Action Plan for Retrofitting Structural BMPs

PROTECT OUR WATER

MĀLAMA I KA WAI

STATE OF HAWAII DEPARTMENT OF TRANSPORTATION

www.stormwaterhawaii.com

Hawaii State Department of Transportation
Highways Division, Oahu District
Storm Water Management Program
NPDES Permit No. HI S000001
April 2015

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Action Plan for Retrofitting Structural BMPs

State of Hawaii Department of Transportation
Highways Division, Oahu District

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ACRONYMS AND ABBREVIATIONS

BMP	Best Management Practice
CWA	Clean Water Act
DOH	State of Hawaii Department of Health
DOT-HWYS	State of Hawaii Department of Transportation, Highways Division, Oahu District
MP	Mile Post
MS4	Municipal Separate Storm Sewer System
MS4 Permit	DOT-HWYS' NPDES Permit No. HI S000001
NPDES	National Pollutant Discharge Elimination System
PID	Point Identification Number
ROW	Right-of-Way
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorous
TSS	Total Suspended Solids
WLA	Waste Load Allocation

1. INTRODUCTION

As required by Part D.1.f.(1).(iv) of the State of Hawaii Department of Transportation, Highways Division, Oahu District's (DOT-HWYS') National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit No. HI S000001 (hereinafter referred to as "MS4 Permit"), DOT-HWYS has developed the following Action Plan for Retrofitting Structural Best Management Practices (BMPs) in their existing MS4. The MS4 Permit requirements are as follows:

> *Pollution Prevention/Good Housekeeping D.1.f.(1).(iv)*
> *"Action Plan for Retrofitting Structural BMPs – Provide the DOH with an Action Plan for Retrofitting Structural BMPs within one (1) year of the effective date of this permit, which shall identify retrofits to be implemented, explanation on the basis of their selection and an implementation schedule. The implementation schedule shall cover a five (5) year period and be updated yearly to include additional retrofit projects with water quality protection measures. The annual updates to the implementation schedule shall be included in the Annual Report with a description of the projects status. The Action Plan may include, but not be limited to projects in compliance with any TMDL implementation and monitoring plan."*

2. SELECTION OF RETROFIT SITES

The purpose of the Action Plan for Retrofitting Structural BMPs is to reduce storm water pollution by designing and constructing/installing appropriate and cost-effective BMPs (retrofits) in strategic locations and structures within DOT-HWYS' existing MS4. Potential retrofit sites were selected through the review of previous MS4 studies and from data collected during routine MS4 monitoring and maintenance activities. The following criteria were used to determine final site selections for the action plan's five year implementation schedule:

1. Verified as a structure or feature of the DOT-HWYS' MS4;
2. Located within DOT-HWYS' right-of-way (ROW), or known to have an access easement, and have readily available construction and maintenance access;
3. Located in a Total Maximum Daily Load (TMDL) or Clean Water Act (CWA) Section 303d listed watershed; and having
4. Significant catchment of runoff from DOT-HWYS' roadway and/or ROW.

3. SUMMARY OF RETROFIT PROJECTS

A total of 30 sites were selected for retrofits throughout DOT-HWYS' MS4 during the five-year implementation period. In addition, approximately eight retrofits are proposed for the DOT-HWYS' Pearl City Baseyard. Site-specific retrofit methods and technologies were chosen based on an evaluation of existing MS4 structures, construction access, maintenance requirements and pollutants of concern at each site. The proposed retrofits include bioswales, settling basins, catch basin inserts, baffle boxes and downspout filters that will treat storm water runoff from approximately 85 acres, including approximately 24 acres of impervious surface. **Table 1** provides a summary of proposed retrofit projects along with their proposed five-year implementation schedule. The implementation year is the year in which the proposed retrofit is scheduled to be completed; however, this schedule is subject to change due to funding availability, permitting delays, or other unforeseen circumstances. Changes to the implementation schedule will be provided in the Annual Report.

Table 1. Proposed Retrofit Sites and Implementation Schedule

Retrofit Site	Retrofit Structure PID	Retrofit Type	Watershed	WLA/TMDL	CWA Section 303(d) Listed	Drainage Areas (Acres)	Impervious Drainage Area (Acres)	Implementation Year
1	600387	Bioswale and Settling Basin	Ala Wai	TN, TP	TN, TP, Turb, chl-a(N), Fecal	1.69	0.91	2015
2	600380	Bioswale and CRM Apron	Ala Wai	TN, TP	TN, TP, Turb, chl-a(N), Fecal	1.46	0.70	2015
3	104155	Bioswale and Settling Basin	Kaneohe	TSS, TN, TP	TN, TP, NO2+NO3, Turb, Dieldrin	1.83	0.83	2016
4	105924	Catch Basin Insert	Kaneohe	TSS, TN, TP	TN, TP, NO2+NO3, Turb, Dieldrin	2.73	0.14	2016
5	106986	Catch Basin Insert	Kaneohe	TSS, TN, TP	TN, TP, NO2+NO3, Turb, Dieldrin	1.87	0.19	2016
6	105923	Catch Basin Insert	Kaneohe	TSS, TN, TP	TN, TP, NO2+NO3, Turb, Dieldrin	4.85	0.34	2016
7	105643	Catch Basin Insert	Kaneohe	TSS, TN, TP	TN, TP, NO2+NO3, Turb, Dieldrin	1.87	0.91	2016
8	105642	Catch Basin Insert	Kaneohe	TSS, TN, TP	TN, TP, NO2+NO3, Turb, Dieldrin	0.94	0.34	2016
9	105644	Catch Basin Insert	Kaneohe	TSS, TN, TP	TN, TP, NO2+NO3, Turb, Dieldrin	0.55	0.28	2016
10	105646	Catch Basin Insert	Kaneohe	TSS, TN, TP	TN, TP, NO2+NO3, Turb, Dieldrin	0.45	0.45	2016
11	105645	Catch Basin Insert	Kaneohe	TSS, TN, TP	TN, TP, NO2+NO3, Turb, Dieldrin	1.68	0.21	2016
12	505398	Baffle Box	Kaneohe	TSS, TN, TP	TN, TP, NO2+NO3, Turb, Dieldrin	17.59	0.5	2016
13	400671	Settling Basin	Kapaa	TSS, TN, TP	TN, TP, NO2+NO3, Turb, TSS, Metals, Lead	8.72	0	2016
14	108140	Nutrient Separating Baffle Box	Kawa	TSS, TN, TP	TN, TP, NO2+NO3, Turb, TSS	7	5	2017
15	601391	Bioswale	Kawa	TSS, TN, TP	TN, TP, NO2+NO3, Turb, TSS	3.04	1.3	2017
16	105648	Bioswale	Kapaa	TSS, TN, TP	TN, TP, NO2+NO3, Turb, TSS, Metals, Lead	2.79	0.89	2018
17	105913	Bioswale	Kapaa	TSS, TN, TP	TN, TP, NO2+NO3, Turb, TSS, Metals, Lead	0.57	0.39	2018
18	105914	Bioswale	Kapaa	TSS, TN, TP	TN, TP, NO2+NO3, Turb, TSS, Metals, Lead	1.61	0.93	2018
19	105915	Bioswale	Kapaa	TSS, TN, TP	TN, TP, NO2+NO3, Turb, TSS, Metals, Lead	0.83	0.47	2018
20	105917	Bioswale	Kapaa	TSS, TN, TP	TN, TP, NO2+NO3, Turb, TSS, Metals, Lead	2.23	0.94	2018
21	104362	Bioswale	Kapaa	TSS, TN, TP	TN, TP, NO2+NO3, Turb, TSS, Metals, Lead	0.9	0.59	2018
22	104360	Bioswale	Kapaa	TSS, TN, TP	TN, TP, NO2+NO3, Turb, TSS, Metals, Lead	0.33	0.23	2018
23	104359	Bioswale	Kapaa	TSS, TN, TP	TN, TP, NO2+NO3, Turb, TSS, Metals, Lead	0.33	0.23	2018
24	104357	Bioswale	Kapaa	TSS, TN, TP	TN, TP, NO2+NO3, Turb, TSS, Metals, Lead	0.2	0.12	2018
25	105651	Bioswale	Kapaa	TSS, TN, TP	TN, TP, NO2+NO3, Turb, TSS, Metals, Lead	1.66	1.26	2018
26	108195	Bioswale	Kawainui	TSS, TN, TP	TN, TP, NO2+NO3, Turb, TSS, Metals, Lead	0.73	0.24	2018
27	108199	Bioswale	Kawainui	TSS, TN, TP	TN, TP, NO2+NO3, Turb, TSS, Metals, Lead	2.16	0.45	2018
28	112422	Bioswale	Kawainui	TSS, TN, TP	TN, TP, NO2+NO3, Turb, TSS, Metals, Lead	0.17	0.05	2018
29	104710	Bioswale	Kapaa	TSS, TN, TP	TN, TP, NO2+NO3, Turb, TSS, Metals, Lead	1.22	0.41	2018
30	104712	Bioswale	Kapaa	TSS, TN, TP	TN, TP, NO2+NO3, Turb, TSS, Metals, Lead	2.88	1.45	2018

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A detailed description of each retrofit site, including a vicinity map and a summary of the basis for their selection, is provided in **Appendix A**. **Table 2** provides a summary of proposed retrofits for the Pearl City Baseyard. More detailed information regarding the proposed Pearl City Baseyard retrofits is provided in **Appendix B**.

Table 2. Proposed Pearl City Baseyard Retrofits

Retrofit (Qty)	Watershed	WLA/TMDL	CWA Section 303(d) Listed	Implementation Year
Downspout Filter (5)	Waiawa	None	TN, TP, NO2+NO3, Turb, trash - H(IP)	2017
Level Spreader (2)	Waiawa	None	TN, TP, NO2+NO3, Turb, trash - H(IP)	2017
Grassed Swale (1)	Waiawa	None	TN, TP, NO2+NO3, Turb, trash - H(IP)	2017

4. FUTURE RETROFIT PROJECTS

As required by Part D.1.f.(1).(iv) of the MS4 Permit, this Action Plan for Retrofitting Structural BMPs will be updated annually to identify additional retrofit projects. Future retrofits will be selected through the review and evaluation of sites identified as potential projects in previous studies and from the review of data collected during ongoing inspections of the MS4.

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Action Plan for Retrofitting Structural BMPs

APPENDIX A: PROPOSED RETROFIT SITE SUMMARIES

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Retrofit Site 1

Associated PID(s): 600387, 303542, 107624

Receiving Water Body: Ala Wai Canal

TMDL/WLA: TN, TP

303(d) Listings: TN, TP, Turb, chl-a(N), Fecal

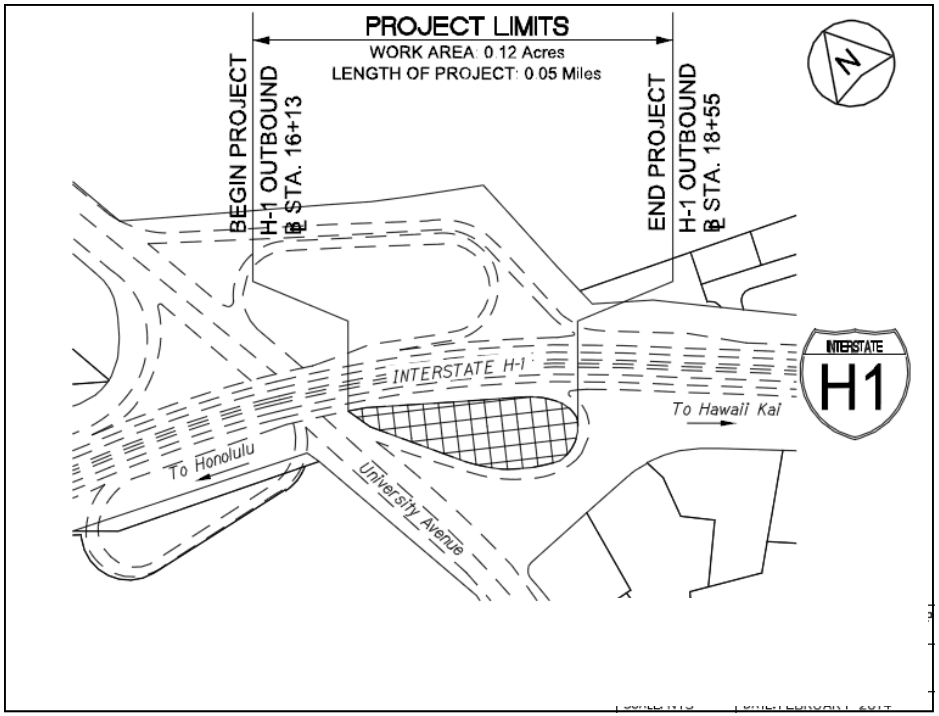
Drainage Area: 1.69 acres

Impervious Area: 0.91 acres

Proposed Retrofit(s): Bioswale and settling basin

The University Avenue Cloverleaf East site consists of a grassy area bounded by the off-ramp from H-1 eastbound to University Avenue (MP 24.20 to 24.30). An inlet on H-1 collects runoff from the eastbound lanes of the highway and conveys it into a concrete open channel that discharges within the cloverleaf. This runoff then sheet flows into a drainage structure near the end of the off-ramp at University Avenue and connects to the CCH's MS4 system.

The proposed bioswale would be constructed between the inlet and outlet located within the cloverleaf, providing treatment to storm water runoff from the adjacent eastbound lanes of H-1. Additionally, the proposed settling basin would provide pre-treatment to storm water before it enters the bioswale, increasing overall pollutant removal efficiencies.



Location Map

Proposed bioswale location

Retrofit Site 2

Associated PID(s): 600380, 600379, 401033

Receiving Water Body: Ala Wai Canal

TMDL/WLA: TN, TP

303(d) Listings: TN, TP, Turb, chl-a(N), Fecal

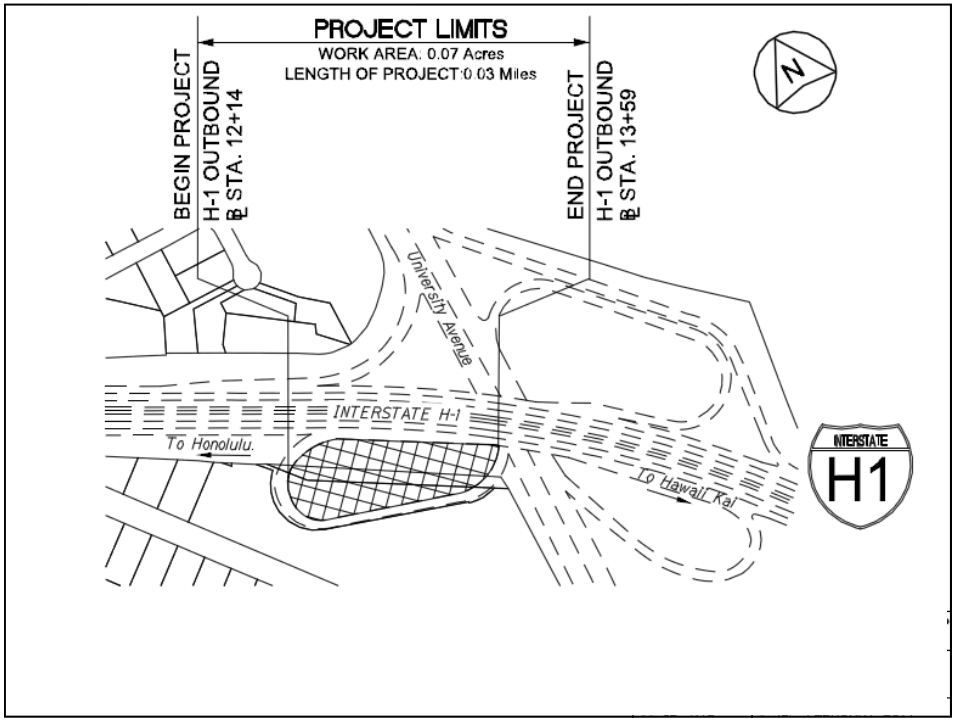
Drainage Area: 1.46 acres

Impervious Area: 0.70 acres

Proposed Retrofit(s): Bioswale and CRM Apron

The University Avenue Cloverleaf West site consists of a grassy area bounded by the on-ramp from University Avenue to H-1 eastbound (MP 24.10 to 24.20). An existing concrete open channel collects runoff from H-1 and conveys it into the CCH's MS4 system via a 24-inch drain line. Flow also enters this drainage basin via a catch basin along the on-ramp.

The proposed bioswale would be constructed between the inlet and outlet located within the cloverleaf and would replace the existing open concrete channel, providing treatment to storm water runoff from the adjacent eastbound lanes of H-1.



Location Map

Proposed bioswale location

Retrofit Site 3

Associated PID(s): 104155

Receiving Water Body: Kaneohe Stream

TMDL/WLA: TSS, TN, TP

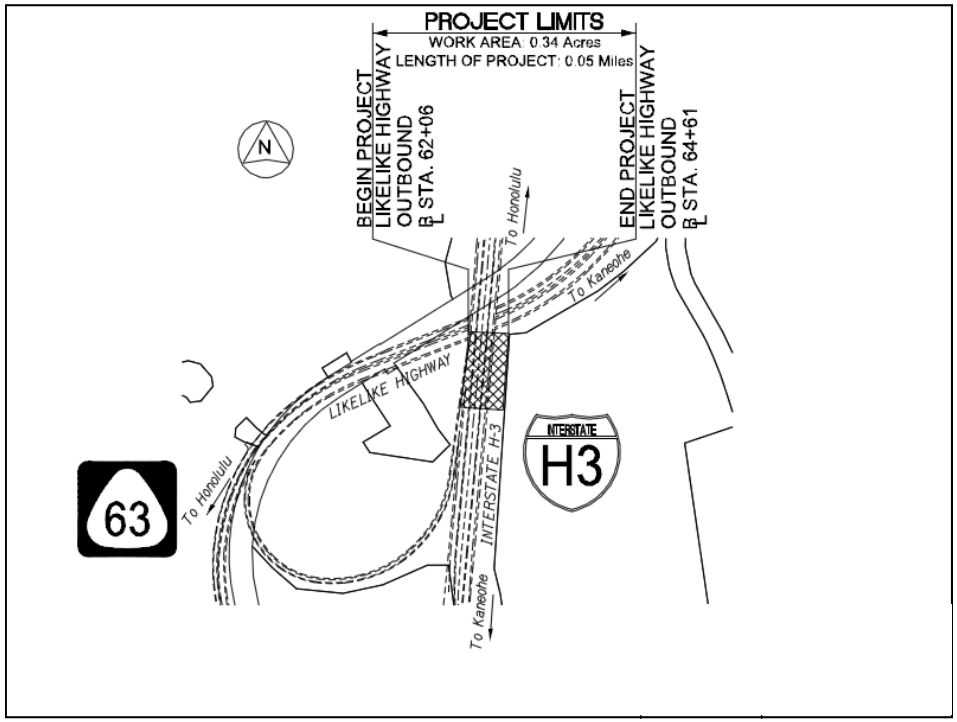
303(d) Listings: TN, TP, NO2+NO3, Turb, Dieldrin - TMDLs approved (sediment and nutrients)

Drainage Area: 1.83 acres

Impervious Area: 0.83 acres

Proposed Retrofit(s): Bioswale and Settling Basin

The H-3 Freeway & Likelike Highway Interchange site is located along the Likelike Highway eastbound lanes beneath, and adjacent to, the H-3 Freeway overpass in Kaneohe. The proposed bioswale will provide treatment for runoff from approximately fifteen H-3 Freeway deck drains and downspouts. In addition, runoff flowing into inlet PID 104155 along Likelike Highway will be diverted into the bioswale for water quality treatment. Construction of a settling basin and apron inline with the bioswale is also proposed to provide storm water pretreatment. A flow dispersal trench at the end of the bioswale will be used to disperse flow into the vegetated area downstream of the system.



Location Map

Proposed bioswale location

Retrofit Site 4

Associated PID(s): 105924

Receiving Water Body: Kaneohe Stream

303(d) Listings: TN, TP, NO2+NO3, Turb, Dieldrin - TMDLs approved (sediment and nutrients)

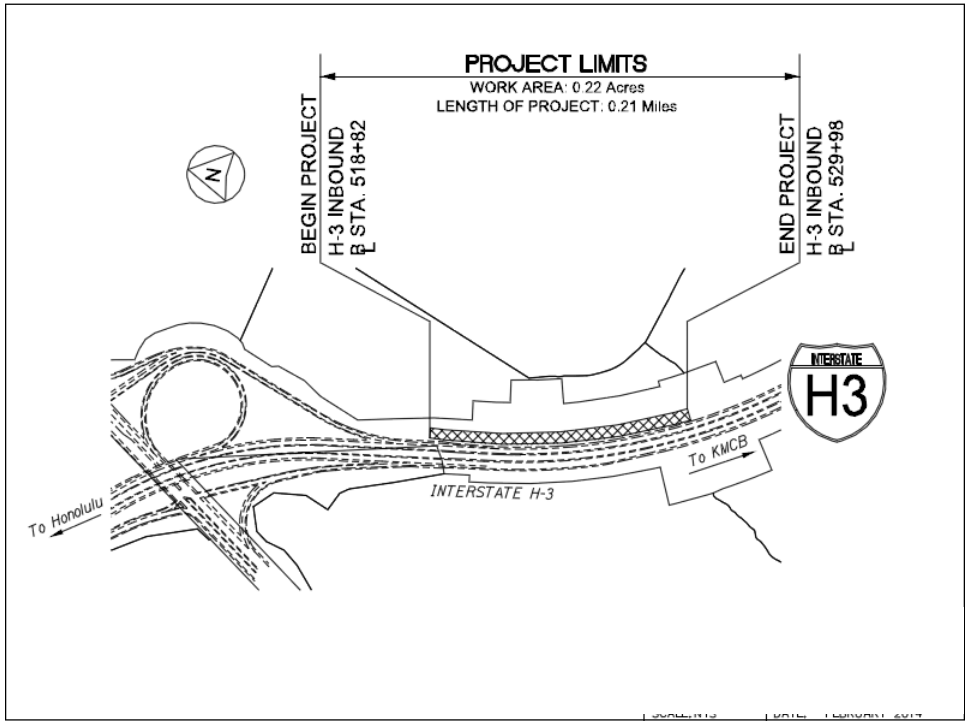
TMDL/WLA: TSS, TN, TP

Drainage Area: 2.73 acres

Impervious Area: 0.14 acres

Proposed Retrofit(s): Catch basin insert

In an ongoing effort to meet WLA requirements in the Kaneohe watershed, eight catch basin inserts are proposed along the H-3 Freeway near the Halekou Interchange in Kaneohe. Vegetated walls are also proposed for the eroded slopes adjacent to the catch basin insert locations to reduce sediment loading and to increase the effectiveness of the inserts. The inserts are designed to remove pollutants and trash by means of screening, separation, and media filtration.



Location Map

Catch basin 105924

Retrofit Site 5

Associated PID(s): 106986

Receiving Water Body: Kaneohe Stream

303(d) Listings: TN, TP, NO2+NO3, Turb, Dieldrin - TMDLs approved (sediment and nutrients)

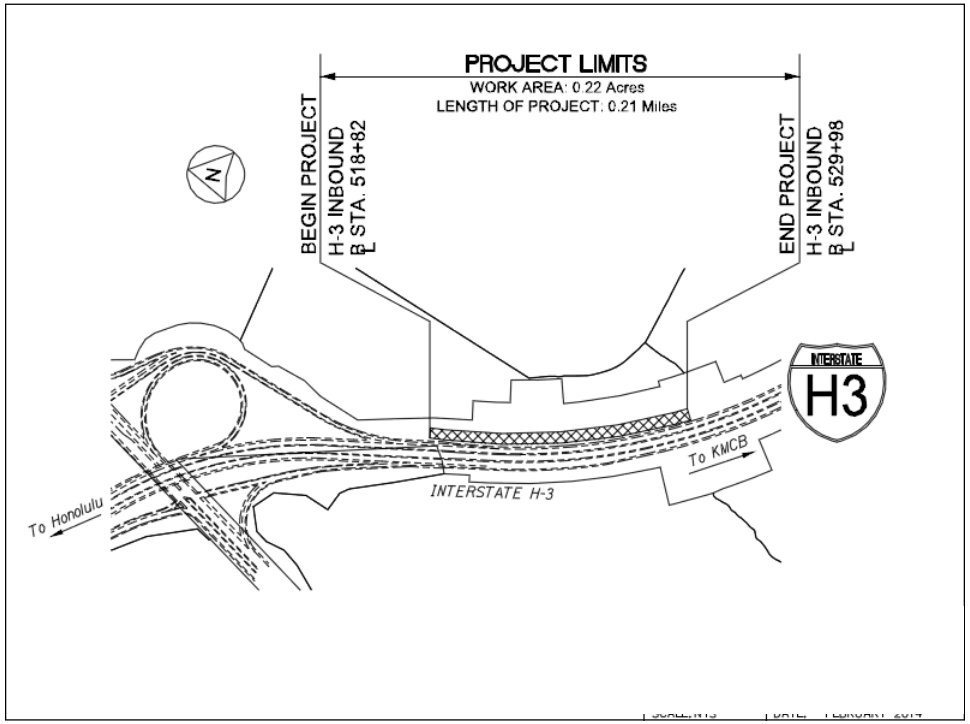
TMDL/WLA: TSS, TN, TP

Drainage Area: 1.87 acres

Impervious Area: 0.19 acres

Proposed Retrofit(s): Catch basin insert

In an ongoing effort to meet WLA requirements in the Kaneohe watershed, eight catch basin inserts are proposed along the H-3 Freeway near the Halekou Interchange in Kaneohe. Vegetated walls are also proposed for the eroded slopes adjacent to the catch basin insert locations to reduce sediment loading and to increase the effectiveness of the inserts. The inserts are designed to remove pollutants and trash by means of screening, separation, and media filtration.



Location Map

Catch basin 106986

Retrofit Site 6

Associated PID(s): 105923

Receiving Water Body: Kaneohe Stream

303(d) Listings: TN, TP, NO2+NO3, Turb, Dieldrin - TMDLs approved (sediment and nutrients)

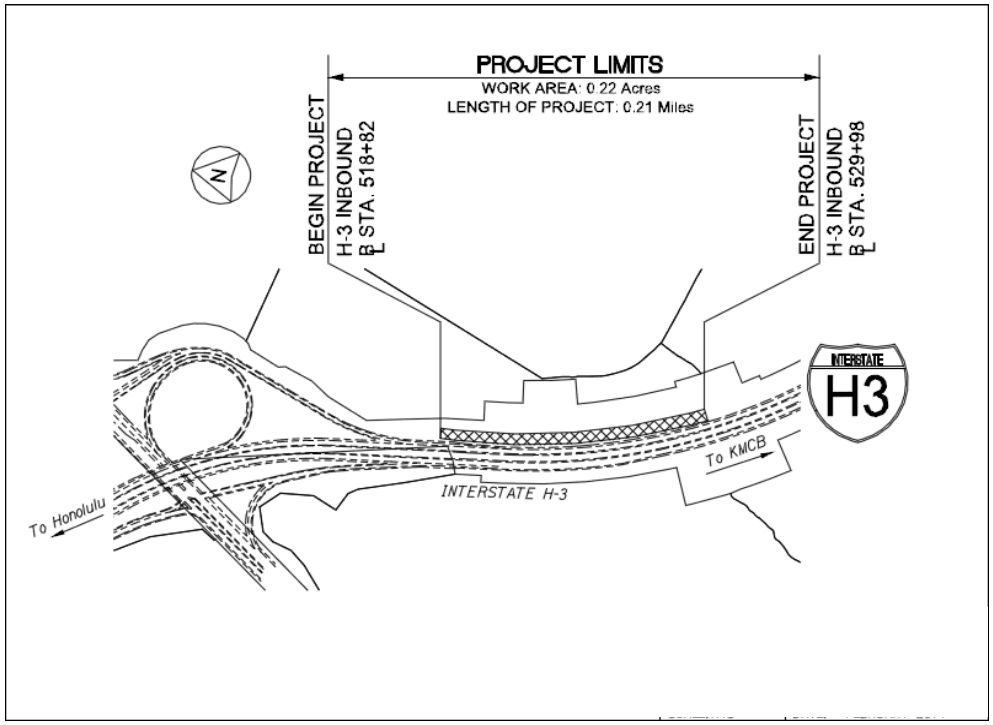
TMDL/WLA: TSS, TN, TP

Drainage Area: 4.85 acres

Impervious Area: 0.34 acres

Proposed Retrofit(s): Catch basin insert

In an ongoing effort to meet WLA requirements in the Kaneohe watershed, eight catch basin inserts are proposed along the H-3 Freeway near the Halekou Interchange in Kaneohe. Vegetated walls are also proposed for the eroded slopes adjacent to the catch basin insert locations to reduce sediment loading and to increase the effectiveness of the inserts. The inserts are designed to remove pollutants and trash by means of screening, separation, and media filtration.



Location Map

Catch Basin 105923

Retrofit Site 7

Associated PID(s): 105643

Receiving Water Body: Kaneohe Stream

303(d) Listings: TN, TP, NO2+NO3, Turb, Dieldrin - TMDLs approved (sediment and nutrients)

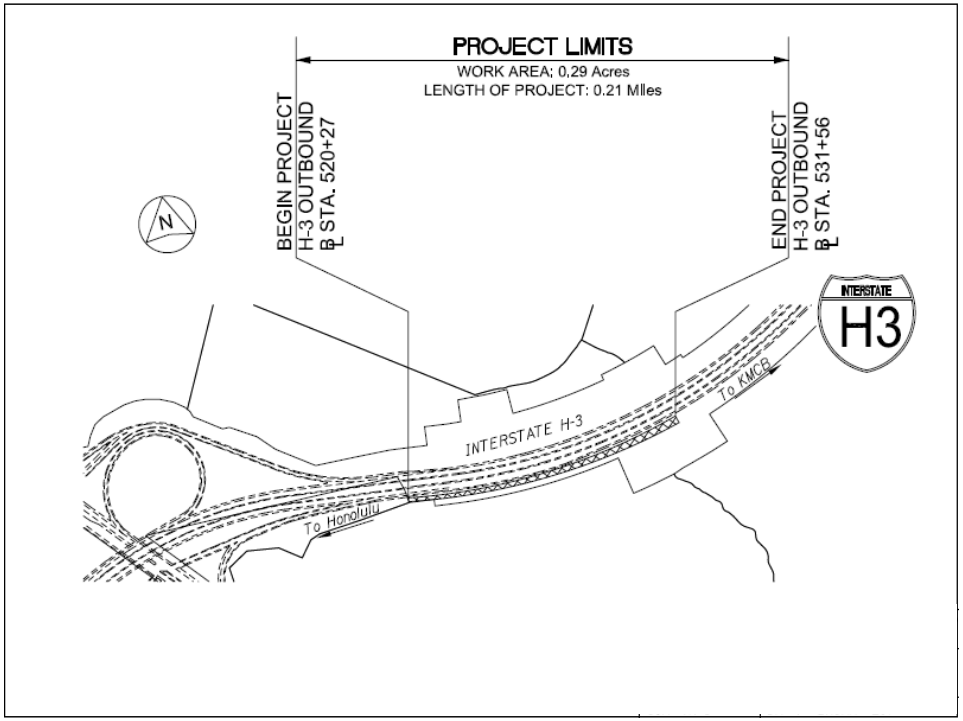
TMDL/WLA: TSS, TN, TP

Drainage Area: 1.87 acres

Impervious Area: 0.91 acres

Proposed Retrofit(s): Catch basin insert

In an ongoing effort to meet WLA requirements in the Kaneohe watershed, eight catch basin inserts are proposed along the H-3 Freeway near the Halekou Interchange in Kaneohe. Vegetated walls are also proposed for the eroded slopes adjacent to the catch basin insert locations to reduce sediment loading and to increase the effectiveness of the inserts. The inserts are designed to remove pollutants and trash by means of screening, separation, and media filtration.



Location Map

Catch Basin 105643

Retrofit Site 8

Associated PID(s): 105642

Receiving Water Body: Kaneohe Stream

303(d) Listings: TN, TP, NO2+NO3, Turb, Dieldrin - TMDLs approved (sediment and nutrients)

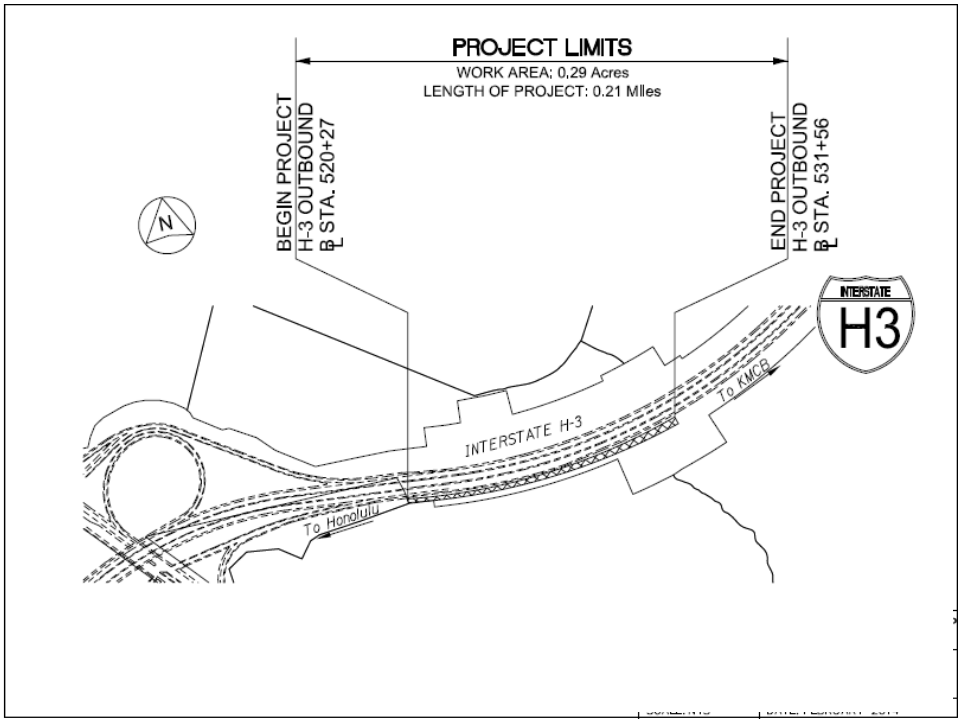
TMDL/WLA: TSS, TN, TP

Drainage Area: 0.94 acres

Impervious Area: 0.34 acres

Proposed Retrofit(s): Catch basin insert

In an ongoing effort to meet WLA requirements in the Kaneohe watershed, eight catch basin inserts are proposed along the H-3 Freeway near the Halekou Interchange in Kaneohe. Vegetated walls are also proposed for the eroded slopes adjacent to the catch basin insert locations to reduce sediment loading and to increase the effectiveness of the inserts. The inserts are designed to remove pollutants and trash by means of screening, separation, and media filtration.



Location Map

Catch Basin 105642

Retrofit Site 9

Associated PID(s): 105644

Receiving Water Body: Kaneohe Stream

303(d) Listings: TN, TP, NO2+NO3, Turb, Dieldrin - TMDLs approved (sediment and nutrients)

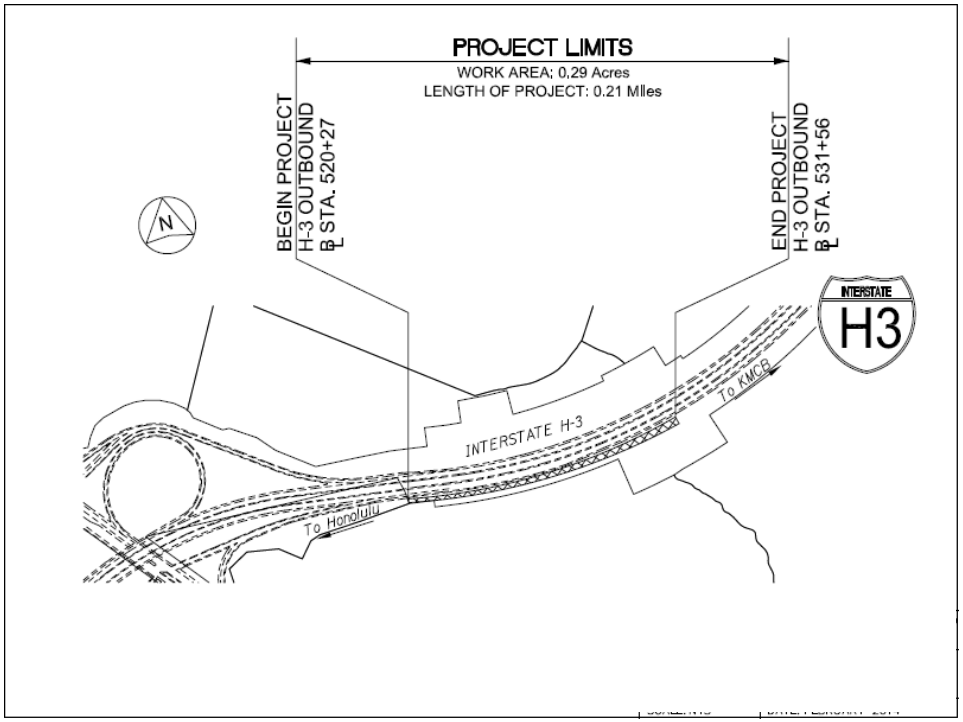
TMDL/WLA: TSS, TN, TP

Drainage Area: 0.55 acres

Impervious Area: 0.28 acres

Proposed Retrofit(s): Catch basin insert

In an ongoing effort to meet WLA requirements in the Kaneohe watershed, eight catch basin inserts are proposed along the H-3 Freeway near the Halekou Interchange in Kaneohe. Vegetated walls are also proposed for the eroded slopes adjacent to the catch basin insert locations to reduce sediment loading and to increase the effectiveness of the inserts. The inserts are designed to remove pollutants and trash by means of screening, separation, and media filtration.



Location Map

Catch basin 105644

Retrofit Site 10

Associated PID(s): 105646

Receiving Water Body: Kaneohe Stream

303(d) Listings: TN, TP, NO2+NO3, Turb, Dieldrin - TMDLs approved (sediment and nutrients)

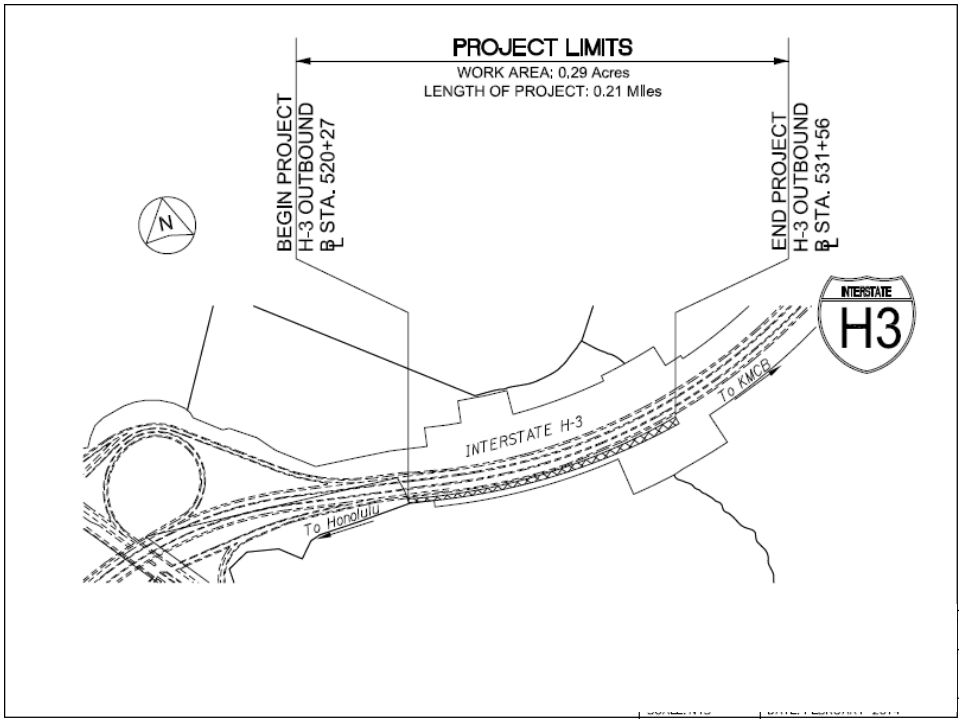
TMDL/WLA: TSS, TN, TP

Drainage Area: 0.45 acres

Impervious Area: 0.45 acres

Proposed Retrofit(s): Catch basin insert

In an ongoing effort to meet WLA requirements in the Kaneohe watershed, eight catch basin inserts are proposed along the H-3 Freeway near the Halekou Interchange in Kaneohe. Vegetated walls are also proposed for the eroded slopes adjacent to the catch basin insert locations to reduce sediment loading and to increase the effectiveness of the inserts. The inserts are designed to remove pollutants and trash by means of screening, separation, and media filtration.



Location Map

Catch Basin 105646

Retrofit Site 11

Associated PID(s): 105645

Receiving Water Body: Kaneohe Stream

303(d) Listings: TN, TP, NO2+NO3, Turb, Dieldrin - TMDLs approved (sediment and nutrients)

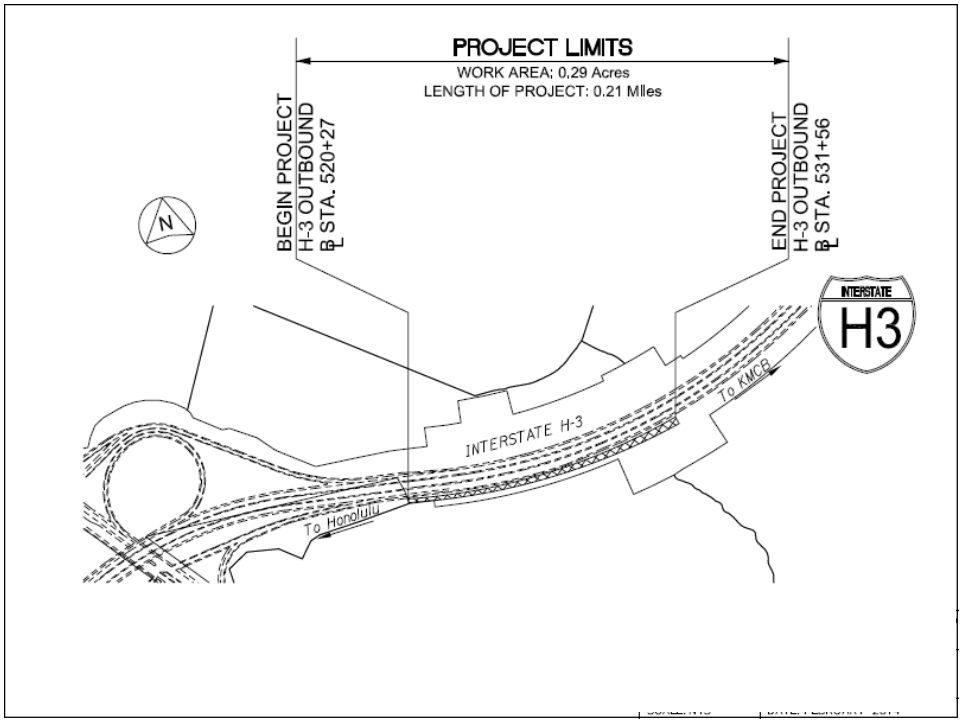
TMDL/WLA: TSS, TN, TP

Drainage Area: 1.68 acres

Impervious Area: 0.21 acres

Proposed Retrofit(s): Catch basin insert

In an ongoing effort to meet WLA requirements in the Kaneohe watershed, eight catch basin inserts are proposed along the H-3 Freeway near the Halekou Interchange in Kaneohe. Vegetated walls are also proposed for the eroded slopes adjacent to the catch basin insert locations to reduce sediment loading and to increase the effectiveness of the inserts. The inserts are designed to remove pollutants and trash by means of screening, separation, and media filtration.



Location Map

Catch basin 105645

Retrofit Site 12

Associated PID(s): 505398

Receiving Water Body: Kaneohe Stream

303(d) Listings: TN, TP, NO2+NO3, Turb, Dieldrin - TMDLs approved (sediment and nutrients)

TMDL/WLA: TSS, TN, TP

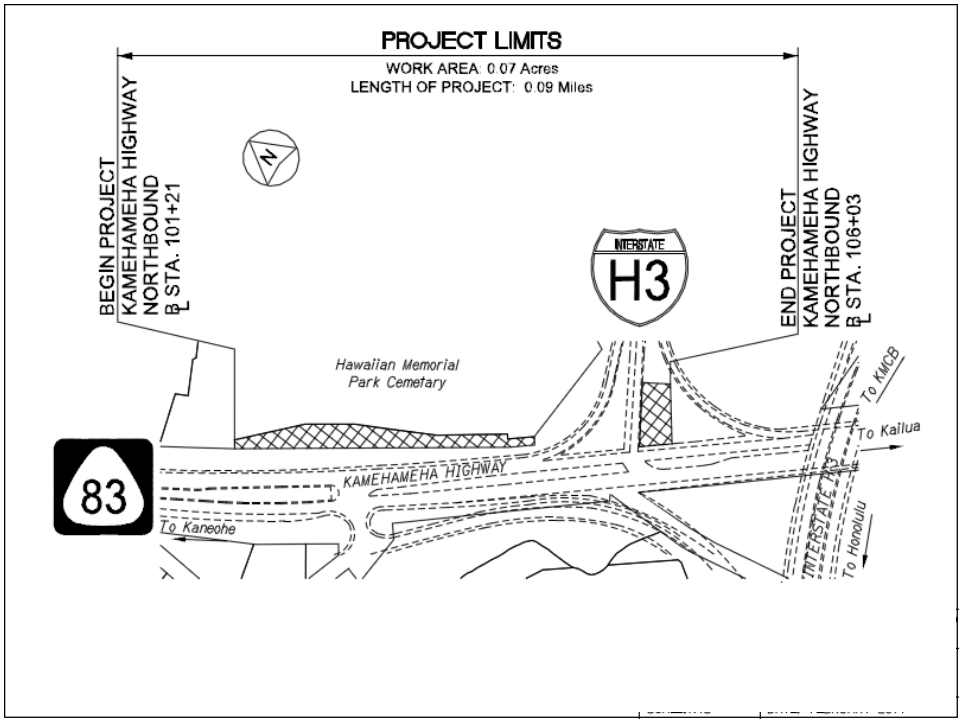
Drainage Area: 17.59 acres

Impervious Area: 0.5 acres

Proposed Retrofit(s): Baffle Box

A baffle box treatment system is proposed for installation into a 60” pipe that collects storm water from two catch basins adjacent to the H-3 Freeway. Storm water from this pipe discharges to an open channel within Halekou Interchange that passes below Kamehameha Highway which ultimately discharges into Kaneohe Stream.

The baffle box will capture sediment as well as trash within the H-3 Freeway/Kamehameha Highway area through a hydrodynamic separator system consisting of multiple sediment removal chambers.



Location Map

Outfall downstream of proposed Baffle Box

Retrofit Site 13

Associated PID(s): 400671

Receiving Water Body: Kapaa Stream

TMDL/WLA: TSS, TN, TP

303(d) Listings: TN, TP, NO2+NO3, Turb, TSS, Metals, lead - TMDLs approved (sediment and nutrients)

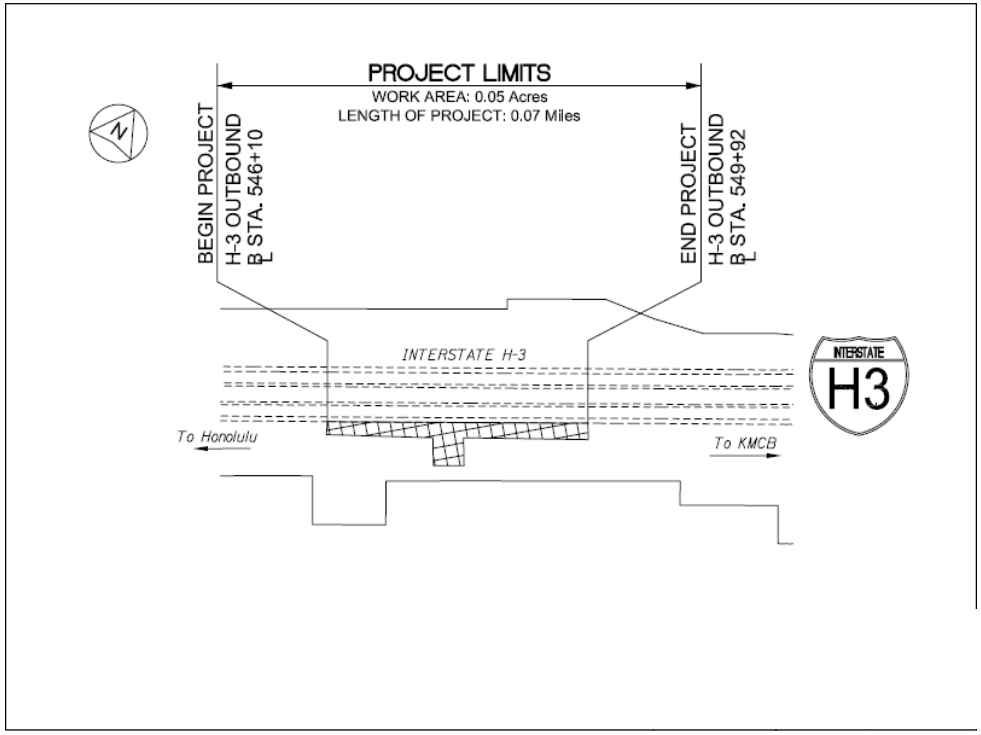
Drainage Area: 8.72 acres

Impervious Area: 0.00 acres

Proposed Retrofit(s): Settling Basin

This MS4 culvert is located along the H-3 Freeway and collects storm water from two existing open concrete channels in addition to sheet flow from the adjacent slope. Due to soil erosion and sedimentation the culvert entrance is currently buried beneath approximately 10 feet of sediment.

The sediment deposition will be removed and a new settling basin will be constructed prior to the culvert entrance. Additionally, the slopes adjacent to the culvert entrance will be repaired and stabilized with erosion control matting to reduce future sediment loading to the culvert.



Location Map

Sediment build up at MS4 culvert entrance

Retrofit Site 14

Associated PID(s): 108140, 108139, 301000

Receiving Water Body: Kawa Stream

TMDL/WLA: TSS, TN, TP

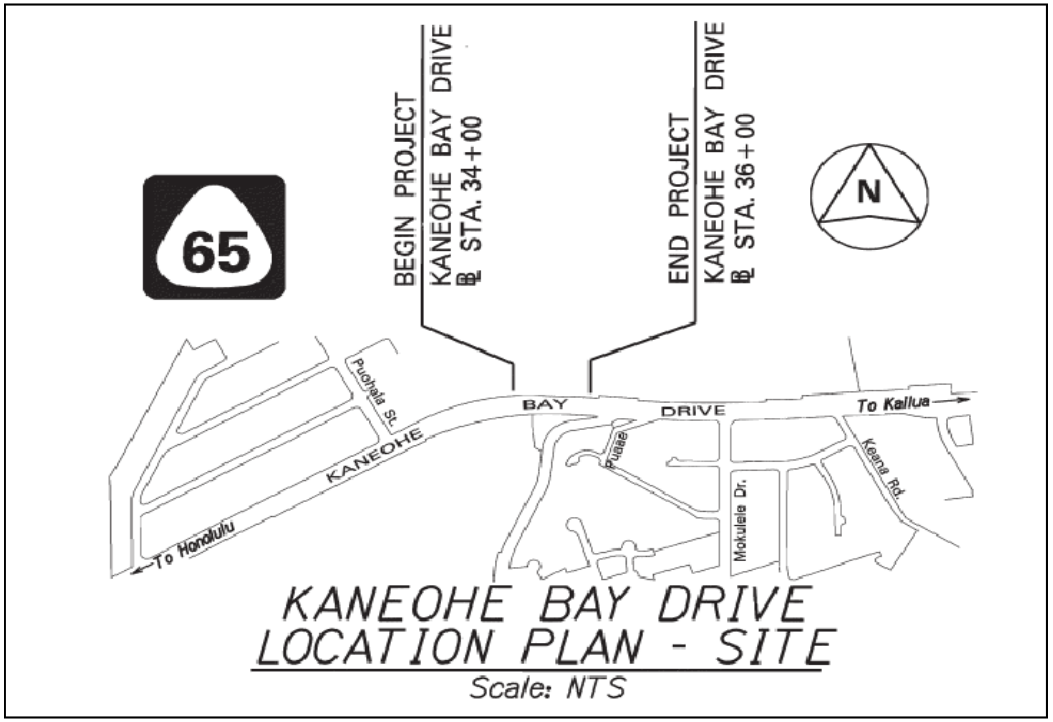
303(d) Listings: TN, TP, NO2+NO3, Turb, TSS, TMDLs approved (sediment and nutrients)

Drainage Area: 7 acres

Impervious Area: 5 acres

Proposed Retrofit(s): Nutrient Separating Baffle Box

This retrofit site was selected in an ongoing effort to meet WLA goals to reduce TSS, TN and TP discharges to Kawa Stream. The proposed Nutrient Separating Baffle Box will replace a storm drain inlet structure and treat storm water runoff from approximately 5 acres of impervious area on Kaneohe Bay Drive.



Location Map

Proposed Baffle Box Location

Retrofit Site 15

Associated PID(s): 601391, 304691, 401331

Receiving Water Body: Kawa Stream

TMDL/WLA: TSS, TN, TP

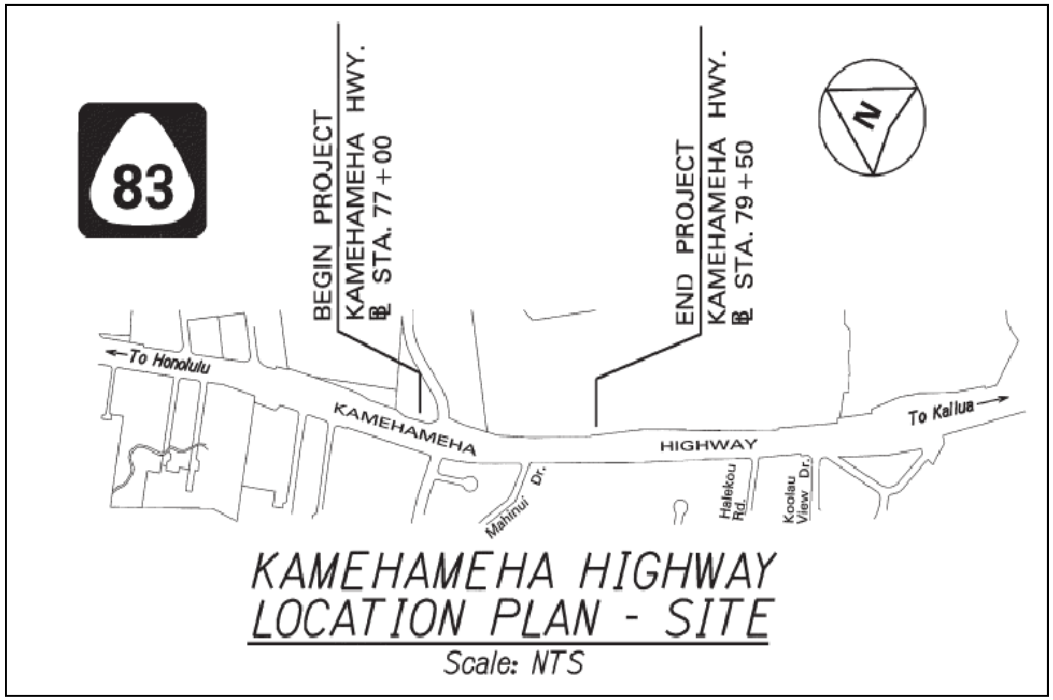
303(d) Listings: TN, TP, NO2+NO3, Turb, TSS, TMDLs approved (sediment and nutrients)

Drainage Area: 3.04acres

Impervious Area: 1.30 acres

Proposed Retrofit(s): Bioswale

This retrofit site was selected in an ongoing effort to meet WLA goals to reduce TSS, TN and TP discharges to Kawa Stream from Kamehameha Highway. The proposed grassed bioswale will replace the open channel PID 601391 and treat storm water runoff from over an acre of impervious surface on Kamehameha Highway.



Location Map

Proposed Bioswale Location

Retrofit Site 16

Associated PID(s): 105648

Receiving Water Body: Kapaa Stream

TMDL/WLA: TSS, TN, TP

303(d) Listings: TN, TP, NO2+NO3, Turb, TSS, Metals, lead - TMDLs approved (sediment and nutrients)

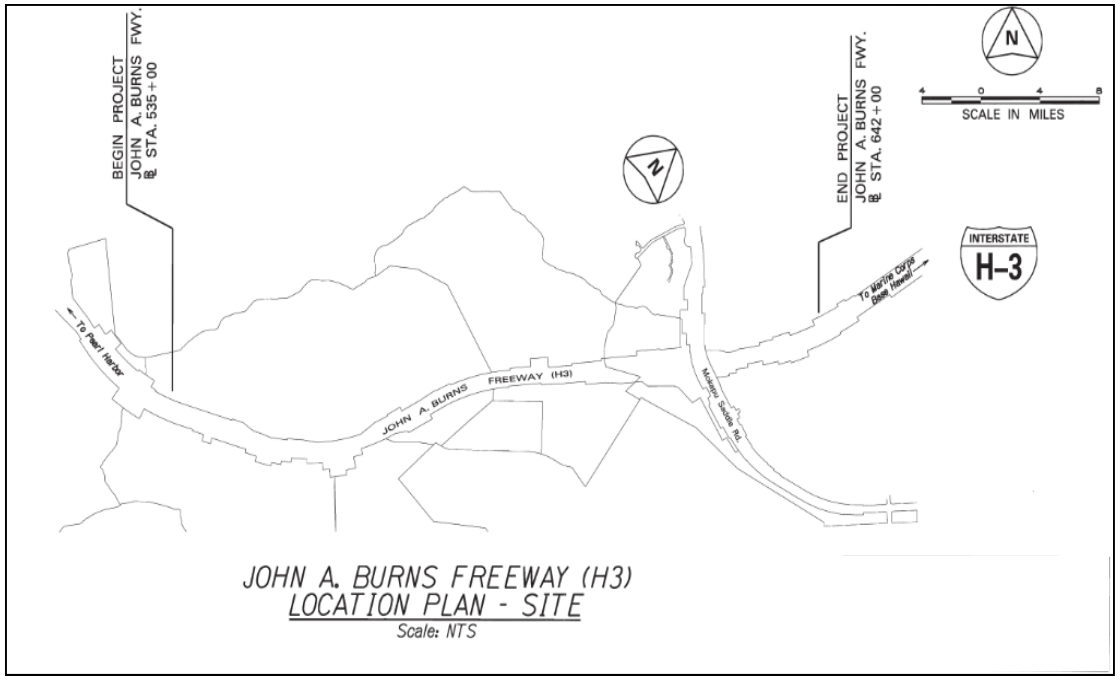
Drainage Area: 2.79 acres

Impervious Area: 0.89 acres

Proposed Retrofit(s): Bioswale

Based on the feasibility study which considered physical constraints, constructability, traffic, safety, aesthetics, pollutant reduction efficiencies, cost, and future maintenance requirements, it was determined that bioswales were the most feasible permanent BMP option for the treatment of storm water runoff along the H-3 freeway within the Kapaa Stream watershed.

Fifteen proposed bioswales along the H-3 corridor within the Kapaa watershed will treat storm water runoff from approximately 9.45 acres of impervious surface. Bioswale lengths range from 64-1000 feet with drainage areas ranging from 0.17 to 2.88 acres.



Location Map

Proposed Bioswale Location

Retrofit Site 17

Associated PID(s): 105913

Receiving Water Body: Kapaa Stream

TMDL/WLA: TSS, TN, TP

303(d) Listings: TN, TP, NO2+NO3, Turb, TSS, Metals, lead - TMDLs approved (sediment and nutrients)

Drainage Area: 0.57 acres

Impervious Area: 0.39 acres

Proposed Retrofit(s): Bioswale

Based on the feasibility study which considered physical constraints, constructability, traffic, safety, aesthetics, pollutant reduction efficiencies, cost, and future maintenance requirements, it was determined that bioswales were the most feasible permanent BMP option for the treatment of storm water runoff along the H-3 freeway within the Kapaa Stream watershed.

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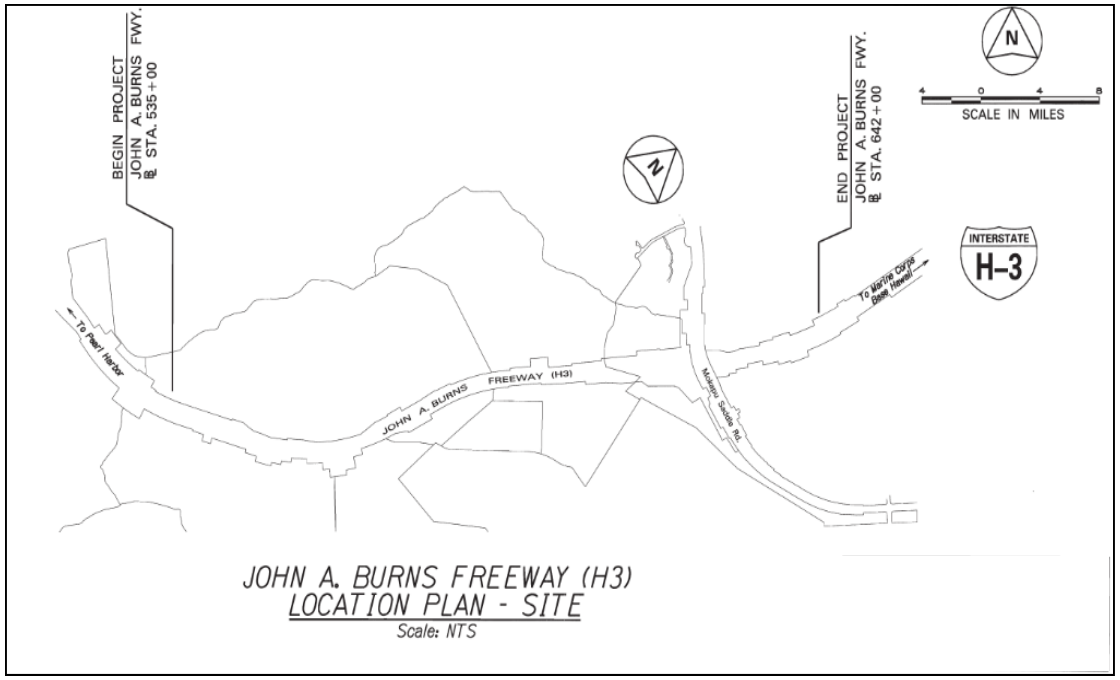

Location Map

Proposed Bioswale Location

Retrofit Site 18

Associated PID(s): 105914

Receiving Water Body: Kapaa Stream

TMDL/WLA: TSS, TN, TP

303(d) Listings: TN, TP, NO2+NO3, Turb, TSS, Metals, lead - TMDLs approved (sediment and nutrients)

Drainage Area: 1.61 acres

Impervious Area: 0.93 acres

Proposed Retrofit(s): Bioswale

Based on the feasibility study which considered physical constraints, constructability, traffic, safety, aesthetics, pollutant reduction efficiencies, cost, and future maintenance requirements, it was determined that bioswales were the most feasible permanent BMP option for the treatment of storm water runoff along the H-3 freeway within the Kapaa Stream watershed.

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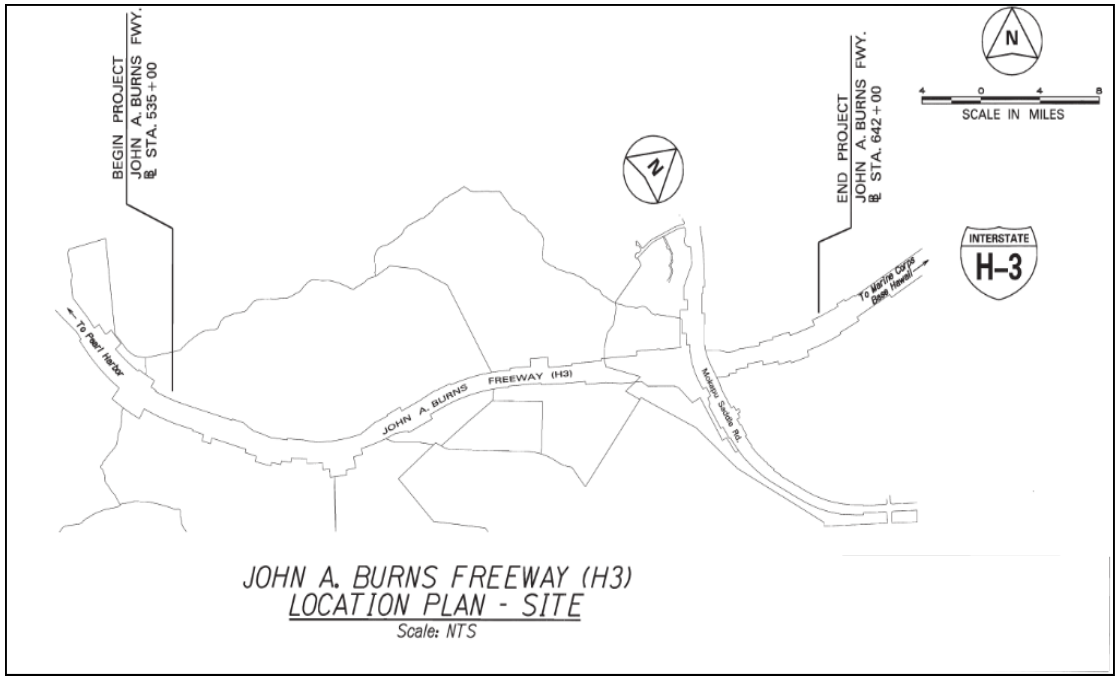

Location Map

Proposed Bioswale Location

Retrofit Site 19

Associated PID(s): 105915

Receiving Water Body: Kapaa Stream

TMDL/WLA: TSS, TN, TP

303(d) Listings: TN, TP, NO2+NO3, Turb, TSS, Metals, lead - TMDLs approved (sediment and nutrients)

Drainage Area: 0.83 acres

Impervious Area: 0.47 acres

Proposed Retrofit(s): Bioswale

Based on the feasibility study which considered physical constraints, constructability, traffic, safety, aesthetics, pollutant reduction efficiencies, cost, and future maintenance requirements, it was determined that bioswales were the most feasible permanent BMP option for the treatment of storm water runoff along the H-3 freeway within the Kapaa Stream watershed.

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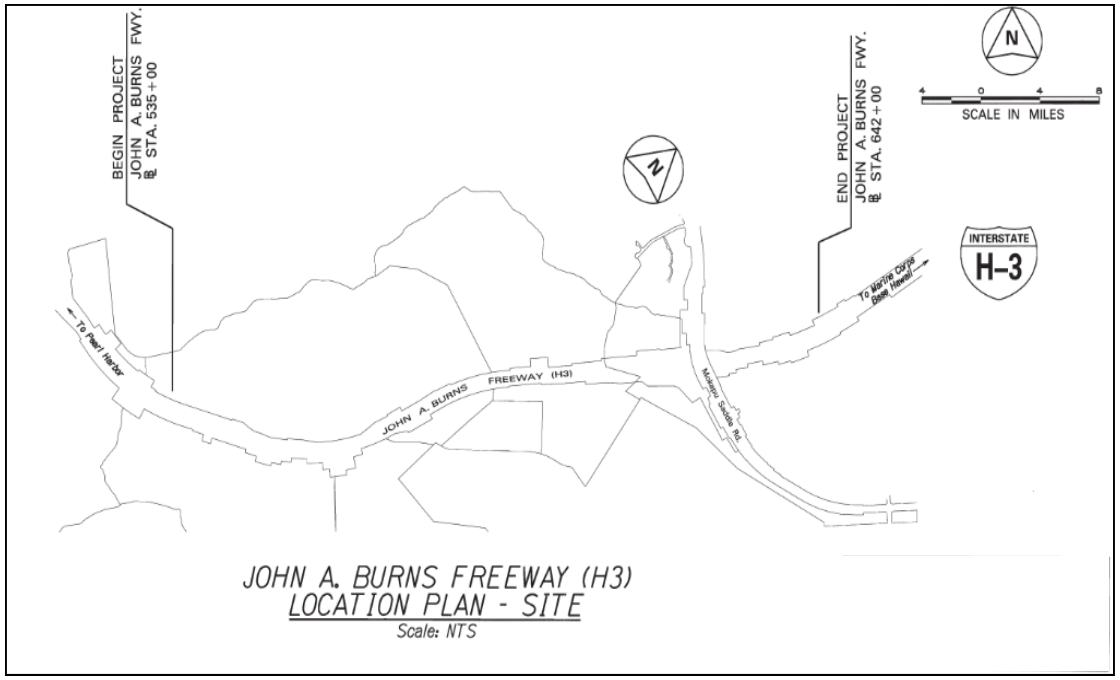

Location Map

Proposed Bioswale Location

Retrofit Site 20

Associated PID(s): 105917

Receiving Water Body: Kapaa Stream

TMDL/WLA: TSS, TN, TP

303(d) Listings: TN, TP, NO2+NO3, Turb, TSS, Metals, lead - TMDLs approved (sediment and nutrients)

Drainage Area: 2.23 acres

Impervious Area: 0.94 acres

Proposed Retrofit(s): Bioswale

Based on the feasibility study which considered physical constraints, constructability, traffic, safety, aesthetics, pollutant reduction efficiencies, cost, and future maintenance requirements, it was determined that bioswales were the most feasible permanent BMP option for the treatment of storm water runoff along the H-3 freeway within the Kapaa Stream watershed.

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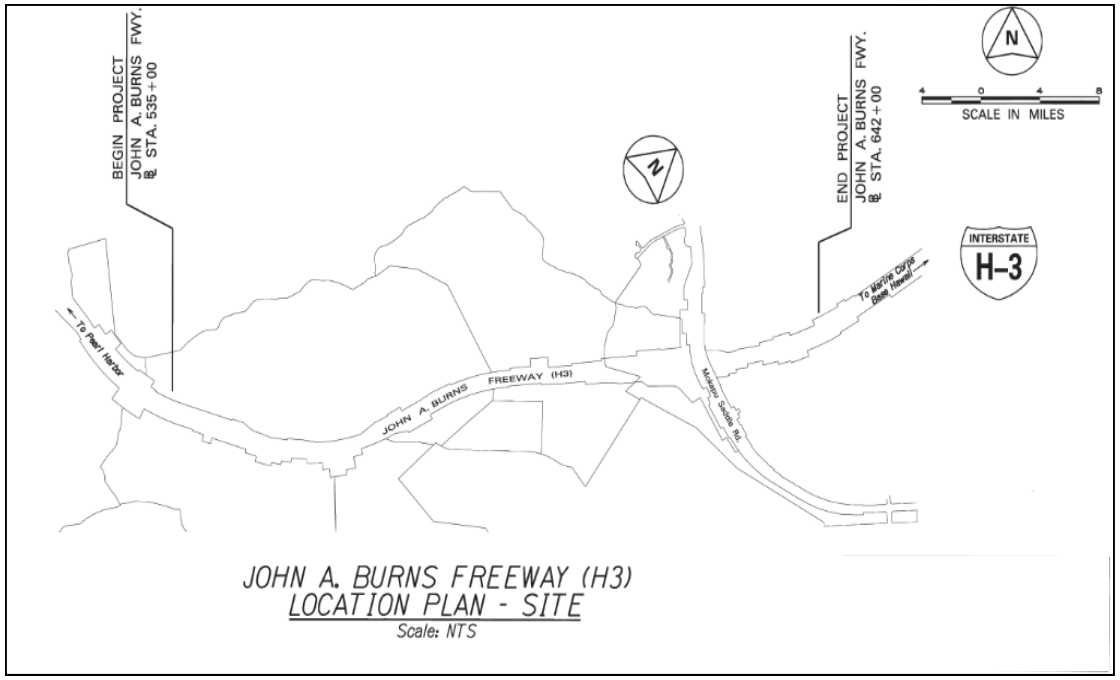


Location Map

Proposed Bioswale Location

Retrofit Site 21

Associated PID(s): 104362

Receiving Water Body: Kapaa Stream

TMDL/WLA: TSS, TN, TP

303(d) Listings: TN, TP, NO2+NO3, Turb, TSS, Metals, lead - TMDLs approved (sediment and nutrients)

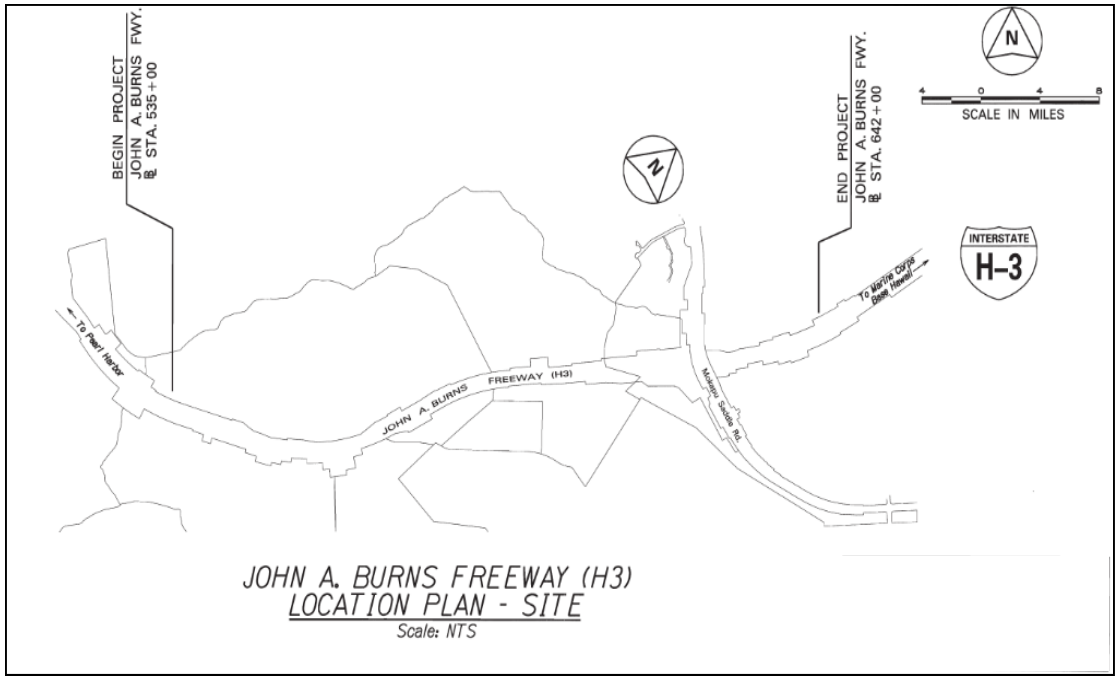
Drainage Area: 0.9 acres

Impervious Area: 0.59 acres

Proposed Retrofit(s): Bioswale

Based on the feasibility study which considered physical constraints, constructability, traffic, safety, aesthetics, pollutant reduction efficiencies, cost, and future maintenance requirements, it was determined that bioswales were the most feasible permanent BMP option for the treatment of storm water runoff along the H-3 freeway within the Kapaa Stream watershed.

Fifteen proposed bioswales along the H-3 corridor within the Kapaa watershed will treat storm water runoff from approximately 9.45 acres of impervious surface. Bioswale lengths range from 64-1000 feet with drainage areas ranging from 0.17 to 2.88 acres.



Location Map

Proposed Bioswale Location

Retrofit Site 22

Associated PID(s): 104360

Receiving Water Body: Kapaa Stream

TMDL/WLA: TSS, TN, TP

303(d) Listings: TN, TP, NO2+NO3, Turb, TSS, Metals, lead - TMDLs approved (sediment and nutrients)

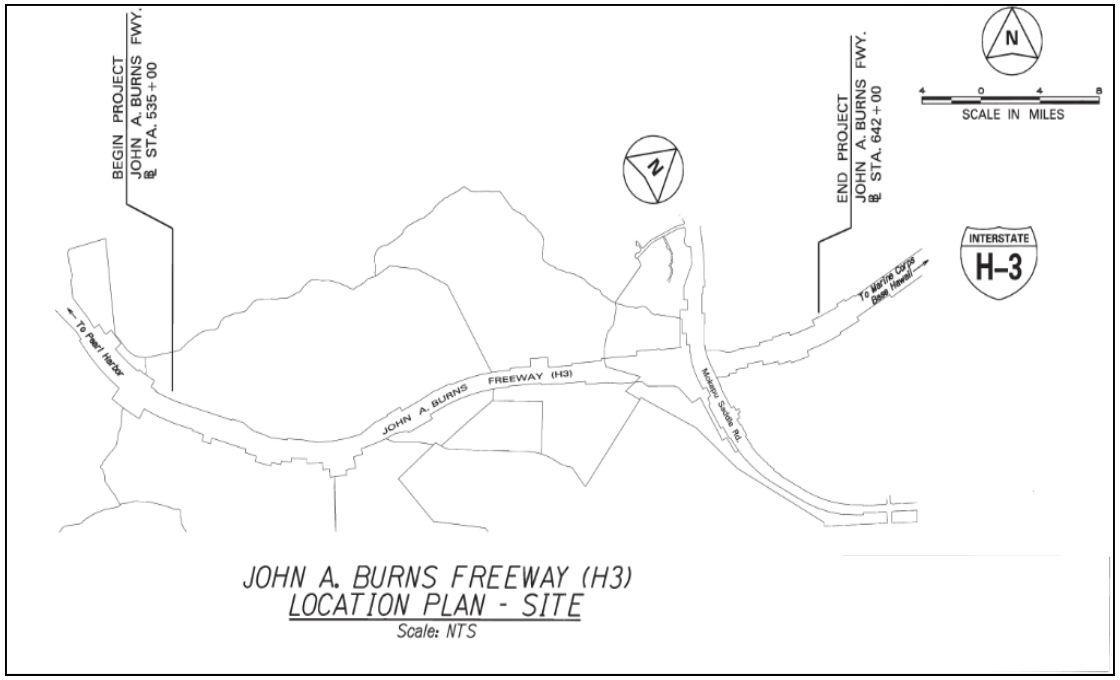
Drainage Area: 0.33 acres

Impervious Area: 0.23 acres

Proposed Retrofit(s): Bioswale

Based on the feasibility study which considered physical constraints, constructability, traffic, safety, aesthetics, pollutant reduction efficiencies, cost, and future maintenance requirements, it was determined that bioswales were the most feasible permanent BMP option for the treatment of storm water runoff along the H-3 freeway within the Kapaa Stream watershed.

Fifteen proposed bioswales along the H-3 corridor within the Kapaa watershed will treat storm water runoff from approximately 9.45 acres of impervious surface. Bioswale lengths range from 64-1000 feet with drainage areas ranging from 0.17 to 2.88 acres.



Location Map

Proposed Bioswale Location

Retrofit Site 23

Associated PID(s): 104359

Receiving Water Body: Kapaa Stream

TMDL/WLA: TSS, TN, TP

303(d) Listings: TN, TP, NO2+NO3, Turb, TSS, Metals, lead - TMDLs approved (sediment and nutrients)

Drainage Area: 0.33 acres

Impervious Area: 0.23 acres

Proposed Retrofit(s): Bioswale

Based on the feasibility study which considered physical constraints, constructability, traffic, safety, aesthetics, pollutant reduction efficiencies, cost, and future maintenance requirements, it was determined that bioswales were the most feasible permanent BMP option for the treatment of storm water runoff along the H-3 freeway within the Kapaa Stream watershed.

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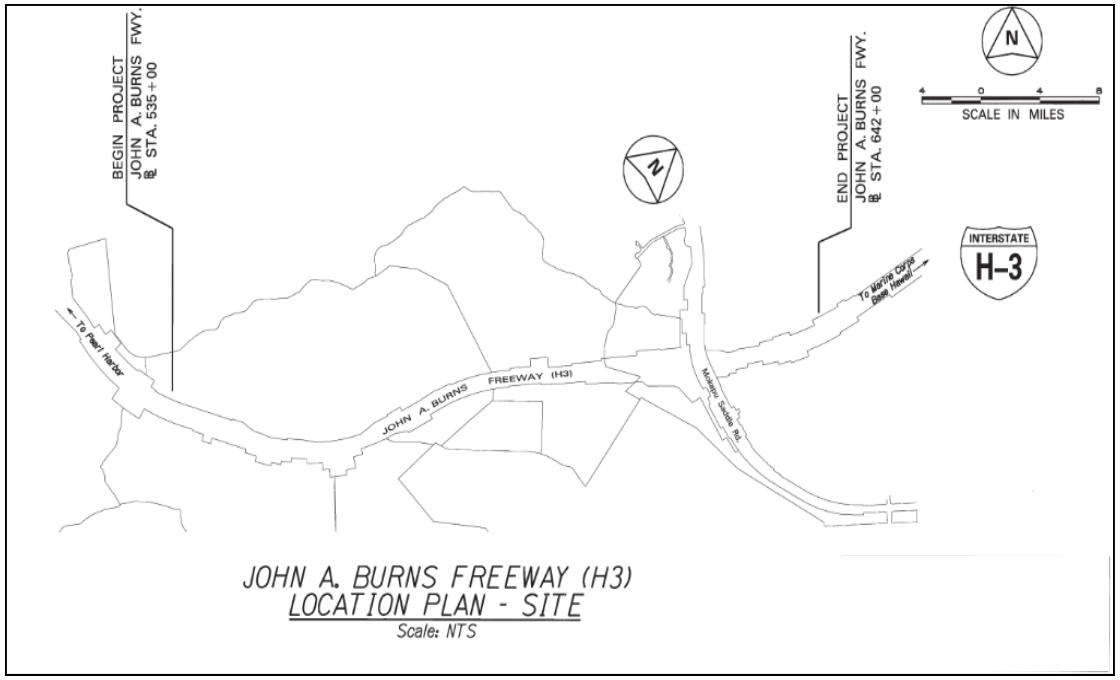

Location Map

Proposed Bioswale Location

Retrofit Site 24

Associated PID(s): 104357

Receiving Water Body: Kapaa Stream

TMDL/WLA: TSS, TN, TP

303(d) Listings: TN, TP, NO2+NO3, Turb, TSS, Metals, lead - TMDLs approved (sediment and nutrients)

Drainage Area: 0.2 acres

Impervious Area: 0.12 acres

Proposed Retrofit(s): Bioswale

Based on the feasibility study which considered physical constraints, constructability, traffic, safety, aesthetics, pollutant reduction efficiencies, cost, and future maintenance requirements, it was determined that bioswales were the most feasible permanent BMP option for the treatment of storm water runoff along the H-3 freeway within the Kapaa Stream watershed.

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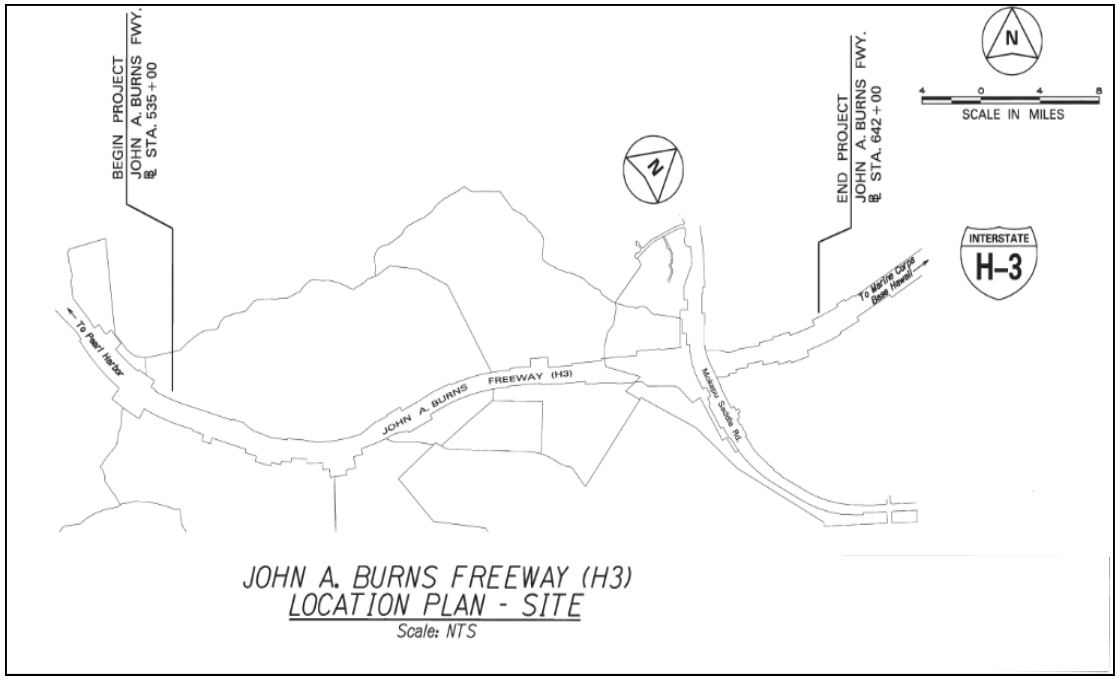

Location Map

Proposed Bioswale Location

Retrofit Site 25

Associated PID(s): 105651

Receiving Water Body: Kapaa Stream

TMDL/WLA: TSS, TN, TP

303(d) Listings: TN, TP, NO2+NO3, Turb, TSS, Metals, lead - TMDLs approved (sediment and nutrients)

Drainage Area: 1.66 acres

Impervious Area: 1.26 acres

Proposed Retrofit(s): Bioswale

Based on the feasibility study which considered physical constraints, constructability, traffic, safety, aesthetics, pollutant reduction efficiencies, cost, and future maintenance requirements, it was determined that bioswales were the most feasible permanent BMP option for the treatment of storm water runoff along the H-3 freeway within the Kapaa Stream watershed.

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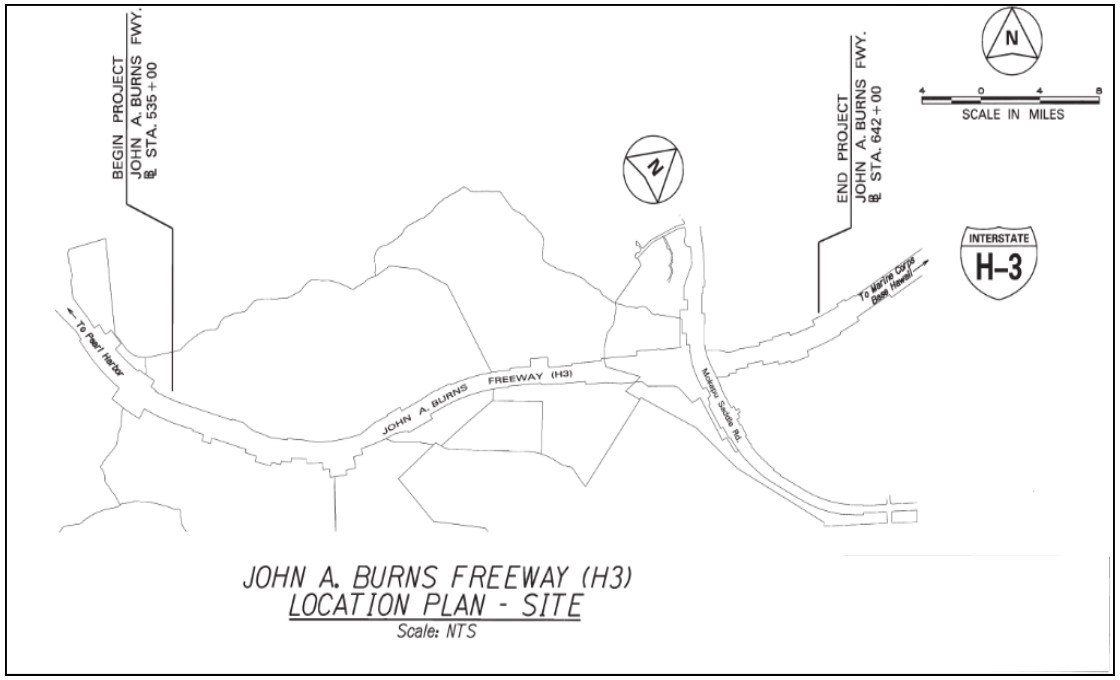


Location Map

Proposed Bioswale Location

Retrofit Site 26

Associated PID(s): 108195

Receiving Water Body: Kawainui Stream

TMDL/WLA: TSS, TN, TP

303(d) Listings: TN, TP, NO2+NO3, Turb, TSS, Metals, lead - TMDLs approved (sediment and nutrients)

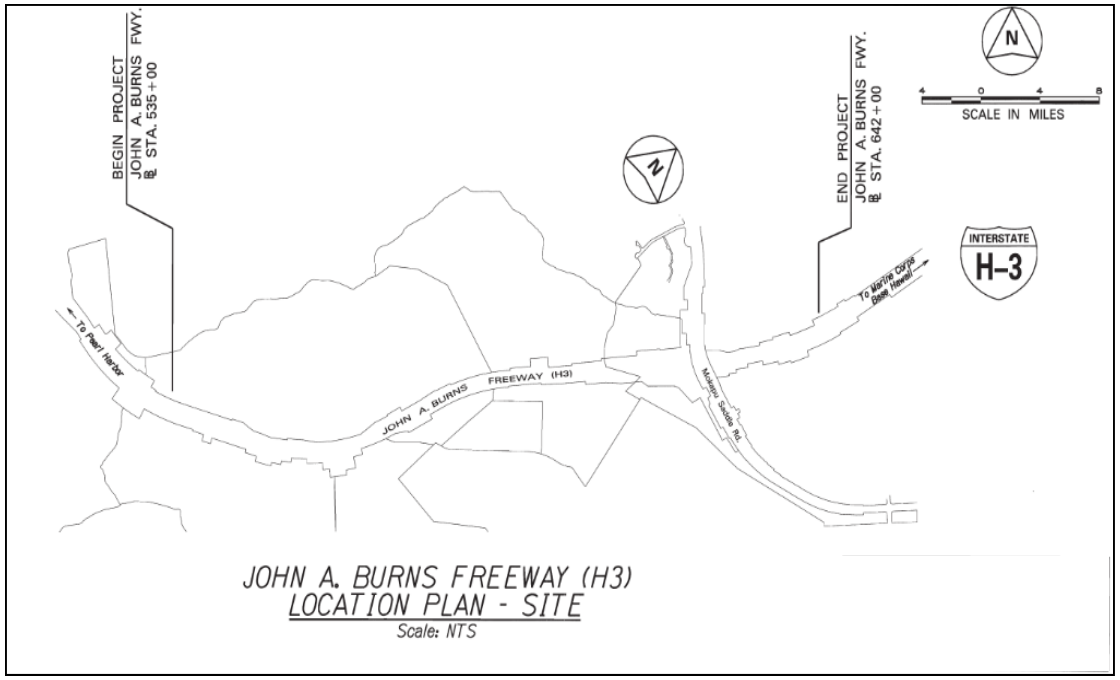
Drainage Area: 0.73acres

Impervious Area: 0.24 acres

Proposed Retrofit(s): Bioswale

Based on the feasibility study which considered physical constraints, constructability, traffic, safety, aesthetics, pollutant reduction efficiencies, cost, and future maintenance requirements, it was determined that bioswales were the most feasible permanent BMP option for the treatment of storm water runoff along the H-3 freeway within the Kapaa Stream watershed.

Fifteen proposed bioswales along the H-3 corridor within the Kapaa watershed will treat storm water runoff from approximately 9.45 acres of impervious surface. Bioswale lengths range from 64-1000 feet with drainage areas ranging from 0.17 to 2.88 acres.



Location Map

Proposed Bioswale Location

Retrofit Site 27

Associated PID(s): 108199

Receiving Water Body: Kawainui Stream

TMDL/WLA: TSS, TN, TP

303(d) Listings: TN, TP, NO2+NO3, Turb, TSS, Metals, lead - TMDLs approved (sediment and nutrients)

Drainage Area: 2.16 acres

Impervious Area: 0.45 acres

Proposed Retrofit(s): Bioswale

Based on the feasibility study which considered physical constraints, constructability, traffic, safety, aesthetics, pollutant reduction efficiencies, cost, and future maintenance requirements, it was determined that bioswales were the most feasible permanent BMP option for the treatment of storm water runoff along the H-3 freeway within the Kapaa Stream watershed.

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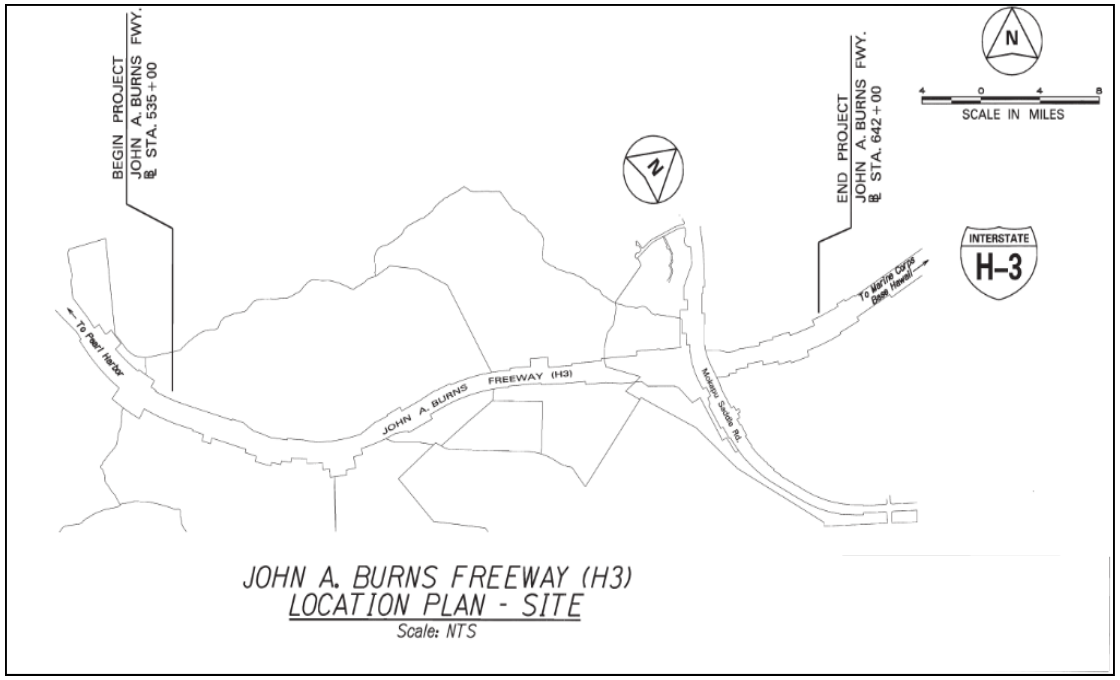

Location Map

Proposed Bioswale Location

Retrofit Site 28

Associated PID(s): 112422

Receiving Water Body: Kawainui Stream

TMDL/WLA: TSS, TN, TP

303(d) Listings: TN, TP, NO2+NO3, Turb, TSS, Metals, lead - TMDLs approved (sediment and nutrients)

Drainage Area: 0.17 acres

Impervious Area: 0.05 acres

Proposed Retrofit(s): Bioswale

Based on the feasibility study which considered physical constraints, constructability traffic, safety, aesthetics, pollutant reduction efficiencies, cost, and future maintenance requirements, it was determined that bioswales were the most feasible permanent BMP option for the treatment of storm water runoff along the H-3 freeway within the Kapaa Stream watershed.

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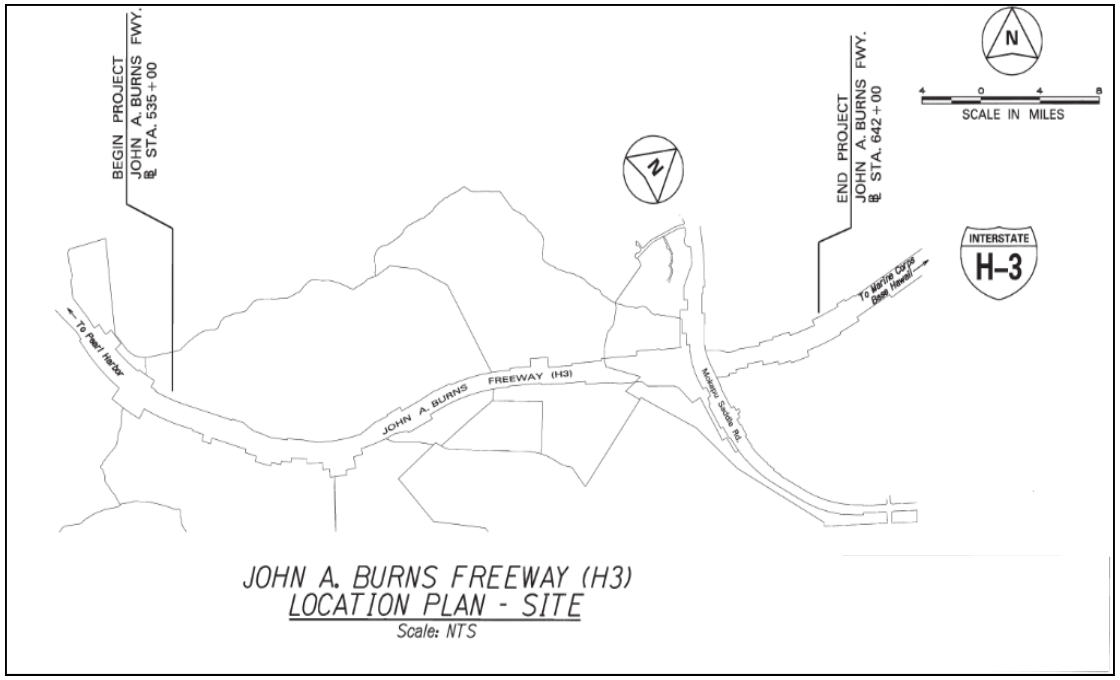

Location Map

Proposed Bioswale Location

Retrofit Site 29

Associated PID(s): 104710

Receiving Water Body: Kapaa Stream

TMDL/WLA: TSS, TN, TP

303(d) Listings: TN, TP, NO2+NO3, Turb, TSS, Metals, lead - TMDLs approved (sediment and nutrients)

Drainage Area: 1.22 acres

Impervious Area: 0.41 acres

Proposed Retrofit(s): Bioswale

Based on the feasibility study which considered physical constraints, constructability, traffic, safety, aesthetics, pollutant reduction efficiencies, cost, and future maintenance requirements, it was determined that bioswales were the most feasible permanent BMP option for the treatment of storm water runoff along the H-3 freeway within the Kapaa Stream watershed.

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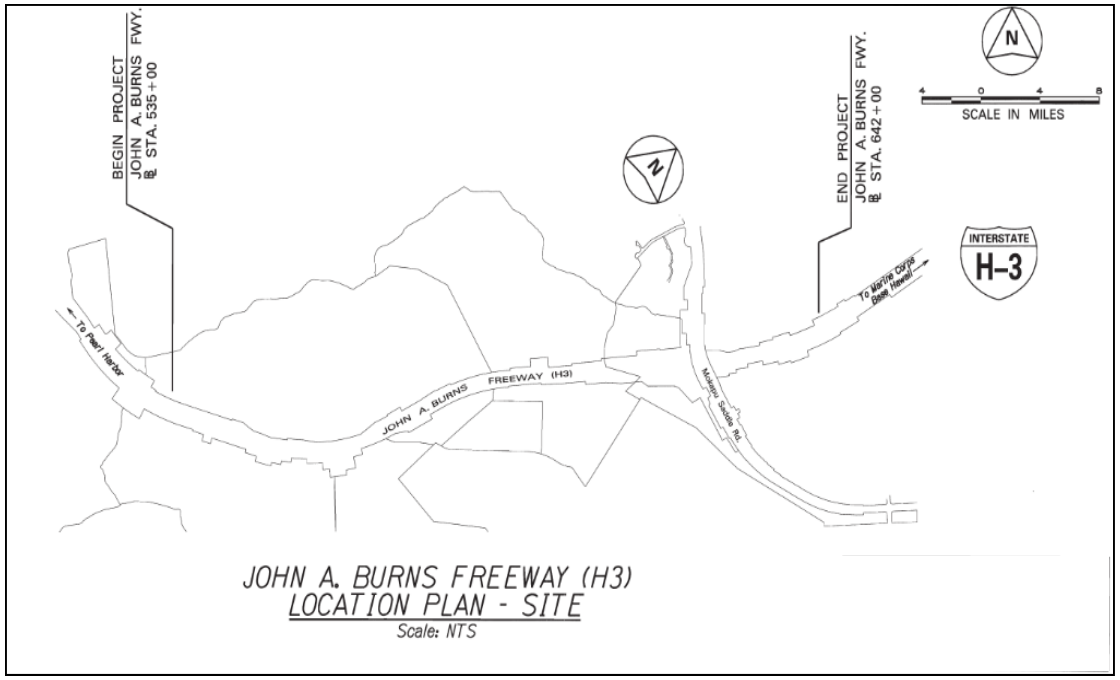

Location Map

Proposed Bioswale Location

Retrofit Site 30

Associated PID(s): 104712

Receiving Water Body: Kapaa Stream

TMDL/WLA: TSS, TN, TP

303(d) Listings: TN, TP, NO2+NO3, Turb, TSS, Metals, lead - TMDLs approved (sediment and nutrients)

Drainage Area: 2.88 acres

Impervious Area: 1.45 acres

Proposed Retrofit(s): Bioswale

Based on the feasibility study which considered physical constraints, constructability, traffic, safety, aesthetics, pollutant reduction efficiencies, cost, and future maintenance requirements, it was determined that bioswales were the most feasible permanent BMP option for the treatment of storm water runoff along the H-3 freeway within the Kapaa Stream watershed.

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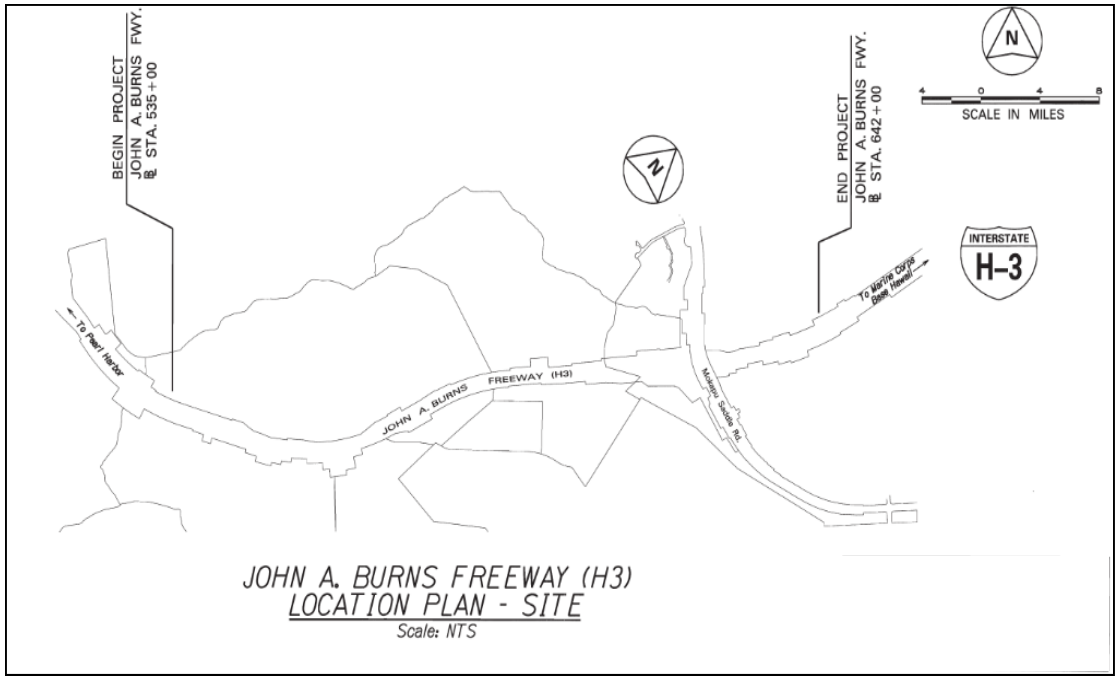

Location Map

Proposed Bioswale Location

Action Plan for Retrofitting Structural BMPs

APPENDIX B: PEARL CITY BASEYARD RETROFITS

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Pearl City Baseyard Retrofits

Receiving Water Body: Waiau Stream

TMDL/WLA: N/A

303(d) Listings: TN, TP, NO2+NO3, Turb, trash - H(IP)

Drainage Area: 4.88 acres

Impervious Area: 3.32 acres

Proposed Retrofits (Qty): Downspout Filter (5), Level Spreader (2), Grassed Swale (1)

The Pearl City Baseyard is located beneath the H-1 freeway in Pearl City. The majority of the site is located under the cover of the freeway viaduct, and therefore, is not exposed to rainfall. However, stormwater runoff can flow through the property from areas located outside of the freeway viaduct overhang and from several downspouts that drain surface runoff from the H-1 via-duct. The proposed baseyard retrofits will provide treatment for this stromwater runoff prior to its discharge offsite.

Location Map

Proposed Grassed Swale Location

Proposed Downspout Filter Location