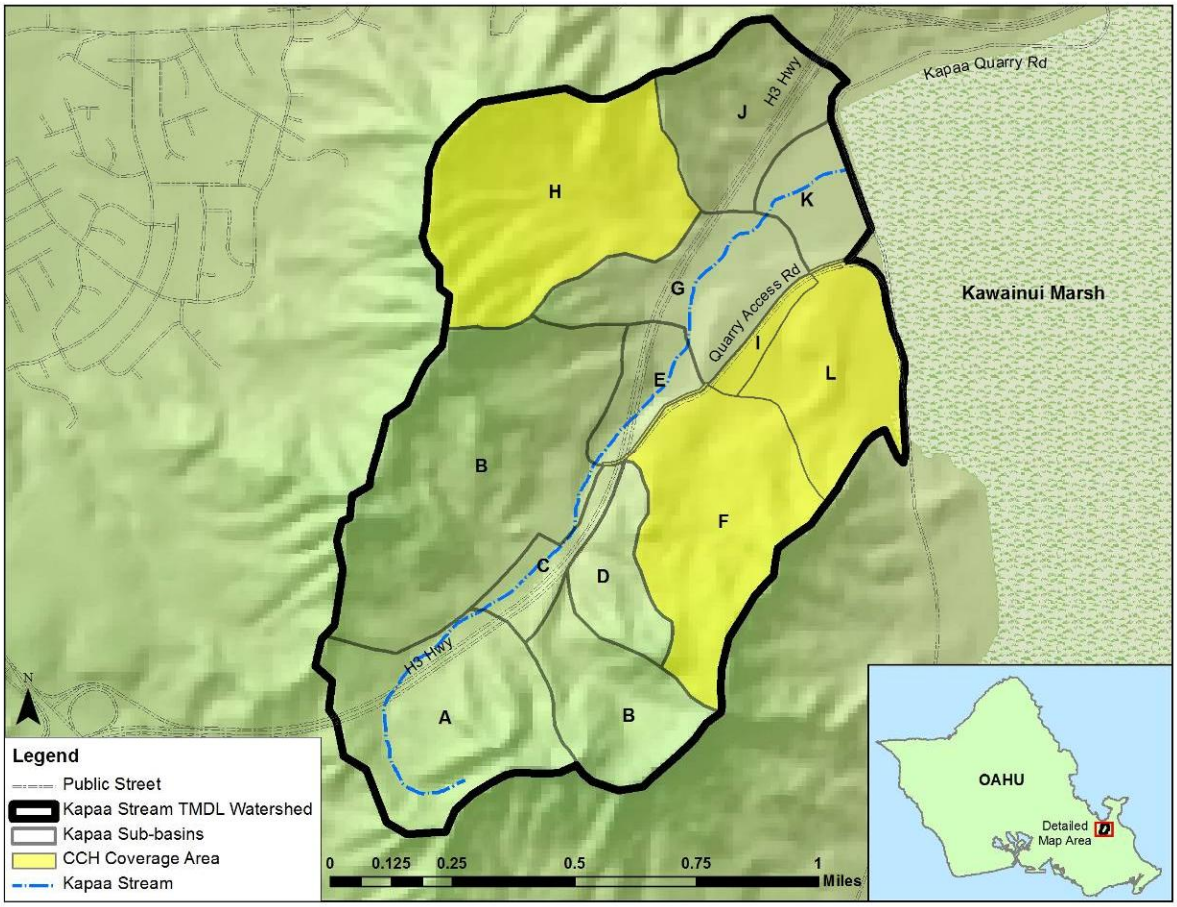

Figure 3: Detail of City MS4 Coverage Area in Kapaa Watershed

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3.0 TMDLs and WLAs for Kapaa Stream Watershed

TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards and is an allocation of that load among the various sources of that pollutant. In 2007, the DOH published and the United States Environmental Protection Agency (EPA) approved TMDLs and WLAs for Kapaa Stream for Total Suspended Solids (TSS), Total Nitrogen (TN), and Total Phosphorus (TP). These TMDLs/WLAs were allocated between the wet and dry seasons for three intervals: 2% Not-to-Exceed (NTE), 10% NTE, and baseflow (non-runoff) conditions. The TMDLs/WLAs were calculated based on flow contribution by stream segment and the state water quality standards (WQS) for the 2% NTE and 10% NTE events and the geometric mean WQS for baseflow conditions. The TMDL report further established existing loading rates for point source discharges including the City and County of Honolulu MS4, CCH Kapaa Sanitary Landfill (closed), CCH Kalaheo Sanitary Landfill (closed), and CCH Kapaa Refuse Transfer Station for the same intervals. The following sections summarize the DOH TMDL calculations and describe the modifications made to those calculations to determine the City's reduction goals.

3.1 Adjustment to Curve Number for Landfill Land Use

The City performed an independent verification of DOH's TMDL calculations and noted an anomaly in the selection of the runoff curve number (CN) for the 'Landfill' land use. Inspection of the hydrologic soil group (HSG) indicates that the area is predominantly, if not entirely, categorized by HSG B. This corresponds to soils that typically have moderate infiltration rates. Per TR-55 documentation (Table 2-2c Runoff Curve Numbers for Other Agricultural Lands), a CN of 48 most accurately represents the existing conditions of the closed landfill sites (i.e., 'brush-weed-grass' mixture with 'Good' hydrologic conditions (>75% ground cover)). Figures 4 and 5 below support this assumption. The original DOH calculations assumed a CN of 86 which is somewhat atypical of HSG B conditions and is more representative of bare soil. For this reason, the CN for the 'Landfill' land use in sub-basins F, H, I, and L were revised to 48.

3.2 Adjustment for Storm Runoff Pollutant Load Concentrations for Landfill Land Use

The City evaluated existing site conditions within the closed Kalaheo Landfill and closed Kapaa Landfill (Phases I and II) and determined that the areas are fully vegetated with well established stands of California grass and Halekoa trees. This field verified current land cover represents a stable condition not particularly susceptible to high erodibility, similar to the adjacent 'Forest/brush' land use identified in the DOH TMDL report. In addition, the topography of the 'Forest/brush' land use (> 50%) is much steeper than the landfill sites (< 30%). Based on this reasoning, the storm runoff pollutant load concentrations for the 'Landfill' land use should be no greater than the 'Forest/brush' land use values assumed by DOH as reported in Table 5.2 (DOH, 2007). For this reason, the storm runoff pollutant loads for the 'Landfill' land use were adjusted to reflect the lower concentrations associated with the 'Forest/brush' land use. This approach is considered conservative since the 'Forest/brush' land use consists of steeper terrain with bare, exposed slopes (see Figure 4) that were not present over the reclaimed landfill sites (see Figure 5).

Figure 4: Current Land Cover Condition – Reclaimed Landfill (Foreground) and Forest/Brush Land Use (Background)	**Figure 5: Typical Land Cover Condition of Reclaimed Landfill Sites**

3.3 Adjustment for Storm Precipitation Data (PRISM 30-Yr Normals)

The City also evaluated the "30-year Normals" data for the 1971-2000 PRISM dataset, which is an update of the 1961-1990 dataset. Based on the City's independent calculations, the precipitation values assumed in the DOH TMDL report warranted adjustment to reflect the current conditions. Overlaying the precipitation grid with the sub-basin boundaries, a weighted average precipitation value was calculated for each sub-basin by month. Monthly averages for May through October were summed to determine the total dry season rainfall. Similarly, monthly averages for November through April were summed to determine the total wet season rainfall. Based on this analysis, most point precipitation values were determined to be lower by 11% to 16% in both the wet and dry seasons.

3.4 CCH Seasonal WLA, Existing Loads, and Reduction Goals

The City calculated its load reduction goals based on the seasonal 2% and 10% NTE criteria using a methodology consistent with the TMDL report with the appropriate adjustments described above.

The following tables summarize the City's seasonal WLA, revised existing loads, and load reductions for the storm runoff conditions (from Tables 6.10 and 6.11, DOH, 2007, with modifications noted in Sections 3.1, 3.2, and 3.3 above). For the following scenarios, it is assumed that a 2% NTE event occurs each day for 2% of the days in the season and a 10% NTE event occurs for 8% of the days in the season (i.e., the 10% NTE events include the 2% NTE events). The wet season is defined as the period between November 1st and April 30th for a total of 181 days. The dry season is defined as the period between May 1st and October 31st for a total of 184 days.

Table 2: ENV (MS4) WLA, Existing Loads, and Reduction Goals

ENV (MS4)	TSS				TN				TP			
	Wet Season		Dry Season		Wet Season		Dry Season		Wet Season		Dry Season	
Interval (%NTE)	2%	10%	2%	10%	2%	10%	2%	10%	2%	10%	2%	10%
WLA (kg/event)	259	22	61	0	1.26	0.08	0.22	0.00	0.36	0.02	0.06	0.00
# of events per season	3.6	14.5	3.7	14.7	3.6	14.5	3.7	14.7	3.6	14.5	3.7	14.7
WLA Load (kg/season)	932	319	226	0	4.54	1.16	0.81	0.00	1.30	0.29	0.22	0.00
Existing Load (kg/season)	904	198	173	0	2.71	0.59	0.52	0.00	1.81	0.40	0.35	0.00
Reduction Required (kg/season)	0	0	0	0	0	0	0	0	0.51	0.11	0.12	0.00
Reduction Required (lb/season)	0		0		0		0		1.4		0.3	

Table 3: Kalaheo Closed Sanitary Landfill WLA, Existing Loads, and Reduction Goals

Kalaheo Closed Sanitary Landfill	TSS				TN				TP			
	Wet Season		Dry Season		Wet Season		Dry Season		Wet Season		Dry Season	
Interval (%NTE)	2%	10%	2%	10%	2%	10%	2%	10%	2%	10%	2%	10%
WLA (kg/event)	135	0	0	0	1.37	0.00	0.00	0.00	0.21	0.00	0.00	0.00
# of events per season	3.6	14.5	3.7	14.7	3.6	14.5	3.7	14.7	3.6	14.5	3.7	14.7
WLA Load (kg/season)	486	0	0	0	4.93	0.00	0.00	0.00	0.76	0.00	0.00	0.00
Existing Load (kg/season)	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Reduction Required (kg/season)	0	0	0	0	0	0	0	0	0	0	0	0
Reduction Required (lb/season)	0		0		0		0		0		0	

Table 4: Kapaa Closed Sanitary Landfill WLA, Existing Loads, and Reduction Goals

Kapaa Closed Sanitary Landfill	TSS				TN				TP			
	Wet Season		Dry Season		Wet Season		Dry Season		Wet Season		Dry Season	
Interval (%NTE)	2%	10%	2%	10%	2%	10%	2%	10%	2%	10%	2%	10%
WLA (kg/event)	800	15	80	0	7.10	0.16	0.82	0.00	1.31	0.03	0.11	0.00
# of events per season	3.6	14.5	3.7	14.7	3.6	14.5	3.7	14.7	3.6	14.5	3.7	14.7
WLA Load (kg/season)	2880	218	296	0	25.56	2.32	3.03	0.00	4.72	0.44	0.41	0.00
Existing Load (kg/season)	272	22	35	0	0.83	0.07	0.10	0.00	0.55	0.04	0.07	0.00
Reduction Required (kg/season)	0	0	0	0	0	0	0	0	0	0	0	0
Reduction Required (lb/season)	0		0		0		0		0		0	

Table 5: Kapaa Refuse Transfer Station WLA, Existing Loads, and Reduction Goals

Kapaa Refuse Transfer Station	TSS				TN				TP			
	Wet Season		Dry Season		Wet Season		Dry Season		Wet Season		Dry Season	
Interval (%NTE)	2%	10%	2%	10%	2%	10%	2%	10%	2%	10%	2%	10%
WLA (kg/event)	42	0	2	0	1.33	0.00	0.09	0.00	0.27	0.00	0.01	0.00
# of events per season	3.6	14.5	3.7	14.7	3.6	14.5	3.7	14.7	3.6	14.5	3.7	14.7
WLA Load (kg/season)	151	0	7	0	4.79	0.00	0.33	0.00	0.97	0.00	0.04	0.00
Existing Load (kg/season)	922	0	0	0	5.79	0.00	0.00	0.00	1.31	0.00	0.00	0.00
Reduction Required (kg/season)	771	0	0	0	1.00	0.00	0.00	0.00	0.34	0.00	0.00	0.00
Reduction Required (lb/season)	1,700		0		2.2		0.0		0.7		0.0	

Based on the above computations, the City's implementation plan will target wet season reductions of TSS loadings by 1,700 lbs, TN loadings by 2.2 lbs, and TP loadings by 1.4 lbs in addition to dry season reductions of TP loadings by 0.3 lbs. TSS and TN load reductions in the dry season are not applicable. The City intends to track maintenance activities based on the entire watershed to maximize the benefit to the receiving waters rather than track each individual entity by specific land use since the ultimate discharge location for all sub-basins is Kawainui Marsh.

It should be noted that the City is preparing to appeal to the State Department of Health to revise the TMDL/WLA calculations to (1) reflect current conditions as new information has become available, (2) resolve inaccurate assumptions in the DOH TMDL calculations, and (3) correct apparent calculation

errors and omissions in the DOH TMDL report in accordance with the modifications described in this section.

3.5 Quantification of TSS Load Reduction

For the purposes of the City's TMDL compliance, TSS is defined as silt, clay, and sand sized particles of 106 microns and smaller. This assumption is based on a 2006 study by the New Jersey Department of Environmental Protection (NJDEP) which indicated that TSS concentrations analyzed by the EPA Method and the Standard Method were well correlated with the true concentration for very fine, fine, and medium–sized particles which were identified as those between 0 and 106 microns (2006). This approach is considered conservative compared to other published guidelines which estimate TSS reduction credits to include particle sizes up to 250 microns (CSN, 2011).

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4.0 Proposed Best Management Practice Implementation and Monitoring Plan

The City will implement various Best Management Practices (BMPs) to reduce pollutants, particularly TSS, TN and TP, from entering Kawainui Marsh. The aggregate effect of these individual activities is expected to reduce the pollutants in the City's stormwater discharge to below the target WLA. This TMDL Implementation Plan identifies specific activities with the goal of reducing pollutants, improving water quality, and increasing the receiving water's ability to support aquatic habitat. While ultimately the attainment of the Kapaa Stream TMDL requires all stakeholders, including major landowners and land operators, to participate in the pollution reduction efforts, the City proposes to implement the following BMPs to reduce point source loads from the City's streets and facilities.

- Outreach and Education, Partnering
- Pollution Prevention and Good Housekeeping

4.1 Partnership with Ameron Hawaii and Other Businesses

Outreach efforts which educate surrounding landowners and business operators to effect changes in their behavior can result in significant reductions of pollutants that would otherwise enter the storm drainage system and receiving waters.

As is evidenced in the Figures 6 and 7 below, there are considerable accumulations of fine sediment on the road surface of Kapaa Quarry Place – the main access to and from the quarry – and on the vegetation lining the roadside. In Figure 6, the right lane (near lane) enters the quarry and has considerably less sediment than the left lane (far lane) which exits the quarry. In Figure 7, the lower branches of the roadside bushes show a clear line of demarcation of fine sediment 3-4 feet above the road surface. These are both clear visual indications that quarry operations are largely responsible for the deposition of fine sediment along the access road.

Figure 6: Fine Sediments Accumulating along Kapaa Quarry Place

Figure 7: Fine Sediments Accumulating on Vegetation along Kapaa Quarry Place

This situation presents a unique opportunity for the City and DOH to partner with Ameron Hawaii in contributing to actively reducing pollutant loads in the watershed, especially since the quarry operations make up a significant portion of the watershed. The City will assist DOH in an effort to develop a plan to engage Ameron Hawaii in reducing pollutant load reductions. Since the timing and effectiveness of such a partnership is difficult to estimate and translating such efforts into quantifiable pollutant load reductions

is difficult to determine, the anticipated removal rates from this activity have not been included in the calculations to quantify TSS, TN or TP load reductions. However, if a methodology is developed to quantify the contribution from surrounding landowners, it will be applied as appropriate. It is assumed that once Ameron Hawaii implements BMPs to control the tracking of sediment and fines off-site, the quantity of TSS removed from street sweeping operations will decrease.

The Kapaa Industrial Park is also located along Kapaa Quarry Place and houses a variety of businesses including a green waste processing facility, automotive shops, a glass making studio, and other retail businesses. The City will assist DOH in engaging the surrounding land users to determine if there are additional opportunities to alter existing business practices to realize pollutant load reductions via education and outreach.

4.2 Pollution Prevention and Good Housekeeping

The City currently implements a host of pollution prevention and good housekeeping (GH) practices across the island. Collectively, these programs are a key element in the diversion of trash, sediment, and nutrients from entering the storm drain system and discharging to receiving waters. The City will implement the following plan to expand its maintenance operations in the Kapaa Stream watershed for the upcoming 2016 fiscal year (FY16).

4.2.1 Street Sweeping

The Kailua Corporation Yard of the City Department of Facility Maintenance (DFM) currently maintains the City's streets and facilities within the Kapaa Stream Watershed. Prior to the start of the street sweeping pilot study, no street sweeping operations were conducted within the Kapaa Stream Watershed. However, DFM has since committed to implementing a routine schedule for street sweeping along Kapaa Quarry Place. The baseyard currently uses a vacuum street sweeper (Allianz Johnston VT560) for its street sweeping operations.

A street sweeping pilot study was initiated in November 2013 to determine baseline conditions in the wet and dry seasons. During the baseline study, the total volume of debris removed from the roadside area was estimated by spreading the collected material into a rectangle of uniform thickness and measuring the dimensions to calculate the volume. In addition, the percent composition of the debris collected (gravel + sand + sediment, green waste, and trash) was visually estimated (note: the fractionation of gravel + sand vs. sediment shown in Table 6 was determined based on the laboratory particle size distribution analysis). The raw data summarizing the estimated removal quantity and debris composition are presented in Table 6 below.

Table 6: Summary of Street Sweeping Baseline Data Collection

Date	Season	Quantity Collected (CY) [1]	Debris Composition (%)[2]			
			Trash	Gravel/Sand	Sediment	Green Waste
11/8/13	Wet	1.5	0	88.87	11.13	0
1/23/14	Wet	0.69	0	10.93	84.07	5
3/25/14	Wet	0.44	0	11.45	88.55	0
5/29/14	Dry	1.56	0	2.88	96.12	1
7/28/14	Dry	0.37	0	2.50	96.50	1
10/3/14	Dry	0.37	0	4.83	80.17	15
11/14/14	Wet	1.36	1	12.25	79.75	7
1/30/15	Wet	0.79	1	15.67	81.33	2
3/6/15	Wet	0.83	0	14.75	85.25	0

[1]Quantity estimated by spreading out the material collected into a uniform thickness and measuring length x width x depth
[2]Debris composition percentages estimated based on visual assessment

Particulate matter (PM) consisting of road sediment/sand/gravel were randomly sampled from the material collected and taken to the University of Hawaii at Manoa Agricultural Diagnostic Service Center for particle size, nitrogen, and phosphorus analysis. The sediment portion of the material collected (< 106 μm) ranged between 80% and 96% of the total particulate fraction by weight. The nitrogen content of the samples varied from 0.001% to 0.56% of total weight with an average concentration of 0.0010 lb-N/lb-PM. The phosphorus content of the samples varied from 0.07% to 0.13% with an average concentration of 0.0010 lb-P/lb-PM, respectively.

Organic matter (OM) was also extracted from the material collected and taken to the University of Hawaii at Manoa Agricultural Diagnostic Service Center for nitrogen and phosphorus analysis. The nitrogen content of the samples varied from 0% to 1.28% of the total weight. The average nitrogen content of all OM collected was 0.0071 lb-N/lb-OM. The phosphorus content of the samples varied from 0% to 0.41% of the total weight. The average phosphorus content of all OM collected was 0.0013 lb-P/lb-OM.

EPA bulk density conversion factors were determined for “gravel” + “sand”, “soil” (for sediment), and “compost” (for green waste) (www.epa.gov/osw/conserve/smm/wastewise/pubs/conversions.pdf).

The TSS load reduction was estimated to include all particles of 106 microns and smaller (according to the particle size distribution analysis) per the following equation:

TSS Load Reduction [lb/sweep] = $V_{TOTAL} * F_{SEDIMENT} * W_{SOIL}$, where:

V_{TOTAL} = Total volume of material collected (CY)

$F_{SEDIMENT}$ = Estimated fraction of sediment by volume based on visual assessment and particle size analysis (%)

W_{SOIL} = Bulk density conversion factor for sediment (2,392 lbs/CY)

TN and TP load reductions were estimated from the measured concentrations along with the bulk density conversion factors according to the following equations:

TN Load Reduction [lb/sweep] = (V_{TOTAL} * $F_{SEDIMENT}$ * W_{SOIL} * N_{PM}) + (V_{TOTAL} * F_{GRAVEL} * W_{GRAVEL} * N_{PM}) + (V_{TOTAL} * F_{OM} * $W_{COMPOST}$ * N_{OM}), where:

V_{TOTAL} = Total volume of material collected (CY)

$F_{SEDIMENT}$ = Estimated fraction of sediment by volume based on visual assessment and particle size analysis (%)

F_{GRAVEL} = Estimated fraction of gravel/sand by volume based on visual assessment and particle size analysis (%)

F_{OM} = Estimated fraction of organic material by volume based on visual assessment (%)

W_{SOIL} = Bulk density conversion factor for sediment (2,392 lbs/CY)

W_{GRAVEL} = Average bulk density conversion factor for gravel and sand (2,600 lbs/CY)

$W_{COMPOST}$ = Bulk density conversion factor for green waste (360 lbs/CY)

N_{PM} = Nitrogen content of particulate matter (gravel, sand, and sediment) (lb-N/lb-PM)

N_{OM} = Nitrogen content of organic material (lb-N/lb-OM)

TP Load Reduction [lb/sweep] = (V_{TOTAL} * $F_{SEDIMENT}$ * W_{SOIL} * $P_{SEDIMENT}$) + (V_{TOTAL} * F_{GRAVEL} * W_{GRAVEL} * $P_{SEDIMENT}$) + (V_{TOTAL} * $F_{GREEN\ WASTE}$ * $W_{COMPOST}$ * $P_{GREEN\ WASTE}$), where:

V_{TOTAL} = Total volume of material collected (CY)

$F_{SEDIMENT}$ = Estimated fraction of sediment by volume based on visual assessment and particle size analysis (%)

F_{GRAVEL} = Estimated fraction of gravel/sand by volume based on visual assessment and particle size analysis (%)

F_{OM} = Estimated fraction of organic material by volume based on visual assessment (%)

W_{SOIL} = Bulk density conversion factor for sediment (2,392 lbs/CY)

W_{GRAVEL} = Average bulk density conversion factor for gravel and sand (2,600 lbs/CY)

$W_{COMPOST}$ = Bulk density conversion factor for green waste (360 lbs/CY)

P_{PM} = Phosphorus content of particulate matter (gravel, sand, and sediment) (lb-P/lb-PM)

P_{OM} = Phosphorus content of organic material (lb-P/lb-OM)

A summary of the computations is provided in Table 7.

Table 7: Summary of Street Sweeping Load Reduction Computations

Date [Season]	Qty (CY)	Material Collected	Concentration (lb/lb)		Qty Removed		
			TN	TP	TSS (lb/sweep)	TN (lb/sweep)	TP (lb/sweep)
11/8/13 [Wet]	1.5	Gravel + Sand[1]	0.00001	0.0080	399	0.04	3.1
		Sediment[2]	0.00001	0.0080			
		Green Waste	0.0000	0.0000			
1/23/14 [Wet]	0.69	Gravel + Sand[1]	0.0030	0.0010	1,390	0.61	1.60
		Sediment[3]	0.0030	0.0010			
		Green Waste	0.0106	0.0011			
3/25/14 [Wet]	0.44	Gravel + Sand[1]	0.0001	0.0011	941	0.11	1.18
		Sediment[3]	0.0001	0.0011			
		Green Waste	0.0034	0.0010			
5/29/14 [Dry]	1.56	Gravel + Sand[1]	0.0056	0.0011	3,576	20.75	4.07
		Sediment[3]	0.0056	0.0011			
		Green Waste	0.0122	0.0010			
7/28/14 [Dry]	0.37	Gravel + Sand[1]	0.00001	0.0012	855	0.02	1.06
		Sediment[3]	0.00001	0.0012			
		Green Waste	0.0079	0.0013			
10/3/14 [Dry]	0.37	Gravel + Sand[1]	0.0005	0.0007	710	0.54	0.61
		Sediment[3]	0.0005	0.0007			
		Green Waste	0.0075	0.0041			
11/14/14 [Wet]	1.36	Gravel + Sand[1]	0.0010	0.0013	2,591	3.46	3.98
		Sediment[3]	0.0010	0.0013			
		Green Waste	0.0128	0.0016			
1/30/15 [Wet]	0.79	Gravel + Sand[1]	0.0004	0.0008	1,537	0.76	1.49
		Sediment[3]	0.0004	0.0008			
		Green Waste	0.0027	0.0005			
3/6/15 [Wet]	0.83	Gravel + Sand[1]	0.0008	0.0008	1,699	1.62	1.62
		Sediment[3]	0.0008	0.0008			
		Green Waste	n/a	n/a			

[1]The fractionation of gravel + sand vs. sediment was determined based on the laboratory particle size distribution analysis.
[2]Sediment was defined as particles sizes < 53 microns
[3]Sediment was defined as particles sizes < 106 microns

The street sweeping pilot study will continue through the end of calendar year 2016 (CY16). Throughout this period, the total volume of material collected and the estimated debris composition will be tracked for each street sweeping cycle. In addition, laboratory analysis for TSS (particle size distribution) and the nutrient content of the particulate fraction and organic fraction of the material collected from street sweeping will be conducted.

Based on the data collected thus far, it is estimated that each street sweeping cycle is anticipated to reduce TSS loadings by 1,600-1,700 lbs, TN loadings by 0-1 lbs, and TP loadings by 2-3 lbs. On average, 2,000 lbs of TSS, 1.0 lbs of TN, and 2.4 lbs of TP are removed per cubic yard of street sweeping debris collected.

It is anticipated that this activity will need to occur approximately once during wet season and once during the dry season to meet the City's TSS, TN, and TP reduction goals. In the event the street sweeping equipment is out of commission for an extended period of time, the baseyard has alternate plans in place to borrow equipment from another baseyard to ensure the removal rate from this activity is sufficient to meet the City's annual WLA.

The seasonal removal quantity will be measured based on the City's fiscal year which begins on July 1st of each year. Data collected from each street sweeping cycle will be tallied and the running total will be measured against seasonal metrics to determine if collections are on target to meet the TSS, TN, and TP reduction goals for the season. If, at any time, the actual collections fall short of the estimates and it appears that routine street sweeping operations scheduled for the remainder of the wet or dry season are not sufficient to meet the reduction goals, additional activities including drain cleaning will be conducted.

4.2.2 Dredging of Sediment Basin

The City maintains a 0.23 acre sediment basin near the base of the Refuse Transfer Station. The sediment basin does not have a direct connection to Kapaa Stream, but rather discharges directly to Kawainui Marsh under Kapaa Quarry Road. The City generally maintains the basin on an annual basis, subject to the availability of equipment and personnel. Maintenance records detailing the quantity and specific composition of the material removed from the site were not available and therefore only rough estimates regarding pollutant removal can be made at this time. The City intends to continue routine maintenance of the sediment basin, but will target its efforts in the wet season to ensure compliance with the City's WLA. In addition, going forward, the City will track the material removed and quantify the sediment fraction to estimate pollutant removal.

4.2.3 Maintenance of Storm Drainage System

Kapaa Quarry Place is a privately owned, City maintained roadway. There is an existing concrete swale along the mauka lane of Kapaa Quarry Place that leads to a spillway and energy dissipator that ultimately discharges to Kapaa Stream below. The City will maintain the swale, spillway, and dissipator to remove sediment and organic material that collects within the conveyances. The amount of material removed will be tracked and quantified similar to the method presented for street sweeping. Inspection and maintenance will occur once per permit term or more frequently if required or complaints are received.

4.3 Permanent BMP

It is not anticipated that permanent BMPs will be required to meet the TSS or nutrient load reductions; however, if it becomes necessary to further reduce pollutant loads, the City will identify potential permanent BMP options which may include installing catch basin inserts in several strategic locations. The decision to implement permanent BMPs will be made after the results of FY17 debris collection data is compiled and analyzed. If it is required, a revised I&M Plan will be submitted to the DOH by the end of FY18. Additional details on the implementation timeline are provided in Section 5.0.

4.4 Summary of BMP Activities

The following table summarizes the estimated effectiveness of the various BMP activities to be implemented by the City.

Table 8: Summary of BMP Activities and Quantitative Reductions

	TSS Reduction (lbs/season)		TN Reduction (lbs/season)		TP Reduction (lbs/season)	
	Wet Season	Dry Season	Wet Season	Dry Season	Wet Season	Dry Season
Ameron Partnership	See Note 1					
Education and Outreach	See Note 2					
Street Sweeping	1,000	1,000	1.0	0.3	2.2	1.9
Sediment Basin Dredging See Note 3	957	-	96	-	48	-
Storm Drain Maintenance	See Note 4					
TOTAL REMOVED	1,957	1,000	97	0.3	50	1.9
REDUCTIONS REQUIRED	1,700	0	2.2	0	2.1	0.3

Note 1: The City will assist DOH in establishing a partnership with Ameron Hawaii to reduce sediments and fines deposited along Kapaa Quarry Road due to the quarry operations. However, due to the difficulty in quantifying future pollutant load reductions, it is assumed that over time, less street sweeping material will be collected due to Ameron's good housekeeping contribution.

Note 2: City will assist DOH in assessing the potential of existing businesses within the Kapaa Industrial Park to determine if there are outreach opportunities to educate business owners about potential pollutant reductions. However, due to the difficulty in quantifying future pollutant load reductions from this activity, no pollutant load reductions have been included for accounting purposes at this time.

Note 3: Historical maintenance records detailing the frequency, quantity, and material composition of the material removed from the sediment basin are not available. Based on the assumption made by DOH in the development of the TMDLs, the potential storage volume is in excess of 2,000 CY. For the purposes of estimating pollutant loads, it is assumed that 20 CY of material is dredged annually.

Note 4: Cleaning of storm drains and drainage structures will be implemented only if collections from other activities are less than anticipated and the City needs additional reductions to meet the load reduction goals for a particular season. Storm drain cleaning may also be done in lieu of additional street sweeping activities based on scheduling and equipment availability.

4.5 Summary of Activities to be Tracked

The City will meet the seasonal TSS, TN, and TP load reduction goals by participating in DOH sponsored education/outreach and partnership campaigns, implementing street sweeping along Kapaa Quarry Place, and dredging the Kapaa Refuse Transfer Station sediment basin.

The City is strongly in support of partnering with neighboring landowners and land operators to conduct education and outreach efforts regarding pollution prevention. The City urges the DOH to engage non-point source dischargers in the watershed to implement BMPs that can prevent migration of pollutants offsite, mitigating effects to downstream landowners and MS4 operators and ultimately the receiving waterbody. The City is committed to supporting DOH in these efforts and is willing to dedicate resources to assist as necessary.

The City intends to continue routine street sweeping along Kapaa Quarry Place indefinitely. The quantity of material collected, the debris composition, and the laboratory analysis for particle size the particulate and organic fraction will continue through the end of the street sweeping pilot study (December 2016). At the conclusion of the pilot study, the analysis for the TSS fractionation and nutrient content of the

collected material will cease and the three years of data will be averaged to determine estimated removal rates going forward. The quantification of the material removed and estimation of debris composition will continue until the end of FY17. After that date, the City will utilize the historical data to determine the basic level of street sweeping activities necessary to meet the pollutant load reduction goal and ultimately the City's WLA.

The City also intends to dredge the Kapaa Refuse Transfer Station sediment basin once during the wet season. The quantity of material removed will be tracked during the three year compliance period to confirm if the expected removal quantity is being met.

The City intends to track maintenance activities based on the entire watershed to maximize the benefit to the receiving waters rather than track each individual entity by specific land use since the ultimate discharge location for all sub-basins is Kawainui Marsh.

If the combination of all of the proposed activities results in less collections than required, the City will reevaluate the program. Depending on the findings, this may result in implementing additional program elements, including identifying opportunities for permanent BMP development.

4.6 Municipal Landfills

The City's Kalaheo Landfill which is located on the west side of Kapaa Stream and the H-3 Freeway received about 1.3 million ton of waste before it was closed in 1990. The Kapaa Landfill which was constructed over the old quarry excavation received approximately 4.5 million tons of municipal solid waste until its final closure in 1996. Both landfills are currently complying with the post-closure requirements of DOH's solid waste regulations, Administration Rules, Chapter 11-58.1.

5.0 Compliance Schedule

The achievement of the City's WLA for the Kapaa Stream Watershed will occur over a period of three and a half years with a final compliance deadline of December 31, 2018. Based on historical collections to date, it is anticipated that a combination of street sweeping (once in the wet season and once in the dry season) and continued maintenance of the Kapaa Refuse Transfer Station sediment basin will collect or treat sediment and organic matter in sufficient quantity to meet the seasonal TSS, TN and TP reduction goals.

If it is determined that significantly more activities are required to meet the target reductions and the City is unable to meet the WLA by the compliance deadline, the City will work with the appropriate agency to reevaluate the program. Depending on the findings, this may result in implementing additional program elements or reevaluating the current conditions to determine if the characteristics of the MS4 discharges have changed. In accordance with these modifications, the City will submit a revised I&M Plan in FY18 and request a modification to the final compliance deadline. The revised plan will outline the additional activities the City plans to implement to achieve the WLA and include a timeline for implementation. The proposed implementation schedule is shown in the following table.

Table 9: Schedule of Compliance

Due No Later Than:	Milestone / Deliverable
June 30, 2015	• Submit updated I&M Plan per Part F.3.a. • Continue 3-yr street sweeping pilot study (quantity of material collected, debris composition, and TSS/TN/TP analysis)
June 30, 2016	• Continue 3-yr street sweeping pilot study (quantity of material collected, debris composition, and TSS/TN/TP analysis)
December 31, 2016	• Complete street sweeping pilot study (TSS/TN/TP analysis) • Continue numerical tracking of GH activities (quantity of material collected and debris composition)
June 30, 2017	• Complete numerical tracking of GH activities (quantity of material collected and debris composition)
December 31, 2017	• Submit street sweeping pilot study report and provide summary of street sweeping material analyzed during pilot study
June 30, 2018	• Complete analysis of GH numerical tracking data to determine basic level of activities necessary, and • If additional activities are required, submit revised I&M Plan which outlines additional activities to be implemented[1]
December 31, 2018	FINAL COMPLIANCE DEADLINE • Submit final report detailing how compliance with WLA reductions was achieved and will be maintained

[1]Other activities are defined as other municipal and public participation maintenance activities such as drain cleaning, volunteer cleanups, regulatory compliance and enforcement policies, homeowner involvement, downspout disconnections, structural retrofits and other structural BMP measures

After the final compliance deadline, the City's compliance will be based on fulfilling the basic level of activities determined to be necessary to meet the pollutant load reduction.

Ultimately, it is the City's goal to contribute to good stewardship of the land and ensure that water quality in and around the island of Oahu is safe and useable for all intended purposes. These activities are proposed to aid in achieving this goal.

6.0 References

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