State of Hawaii, Department of Transportation
Highways Division, Oahu District

Storm Water Management Program Annual Monitoring Plan 2022 - 2023

State of Hawaii, Department of Transportation
Highways Division, Oahu District
2022 - 2023 Annual Monitoring Plan
June 2022

STATE OF HAWAII, DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION, OAHU DISTRICT

ANNUAL MONITORING PLAN 2022 – 2023

MS4 NPDES Permit No. HI S000001

State of Hawaii, Department of Transportation
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727 Kakoi Street, Honolulu, Hawaii 96819

June 2022
Version: Final

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ACRONYMS AND ABBREVIATIONS

AMS	Asset Management System
BMP	Best Management Practice
CCH	City and County of Honolulu
COC	Chain of Custody
CWA	Clean Water Act
DOH	State of Hawaii Department of Health
DOT-HWYS	State of Hawaii Department of Transportation, Highways Division, Oahu District
EPA	U.S. Environmental Protection Agency
I&M	Implementation and Monitoring
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LDPE	Low-Density Polyethylene
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
PID	Point Identification Number
QA/QC	Quality Assurance/Quality Control
ROW	Right-of-Way
RPD	Relative percent difference
SM	Standard Methods
SWMP	Storm Water Management Program

TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
WLA	Waste Load Allocation

1.0 MONITORING PROGRAM OBJECTIVES | MS4 NPDES Permit Part F.1.b.(1)

The State of Hawaii Department of Transportation, Highways Division, Oahu District (DOT-HWYS) owns and operates a municipal separate storm sewer system (MS4) and has developed and implemented a Storm Water Management Program (SWMP) as required by National Pollutant Discharge Elimination System (NPDES) Permit No. HI S000001 (hereinafter MS4 NPDES Permit), effective September 1, 2020.

The MS4 NPDES Permit requires that the DOT-HWYS SWMP reduce, to the maximum extent practicable, the discharge of pollutants to and from the MS4 to protect water quality and to satisfy the appropriate water quality requirements of the Clean Water Act (CWA).

This *2022 – 2023 Annual Monitoring Plan* (hereinafter *Monitoring Plan*) is submitted to satisfy MS4 NPDES Permit Part F.1, which requires DOT-HWYS to submit an Annual Monitoring Plan to the State of Hawaii Department of Health (DOH) for review and acceptance by June 1st of each year. The activities described in the *Monitoring Plan* will be implemented over the fiscal year from July 1 through June 30 (hereinafter Monitoring Year).

1.1 Annual Monitoring Plan | MS4 NPDES Permit Part F.1.a (1) – F.1.a. (7)

This Monitoring Plan provides the framework to collect water quality samples for analysis in the Kaelepulu and Moanalua watersheds to:

- Study 1: Evaluate DOT-HWYS contribution to watershed health and identify pollutant sources.
- Study 2: Evaluate the effect of rainfall duration and/or intensity on storm water runoff concentrations.

Table 1 demonstrates how the *Monitoring Plan*'s studies align with the monitoring program objectives required by the MS4 NPDES Permit Parts F.1.a.(1) through F.1.a.(7).

Table 1. MS4 NPDES Permit Requirements for the Monitoring Program.

MS4 NPDES Permit Reference	Study #1: Evaluate DOT-HWYS contribution to watershed health and identify pollutant sources	Study #2: Evaluate the effect of rainfall duration and/or intensity on storm water runoff concentrations
Part F.1.a.(1) – Assess compliance with permit (including TMDL I&M Plans and demonstrating consistency with WLAs).	X	X
Part F.1.a.(2) – Measures the effectiveness of Permittee's storm water management program.	X	X
Part F.1.a.(3) – Assess the overall health of the receiving waters based on the chemical, physical, and biological impacts resulting from storm water discharges and an evaluation of the long-term trends.	X	X
Part F.1.a.(4) – Characterize storm water discharges from the MS4.	X	X
Part F.1.a.(5) – Identify sources of specific pollutants.	X	X
Part F.1.a.(6) – Detect and eliminate illicit discharges and illegal connections to the MS4.	X	X
Part F.1.a.(7) – Assess the water quality issues in the watershed resulting from storm water discharges to receiving waters.	X	X

1.2 DOT-HWYS Monitoring Program

DOT-HWYS conducts water quality monitoring as a part of the SWMP to assess pollutant load contributions from DOT-HWYS right-of-way (ROW) to state waters. The primary purpose of this monitoring is to assess the characteristics of storm water (quality and quantity), and evaluate potential impacts to the watershed and receiving waterbodies so that effective control mechanisms can be developed and implemented.

Historic, ongoing, and future efforts of the Monitoring Program focus on watersheds with impaired waterbodies per CWA Section 303(d), and in watersheds where Total Maximum Daily Loads (TMDLs) that have been approved that identify DOT-HWYS as a pollutant source through the assignment of a Waste Load Allocation (WLA).

DOT-HWYS is also proactively implementing monitoring in anticipation of future TMDLs that may be approved during the current permit term. Water quality monitoring activities are conducted in watersheds that are listed as High Priority for a TMDL in the State of Hawaii Water Quality Monitoring and Assessment Report (Clean Water Branch 2022) Appendix C, and in watersheds identified by DOH through informal communications.

This *Monitoring Plan* describes the monitoring activities planned on a watershed basis to assess water quality issues resulting from storm water discharges to receiving waters.

1.2.1 Long-Term Watershed Monitoring Approach

DOT-HWYS has implemented a watershed-based approached to establish a long-term monitoring strategy. Since 2001, DOT-HWYS has sampled and evaluated storm water runoff from various watersheds island-wide to identify potential sources of pollutants and assess its impact on water quality in receiving waters. Watersheds are identified based on the CWA Section 303(d) List of Impaired Waters on Oahu, DOT-HWYS contributing area, and potential pollutant loads. Table 2 shows the historical sampling effort and number of samples collected within the corresponding watershed.

Table 2 - DOT-HWYS Historical Sampling June 2001- July 2021

Watershed	Data Collection Period	No. of Storm Water Samples
Aiea	2011 – 2014	20
Ala Wai	2006 – 2010	130
Halawa	2001 – 2009	167
Kaelepulu	2007 – 2010, Current	81
Kaneohe	2009 – 2021	219
Kapaa	2007 – 2009	209
Kapakahi	2009 – 2015	98
Kawa	2006 – 2007, 2012 – 2021	334
Kawanui	2008 – 2009	85
Moanalua	Current	9
Waiawa	2009 – 2012	88
Waikele	2010 – 2014	254
Waimalu	2009 – 2012	112
Waimanalo	2007 – 2011	164

1.2.2 Monitoring Program Framework Documents

The MS4 NPDES Permit requires five types of plans and reports to address and report on SWMP monitoring activities. The plans and reports, along with the MS4 NPDES Permit submittal date requirements for each, are as follows.

- *Storm Water Management Program Plan* – Submitted in February 2022.
- *Annual Report* – To be submitted each year by October 31st reporting on the previous fiscal year.
- *TMDL Implementation and Monitoring (I&M) Plans* – Five plans submitted October 28, 2014, and one plan submitted May 8, 2020.
- *Annual Monitoring Plan* – To be submitted each year by June 1st, describing planned monitoring activities for the upcoming fiscal year.
- *Annual Monitoring Report* – To be submitted each year by October 31st, reporting on all monitoring activities during the previous fiscal year.

These documents comprise the framework by which DOT-HWYS monitors and evaluates the compliance status and effectiveness of the SWMP. Collectively, they detail program activities, standards and milestones, assessment methods, and results of SWMP implementation.

The *2022 Storm Water Management Program Plan*, appendices, and related plans are on the DOT-HWYS website, www.stormwaterhawaii.com.

2.0 Monitoring Locations | MS4 NPDES Permit Part F.1.b.(2) and F.1.b.(3)

During Monitoring Year 2022 – 2023, DOT-HWYS will continue conducting water quality monitoring activities in the Kaelepulu Stream Watershed and Moanalua Stream Watershed as described below.

Kaelepulu Stream Watershed

- Site #1: Water quality monitoring of MS4 network along Kalanianaole Highway which connects to the City and County of Honolulu's (CCH) MS4 and then discharges to Kaelepulu Stream, approximately 0.5 miles upstream of Kaelepulu Pond.
- Site #2: Water quality monitoring of MS4 network along Kalanianaole Highway which discharges to an intermittent portion of Kaelepulu Stream.

Moanalua Stream Watershed

- Site #1: Water quality monitoring of MS4 network along H-1 Freeway and Ala Napunani Street interchange which discharges to an intermittent portion of Moanalua Stream.
- Site #2: Water quality monitoring of MS4 network along Puuloa Road, North King Street, and H-1 Freeway interchange which discharges to Moanalua Stream, approximately one mile upstream from Keehi Lagoon.
- Site #3: Water quality monitoring of MS4 network along H-1 Freeway near the Funston Road interchange which discharges to an intermittent portion of Moanalua Stream (Kahauiki Tributary).

The proposed locations of storm water quality sampling sites for Monitoring Year 2022 – 2023 are provided in Appendix A. Details about planned monitoring activities at each location are provided in the following sections.

2.1 Kaelepulu Stream Watershed Monitoring

The Kaelepulu Watershed is located on the windward slopes of the Koolau Mountain range. It is bordered on the west by Kawainui Stream Watershed, and Waimanalo Stream Watershed to the east. The development in the watershed is mostly residential, with some small businesses and agricultural parcels. There are two state roads in the watershed, Kailua Road (Route 61) and Kalanianaole Highway (Route 73).
Kailua Road is located in the watershed approximately a half mile northwest from its junction with Kalanianaole Highway, and extends to the northwest past the Kawainui Canal to its terminus at Oneawa Street. Several curb and median storm drainage networks along Kailua Road direct runoff from the highway lanes to the CCH MS4, that drains to the Kawainui Canal, which ultimately discharges into Kailua Bay at Kailua Beach.

Kalanianaole Highway is located in the watershed approximately one mile southeast from its junction with Kailua Road, and extends to the southeast, past Keolu Drive. The east border of Kaelepulu Watershed intersects Kalanianaole Highway approximately 850 feet from the southern outlet for Old Kalanianaole Road (CCH road). Several curb and median storm drainage networks along the Kalanianaole Highway direct runoff from the highway lanes to the CCH MS4, which eventually drains into intermittent and perennial branches of Kaelepulu Stream, then to Kaelepulu Pond, which ultimately discharges into Kailua Bay at Kailua Beach.

Kailua Bay is categorized as a Class A receiving water by Hawaii Administrative Rules Chapter 11, Section 54-3 (DOH 2021). Kaelepulu Stream to Kailua Beach are listed as impaired for Enterococci, Total Nitrogen (TN), Nitrate-Nitrite, Total Phosphorus (TP), Turbidity, Ammonium-Nitrogen, and Chlorophyll A on the 2022 CWA Section 303(d) List of Impaired Waters on Oahu.

The DOH Clean Water Branch has initiated development of a TMDL for the Kaelepulu Stream Watershed. Supporting this effort, DOT-HWYS resumed water quality monitoring in the watershed during the 2021 – 2022 Monitoring Year to help characterize storm water runoff from DOT-HWYS, and assess the potential for implementing enhanced operational or structural Best Management Practices (BMPs) along Kalanianaole Highway. During the Monitoring Year 2022 – 2023, DOT-HWYS will continue to collect storm water quality samples from two new monitoring sites in the Kaelepulu Stream Watershed.

See Appendix A for the location figures of the Kaelepulu Stream Watershed Monitoring Sites.

2.1.1 Kaelepulu Stream Watershed Monitoring Site #1

During Monitoring Year 2022 – 2023, DOT-HWYS will continue conducting storm water monitoring on a portion of Kalanianaole Highway which lies immediately west of the intersection with Keolu Drive. The drainage alignment is approximately 250 yards long and has an area just under two acres. Storm water runoff in the area flows off the highway and is collected by a network of grated drain inlets in a concrete median and the makai shoulder of the northbound road. This drainage area discharges to a 30-inch pipe which connects to the CCH MS4 at manhole Point Identification Number (PID) 201749. Discharge from the DOT-HWYS ROW is then mixed with runoff from the residential neighborhood along Keolu Drive, which flows into a perennial portion of Kaelepulu Stream, approximately 0.5 miles upstream of Kaelepulu Pond.

Storm water quality samples will be collected from this site using automated samplers, grab samples, or a combination of both.

See Appendix A for the location figure of the Kaelepulu Stream Watershed Monitoring Site #1.

2.1.2 Kaelepulu Stream Watershed Monitoring Site #2

During Monitoring Year 2022 – 2023, DOT-HWYS will continue conducting storm water monitoring on a portion of Kalanianaole Highway which lies south of Keolu Drive. The drainage area is approximately 500 yards long and has an area of approximately one-and-a-half acres. Storm water runoff in the drainage area sheet flows off the highway and is collected by a series of grated drain inlets on the shoulder. This drainage area discharges to a channelized culvert via an open channel at outfall PID 304739. The channelized culvert drains to a grassed area that connects to an intermittent portion of Kaelepulu Stream.

Storm water quality samples will be collected from this site using automated samplers, grab samples, or a combination of both.

See Appendix A for the location map of the Kaelepulu Stream Watershed Monitoring Site #2.

2.1.3 Kailua Road Monitoring Evaluation

During Monitoring Year 2022 – 2023, DOT-HWYS will evaluate stormwater features along Kailua Road and discharge points at the Kawainui Canal to determine a potential sample location in this area of the watershed. Once established, storm water quality grab samples may be collected from the sample point during active rainfall events for inclusion in the Annual Monitoring Report.

2.1.4 Kaelepulu BMP Activities

During Monitoring Year 2022 – 2023, DOT-HWYS will track operational BMPs conducted within the Kaelepulu Watershed monitoring site's drainage areas to evaluate the effectiveness at reducing pollutant concentrations and flow. BMPs evaluated will include the following:

- Landscaping maintenance and litter removal, including the frequency and quantity of material removed / disposed.
- Street sweeping, including the frequency, coverage, and quantity of material removed / disposed.
- Manhole and inlet cleaning, including the frequency and quantity of material removed / disposed.

2.2 Moanalua Stream Watershed Monitoring

Moanalua Stream Watershed is located near a densely populated portion of the City of Honolulu near Daniel Inouye International Airport and the neighborhoods of Salt Lake and Kalihi. Moanalua Stream Watershed was selected for monitoring since it contains the largest amount of DOT-HWYS ROW that drains to Keehi Lagoon, a Class A receiving waterbody determined to be a high priority for TMDL development by DOH.
The higher regions of Moanalua Stream Watershed contain mixed residential and business developments, while the lower portion of the watershed contains commercial and industrial facilities. State routes in the watershed include H-1 Freeway, H-201 Freeway and Nimitz Highway (Route 92).

During the 2021 – 2022 Monitoring Year, DOT-HWYS commenced water quality sampling of discharges from DOT-HWYS ROW into Moanalua Stream to help characterize storm water runoff and assess the potential of implementing enhanced operational or structural BMPs in the watersheds (or other watersheds which drain to the impaired waters of Keehi Lagoon). During Monitoring Year 2022 – 2023, DOT-HWYS will continue to collect storm water quality samples from three monitoring sites in the Moanalua Stream Watershed.

See Appendix A for the location figures of the Moanalua Stream Watershed Monitoring Sites.

2.2.1 Moanalua Stream Watershed Monitoring Site #1

During Monitoring Year 2022 – 2023, DOT-HWYS will continue conducting storm water monitoring on a portion of the H-1 Freeway and adjacent roads near the Ala Napunani Street interchange. The drainage area is approximately five acres. Storm water runoff in the area is collected by a network of grated drain inlets in the concrete medians along the freeway, adjacent roads, and ramps. This drainage area discharges to a 60-inch pipe which outfalls at PID 300311 directly into an intermittent portion of Moanalua Stream.

Storm water quality samples will be collected at grated drain inlet PID 110647, which is approximately 325 yards upstream of the outfall to Moanalua Stream. This point of the MS4 network was selected since it does not contain contributions from the non-DOT-HWYS property along Ala Napunani Street.

Storm water quality samples will be collected from this site using automated samplers, grab samples, or a combination of both.

See Appendix A for the location map of Moanalua Stream Watershed Monitoring Site #1.

2.2.2 Moanalua Stream Watershed Monitoring Site #2

During Monitoring Year 2022 – 2023, DOT-HWYS will continue conducting storm water monitoring on a portion of Puuloa Road, H-1 Freeway, and North King Street near the Puuloa Road interchange. The drainage area is approximately 12 acres. Storm water runoff from the north end of Puuloa Road, the on-ramp to North King, a 0.25-mile length of H-1 Freeway, and the Kaua Street on-ramp, drains into a 54-inch pipe that runs along North King Street. This pipe splits at inlet PID 115335 and discharges directly into Moanalua Stream via two 42-inch outfalls (PID 304426 and PID 303121), approximately one mile upstream of Keehi Lagoon.

Storm water quality samples will be collected at inlet PID 103372 since the outfalls to the stream are partially buried in the stream bank and will likely be submerged under stream water during large storm events and/or high tide. The inlet closer to the stream, PID 115335, is also inaccessible for sampling.

Storm water quality samples will be collected from this site using automated samplers, grab samples, or a combination of both.

See Appendix A for the location figure of Moanalua Stream Watershed Monitoring Site #2.

2.2.3 Moanalua Stream Watershed Monitoring Site #3

During Monitoring Year 2022 – 2023, DOT-HWYS will continue conducting storm water monitoring on a portion of the H-1 Freeway near the Funston Road interchange. The drainage area is approximately two acres. Storm water runoff in the area flows off the highway and is collected by a network of grated drain inlets in the concrete medians and shoulders of the road. This drainage area discharges to a 24-inch pipe which outfalls at PID 304595 to a grassed area, and eventually into an intermittent portion of Moanalua Stream (Kahauiki Tributary).

Because PID 304595 is located within a fenced area along Moanalua stream and is not accessible, storm water quality samples will be collected from inlet PID 103380.

Storm water quality samples will be collected from this site using automated samplers, grab samples, or a combination of both.

See Appendix A for the location figure of Moanalua Stream Watershed Monitoring Site #3.

2.2.4 Moanalua BMP Activities

During Monitoring Year 2022 – 2023, DOT-HWYS will track operational BMPs conducted within the Moanalua Stream Watershed monitoring site's drainage areas to evaluate the effectiveness at reducing pollutant concentrations and flow. BMPs evaluated will include the following:

- Landscaping maintenance and litter removal, including the frequency and quantity of material removed / disposed.
- Street sweeping, including the frequency, coverage, and quantity of material removed / disposed.
- Manhole and inlet cleaning, including the frequency and quantity of material removed / disposed.

2.3 Other Watershed Monitoring

2.3.1 Existing TMDL Monitoring

This section describes how the sampling results will used/facilitate analysis of current and future TMDLs.

The U.S. Environmental Protection Agency (EPA) has approved TMDLs for the Ala Wai Canal, Kawa Stream, Waimanalo Stream, Kapaa Stream, Kaneohe Stream and Waikele Stream Watersheds. During Monitoring Year 2022 – 2023, DOT-HWYS Monitoring Program will continue monitoring activities in DOT-HWYS ROW located in the six TMDL areas as described in the applicable I&M Plans. Monitoring activities in the TMDL Watersheds include tracking and analysis of BMPs such as street sweeping and other debris control operations and maintenance activities, and collection of rainfall data from rain gauges within each watershed.

A complete description of the BMPs, monitoring activities, and assessment methods for each TMDL watershed are provided in their corresponding I&M Plan. The six I&M Plans are provided on the DOT-HWYS website, www.stormwaterhawaii.com/resources/plans.

2.3.2 Future TMDL Monitoring

In addition to conducting monitoring activities in approved TMDL areas, DOT-HWYS also proactively plans and implements monitoring activities in anticipation of future TMDLs. Monitoring is conducted in watersheds that are listed as High Priority for a TMDL in Appendix C of the State of Hawaii Water Quality Monitoring and Assessment Report (Clean Water Branch 2022), and in watersheds identified by DOH through informal communications.

Kaelepulu Stream Watershed and Moanalua Stream Watershed are currently prioritized by DOH for the development of future TMDLs. During Monitoring Year 2021 – 2022 DOT-HWYS initiated monitoring activities in these two watersheds. Collection of samples that characterizes storm water runoff from DOT-HWYS ROW in these specific watersheds will provide data for potential WLAs that may be assigned to DOT-HWYS, as well as provide data to identify effective operational and structural BMPs.

2.3.3 Other High Priority Waterbodies and Watersheds

Per MS4 NPDES Permit Part F.4, as additional TMDLs are adopted by DOH, which are approved by the EPA and that identify DOT-HWYS as a source, DOT-HWYS shall develop I&M Plans for a minimum of one additional TMDL waterbody or watershed per year within one year of the approval date.

As part of a proactive watershed-based approach to monitoring, DOT-HWYS will continue to periodically review the most recent release of the *State of Hawaii Water Quality Monitoring and Assessment Reports*, in particular Appendix C, which contains the CWA Section 303(d) List of Impaired Waters on Oahu.

DOT-HWYS will also continue to proactively collaborate and share data with DOH and EPA in order to assist the agencies in the long-term planning efforts towards assessing impaired waterbodies, and identifying and developing TMDLs for watersheds.

The Kalihi and Kaupuni Watersheds were also listed as High Priority for TMDL development in the *2022 State of Hawaii Water Quality Monitoring and Assessment Report*. DOT-HWYS will continue to coordinate with DOH and other regulating agencies regarding high priority waterbodies in order to facilitate and prepare for the development of new TMDLs.

During Monitoring Year 2022 – 2023, DOT-HWYS plans to review existing water quality data from Oahu's receiving waters (i.e., surface water such as streams, estuaries, or marine shorelines) for select TMDL or high-priority watersheds. Data collected will be used in conjunction with water quality sample laboratory data collected during storm water discharges to assess impacts to receiving waters and specific water quality issues resulting from storm water discharges from the DOT-HWYS MS4, as well as to evaluate the long-term trends.

DOT-HWYS will continue to collaborate and communicate with regulatory agencies such as DOH and EPA, and will consider the locations of other agencies' stream monitoring sites while planning and reporting on DOT-HWYS storm water monitoring activities. The results of the assessment of DOT-HWYS impact to the overall health of the receiving waters, based on the chemical, physical, and biological impacts resulting from storm water discharges, will assist DOT-HWYS to identify management measures proven to be effective or ineffective at reducing pollutants and flow, and provide guidance for future planning and design of institutional and post-construction BMPs.

2.3.4 Illicit Discharge Detection and Elimination Monitoring

MS4 NPDES Permit Parts F.1.a.(5) and (6) require that objectives of the DOT-HWYS Monitoring Program include measures for identifying sources of specific pollutants, and detecting and eliminating illicit discharges and illegal connections to the MS4. DOT-HWYS has a processes for identifying sources of specific pollutants, and detecting and eliminating illicit discharges and illegal connections to the MS4, through implementation of the Industrial Commercial Activities Discharge Management Program , Illicit Discharge Detection and Elimination Program, Baseyard Inspections, and the Trash Reduction Plan. Details of these plans and programs are located in the 2022 SWMP Plan.

3.0 **Analytical Methods** | MS4 NPDES Permit Part F.1.b.(4) and F.1.b.(5)

3.1 Watershed Water Quality Monitoring

Storm water samples collected under the Watershed Water Quality Monitoring Program, as described in Section 2, will be analyzed for TN, which is a calculation of Nitrate plus Nitrite, and Total Kjeldahl Nitrogen (TKN), TP, Ammonia, and Total Suspended Solids (TSS) by a State-approved laboratory. These parameters were selected since they are the most representative of the pollutants of concern for the watersheds of interest and the 303(d) List of Impaired Waters.

Table 2 lists the preferred analytical methods for each parameter and their associated holding times and preservation methods. If the analytical methods in Table 2 are not available, alternative methods may be approved under the guidelines of *Code of Federal Regulations, Title 40, Subchapter D, Part 136 Guidelines Establishing Test Procedures for the Analysis of Pollutants*.

Table 3. Storm Water Monitoring Parameters.

Parameter (mg/L)	Analytical Method	Holding Time (Days)	Preservation Method
Total Kjeldahl Nitrogen (TKN)	EPA 351.2	28	Cool to ≤6°C pH<2 using sulfuric acid
Nitrate + Nitrite	SM[1]4500-NO2-B SM[1]4500-NO3-E	28	Cool to ≤6°C pH<2 using sulfuric acid
Total Nitrogen (TN)	Calculated by TKN plus Nitrate + Nitrite		
Total Phosphorus (TP)	SM[1]4500PE	28	Cool to ≤6°C, pH<2 using sulfuric acid
Total Suspended Solids (TSS)	SM[1]2540D	7	Cool to ≤6°C
Ammonia as Nitrogen[2]	EPA 350.1	28	Cool to ≤6°C pH<2 using sulfuric acid

[1] Standard Methods (SM)
[2] Only samples collected from Kaelepulu Stream Watershed will be analyzed for the indicated parameter.

Holding time is the maximum suggested period between sample collection and laboratory analysis. The laboratory will notify the Project Manager and note in the Analytical Report if samples are received outside of the holding time. Holding times assume proper preservation methods have been followed.

Water quality testing parameters under other SWMP programs may differ from those listed in Table 2. The Monitoring Team will determine the specific parameters for field or laboratory analysis on a case-by-case basis.

3.2 Storm Event Characterization

Precipitation will be monitored using a combination of on-site or web-based rain gauges, and the Molokai radar managed by the National Oceanic and Atmospheric Administration's National Weather Service. This data will be used to delineate storm characteristics (timing, duration, intensity, and relative total rainfall), and the range of discharge volumes that occur during sampling events. Rain gauges have been installed at locations within or near the Moanalua and Kaelepulu monitoring sites, as depicted in Appendix A.

When rainfall is anticipated based on local weather forecasts, online radar imagery will be monitored to determine the projected timing, duration, and intensity of incoming precipitation at the monitoring sites. The rain gauges will also be monitored to evaluate the intensity of rainfall at each location. If the rainfall volume is anticipated to be over one tenth of an inch, the Monitoring Team will mobilize sampling equipment and supplies to collect grab samples or samples from the automated samplers, as applicable.

4.0 Quality Assurance/Quality Control Procedures | MS4 NPDES Permit Part F.1.b.(6)

Quality Assurance/Quality Control (QA/QC) is an important component of an effective sampling program. This section provides details of, laboratory analytical methods, QA/QC procedures to be used in TMDL watershed monitoring, illicit discharge sampling, post-construction BMP effectiveness studies, and other storm water discharge characterization conducted as part of the DOT-HWYS SWMP.

4.1 Field Sampling Methods

This section provides information regarding the specific field methods that will be used to accomplish the water quality monitoring activities.

4.1.1 Automated Sample Collection

Automatic samplers may be used to collect samples and provide data control and logging for sensors. Each automatic sampler will be programmed to obtain a timed series of samples throughout a rainfall event. Once the water flow in the drainage structure reaches a predetermined depth, samplers will collect runoff at a prescribed time frequency. The samples are automatically collected by a pumping mechanism that draws water from the main channel of flow through a laboratory-grade vinyl tube and into a clean plastic bottle. Automatic samplers will normally be programmed to collect samples every 2-15 minutes to increase the chances of capturing a runoff event. In the occurrence of larger storms, samples may be collected at less frequent intervals to provide a more accurate representation of runoff from the entire storm. Samples will be collected until runoff slows to a point where there is insufficient water at the intake, there is no flow, and/or the supply of bottles is exhausted. The bottles can be submitted to the laboratory as discrete samples, or as composite sample(s), which can be obtained from combining multiple containers from different periods of the storm event. Automatic samplers will be serviced immediately following a storm event.

All samples will be placed on ice and maintained at a temperature equal to or less than 6 degrees Celsius (°C) until they are delivered to the laboratory. Sample containers will be packaged and handled to protect the integrity of the water samples.

4.1.2 Manual Sample Collection

Manual samples may be collected by field personnel during a storm event. Storm events will be monitored by radar so that field personnel can be present in the watershed during active storms to obtain manual samples. Samples will be manually collected at 1-minute to 60-minute intervals depending on the anticipated storm duration and intensity. Samples will be deposited into clean, labeled plastic bottles. Samples will be collected via peristaltic pump through single use low-density polyethylene (LDPE) tubing directly into the appropriate sample bottles. The LDPE tubing will be weighed down at one end to aid in sample collection in high flow situations. If necessary, an extension pole, rope, or other apparatus can be used to aid in sample collection, especially during high flow conditions. Samples collected by this method will be considered a grab sample.

Manual samples will be placed on ice and maintained at a temperature equal to or less than 6°C until they are delivered to the laboratory. Sample containers will be packaged and handled to protect the integrity of the water samples.

4.1.3 Sampling Equipment Decontamination and Calibration

Samples collected using non-disposable or non-dedicated equipment will require decontamination between samples to prevent cross-contamination. Prior to the start of sampling, surfaces of the sampling equipment that come into direct contact with sample water will be decontaminated. After each use, sample collection containers and lids will be decontaminated by a certified laboratory according to standard sampling protocols. In the event that this is not possible, containers will be washed using a non-phosphate detergent solution and brushed to remove sediment. Each bottle will then be triple rinsed and air-dried.

Field monitoring equipment will be calibrated according to manufacturer's instructions.

4.2 Data Management

Precautions will be taken in the storage and analysis of data to prevent errors, loss, or misinterpretation of data. Before data is modified or analyzed, a copy of the original data will be archived.

4.2.1 Documentation

Information will be hand recorded on standardized Field Logs and Chain of Custody (COC) forms, which are scanned and electronically filed in a dedicated project folder on a secure server. The COC forms will accompany all samples. A Field Log will be kept for each sampling site with the details of the date, time, personnel, purpose of visit, weather, conditions observed, samples collected, and actions performed. Photographs may be used to document field conditions and samples.

Hard copies of COC forms and Field Logs will be stored for at least 30 days after the *Annual Monitoring Report 2022 – 2023* is submitted to DOH.

<u>Sample Labeling</u>

All sample bottles are given simple consecutive labels specific to each sample location. Information such as sample date, time, analysis method, preservation method (if any), conditions, and personnel present are recorded in the Field Logs and COC forms, and linked to specific sample bottle numbers when appropriate.

Chain of Custody

The COC forms will be used to trace the possession of each sample from the time it is collected until completion of analyses. All samples submitted to the laboratory will be accompanied with a COC form. The COC form details the following information, at minimum, as follows:

- Name and contact information of sampling personnel
- Name and contact information for laboratory
- Sampling contract name
- Sample ID number
- Date and time of sample collection
- Sample matrix
- Sample location
- Number of containers
- Preservation method, if any
- Analytical test parameters
- Analytical method
- Sample temperature
- Name and signature(s) of persons involved in the COC
- Date and method of delivery

DOT-HWYS and the laboratory will maintain electronic copies of each COC form. Electronic copies of the completed COC forms will be submitted to DOH as an appendix of the *Annual Monitoring Report 2022 – 2023*.

Custody seals will be affixed to sample coolers to ensure that the sample chain of custody has not been compromised during transit to the laboratory.

AMS Maximo

DOT-HWYS inventories and monitors SWMP assets and activities through an integrated, multiplatform asset management system (AMS). The foundation of the AMS is a georeferenced inventory of all known MS4 drainage structures and post-construction BMPs hosted on Esri's ArcGIS platform. All assets can be explored alongside reference information including hydrology, infrastructure, and cadastral datasets in an interactive, web-based map application (AMS Viewer).

The spatial inventory is directly linked to a relational database hosted on IBM's Maximo Asset Management platform (AMS Maximo). AMS Maximo connects each individual asset to an attribute dataset and inspection work orders. Inspectors enter data into AMS Maximo either directly through its web interface or through a mobile data collection app, such as ArcGIS Field Maps or Survey123.

The AMS is the principal management tool used by DOT-HWYS for short-term planning and long-term compliance monitoring. The AMS allows program managers to assess compliance with MS4 NPDES Permit requirements, measure effectiveness, and make modifications as necessary, by facilitating the visibility of resources and comprehensive data analysis

Field Logs

Field Logs are completed during every sampling event to document the details of site visits such as location, date, time, personnel, purpose of visit, weather, conditions observed, samples collected, and actions performed. Data is then transferred to the AMS Maximo TMDL Module for storage and analysis.

Photographs

Photographs may be taken of each sample, by DOT-HWYS or the laboratory, to document visual characteristics of the sample contents. Photographs will be stored electronically in a dedicated project folder on a secure server and within the AMS Maximo TMDL Module.

4.3 Analytical Results

Each set of sample results will be provided in the analytical laboratory's report. This report will contain relevant information about the sample receipt and analysis procedures, including descriptions of problems with the analyses, corrective actions if applicable, deviations from analytical methods, QC results, and a definition list for each qualifier used. The laboratory analysis results reports will be maintained in a dedicated project folder on a secure server.

4.3.1 Data Quality Assessment

All generated data will undergo data verification and validation. The items listed below will be evaluated, as applicable to the analytical method. Qualifiers will be applied, as necessary.

- Deliverables
- COC/Condition of samples at laboratory receipt
- Holding times
- Calibration (initial and continuing)
- Blanks (method and calibration)
- Laboratory replicates
- Laboratory Control Samples/Laboratory Control Sample Duplicates
- Matrix Spikes/Matrix Spikes Duplicates
- Field QC samples
- Compound quantification and reported detection limits
- Overall assessment of data

The data will be reviewed in accordance with appropriate EPA method-specific, and/or laboratory-specific QC guidance documents.

4.3.2 Field Quality Assurance/Quality Control

The field and laboratory QA/QC procedures ensure the reliability and validity of field data gathered as part of the overall program.

Equipment Rinsate Blanks

Equipment rinsate blanks verify the adequacy of the decontamination process and whether the equipment is a source of sample contamination. To confirm that non-dedicated, non-disposable sampling devices have been effectively decontaminated, rinsate samples will be collected and submitted to the laboratory for analysis. These samples will be submitted for analysis as normal samples.

The equipment rinsate blank will be collected from the decontaminated equipment prior to or after the completion of sampling. These samples will be obtained by pouring distilled or deionized water through or over sampling equipment. The water will be collected in a clean sample container and will be transported to the laboratory for analysis. Equipment rinsate blanks will be collected and analyzed for the same parameters listed in Table 2, as applicable.

Should the rinsate blank contain levels of contaminants within an order of magnitude above the analysis detection limits or within an order of magnitude of associated samples, potential contamination will be documented. No field rinsate blank is required for dedicated equipment (not reused to obtain other samples), or for laboratory supplied and/or cleaned containers. Equipment rinsate blanks will be collected at a frequency of one per twenty normal samples per matrix, or one per sampling event, whichever is more frequent.

Field Duplicates

A field duplicate will be collected at the same location immediately following the parent sample and will be composited with the parent sample. Duplicate samples will be assigned a different sample ID but is labeled in a manner such that it is not apparent to the laboratory. Duplicate samples will be preserved, packaged, and sealed in the same manner as other samples of the same matrix. The field duplicates will be sent blind to the laboratory. A minimum of 10% of normal samples will have a corresponding field duplicate sample.

Field duplicates will be collected and analyzed for the same parameters listed in Table 2, as applicable. Results for field duplicates will be used to verify the precision of the laboratory and/or sampling method and serve as an indicator of potential cross-contamination.

4.3.3 Laboratory Quality Assurance/Quality Control

The laboratory QA/QC procedures ensure the reliability and validity of field and analytical laboratory data gathered as part of the overall program.

Container Certificate of Analysis

Bottles used for preservation and shipping are provided by the laboratory and are certified according to the container manufacturer's Certificate of Analysis.

Laboratory Quality Control Samples

Laboratory QC samples are analyzed as part of standard laboratory practice. The laboratory monitors the precision and accuracy of the results of analytical procedures through the analysis of QC samples, including Laboratory Control Samples (LCS)/LCS Duplicate (LCSD) samples, method blanks, laboratory replicates, and Matrix Spikes (MS)/MS Duplicates (MSD) samples, one per batch per analysis.

A routinely collected water sample contains sufficient mass for both routine sample analysis and additional laboratory QC analyses, with the exception of MS/MSD samples. These will be analyzed at a frequency of one per sampling event. Precision, accuracy/bias, representativeness, completeness, and comparability are the data quality indicators used to assess the sampling results for usability. Each data quality indicator is described as follows, including a definition of the terminology and the process for calculating the indicator.

Precision

Precision criteria monitor analytical reproducibility, and is the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. The QC measures for precision include field duplicates, laboratory duplicates, LCS and LCSD samples, and MS and MSD samples. Precision is expressed as relative percent difference (RPD), which is calculated by dividing the absolute difference of two samples by their mean, as shown in the equation below.
The method performance criteria for precision is RPD ≤ 30%.

$$\text{Relative Percent Difference} = \frac{(Result_{\text{Parent Sample}} - Result_{\text{Duplicate Sample}})}{\frac{(Result_{\text{Parent Sample}} + Result_{\text{Duplicate Sample}})}{2}}$$

Precision variability may be the result of one or more of the following: field instrument variation, analytical measurement variation, poor sampling technique, sample transport problems, or spatial variation (heterogeneous sample matrices). To identify the cause of imprecision, the field sampling design rationale and sampling techniques will be evaluated, and both field and analytical duplicate sample results will be reviewed. If poor precision is indicated in both the field and analytical duplicates, then the laboratory may be the source of error. If poor precision is limited to the field duplicate results, then the sampling technique, field instrument variation, sample transport, and/or spatial variability may be the source of error.

Accuracy/Bias

Accuracy is the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) that are due to sampling and analytical operations. Examples of QC measures for accuracy include MS, LCS, and equipment rinsates (if non-dedicated sampling equipment is used). Accuracy is measured by the percent recovery for spiked samples (LCS/LSCD, and MS/MSD). The method performance criteria for accuracy/bias will be established based upon the specific laboratory's statistically determined internal performance QC limits.

Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared with the amount that was expected to be obtained under correct, normal circumstances. Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. The method performance criteria for completeness is 90%. Completeness measures the effectiveness in sample collection, analysis, and result reporting of the entire Monitoring Program, and is calculated on a per-analyte basis by the percentage of usable data (usable data divided by the total possible data), as follows.

$$\%\ Completeness = \frac{Number\ of\ Valid\ Results}{Number\ of\ Possible\ Results}\ x\ 100$$

'Number of Valid Results' is the number of possible results minus the number of possible results not reported. Results may not be reported in instances in which the sample(s) are not analyzed for any reason (holding time violations in which resampling and analysis were not possible, samples spilled or broken, etc.).

Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another. In order to meet the needs of the data users, the samples will be collected using the *Monitoring Plan* guidelines, applicable field sampling techniques, and specific analytical methodology. If field QC issues affecting comparability are identified, data will be qualified as estimated.

5.0 Estimated Budget for Monitoring Program | MS4 NPDES Permit Part F.1.b.(7)

This section provides an estimated budget for Monitoring Year 2022-2023.

Components that will require funding include the following:

- Sampling site setup and maintenance
- Storm water sampling and analysis
- Data analysis and reporting
- Administration and recordkeeping

Table 3 shows the estimated costs associated with water quality monitoring for Monitoring Year 2022 – 2023, as detailed in Section 2.0.

Table 4. Estimated Costs Associated with 2022-2023 Water Quality Monitoring.

Program Component	Estimated Annual Cost
Labor	$80,000
Materials	$16,000
Laboratory Analyses	$75,000
ESTIMATED TOTAL	$171,000

6.0 References

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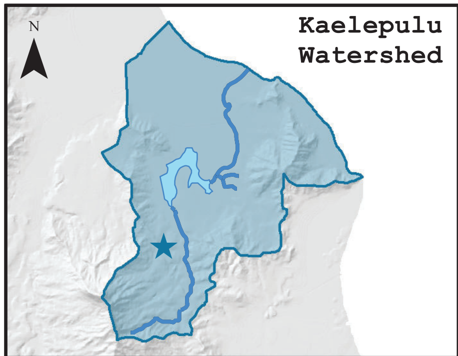
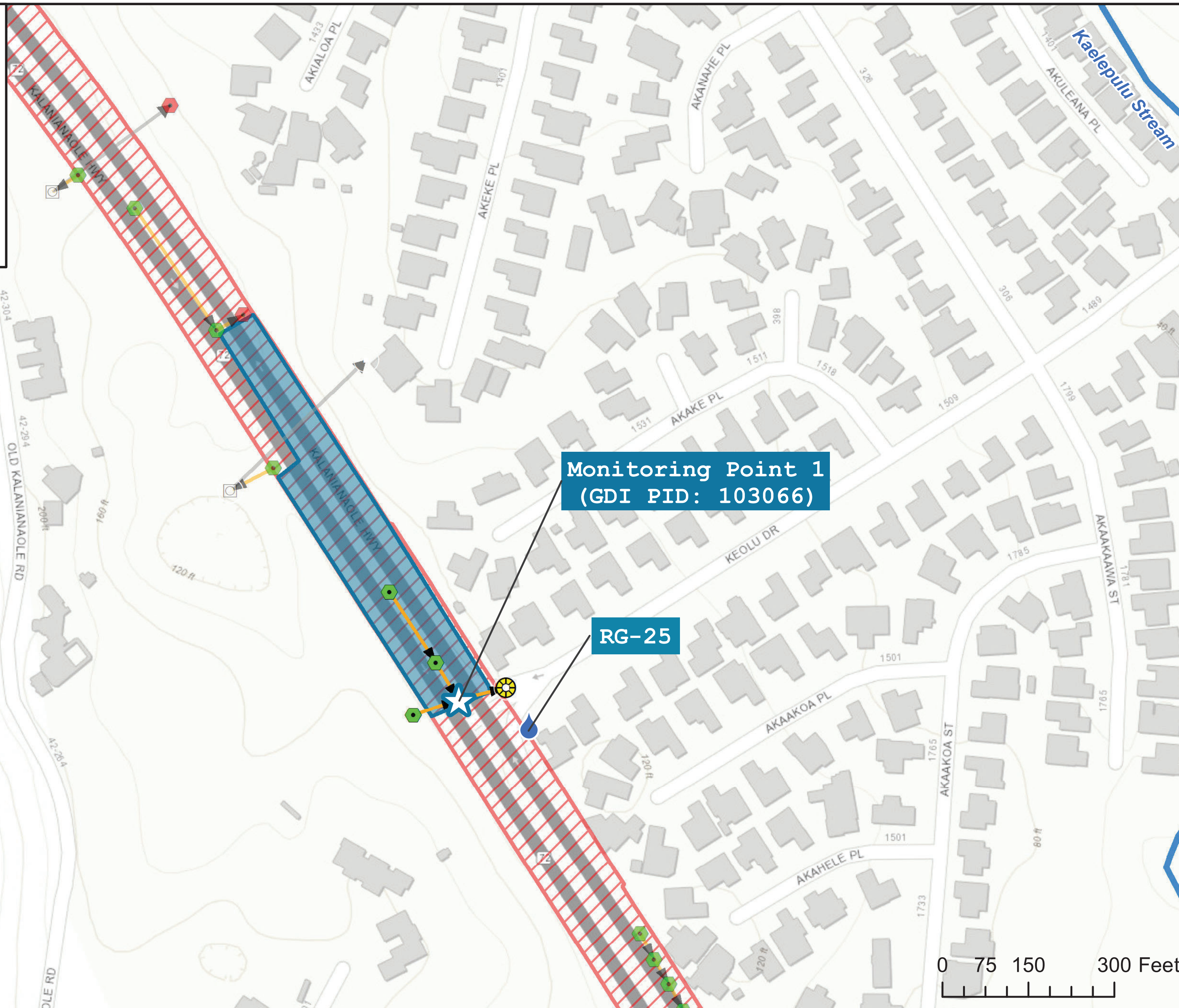
APPENDIX A

Monitoring Site Location Figures





Kaelepulu Stream Watershed Monitoring Site #1

March 2022

Legend

- Outfalls
- Inlets
- Culvert Entrances
- Manholes
- JTP
- Rain Gauge
- Open Channels
- Pipes
- Culverts
- Streams
- Drainage Area
- DOT ROW

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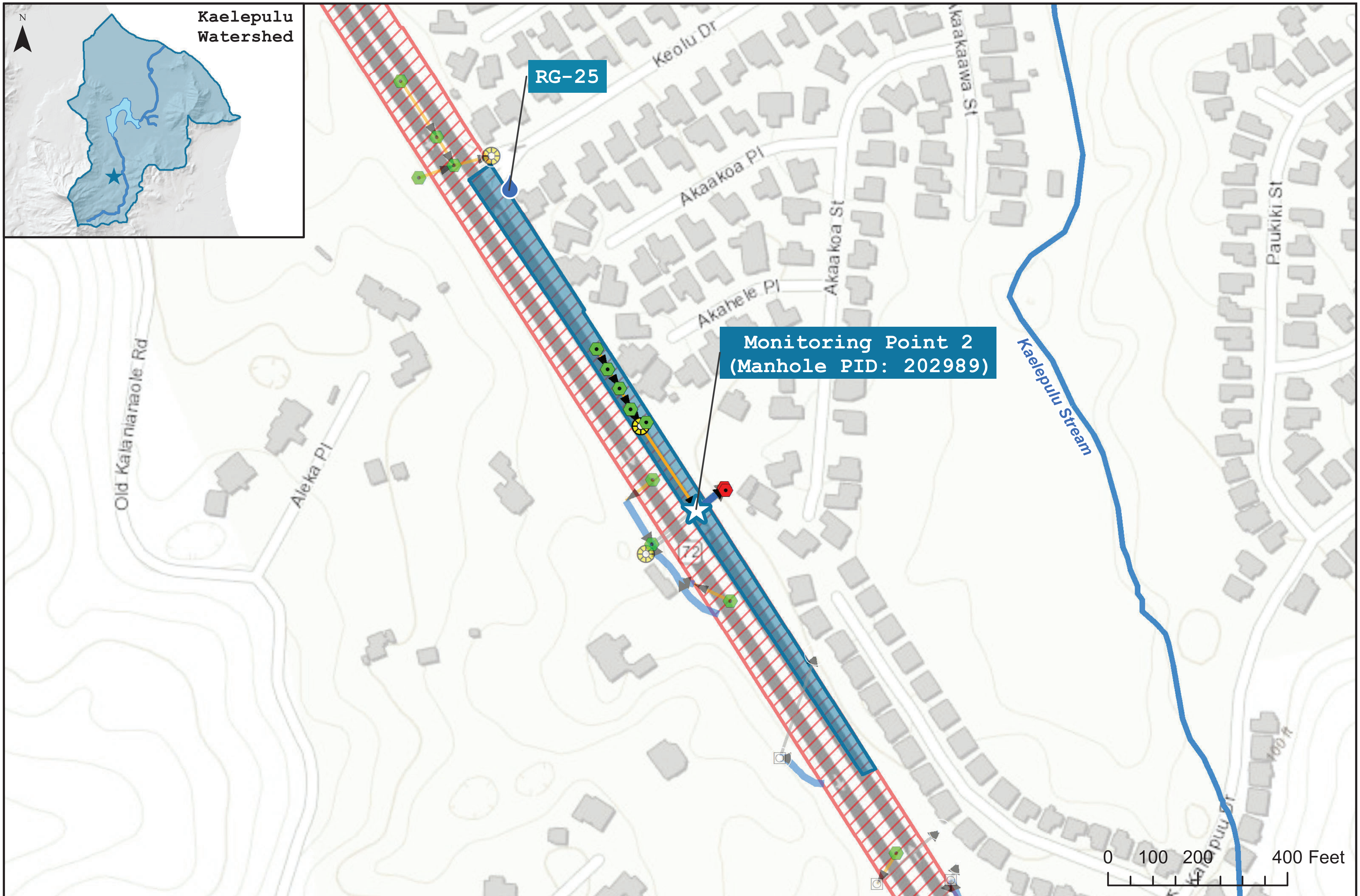

Kaelepulu Stream Watershed Monitoring Site #2

March 2022

Legend

- Outfalls
- Inlets
- Culvert Entrances
- Manholes
- JTP
- Rain Gauge
- Open Channels
- Pipes
- Culverts
- Streams
- Drainage Area
- DOT ROW

Department of Transportation · State of Hawaii

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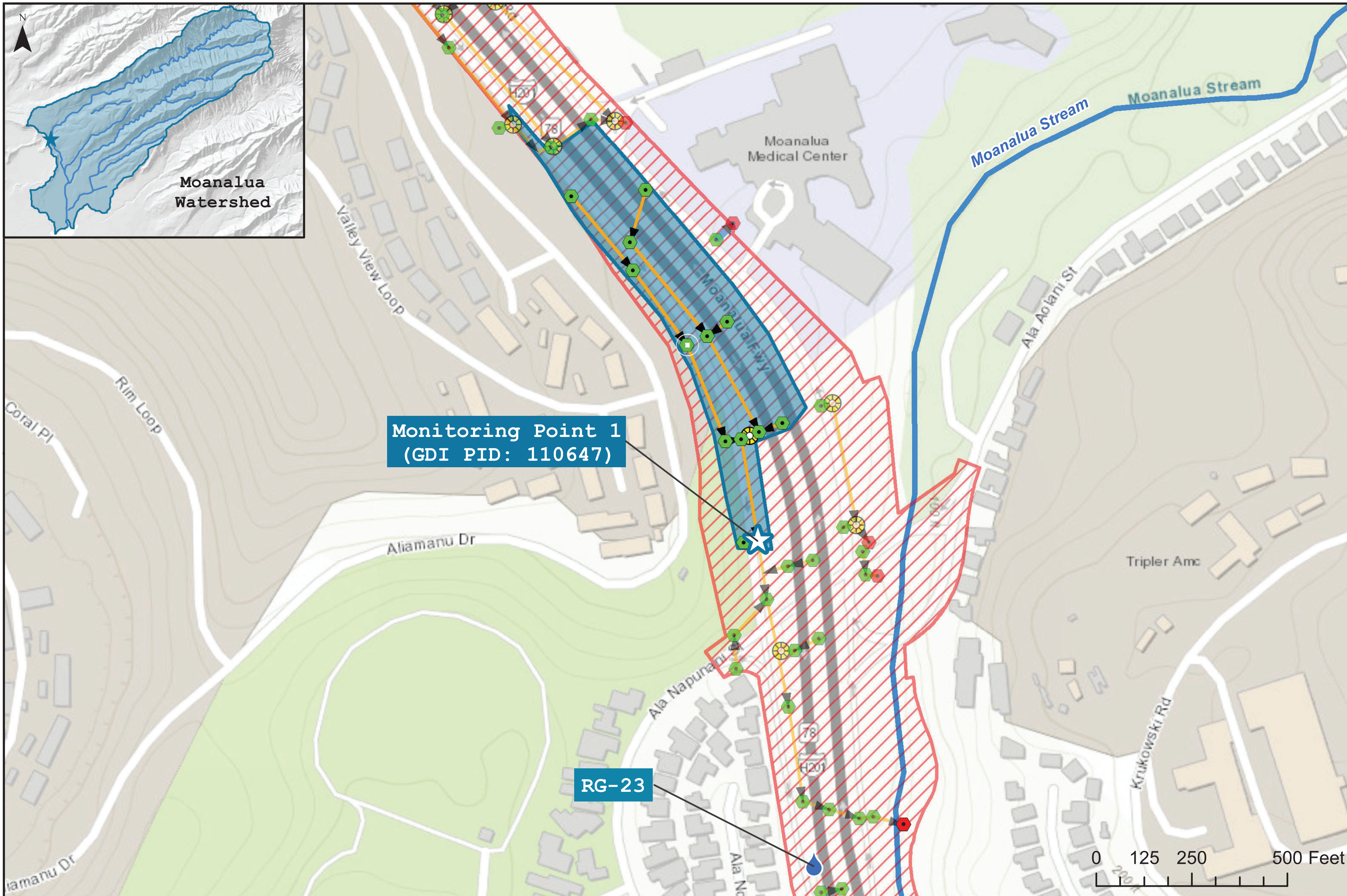

Moanalua Stream Watershed Monitoring Site #1

March 2022

Legend

- Outfalls
- Inlets
- Culvert Entrances
- Manholes
- JTP
- Rain Gauge
- Open Channels
- Pipes
- Culverts
- Streams
- Drainage Area
- DOT ROW

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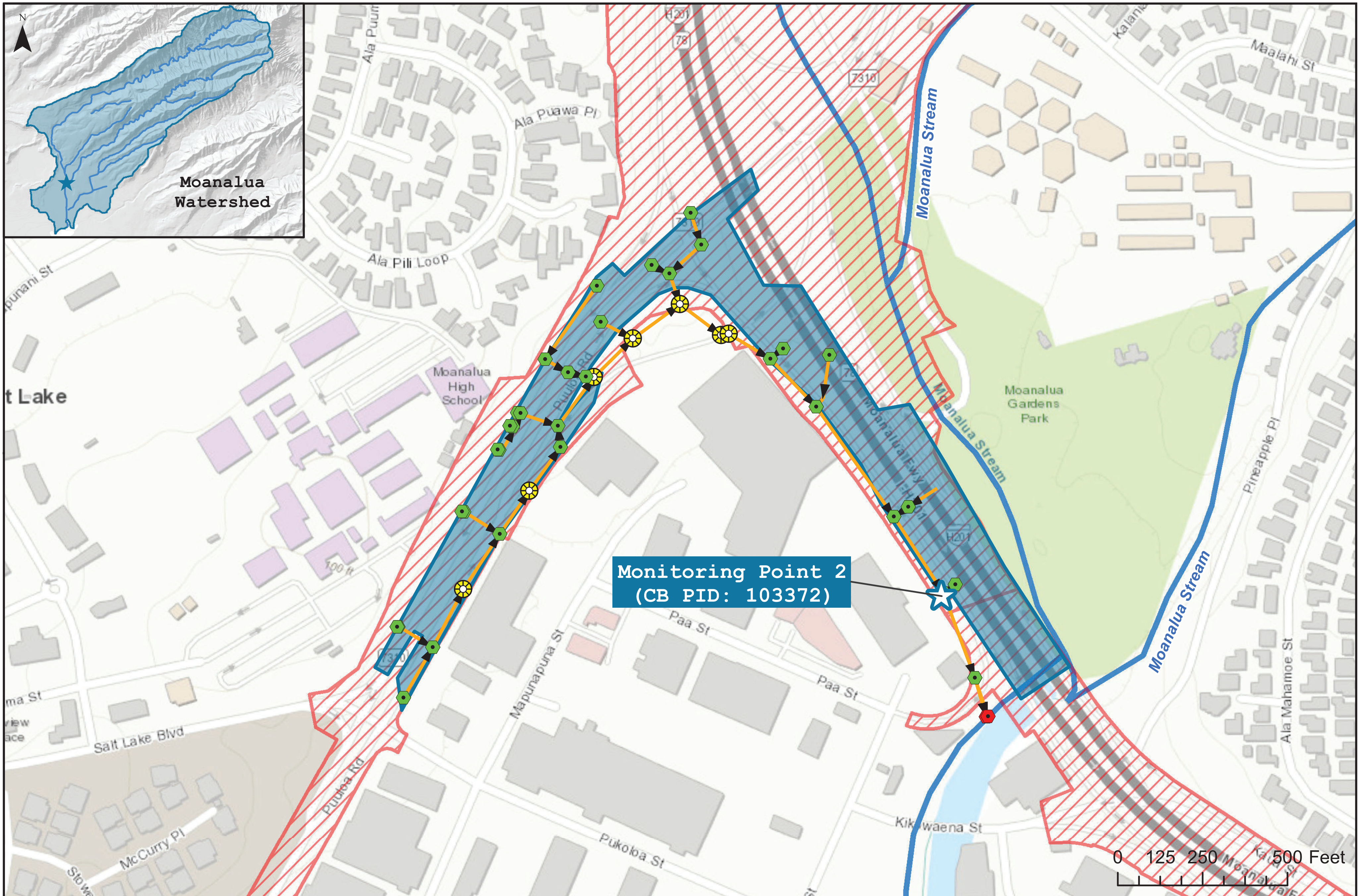

Moanalua Stream Watershed Monitoring Site #2

March 2022

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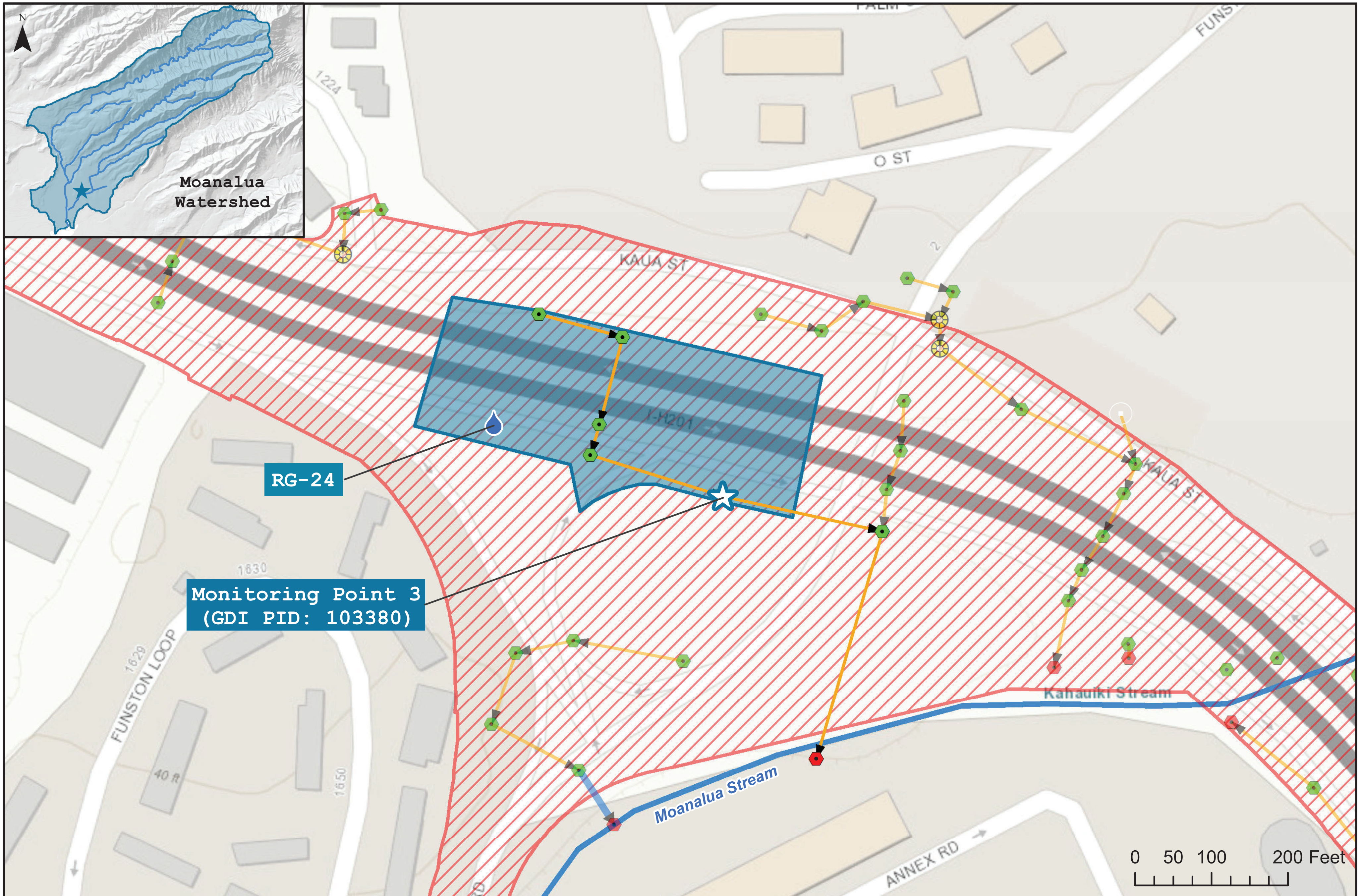

Moanalua Stream Watershed Monitoring Site #3

March 2022

Legend

- Outfalls
- Inlets
- Culvert Entrances
- Manholes
- JTP
- Rain Gauge
- Open Channels
- Pipes
- Culverts
- Streams
- Drainage Area
- DOT ROW