Appendix I4: Implementation and Monitoring Plan for Ala Wai Canal, 2015

IMPLEMENTATION AND MONITORING PLAN FOR ALA WAI CANAL 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
CMU	Concrete Masonry Unit
CRM	Concrete Rubble Masonry
CSM	City and County of Honolulu, Department of Environmental Services, Collection System Maintenance
CY	Calendar Year
DDC	City and County of Honolulu, Department of Design and Construction
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
I&M Plan	Implementation and Monitoring Plan
MS4	Municipal Separate Storm Sewer System
NCDC	National Climatic Data Center
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 Ala Wai Canal in 1995 which were approved by the Environmental Protection Agency (EPA) in 1996. In 2002, the EPA and DOH issued revised TMDLs and further defined annual Wasteload Allocations (WLAs) for point dischargers including the City and County of Honolulu (City or CCH) and the State of Hawaii Department of Transportation (DOT). Additionally, load reduction requirements for Total Nitrogen (TN) and Total Phosphorus (TP) were provided in the form of percentage reductions. The City's existing annual pollutant load and annual (mass) load reductions were calculated from the given data. Furthermore, since the CCH and DOT were assigned a combined WLA, the City estimated its fraction of the total MS4 coverage area based on GIS data for urban land use coverage. The City's MS4 service area includes parks, Ala Wai Golf course, single family and high density residential neighborhoods, commercial areas, and City streets. The resulting load reduction goals for TN and TP are as follows:

Table ES-1: Total Nitrogen and Total Phosphorus Load Reduction Summary

	Unit	TN	TP
Urban Source WLA[1]	kg/d	6	4
Urban Source Reduction Required[1]	%	65	50
Urban Source Existing Load	kg/d	17.14	8.00
Urban Source Reduction Required	kg/d	11.14	4.00
Urban Source Reduction Required	kg/yr	4,067	1,460
CCH MS4 Coverage Area	%	88.63	88.63
CCH Reduction Required	kg/yr	3,605	1,294
CCH Reduction Required	lb/yr	7,947	2,853

[1]Source: DOH TMDL Report (2002), Table 8

Based on this analysis which has received DOH concurrence, the City will implement Best Management Practices (BMPs) targeted at removing 7,947 lbs of TN and 2,853 lbs of TP annually.

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

- Public outreach efforts informing homeowners of how their actions affect water quality in the Ala Wai Canal;
- Public outreach efforts targeted to homeowners who could make improvements around their homes such as disconnecting roof drains;
- Hosting volunteer events (Adopt-a-Stream, Adopt-a-Block, Make a Difference Day, Storm Drain Stenciling, etc.)
- Tracking DFM street sweeping collections;
- Tracking DFM stream cleaning of Manoa and Palolo Streams;
- Inspecting, maintaining, and/or installing permanent BMPs,
- Continued maintenance of water quality improvement projects, and
- Inspecting and cleaning drainage structures and conveyances as necessary.

The combination of these efforts is expected to remove nutrients, namely TN and TP, from the waste stream and ultimately achieve the targeted WLA. The following table provides a summary of the estimated pollutant load reductions for each of the City's BMPs. If additional activities (ex. additional street sweeping cycle(s), drain cleaning and/or additional permanent BMPs) are required to meet the target reductions, the City will implement them as necessary.

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

	TN Reduction (lbs/year)	TP Reduction (lbs/year)
Downspout Disconnect	*	*
Public Outreach and Education	*	*
Volunteer Cleanup Events	150	45
Water Quality Improvement Projects	1,486	401
Street Sweeping (Day shift)	6,092	1,228
Street Sweeping (Waikiki Night shift)	1,876	392
Permanent BMPs (existing)	13.4	5.1
Permanent BMPs (proposed)	22.5	0.8
Stream Cleaning	2,300	510
Storm Drain Maintenance	1,700	400
TOTAL	13,640	2,982
REDUCTIONS REQUIRED	7,947	2,853

* The City will conduct a public education and outreach program to all homeowners within the watershed; however, due to difficulty in quantifying pollutant load reductions due to behavior changes, no homeowner contribution is assumed for accounting purposes at this time.

**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 June 30, 2021.

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 Ala Wai Canal by the end of Fiscal Year 2015 (FY15). For the purpose of complying with the foregoing requirement, the City is submitting this I&M Plan for the Ala Wai Canal.

The DOH developed and established Total Maximum Daily Loads (TMDLs) for Ala Wai Canal in 1995 which were approved by the Environmental Protection Agency (EPA) in 1996. In 2002, the EPA and DOH issued revised TMDLs and further defined annual Wasteload Allocations (WLAs) for point dischargers including the City and County of Honolulu (City or CCH) and the State of Hawaii Department of Transportation (DOT) in its technical report *Revisions to Total Maximum Daily Loads for the Ala Wai Canal, Island of Oahu, Hawaii* (DOH, June 2002). This I&M Plan will address specific City activities targeted to reducing Total Nitrogen and Total Phosphorus discharges in the Ala Wai Canal 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 Ala Wai Canal Watershed

The Ala Wai Canal watershed is a 16.5 square mile (10,515 acre) basin located on the south shore of Oahu. It consists of areas in Makiki, Manoa, Palolo, St. Louis Heights, Kapahulu, Ala Moana, and Waikiki. The TMDL watershed boundary, as defined by the DOH, includes Makiki Stream watershed, Manoa-Palolo Stream watershed, and a portion of the Ala Wai Canal watershed that discharges directly to the canal (see Figure 1).

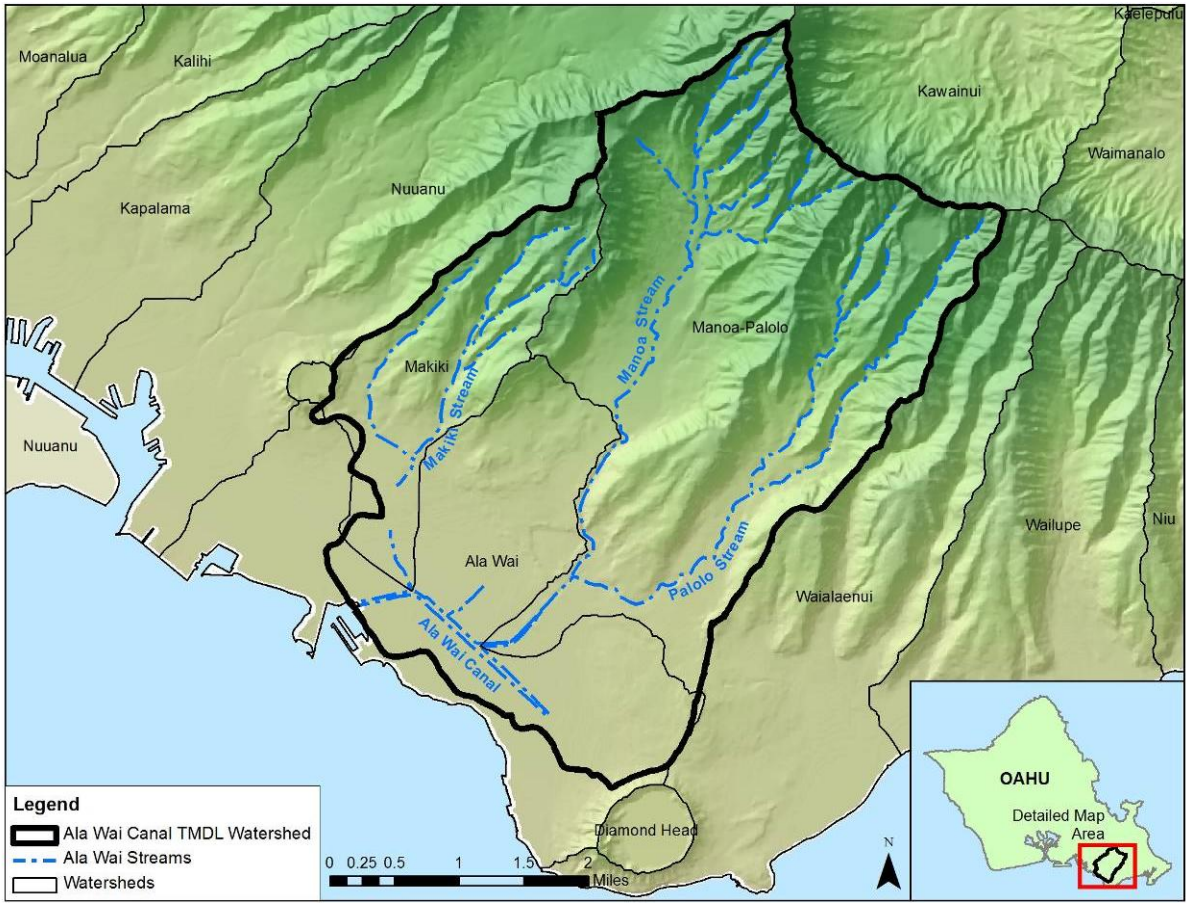

Figure 1: Ala Wai Canal Watershed

The canal itself is a 2-mile long artificial estuary constructed in the 1920s to drain the marshy areas around Waikiki (see Figure 2). The canal receives inflows from three major tributaries – Manoa, Palolo, and Makiki – and several minor urban tributaries. Ala Wai Canal was listed in the 1998 Clean Water Act §303(d) list of impaired water bodies for excessive nutrients, sediment, metals, pathogens, and pesticides. The stagnant nature of the canal (minimal freshwater inflows) and poor mixing conditions (due to its narrow geometry) contribute to the water quality problems. The canal discharges into Mamala Bay near the Ala Wai Yacht Harbor.

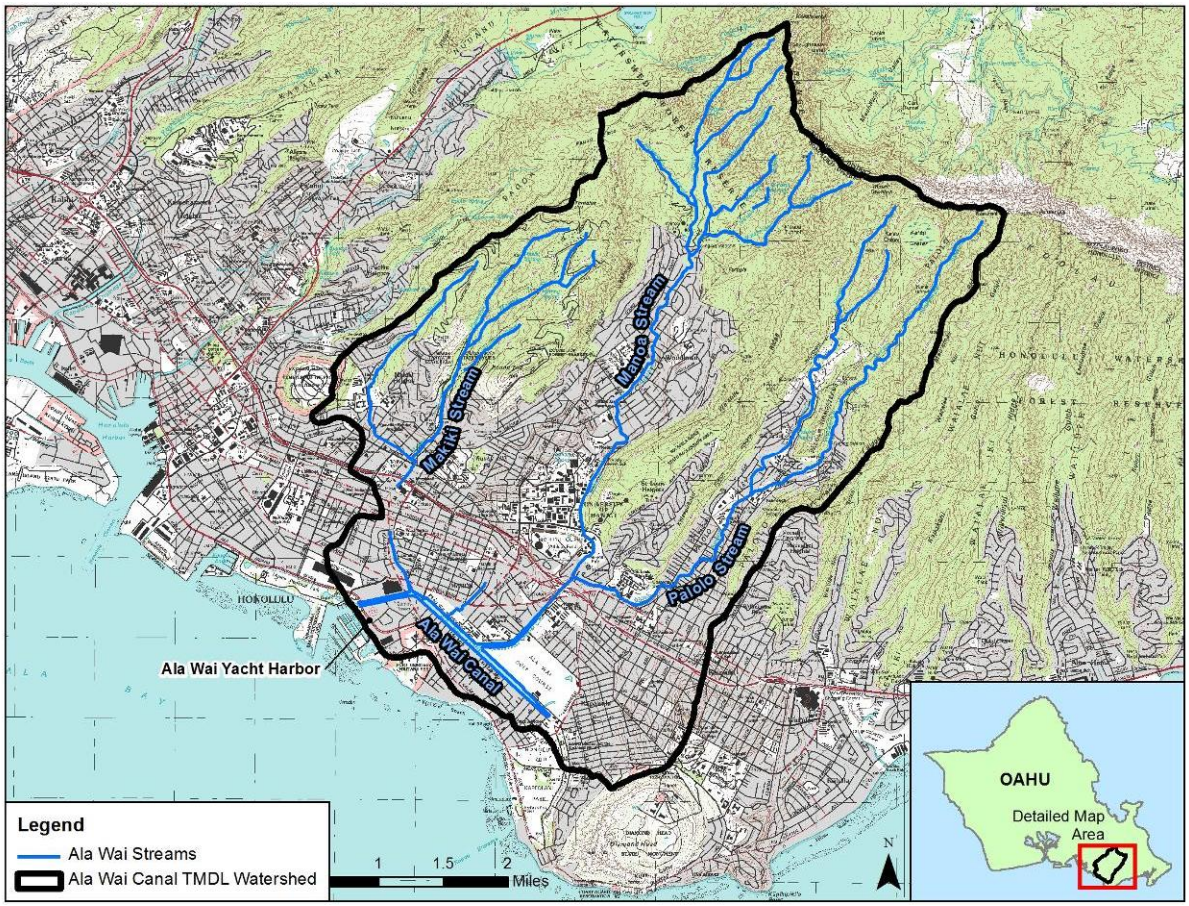

Figure 2: Ala Wai Canal USGS Map

Land use in the watershed consists of forested conservation lands (approximately 46%) in the higher elevations and urbanized areas (approximately 53%) at the lower elevations (see Figure 3). Single family and multi-unit residential housing make up the bulk of the urban land use which also includes the highly developed Waikiki corridor and the University of Hawaii at Manoa campus. The conservation lands are managed by the Hawaii Department of Land and Natural Resources. The urbanized areas of the watershed are generally within the jurisdiction of the City and County of Honolulu, State of Hawaii Department of Transportation, and other private landowners.

Based on GIS parcel data, it was determined that the combined total of the Honolulu Board of Water Supply, State Department of Education, State Department of Transportation – Highways Division (including 18 permitted connections), and the University of Hawaii's individual MS4 coverage areas is approximately 11.37% of the urban lands within the watershed boundary. Conservatively, this assumes the City and County of Honolulu's MS4 covers the remaining 88.63% of the urban lands.

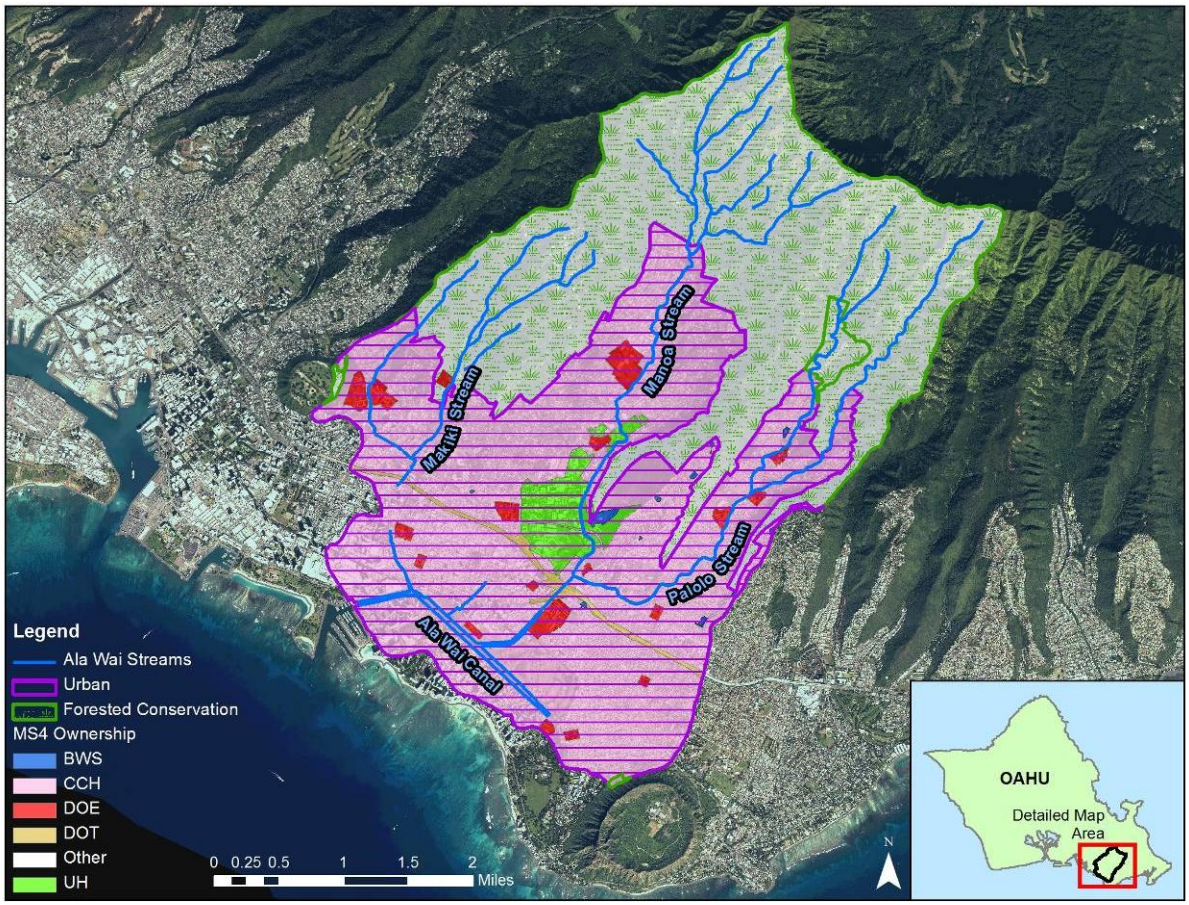

Figure 3: Ala Wai Canal Aerial Photo with Land Use

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3.0 TMDLs and WLAs for Ala Wai Canal 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 1995, the DOH published TMDLs for Ala Wai Canal which were approved by the Environmental Protection Agency (EPA) in 1996. In 2002, the EPA and DOH issued revised TMDLs and further defined annual Wasteload Allocations (WLAs) for point dischargers including the City and County of Honolulu (City or CCH) and the State of Hawaii Department of Transportation (DOT). 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 CCH Annual WLA, Existing Loads, and Reduction Goals

The DOH established annual urban source WLAs for TN and TP as summarized in Table 1 below. In addition, load reduction requirements for each nutrient of concern were provided in the form of percentage reductions. The existing urban source annual pollutant load and the annual urban source (mass) load reductions were calculated from the given data. Furthermore, since the CCH and DOT were assigned a combined WLA, the City estimated its fraction of the total MS4 coverage area based on GIS data for urban land use coverage. The City's MS4 service area includes parks, Ala Wai Golf course, single family and high density residential neighborhoods, commercial areas, and City streets for a total of 88.63% of the urban lands.

The following table summarizes the annual WLAs, existing loads, and load reductions required for the Ala Wai Canal watershed.

Table 1: Annual CCH WLA, Existing Loads, and Reduction Goals

	Unit	TN	TP
Urban Source WLA[1]	kg/d	6	4
Urban Source Reduction Required[1]	%	65	50
Urban Source Existing Load	kg/d	17.14	8.00
Urban Source Reduction Required	kg/d	11.14	4.00
Urban Source Reduction Required	kg/yr	4,067	1,460
CCH MS4 Coverage Area	%	88.63	88.63
CCH Reduction Required	kg/yr	3,605	1,294
CCH Reduction Required	lb/yr	7,947	2,853

[1]Source: DOH TMDL Report (2002), Table 8

Based on the above computations, which have been reviewed and concurred by DOH, the City's implementation plan will target reductions in TN loadings by 7,947 lbs and TP loadings by 2,853 lbs annually.

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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 TN and TP, from entering the streams and Ala Wai canal. 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 stream's ability to support aquatic habitat. While ultimately the attainment of the Ala Wai Canal TMDL requires all stakeholders, including major landowners and land operators, to participate in pollution reduction efforts, the City proposes to implement the following BMPs to reduce point source loads from the City's streets and facilities.

- Community Involvement and Outreach/Education
- Pollution Prevention and Good Housekeeping
- Permanent BMPs
- Water Quality Improvement Projects

4.1 Community Involvement and Outreach/Education

Outreach efforts which educate the general public to effect changes in their behavior can result in significant reductions of pollutants that would otherwise enter the storm drain system and receiving waters.

4.1.1 Downspout Disconnection

Building rooftops are impervious surfaces, similar to paved streets and parking lots that accumulate debris, chemicals, fine sediment, nutrients or other pollutants that could adversely affect water quality if the runoff is discharged untreated. Connected downspouts discharge rooftop runoff either directly to the storm drain system or to impervious surfaces. In both cases, there is little to no treatment of storm water runoff before it reaches the stream system. Most of the nitrogen contained in storm water is in the form of dissolved nitrate. Since the nitrogen is not in solid form, removal through plant uptake has been shown to be much more effective than filtration methods.

Downspout disconnection can help reduce runoff volume, rate, and accumulated rooftop pollutants introduced to local streams by allowing runoff water to pass through the initial plant uptake process as well as the secondary infiltration process rather than discharging directly to the storm drainage system. Disconnected downspouts typically drain to pervious areas such as yards and lawns, rain barrels, or rain gardens, all of which allow rooftop runoff to enter treatment prior to discharge.

It is estimated that there are between 15,000 and 20,000 residential, commercial, government, and educational structures within the Ala Wai watershed. It is unknown how many of these structures may be suitable for downspout disconnection; however, if a potential for substantial pollutant load reductions via downspout disconnection can be realized and quantified, the City will prepare an informational mailer to property owners educating them on the benefits of downspout disconnection. The mailer will specify the benefits of such activity and provide property owners with resources for additional information.

Literature data suggests that for each 1 acre of impervious rooftop that is disconnected and allowed to infiltrate or pass through some other form of treatment, it will generate pollutant load reductions of approximately 7.6 lbs of TN and 0.24 lbs of TP annually. This estimation is based on the following equation:

Load Reduction [lb/yr] = LR * A_{IMP} * P * RE * C, where:

LR = Loading rate for urban land use (NY State Stormwater Management Design Manual) (1.5 mg/L for TN; 0.11 mg/L for TP)

A_{IMP} = impervious rooftop drainage area suitable for disconnection (1 acre)

P = Average annual precipitation (40 in/yr, Hawaii Rainfall Atlas, median annual rainfall isohyetals for urban land use within watershed boundary)

RE = Removal Efficiency for Specific BMP Type (open channel removal rate 56% for TN and 24% for TP per National Pollutant Removal Performance Database, Center of Watershed Protection [CWP], 2007)

C = Conversion Factor, 0.2266

While downspout disconnection is a meaningful and tangible homeowner contribution to reducing pollutants in the waste stream, this activity has not been included in the accounting of TN or TP load reductions from the City's MS4 due to uncertainty in the participation rate. If, however, it is determined, based on photographic evidence, that a significant number of homeowners have taken action, reduction contributions from this activity will be used to offset other activities such as street sweeping and drain cleaning.

4.1.2 Public Outreach and Education/Volunteer Cleanup

Raising awareness among landowners and land operators about some of the common activities around their properties that can negatively affect water quality can invoke a behavior change. This shift in behavior is a primary citizen-based strategy that can yield significant positive results and water quality improvements.

The City generally hosts at least one storm drain stenciling event per year within the Ala Wai watershed resulting in the stenciling of 50-100 drain inlets. However, since the effects of such public education and outreach activities on storm water discharges is difficult to quantify, the anticipated removal rate has not been included in the calculations to quantify TN or TP load reductions. However, if a methodology is developed to quantify the public outreach and education contribution in removal of TN and TP from the waste stream, it will be used to offset other activities such as street sweeping and drain cleaning.

The City regularly partners with local community groups to organize clean up events such as the Adopt-a-Block, Adopt-a-Stream, and Make a Difference Day programs. In June 2013, the City conducted a special clean up event in conjunction with the MERCY church worldwide volunteer group at select locations in Manoa, Palolo, and Makiki. That event removed over 4.5 CY of yard waste, sediment, trash, and gravel from over 12.5 miles of City's roads. Eleven representative samples of the material collected at this event were analyzed for nutrient content. The estimated pollutant load removed was 20 lbs of TN and 7 lbs of TP from this single event which attracted over 50 volunteers.

Such volunteer clean-up events are scheduled periodically in the Manoa, Palolo, Moiliili, and Makiki areas. Table 2 summarizes the events and estimated pollutant load reductions over the past four fiscal years.

Table 2: Summary of Volunteer Clean-up Events

Fiscal Year	# of Events[1]	Approx. Qty. of Material Removed (CY)	Estimated Pollutant Removal	
			TN (lb)	TP (lb)
FY12	2	7.5	22.3	12.9
FY13	7	21	117.7	33.2
FY14	4	44	325.5	84.0
FY15 (partial)[2]	6	28.8	150.1	52.2
Four-Year Average (lb/FY)			153.9	45.6

[1]The City hosts additional events such as Storm Drain Stenciling; however, since material is not physically collected and removed at these events, they are not included in the table

[2]Three additional events are scheduled for the remainder of FY15, weather permitting

Based on this historical data and continuing partnerships with community groups such as Malama Manoa and MERCY church, it is anticipated that the contribution from volunteer clean-ups will continue into the foreseeable future. As such, it has been assumed, based on historical collections, that approximately 150 lbs of TN and 45 lbs of TP will continue to be removed annually from the Ala Wai Canal waste stream as a result of volunteer clean-up events.

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 Ala Wai Canal watershed for the 2016 fiscal year (FY16).

4.2.1 Street Sweeping

The Sand Island satellite baseyard of the City Department of Facility Maintenance (DFM) currently conducts street sweeping operations along City streets within the Ala Wai Canal Watershed. Routine street sweeping is generally conducted as follows:

- Waikiki – weekly or twice a week (night and day shifts)
- Major Arterial Roadways (Beretania Street, King Street, Young Street, Kapiolani Blvd., Kalakaua Ave., Kuhio Ave., Ala Wai Blvd., Kapahulu Ave. (partial), Waialae Ave. (partial), and University Ave (partial)) - weekly
- Manoa / Palolo / Makiki residential areas – monthly or less frequently

The major arterial roadways are generally swept in the overnight hours. The minor arterials and collector streets are swept during the day.

The baseyard uses both broom and regenerative air street sweepers. The equipment is fully functional and operational approximately 77% of the time (approximately 40 weeks/yr). This estimation takes into account holidays, staff sick leave days, and equipment maintenance downtime.

A street sweeping pilot study was initiated in August 2014 to determine baseline conditions. 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.

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 nitrogen and phosphorus analysis. The nitrogen content of the samples varied from 0.002% to 1.68% of total weight with an average concentration of 0.0037 lb-N/lb-PM. The phosphorus content of the samples varied from 0.08% to 3.14% with an average concentration of 0.002 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 0.11% to 3.92% of the total weight. The average nitrogen content of all OM collected was 0.017 lb-N/lb-OM. The phosphorus content of the samples varied from 0.06% to 2.20% of the total weight. The average phosphorus content of all OM collected was 0.0019 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).

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] = $(V_{TOTAL} * F_{G+S+S} * W_{G+S+S} * N_{PM}) + (V_{TOTAL} * F_{OM} * W_{COMPOST} * N_{OM})$, where:

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

F_{G+S+S} = Estimated fraction of gravel + sand + sediment by volume based on visual assessment (%)

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

W_{G+S+S} = Average bulk density conversion factor for gravel, sand, and sediment (2,466 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 matter (green waste) (lb-N/lb-OM)

TP Load Reduction [lb/sweep] = $(V_{TOTAL} * F_{G+S+S} * W_{G+S+S} * P_{PM}) + (V_{TOTAL} * F_{OM} * W_{COMPOST} * P_{OM})$, where:

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

F_{G+S+S} = Estimated fraction of gravel + sand + sediment by volume based on visual assessment (%)

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

W_{G+S+S} = Average bulk density conversion factor for gravel, sand, and sediment (2,466 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 matter (green waste) (lb-P/lb-OM)

A summary of the estimated weekly pollutant removals is provided in Tables 3 (night shift) and 4 (day shift).

Table 3: Summary of Street Sweeping Removal Rates (Night Shift)

Week	Qty. Removed (CY)	Estimated Pollutant Removal (lb/week)	
		TN	TP
1	7.33	50.66	14.13
2	5.09	29.35	5.16
3	3.40	21.03	3.70
4	5.77	45.71	6.97
5	3.75	22.31	3.73
6	7.50	41.63	29.81
7	5.93	40.31	6.00
8	17.14	164.12	18.83
9	6.37	51.34	5.00
10	3.08	19.56	2.43
11	8.15	103.57	14.65
12	11.00	120.62	10.23
13	6.62	25.49	8.24
14	8.17	110.85	9.92
15	5.96	46.61	6.30
16	3.61	28.82	3.08
17	1.78	14.37	1.70
18	2.47	22.52	2.43
19	5.93	25.50	6.41
20	7.16	14.89	18.65
21	3.80	14.36	2.00
22	14.87	43.93	34.80
23	6.11	29.56	10.63
24	4.15	38.39	11.17
Weekly Average		46.89	9.83

Table 4: Summary of Street Sweeping Removal Rates (Day Shift)

Week	Qty. Removed (CY)	Estimated Pollutant Removal (lb/week)	
		TN	TP
1	24.88	211.59	35.35
2	12.35	112.84	17.73
3	39.93	257.70	54.77
4	33.89	221.29	46.74
5	30.69	116.98	25.17
6	7.53	38.84	4.82
7	15.91	116.23	13.98
8	40.32	253.45	61.74
9	14.66	34.54	13.32
10	43.11	213.26	40.40
11	26.41	138.95	31.34
12	24.36	112.21	22.44
Weekly Average		152.32	30.65

Based on this analysis, it is estimated that each weekly street sweeping operation is anticipated to reduce TN loadings by 152.3 lbs and TP loadings by 30.7 lbs during the day shift and 46.9 lbs of TN and 9.8 lbs of TP during the night shift. This totals to 7,968 lbs of TN and 1,620 lbs of TP per year based on a 77% utilization rate. On average, 5-8 lbs of TN and 1-2 lbs of TP are removed per cubic yard of street sweeping debris collected.

The day shift street sweeping operations will occur approximately two to three days per week within the Ala Wai Canal watershed boundary. The remainder of the day shifts will be dedicated to sweeping the balance of the Honolulu district which spans from Kalihi to Hawaii Kai. The night shift street sweeping operation in Waikiki will occur approximately weekly. In the event the street sweeping equipment is out of commission for an extended period of time, the baseyard will borrow equipment from another baseyard to ensure the removal rate from this activity is sufficient to meet the City's WLA.

The annual 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 annual metrics to determine if collections are on target to meet the TN and TP reduction goals for the year. 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 year are not sufficient to meet the reduction goals, additional activities including drain cleaning will be conducted.

4.2.2 Stream Cleaning

The DFM Halawa Corporation Yard maintains the portion of Manoa and Palolo Streams between the upstream urban boundary (as accessible via public roads) and Date Street. The streams are scheduled for cleaning once every three to five years and require about 25-30 working days to complete the entire length. The Manoa, Palolo, and Makiki streams are also inspected and cleared as necessary prior to large anticipated storm events and/or as complaints are received.

Stream cleaning in Manoa and Palolo Streams occurred most recently in May – August 2014. The crews worked intermittently over a four month period to clear sediment, gravel, trash, and green waste from the channel. It is estimated that 72 CY of material was removed during each work day resulting in TN reductions of 460 lbs and TP reductions of 102 lbs.

Currently, stream cleaning in Manoa and Palolo Streams is not scheduled on an annual basis; however, DFM will adjust their maintenance schedule beginning in FY16 to include a portion of Manoa and/or Palolo Stream(s) annually. As such, only a portion of the stream will be maintained in any given year rather than a systemwide cleaning every three to five years. This I&M Plan assumes five days per year are dedicated to stream cleaning within the Ala Wai Canal watershed, and it is anticipated that 2,300 lbs of TN and 510 lbs of TP will be removed annually from this activity. If DFM is unable to perform the stream cleaning in any given year, other activities will be increased to ensure the City's WLA is met.

4.2.3 Pump Station Maintenance

There are three Collection System Maintenance (CSM) Division pump stations within the Ala Wai Canal watershed that pump sewage to the Sand Island Wastewater Treatment Plant. The Beachwalk Pump Station is located in Waikiki near the intersection of Kuhio Avenue and Kaiolu Street. The 1.15-acre facility consists of a driveway and parking area, a pump station building, a generator building, and a 6,000-gallon underground fuel storage tank. The Fort DeRussy Pump Station is located in Waikiki on Kalakaua Avenue. The 0.31-acre facility consists of a driveway, a parking area, and a three-story pump station building which houses a wet well, three pumps, and a restroom. The Moana Park Pump Station is located at the eastern end of Ala Moana Beach Park on Ala Moana Boulevard. The 0.075-acre facility consists of a driveway, a parking area, a two-story pump station building, a generator building, and a 600-gallon underground fuel storage tank. All sites are unmanned and closed at all times except during routine inspections which occur three times a day, seven days a week.

The City currently has a landscape maintenance contractor perform regular monthly maintenance on the property grounds. However, maintenance records detailing the specific composition of the debris removed from the site were not available, and therefore estimations regarding pollutant removal cannot be made at this time.

4.2.4 Maintenance of Storm Drainage System

Within the Ala Wai Canal watershed, the City currently maintains nearly 2,500 inlets (catch basins and grated inlets), 1,570 manholes, and 460,000 linear feet of ditches, reinforced concrete drainage pipes, and box culverts. The City routinely inspects its drainage facilities once every five years (once per permit term) and cleans all structures that are at least 50% full. Cleaning is performed more frequently if complaints are received. The City will continue this routine maintenance through the end of the permit term (2020).

Based on historical cleaning records, approximately 1,253 structures were cleaned within the Ala Wai watershed between FY12 and FY14. Assuming similar nutrient content to that of the material collected during the street sweeping pilot study, this activity resulted in about 5,296 lbs of TN removal and 1,211 lbs of TP removal during the three year period. This results in an average reduction of 1,700 lbs of TN and 400 lbs of TP in any given year.

This activity will continue to occur once a permit term; however the City will attempt to schedule the maintenance route such that a portion of the Ala Wai canal conveyances and structures are cleaned each year. If the anticipated reductions from the collective efforts of the other activities do not adequately

account for the necessary nutrient removal quantities, storm drain maintenance may occur more frequently to increase removal rates needed to meet the annual load reduction goals.

4.3 Permanent BMP

4.3.1 Existing Permanent BMPs

Permanent BMPs mandated by the City's Rules Related to Storm Drainage Standards (rev. December 2012) have resulted in the construction of at least 12 permanent BMP structures as shown in Table 5. The estimated pollutant removal rates are based on manufacturer's reported test data and the Center for Watershed Protection's National Pollutant Removal Performance Database (September 2007). In cases where nutrient removals were not reported for proprietary devices, it was assumed that TN and TP are removed at a rate of 0.3% of TSS removal by weight based on street sweeping collections. All efficiencies were reduced by an additional 30% to account for bypass flow and/or improper/overdue maintenance by landowners.

Table 5: Summary of Existing Permanent BMPs

Location	Treatment Area (Acres)	Ave. Annual Precip (in/yr)[1]	Device	Removal Quantity[2]	
				TN (lb/yr)	TP (lb/yr)
Walmart	4.45	31.73	AquaSwirl	1.1	1.1
Nordstrom	4.02	30.40	VortSentry HS	0.9	0.9
StorQuest	0.15	32.56	Detention Vault	0	0
Royal Hawaiian S.C.	5.07	27.53	FloGard+Plus	1.0	1.0
Waikiki Beach Walk Embassy Suites	0.65	27.53	VortSentry HS	0.1	0.1
The Watermark	0.23	29.55	Insert	0.1	0.1
The Cove Waikiki	1.65	29.55	Landscaping	4.9	0.6
Allure Waikiki	0.27	29.71	Insert	0.1	0.1
Loft @ Waikiki	0.21	28.56	Biofiltration	0.5	0.1
KCAA Mother Rice Pre-School	1.21	33.11	Infiltration	4.0	0.5
Manoa Cottage East	0.5	29.53	Insert	0.1	0.1
Huapala Senior Care	1.23	66.74	Insert	0.7	0.7
TOTAL REDUCTION (lb/yr)				13.4	5.1

[1]Average Annual Precipitation estimated from long-term rainfall data (1971-2000 PRISM 30-yr normals dataset)

[2]Removal efficiency for each proprietary device is per manufacturer's reported test data. In the absence of manufacturer test data for nutrient removal efficiency rates, the estimated removal quantity is based on street sweeping data (TN and TP reductions are typically 0.3-0.4% of TSS). Removal efficiencies for landscaping (open channel), filtration, and infiltration are as reported by CWP, National Pollutant Removal Performance Database (Sept. 2007). All efficiencies have been reduced by an additional 30% to account for bypass flow and or overdue/improper maintenance.

Based on the conservative calculations for the existing permanent BMPs, it is assumed that this activity will remove 13.4 lbs of TN and 5.1 lbs of TP annually.

4.3.2 Proposed Permanent BMPs

The City is aware of the following proposed permanent BMPs that are pending completion within the current permit term:

Table 6: Summary of Proposed Permanent BMPs

Location	Treatment Area (Acres)	Ave. Annual Precip (in/yr)[1]	Device	Removal Quantity[2]	
				TN (lb/yr)	TP (lb/yr)
Ala Wai Golf Course Parking Lot	4.8	27.26	Grassed Swale	17.4	0.5
Ala Wai Community Park	0.4	29.71	Rain Garden	1.6	0.0
Ala Wai Community Park	0.4	29.71	Grate Inlet Skimmer Box	1.6	0.1
Ala Wai Community Park	0.1	29.71	Infiltration Chamber	0.3	0.0
Ala Wai Neighborhood Park	0.4	29.91	Rain Garden	1.6	0.0
TOTAL REDUCTION (lb/yr)				22.5	0.8

[1]Average Annual Precipitation estimated from long-term rainfall data (1971-2000 PRISM 30-yr normals dataset)

[2]Removal efficiency for each proprietary device is per manufacturer's reported test data. In the absence of manufacturer test data for nutrient removal efficiency rates, the estimated removal quantity is based on street sweeping data (TN and TP reductions are typically 0.3-0.4% of TSS). Removal efficiencies for landscaping (open channel), filtration, and infiltration are as reported by CWP, National Pollutant Removal Performance Database (Sept. 2007). All efficiencies have been reduced by an additional 30% to account for bypass flow and or overdue/improper maintenance.

Based on calculations similar to those present in Section 4.3.1 for existing permanent BMPs, it is assumed that the proposed permanent BMPs will remove 22.5 lbs of TN and 0.8 lbs of TP annually.

4.3.3 Future Permanent BMPs

While it is highly likely that additional permanent BMPs will be constructed and made operational during the Compliance Period, it is unknown where these devices will be located, the extent of the treatment area, and the specific treatment/device. Therefore, future BMPs will be accounted for in a similar manner as the existing BMPs once they are brought online. The addition of permanent BMP improvements throughout the watershed is anticipated to offset the need for some of the existing good housekeeping activities, such as street sweeping and drain cleaning.

4.4 Water Quality Improvement Projects

4.4.1 Drainage Ditch Emergency Repairs at 742 Hausten Street

Following heavy rains in 2011, an existing Concrete Rubble Masonry (CRM) retaining wall fronting a residence at 742 Hausten Street collapsed resulting in erosion of the resident's front yard (see Figure 4). The eroded material discharged into an un-named drainage ditch approximately ½ mile upstream of the Ala Wai Canal. The City Department of Facilities Maintenance installed temporary sand bags to prevent further soil loss while a permanent solution was being developed. In 2012, a new CRM retaining wall

was constructed at a cost of $150,000 (see Figure 5). Had the exposed slope not been repaired, the bare slope would have continued to erode indefinitely, sending nutrient laden sediment into the waterway.

Figure 4: Before Condition – Erosion Damage at Hausten Drainage Ditch

Figure 5: After Condition with New CRM Wall

Estimated pollutant reductions from this project are based on the soil erosion prevention applied to the area. The Universal Soil Loss Equation (USLE)(DPP, 1999) used to estimate soil losses and runoff from the drainage ditch in the vicinity of 742 Hausten Street is expressed as follows:

Long-term average annual soil loss, A [lbs/acre/season] = R * K * LS * C * P * 2000, where:

R = Rainfall Erosivity Factor (220)

K = Soil Erodibility Factor (0.17, EmA)

LS = Slope-Length/Slope-Gradient Factor (0.92)

C = Cover and Management Factor (1.0, Bare Soil)

P = Erosion Control Practice Factor (1.0, No Controls)

TN Load Reduction [lb] = A * A_{TOTAL} * $N_{SEDIMENT}$, where:

A = Long-term Average Annual Soil Loss (lbs/acre/year)

A_{TOTAL} = Project Area (0.0028 acre)

$N_{SEDIMENT}$ = Nitrogen content of gravel and sediment (0.0152 lb-N/lb-PM)

TP Load Reduction [lb] = A * A_{TOTAL} * $P_{SEDIMENT}$, where:

A = Long-term Average Annual Soil Loss (lbs/acre/year)

A_{TOTAL} = Project Area (0.0028 acre)

$P_{SEDIMENT}$ = Phosphorus content of gravel and sediment (0.0041 lb-P/lb-PM)

A summary of the computations is provided in Table 7.

Table 7: Summary of 742 Hausten Street Stream Bank Repair Load Reduction Computations

Annual Soil Loss, A (lbs/ac/season)	Sediment Concentration		Area (acre)	Qty Removed	
	(lb-N/lb-PM)	(lb-P/lb-PM)		TN (lb/year)	TP (lb/year)
68,816	0.0152	0.0041	0.0028	2.94	0.79

4.4.2 Drainage Ditch Repairs at 603 Isenberg Street

In 2013, an existing Concrete Masonry Unit (CMU) channel wall fronting a residence at 603 Isenberg Street collapsed resulting in erosion of subsurface material into the drainage ditch (see Figure 6). The eroded material discharged into Hausten Ditch approximately ¼ mile upstream of the Ala Wai Canal. The City Department of Facilities Maintenance installed temporary sand bags to prevent further soil loss while a permanent solution was being developed (see Figure 7). The permanent fix, which involves construction of a 44 linear foot long gabion wall, is currently under construction. Had the exposed slope not been repaired, the bare slope would have continued to erode indefinitely, sending nutrient laden sediment into the waterway.

The estimated construction cost for this project is $150,000.

Figure 6: Before Condition – Erosion Damage at Hausten Drainage Ditch in the Vicinity of 603 Isenberg Street

Figure 7: Interim Condition with Temporary Sand Bags

Similar to the ditch repair along Hausten Street (see Section 4.4.1), the USLE was used to estimate soil losses and the pollutant load reduction from this project based on the following parameters:

R = Rainfall Erosivity Factor (220)

K = Soil Erodibility Factor (0.1, FL)

LS = Slope-Length/Slope-Gradient Factor (0.92)

C = Cover and Management Factor (1.0, Bare Soil)

P = Erosion Control Practice Factor (1.0, No Controls)

A_{TOTAL} = Project Area (0.0056 acre)

The computations are summarized in Table 8 below.

Table 8: Summary of 603 Isenberg Street Stream Bank Repair Load Reduction Computations

Annual Soil Loss, A (lbs/ac/year)	Sediment Concentration		Area (acre)	Qty Removed	
	(lb-N/lb-PM)	(lb-P/lb-PM)		TN (lb/year)	TP (lb/year)
40,480	0.0152	0.0041	0.0056	3.42	0.92

4.4.3 Fiber Reinforced Concrete Fill in the Vicinity of 616 Hausten Street

A nearly 280 linear foot section of existing CRM wall in the vicinity of 616 Hausten Street was damaged in the summer of 2013. The damaged portion of the wall spanned seven residential properties (see Figure 8). The predominant form of damage was a series of voids along the base of the CRM wall that would allow the retained sediment to discharge into Hausten ditch and ultimately into Ala Wai Canal (see Figure 9). The proposed repair for this site involves filling the voids with fiber reinforced concrete fill (see shaded areas in Figure 8).

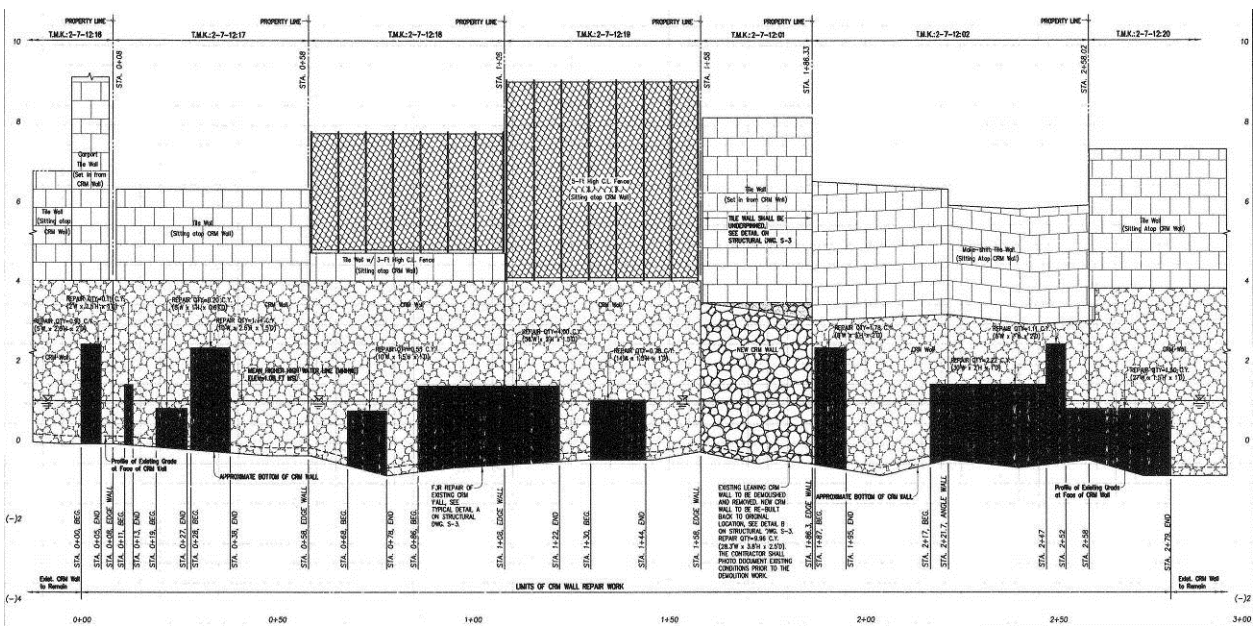

Figure 8: Preliminary Plan for Fiber Reinforced Concrete Fill Areas in the Vicinity of 616 Hausten Street

Within this stretch, a 28 linear foot CRM Wall fronting 620 Hausten Street (Sta. 1+58 to 1+86.33 in Figure 8) was deemed unsalvageable and will be reconstructed (see Figure 10). An existing wall offset towards the private property at the same location will also require additional stabilization via reinforced concrete underpinning. Had these repairs not been made, sediment would have continued to discharge to Hausten Ditch indefinitely.

The estimated construction cost for this project is $200,000.

Figure 9: Voids in Existing CRM Wall in the Vicinity of 616 Hausten Street

Figure 10: Damaged CRM Wall fronting 620 Hausten Street

Similar to the ditch repair along Hausten Street (see Section 4.4.1), the USLE was used to estimate soil losses and the pollutant load reduction from this project based on the following parameters:

R = Rainfall Erosivity Factor (220)

K = Soil Erodibility Factor (0.1, FL)

LS = Slope-Length/Slope-Gradient Factor (0.92)

C = Cover and Management Factor (1.0, Bare Soil)

P = Erosion Control Practice Factor (1.0, No Controls)

A_{TOTAL} = Project Area (0.0192 acre)

The computations are summarized in Table 9 below.

Table 9: Summary of Fiber Reinforced Concrete Fill Load Reduction Computations

Annual Soil Loss, A (lbs/ac/year)	Sediment Concentration		Area (acre)	Qty Removed	
	(lb-N/lb-PM)	(lb-P/lb-PM)		TN (lb/year)	TP (lb/year)
40,480	0.0152	0.0041	0.0192	11.82	3.19

4.4.4 Ala Wai Golf Course Grassing and Irrigation Improvements

In 2011, the City began construction on the Ala Wai Golf Course Grassing and Irrigation Improvements project. The project involved re-grassing over 9 acres of fairway and fringe areas throughout the course, including buffer areas around water hazards and nearly 4,000 linear feet of buffer along Ala Wai Canal, Manoa-Palolo Canal, and two open channels outfalling directly to Ala Wai Canal (see Figure 11). The project also replaced the aging irrigation system to ensure that the new landscaping would thrive and maintain healthy growth.

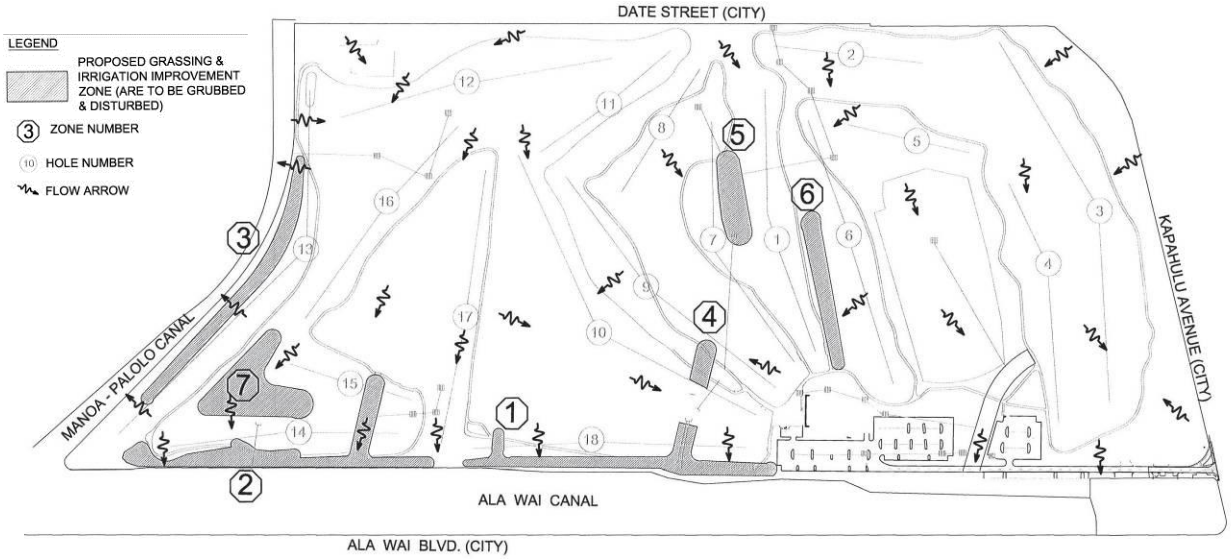

Figure 11: Ala Wai Golf Course Grassing and Irrigation Improvements Project Location Map

Similar to the ditch repair along Hausten Street (see Section 4.4.1), the USLE was used to estimate soil losses and the pollutant load reduction from this project based on the following parameters:

R = Rainfall Erosivity Factor (220)

K = Soil Erodibility Factor (0.11, FL and EmA)

LS = Slope-Length/Slope-Gradient Factor (0.28)

C = Cover and Management Factor (0.4 Before, 0.01 After)

P = Erosion Control Practice Factor (1.0, No Controls)

A_{TOTAL} = Project Area (9.1 acre)

The computations are summarized in Table 10 below.

Table 10: Summary of Ala Wai Golf Course Grassing and Irrigation Improvements Project

Condition	Annual Soil Loss, A (lbs/ac/year)	Sediment Concentration		Area (acre)	Nutrient Load	
		(lb-N/lb-PM)	(lb-P/lb-PM)		TN (lb/year)	TP (lb/year)
Before	5,578	0.0152	0.0041	9.1	769.1	207.4
After	139	0.0152	0.0041	9.1	19.2	5.2
TOTAL REDUCTION (lb/yr)					749.8	202.3

Based on the soil loss calculations of before and after conditions, it is anticipated that this improvement will reduce TN loadings by 749.8 lbs per year and TP loadings by 202.3 lbs per year.

4.4.5 Ala Wai Driving Range Improvements NPDES Small MS4 Permit Program

The City is currently finalizing design plans to re-grass the Ala Wai Golf Course driving range which is largely exposed dirt (see Figure 12). The 7 acre site will also be retrofitted with an irrigation system to ensure continued healthy plant growth.

Figure 12: Ala Wai Golf Course Driving Range (Google Earth 2009)

Similar to the ditch repair along Hausten Street (see Section 4.4.1), the USLE was used to estimate soil losses and the pollutant load reduction from this project based on the following parameters:

R = Rainfall Erosivity Factor (220)

K = Soil Erodibility Factor (0.16, FL and EmA)

LS = Slope-Length/Slope-Gradient Factor (0.11)

C = Cover and Management Factor (0.9 Before, 0.01 After)

P = Erosion Control Practice Factor (1.0, No Controls)

A_{TOTAL} = Project Area (7.0 acre)

The computations are summarized in Table 11 below.

Table 11: Summary of Ala Wai Golf Course Driving Range Improvements Project

Condition	Annual Soil Loss, A (lbs/ac/year)	Sediment Concentration		Area (acre)	Nutrient Load	
		(lb-N/lb-PM)	(lb-P/lb-PM)		TN (lb/year)	TP (lb/year)
Before	6,795	0.0152	0.0041	7.0	726.6	196.0
After	76	0.0152	0.0041	7.0	8.1	2.2
TOTAL REDUCTION (lb/yr)					718.5	193.8

Based on the soil loss calculations of before and after conditions, it is anticipated that this improvement will reduce TN loadings by 718.5 lbs per year and TP loadings by 193.8 lbs per year.

4.5 Summary of BMP Activities

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

Table 12: Summary of BMP Activities and Quantitative Reductions

	TN Reduction (lbs/year)	TP Reduction (lbs/year)
Downspout Disconnect	*	*
Public Outreach and Education	*	*
Volunteer Cleanup Events	150	45
Water Quality Improvement Projects	1,486	401
Street Sweeping (Day shift)	6,092	1,228
Street Sweeping (Waikiki Night shift)	1,876	392
Permanent BMPs (existing)	13.4	5.1
Permanent BMPs (proposed)	22.5	0.8
Stream Cleaning	2,300	510
Storm Drain Maintenance	1,700	400
TOTAL	13,640	2,982
REDUCTIONS REQUIRED	7,947	2,853

*The City will conduct a public education and outreach program to all homeowners within the watershed; however, due to difficulty in quantifying pollutant load reductions due to behavior changes, no homeowner contribution is assumed for accounting purposes at this time.

**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.

4.6 Summary of Activities to be Tracked

The City will meet the specified TN and TP annual load reduction goals by employing a combination of street sweeping, stream cleaning, storm drain maintenance, hosting volunteer cleanup events, maintaining water quality improvement project sites, and inspecting/maintaining/installing permanent BMP devices.

The City intends to continue routine street sweeping within the Ala Wai Canal watershed indefinitely. The quantity of material collected, the debris composition, and the laboratory analysis of the particulate and organic matter will continue through the end of the street sweeping pilot study (December 2016). At the conclusion of the pilot study, laboratory analysis for the nutrient content of the collected material will cease and the two 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 FY18. 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 will also track and quantify the material removed and debris composition from stream and storm drain cleaning operations until the end of FY18. Laboratory analysis of the material collected is not

anticipated to be conducted since the nutrient content is expected to be similar to that of the street sweeping material. Beginning in FY19, the City will utilize the historical collection data along with the street sweeping pilot study data to determine the basic level of stream and storm drain cleaning necessary to meet the pollutant load reduction goal and ultimately the City's WLA

The City will continue to track the number of trash bags of material collected through public outreach events indefinitely. Laboratory analysis of the material collected is not anticipated to be conducted.

The City will also maintain the water quality improvement sites indefinitely. Maintenance activities will include period site visits to visually inspect for signs of erosion or damage. The sites will also be inspected following periods of heavy rainfall. If repairs are required, they will be conducted at that time of the site visit.

It is anticipated that the following activities will occur at the following frequencies and be tracked on an annual basis.

- Street sweeping collections – approximately 40 weeks/yr
- Stream cleaning – approximately 5 days per year
- Storm drain maintenance – approximately 400 per year
- Hosting volunteer events – approximately once per quarter
- Maintaining water quality improvement project sites – indefinitely
- Inspecting/maintaining existing permanent BMP devices – indefinitely
- Constructing new permanent BMP devices – case by case basis

The City also intends to conduct the following public outreach and educational efforts, but due to a lack of a methodology to account for nutrient reductions, there is no tracking protocol or timeline for implementation:

- Public outreach efforts informing homeowners of how their actions affect water quality in the Ala Wai Canal; and
- Public outreach efforts targeted to homeowners who could make improvements around their homes such as disconnecting roof drains.

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.

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5.0 Compliance Schedule

The achievement of the City's WLA for the Ala Wai Canal Watershed will occur over a period of six years with a final compliance deadline of June 30, 2021. Based on historical collections, it is anticipated that a combination of street sweeping, stream cleaning, storm drain maintenance, hosting volunteer cleanup events, maintaining water quality improvement project sites, and inspecting/maintaining/installing permanent BMP devices will collect or treat sediment and organic matter in sufficient quantity to meet the annual TN and TP load reduction goals.

Since street sweeping accounts for the largest portion of the pollutant load reduction, the actual level of other activities required to meet the reduction goals won't be known until the conclusion of the pilot study. 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 FY20 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 13: Schedule of Compliance

Due No Later Than:	Milestone / Deliverable
June 30, 2015	• Submit updated I&M Plan per Part F.3.a • Continue 2-yr street sweeping pilot study (quantity of material collected, debris composition, and TN/TP analysis)
June 30, 2016	• Continue 2-yr street sweeping pilot study (quantity of material collected, debris composition, and TN/TP analysis)
December 31, 2016	• Complete street sweeping pilot study (TN/TP analysis) • Continue numerical tracking of GH activities (quantity of material collected and debris composition)
December 31, 2017	• Continue numerical tracking of GH activities (quantity of material collected and debris composition) • Submit street sweeping pilot study report and provide summary of street sweeping material analyzed during pilot study
June 30, 2018	• Complete numerical tracking of GH activities (quantity of material collected and debris composition)
June 30, 2019	• Complete analysis of GH numerical tracking data to determine basic level of activities necessary
June 30, 2020	• If additional activities are required, submit revised I&M Plan which outlines additional activities to be implemented[1]
June 30, 2021	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.

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