# ATTACHMENT J

# AIEA STREAM MONITORING AND ASSESSMENT PLAN

# Aiea Stream Water Quality Monitoring and Assessment Plan

## For Interstate Route H-1,
## Aiea Stream Erosion Control Project
## DOT No. H1E-01-11MR

## Aiea, HI

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## EXECUTIVE SUMMARY

The north bank of Aiea Stream just below the H-1 Freeway is experiencing erosion that threatens adjacent buildings and is to be stabilized using a combination of concrete grout, reinforcement, and rock rip-rap. The stream only flows during rainfall events and is typically dry at the construction site. Standard erosion control BMPs will be augmented by two temporary 36-inch pipes installed in the streambed to transmit water from intermittent stream flow events past the project areas disturbed by construction. Construction will be scheduled to occur during drier months of the year (April–October) and is anticipated to be completed within 140 working days.

Environmental monitoring of the site will consist of photographic documentation, water quality sampling during flow events, and post-construction physical measurement of stream erosion downstream of the site. Photographic documentation and water quality sampling will be conducted weekly for up to 10 weeks prior to construction, three times per week during construction, and weekly for up to 2 weeks post-construction to include up to 3 stream flow events. The intent of the pre- and post-construction water quality monitoring is to visit the site during up to three rainfall events so that control (upstream) and project impacted (downstream) samples can be collected for comparison purposes. The water quality parameters most likely to be impacted by construction and to be measured include total suspended solids (TSS), turbidity, temperature, pH, and oil and grease (O&G). In addition, water depth will be measured and used to estimate flow rate. All field monitoring activities will be documented in Field Reports. Field Reports that include water quality samples or that describe potential problems with BMPs will result in the development of an Event Report. Event Reports will be forwarded to the State Department of Health (DOH), will document problems noted, and will document steps taken by the contractor to remediate these issues. Downstream erosion monitoring using standard survey techniques will be conducted for up to two years after construction in the reach below and immediately across the construction site.

# CHAPTER 1 INTRODUCTION

## 1.1 PURPOSE FOR MONITORING

The goal of the Clean Water Act (CWA) is to minimize pollution of waters of the United States from all types of discharges. Section 401 of the CWA (33 USC 1341) creates a process for states to verify that federally permitted activities or projects will conform to the state’s water quality standards. As part of this process, the federal permit applicant generally demonstrates that the potential for pollutant discharge associated with the activity will be avoided and/or minimized through the development and implementation of a Best Management Practice (BMP) plan. Additionally, a water quality monitoring plan is developed as a tool to monitor BMP effectiveness and to verify that discharges resulting from project activities comply with effluent limitations and water quality standards. This plan serves as the Applicable Monitoring and Assessment Plan (AMAP) for the Aiea Stream Project (shown in Figure 1) and has been developed to meet these objectives and to consider the potential long term project impacts. This plan includes a detailed quality assurance and quality control (QA/QC) plan and is supported by a discussion of the data quality objectives (DQO). Any changes to this AMAP will be submitted to the State of Hawaii Department of Transportation Highways Division for review and then submitted to the Department of Health Clean Water Branch (DOH-CWB).

The purpose of this project is to stabilize and reinforce a portion of Aiea Stream’s north bank, which is experiencing down-cutting and erosion. The project involves the installation of a texturized shotcrete facing and soil nails to stabilize the bank. During construction, the stream water quality could potentially be impacted by soil erosion, the inflow of concrete, concrete wash water, or oil and grease (O&G) from construction equipment. This AMAP seeks to monitor the efficacy of the construction project BMPs in preventing these pollutants from entering the stream and to document discharge events should they occur. In achieving these objectives, water quality monitoring will consist of three phases that are distinguished by duration and sampling frequency: pre-construction, construction, and post-construction (see Section 2.1). It is the responsibility of the Contractor, however, to conduct daily inspections of the project BMPs, take photos, and record findings.

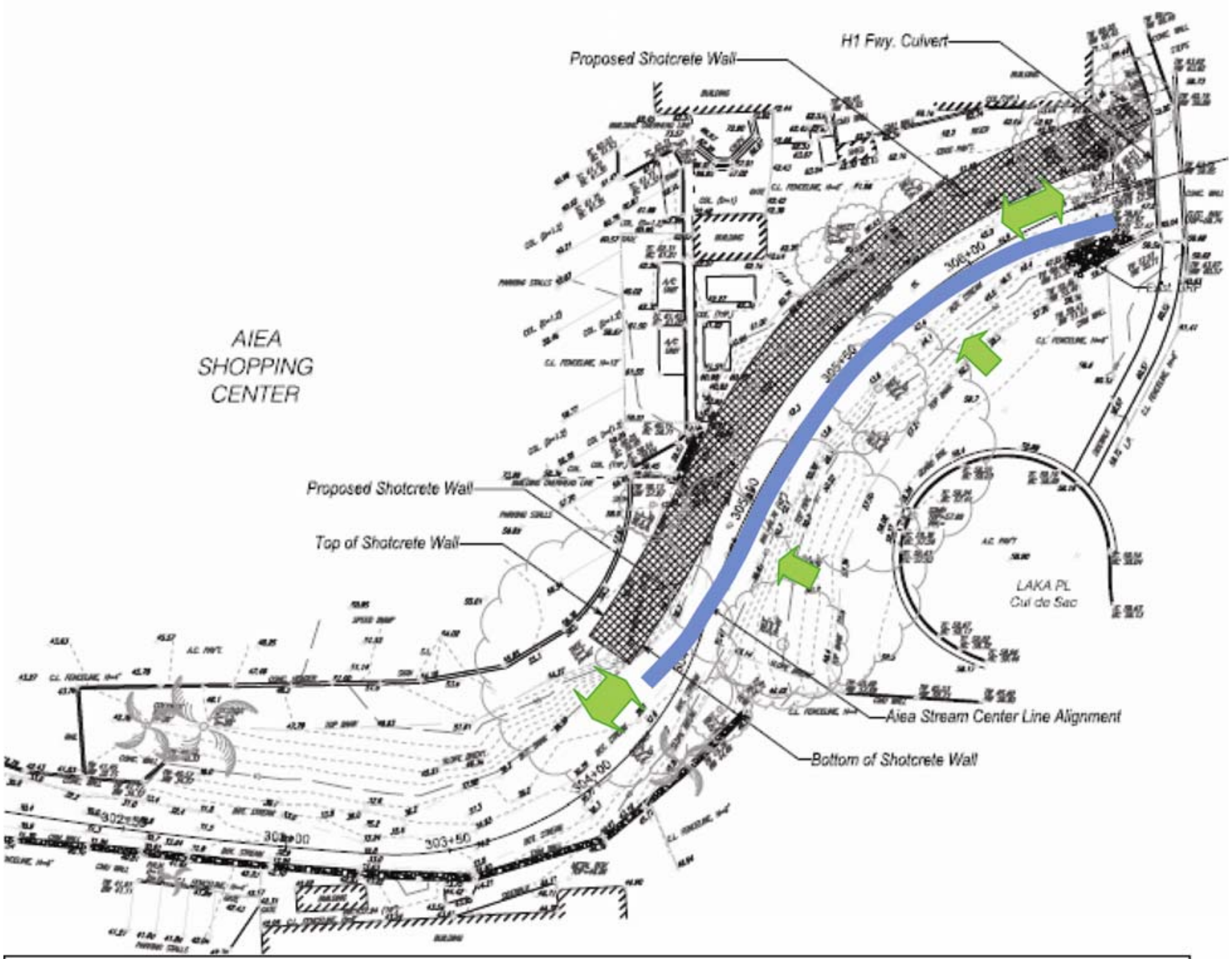
The Department of Health (DOH) has expressed concern that stream bank modifications to prevent erosion within the project area could result in increased erosion rates downstream of the project. The streambed is already known to be experiencing incision, which this project addresses; and it is important not to transfer erosion potential downstream. The primary concern below the project site is potential erosion to the left (south) bank of the stream below the footing of the existing concrete rubble masonry rock wall. Therefore, this plan outlines steps to monitor for downstream erosion over a two-year period post-construction. The erosion monitoring is a post-construction activity that is separate from the water quality monitoring. Procedures and methods specific to the monitoring are included throughout this AMAP.

## 1.2 SITE DESCRIPTION

The State Department of Land & Natural Resources (DLNR) classifies Aiea Stream (Code 4-03) as an intermittent stream only flowing during active rainfall runoff events, with the exception of un-quantified groundwater input near the mouth of the stream well below the proposed project. There are no U.S. Geological Survey (USGS) flow records published for the stream, which has a total length of 3.47 miles and drains a 1.3-square-mile watershed to the project site. The watershed extends to about half-way to the crest of the Koʻolau Mountains. The stream is on the

State's 2006 list of water quality limited segments with total nitrogen, nitrate plus nitrite, trash, and turbidity listed as the primary water quality criteria of concern. The project is located immediately below the H-1 Freeway (see Figure 1) at Latitude 21º 22' 45.10", Longitude 157º 55' 44.26". The elevation of the streambed falls from about 45 feet at the exit of the freeway's double-cell box culvert to about 35 feet, 200 feet downstream.

**Figure 1: Project Site Map**



Aiea Stream project site just below H-1 Freeway. Hatched area on right bank showing location of bank stabilization structure, with bypass pipes shown (blue) in the streambed on left side of the bed. Bypass extends from sandbag dam at H-1 Freeway left bank culvert outlet to below project site. Six standard project photo locations are indicated by green arrows. During flow events, samples will be collected at four locations (see Appendix A). Estimated flow volumes associated with each sample will be recorded.

The project site was surveyed previously in 2010 by Oceanit to determine the location of the ordinary high water mark (OHWM) and U.S. Army Corps of Engineers (USACE) jurisdiction. The OHWM lines are indicated on the site photographs in Figures 2 and 3. The project site is a nontidal stream flowing directly to the East Loch of Pearl Harbor and, as previously mentioned, is classified as intermittent by the State DLNR. The stream appears to flow only during either very heavy rainfall events or in response to rainfall directly on the site. At the time of inspection, there was no water flow at the project site immediately below the H-1 Freeway even though the preceding days had recorded significant rainfall in the mountains above the site. During the site inspection there was a great deal of trash within the streambed and banks. Subsequent site inspections conducted in June 2012 located two nearby storm drain inlets from which this trash and other potential non-point source pollutants could emanate - one at the cul de sac and the other along H-1 Freeway, which flows through a 36” pipe, entering the box culvert at the cul de sac inlet. There were no wetland indicators visible in or adjacent to the project site. This stream reach is classified as an intermittent tributary to a water of the US from its mouth at Pearl Harbor up past the project site to the end of the reach at the first main bifurcation approximately 1.5 miles above the H-1 Freeway.

The streambed appears to have undergone a great deal of human-induced change in the past so the long-term bed and bank features characteristic of the OHWM in a stable stream are either not present or deemed not reliable. The double-cell box culvert above the site is part of a counterclockwise curve in the stream with the outer (right, facing downstream) culvert completely clear (indicating occasional significant flows) and the left culvert significantly filled with 3 feet of bed rubble (indicating a high bed load in the stream). The streambed within the project boundary appears to be undergoing long-term downward erosion. The OHWM appears to range from about 1–2 feet above the lowest streambed elevation in any cross section. The exception to this is within the culvert beneath the freeway where flow speeds are likely much higher and the OHWM is lower and directly below the culvert outfall where scouring has left a relatively deep pool. Inspection indicates a cross-sectional area below the OHWM of about 9 to 9.5 square feet. Given the roughness of the streambed and an average flow speed of 5 feet per second (fps), this would appear reasonable to accommodate a flow of 40–50 cubic feet per second (cfs) during the stream-forming flow expected to occur every 1.5–2 years.

The north bank proposed for stabilization consists primarily of a bare un-layered dirt slope (see Figures 2 and 3) consistent with the application of fill on this bank prior to construction of the adjacent structures. During the project construction, two temporary 36-inch pipes will be installed on the left side of the streambed from the H-1 Freeway culvert to down below the project site. These pipes will intercept normal storm flow from above the project site and bypass the flow to below the project site. The streambed and bank area where construction will occur will be isolated with a sandbag berm and silt fence. The intent of this berm in combination with the bypass pipes is to isolate construction impacts away from the storm flow events. There is no drain pipe from the sandbagged construction site back to the stream. Water that accumulates within the construction area will either be infiltrated or disposed of off-site as specified in the construction contract documents.

Figure 2 shows the north bank near the center of proposed project. Note the line of rounded “river rock” embedded in the bank from white arrow to hand, indicating possible historical elevation of a portion of the streambed. Un-layered dirt and angular rocks above this elevation are indicative of fill. OHWM shown as dotted red line. Photo dated November 6, 2009 between 08:30 and 11:00.

Figure 3 shows the upstream view of the north bank (left side of photo), proposed for shotcrete stabilization. OHWM shown as dotted red line. The 40-inch cul-de-sac drain is visible on the right. Photos dated November 6, 2009 between 08:30 and 11:00.

Figure 4 shows the downstream view of the north bank. Note the line of river rock mid-face and absence of roots on face of north bank. OHWM shown as dotted red line. The 40-inch cul-de-sac drain is visible on the left. Photos dated November 6, 2009 between 08:30 and 11:00.

**Figure 2: North Bank Side View**

**Figure 3: North Bank Upstream View**

**Figure 4: North Bank Downstream View**

# CHAPTER 2 SAMPLE QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

The procedures outlined in this sample QA/QC section are to ensure that:

- Samples are collected, processed, stored, shipped, and analyzed using acceptable standardized procedures
- Quality of generated data is documented adequately
- Results are reported completely and accurately
- Security of samples and data are maintained at all times

Procedures covered in this monitoring and assessment plan are specific to this individual project site. This document addresses the QA/QC plan elements described in “Guidance for Preparation of Combined Work/Quality Assurance Project Plans for Environmental Monitoring” (U.S. EPA 1984) and is in accordance with NPDES Stormwater Sampling guidance document EPA 833-B-92-001. The following activities as related to environmental sampling are addressed below:

- Sampling locations
- Sample frequency
- Sampling preparation
- In situ instrumentation
- General maintenance and calibration
- Log keeping
- Sample size
- Sample containers
- Sample preservation
- Sample holding times
- Sample collection
- Sample handling
- Sample labeling
- Chain-of-custody record
- Sample shipping

The following water quality parameters and precision of measurements are recommended to be monitored at the site:

- Water depth (1 inch, in situ measurement, used to document flow events)
- Turbidity (0.5 Nephelometric Turbidity Unit [NTU] or 2% of reading, whichever is greater)

- pH (0.1 standard units)
- Temperature (0.1°C)
- Total suspended solids (TSS, 1 mg/L)
- O&G (1 mg/L)

Because the stream at this location only flows during active rainfall events, placement of in situ water quality meters is not recommended since water quality testing can only be done during these intermittent and infrequent flow events. Assessment of BMP conditions, however, can be conducted in the absence of water flow.

Stream erosion will be monitored through topographic measurement of the streambed within and below the project site. A description of this process is given in Section 3.

## 2.1 SAMPLING DURATION AND FREQUENCY

Water quality monitoring samples will be taken prior to construction, during construction, and after construction is completed. The duration and frequency of these samples are detailed in this section. See Section 5.5 for the conditions under which the different types of reports will be generated.

For erosion monitoring, a baseline cross section survey will be conducted just prior to the start of the project; cross sections at the completion of the project; and cross sections at approximately 24 months after completion of the project. An additional 7 surveys will be completed at approximately 3-month intervals following the completion of the project, except if there is a rainfall event that exceeds a two-year, six-hour event (i.e. 3 inches), the stream will be surveyed as soon as feasible following the event. This survey will substitute for the next scheduled quarterly survey.

### 2.1.1 Pre-Construction

Prior to construction, the site will be visited on ten occasions at weekly intervals and water quality data will be obtained if there is flow at the site. Sampling will be attempted once a week for up to ten weeks. Photographic documentation showing consistent views of site conditions will be taken during each field visit.

Baseline data for the erosion survey will be taken once prior to the start of construction.

### 2.1.2 During Construction

During construction, in-situ water quality monitoring and grab samples for water quality and oil & grease samples will be taken if there is water flow in the stream at the time of the site visit. Photographs will be taken to document the conditions in the presence or absence of water flow in the stream during each field visit.

Baseline data for the erosion survey will be taken just prior to the end of construction.

### 2.1.3 Post-Construction

At one and two weeks following completion of the project, water quality data (if water is in the stream) and photographic data will be acquired. After completion of the project, the site will be visited at least twice if there are no stream flow events and up to three times if there are stream flow events from which water quality samples can be obtained.

Erosion data will be acquired at approximately three-month intervals over a period of two years. In the event that a two-year, six-hour rainfall event (or greater) occurs during the monitoring period, a survey will be conducted as soon as feasible following the storm. This survey shall replace the next regularly scheduled three-month survey.

## 2.2 SAMPLING STATIONS

Because the construction site is along a stream, it is assumed that pollutants will be transferred linearly downstream leaving upstream areas unimpacted. One primary BMP proposed is a pair of temporary 36-inch pipes laid in the streambed. These pipes act as a bypass transporting the flow of stream water past the construction site. Another primary BMP is a wall of sandbags placed in the streambed and closed with return walls to the right bank above and below the construction site. The area within the walls will not drain to the stream and will contain runoff from on-site rainfall events.

- Four water quality monitoring stations are proposed (See Appendix A):
- The control monitoring station (Water Quality Monitoring Location 1) is located above the primary construction site within the Freeway box culvert at the entrance to the 36-inch bypass pipe. If safety considerations exist (high water, low clearance) this station may be moved upstream to the next bridge mauka of the freeway.
- A monitoring station will also be located at the end of a 36" pipe entering the box culvert shown in Appendix A (Water Quality Monitoring Location 2) to sample water coming directly from H-1 Freeway.
- A monitoring station located at the end of the 12" bypass pipe (Water Quality Monitoring Location 3) will sample water coming from the box culvert, which includes water flowing from the cul de sac (near the construction entrance).
- The impact monitoring station (Water Quality Monitoring Location 4) will be located approximately 25 feet below the outlet of the bypass pipe below the construction site.

The site will be visited at least three times during each work week during regularly scheduled work hours. If a flow event is anticipated during construction hours, the site will be accessed up to three flow events per week with each visit substituting for one site visit that would normally have been conducted on a day without stream flow. During site visits, if there is water in the stream then measurements of temperature, turbidity, and pH will be obtained with an in situ instrument and grab samples will be obtained for laboratory analyses of TSS, and O&G. If in-situ water quality measurements indicate more than a 10% difference in either pH or increased turbidity as compared to either the highest of pre-construction samples or 10% higher than the control site at the time of sampling then, this will constitute a significant difference and will be noted in the Event Report. Rainfall data will be collected from the closest publicly accessible rain gage in the watershed. If there is no flow at the site, this condition shall be noted and monitoring shall consist only of photographic documentation from predetermined and consistent locations and views.

Erosion will be monitored along six set transects (as shown in Appendix E) at three-month intervals for two years after completion of construction.

## 2.3 SAMPLING PREPARATION

This monitoring and assessment plan is being prepared prior to the sampling activities and will be discussed and/or reviewed by all personnel materially involved in the sampling activity. Deviation from this sampling plan due to unforeseen site conditions or changes in construction methods must be discussed and submitted to DOH. Preparation for sampling includes the following activities:

- Determination of sampling locations. If there is no flow in the stream, then only photographs will be obtained at the standardized locations as noted in Figure 1. If there is flow, then water quality shall be measured in situ and water quality grab samples shall be taken from the upstream flow and from the water emanating from the construction site and delivered to the laboratory for analyses of TSS and O&G. All samples shall be documented with photographs.
- Written approval from the Hawai‘i Department of Transportation (HDOT) contractor to allow the HDOT’s water quality monitoring consultant access to the project site to obtain samples for the selected locations.
- Written approval from DOH regarding this monitoring and assessment plan
- Determination of sampling methods and volumes required for the desired tests
    - pH – in situ measurement with a field pH meter, ±0.1 pH unit
    - Temperature – in situ measurement with digital thermometer in the pH meter, ±0.1°C
    - Turbidity – in situ measurement with YSI data sonde or similar, calibrated prior to use
    - TSS – 1-liter grab sample, laboratory analyzed by filtration
    - O&G – grab sample into prepared O&G sample bottle.
- Review of plans for instrument maintenance
- Preparation of sample bottles
- Preparation of coolers, ice, other materials, and safety gear specific to the job site
- Informing the laboratory regarding a possible sample delivery
- Checking all special equipment needed for sample collection
- Identification of all sample splits or performance samples to be submitted with the storm water samples
- Review of all pertinent QA/QC procedures

Planning should ensure that study objectives and their relative importance and priority are understood by all field personnel. This planning will ensure adequate evaluation of impacts of field modifications to the plan on overall project goals. Contingency plans that include potential problems and their solutions should be outlined. An equipment checklist should be prepared to ensure availability of all tools and supplies. All equipment should be cleaned and stored in working condition after each sampling episode.

Erosion topography measurements must be taken using fixed and surveyed reference marks for continual reference over a two-year period after completion of construction.

## 2.4 IN SITU INSTRUMENTATION

Parameters that are frequently measured with in situ instruments are depth, temperature, pH, conductivity, turbidity, dissolved oxygen concentration, and oxidation reduction potential. At the Aiea Stream project site, only a water depth sensor will be installed permanently on site. Other in situ measurements will be taken with a portable measurement device such as a YSI data sonde or equivalent. These instruments should be operated in accordance with their respective operations manuals. The following precautions should be taken when transporting and using the equipment in the field:

- Ensure that cables are sufficiently long for operation at sites.
- Ensure that the instrument operating range and accuracy are within acceptable limits for the project.
- Electrical connectors should be waterproof.
- Field calibration of sensors should be possible.
- Instruments should be transported in boxes designed for this purpose.
- Sensors should be rinsed with distilled water after each measurement.
- Optical surfaces should be cleaned with alcohol and lens tissue between measurements.
- Instruments should be protected from heating and direct sunlight.
- External sensors should be covered and adequately protected whenever the instrument is not being used.
- Instruments should be allowed to warm up before calibration or field use.
- Instruments should be field calibrated at the beginning of each day’s measurements.
- Excessive strain should not be placed on electrical cables.

## 2.5 GENERAL MAINTENANCE AND CALIBRATION

Routine maintenance inspection of in situ instruments should follow the manufacturer’s recommendations. General procedures include:

- All rubber parts that may get immersed should be coated with silicone grease.
- Connectors should be inspected for bent or broken pins, which may cause faulty connections and flooded cables.
- Cables should be inspected for nicks, cuts, abrasions, or other signs of physical damage.
- Seals should be inspected and periodically cleaned and greased to ensure a waterproof fit.
- Desiccant should be inspected and replaced with fresh or reactivated desiccant when necessary.

Factory servicing and calibration should be made annually or when instrument malfunctions cannot be corrected by following the operations manual. Factory calibrations may also be required when certain major components of the system are replaced. Calibration log sheets shall accompany a report that uses data from the instrument. The log sheet in Appendix B can be used for calibration.

## 2.6 LOG KEEPING

A field sample log sheet (see Appendix B) will be used each time the site is visited whether or not actual water samples are taken. This log sheet can be combined with the chain-of-custody form where convenient. However, all the following information should be entered:

- Project title
- DOT project number
- WQC File No.
- Date and time
- Contractor’s Work in Progress
- Sampling location
- Station number
- Sample number
- Replicate number if applicable
- Weather conditions
- Comments on sample condition
- Comments on sample quality
- Names of members of the sampling crew
- General site conditions
- Photo log

## 2.7 SAMPLE CONTAINER PREPARATION

Sample containers will be washed with Alconox soap and warm freshwater and rinsed with tap water three times. Next, the containers will be rinsed with distilled water at least twice. After the final rinse, containers will be air-dried and sealed. Sample bottles for O&G will be laboratory cleaned, rinsed with hexane, and sealed. The recommended sample sizes, type of containers, preservation, and holding times for samples are listed in Table 1. For the Aiea Stream site, two types of containers shall be available for use at all sampling events: 1) TSS, one liter bottle, and 2) O&G, acid-rinsed glass jar.

## 2.8 SAMPLE COLLECTION

For this site, a “grab sample” will be obtained during pre-construction visits only if flowing water is available at the site. Subsequent grab samples taken during the active project will be taken during construction site visits whenever flow is present. Grab samples will be obtained by removing the sample bottle cap with one gloved hand while pushing the inverted bottle below the surface of the water with the other gloved hand. Once the bottle is underwater, it will be slowly turned upright allowing subsurface water to enter. If the sample is taken from the upstream bridge or if the water surface cannot be safely reached by hand, then a pole sampler may be used with the sample bottle affixed to the end of the pole. Care must be taken not to allow either surface film or stirred up bottom sediments to enter the bottle.

If there is insufficient water depth to collect a grab sample in this manner, then the sample will be obtained from a spill point where water naturally falls from one elevation down to the next. In the event that both of the above methods are not practical, then a 6-inch excavation may be created in the flow stream to pool water to be sampled. If a pool is created, then the water flowing across the pool shall be allowed to flush the pool for at least five minutes prior to obtaining a grab sample. The method used to obtain the sample shall be documented in the field report.

## 2.9 SAMPLE HANDLING

Samples will be capped, placed into resealable plastic bags, and then placed on ice in a cooler for transport to a laboratory. After sample collection, proper sample handling will ensure that changes in the constituents of interest are minimized and will guard against errors when shipping and analyzing samples. Recommended sample sizes, type of containers, sample preservation, and storage requirements for each variable will be followed. The following table will be referenced to ensure QA/QC in sample handling.

### 2.9.1 Field Procedures

It is important throughout a sampling and analysis program to maintain the integrity of the sample from time of collection to the point of data reporting. This integrity should be achieved by using chain-of-custody procedures that ensure procession and handling of samples to be traced from collection to the final destination. Proper chain-of-custody documentation includes:

- Field logbook
- Sample labels
- Chain-of-custody records (See Appendix C)
- Measurement of pH and temperature
- Sample shipment method

### 2.9.2 Field Logbook

All pertinent information on field activities and sampling efforts should be recorded in the field logbook. A field data sheet will be provided for the sampling site (see Section 2.6 Log Keeping).

### 2.9.3 Sample Labels

Sample labels must be waterproof and must be securely fastened to the outside of each sample container to prevent mis-identification of samples. Labels must contain at least the sample number, preservation technique, date and time of collection, sample location, and name of sample collector. Labels should be marked with indelible ink.

**Table 1. Recommended sample sizes, containers, preservation, and holding times for samples1**

| Measurement | Minimum Sample Size2 (mL) | Container Polyethylene (P) Glass (G) | Preservative3 | Maximum Holding Time |
|---|---|---|---|---|
| pH Method: EPA 150.1<br>YSI 2600, or equilavent | 25 | P,G | None | Analyze Immediately 4 |
| Temperature, °C | 1,000 | P,G | None | Analyze Immediately 4 |
| Turbidity, NTU Method: EPA 180.1<br>YSI 2600, or equilavent<br>Nephelometer light reflection at 90° | 100 | P,G | In-Situ | 48 hours |
| Total Susp. Solids, mg/L Method EPA 160.2 Filtered dry weight | 1,000 | P,G | Cool, 4°C | 7 Days |
| Oil & Grease, mg/L Method EPA 1664 n-hexane extraction | 1,000 | Glass only | Cool, 4°C<br>$H_2SO_4$ to pH<2 | 28 Days |

### 2.9.4 Chain-of-Custody Records

A chain-of-custody record must accompany every group of samples. Each person who has custody of samples must sign the form and ensure that the samples are not left unattended unless secured properly. Sample containers should be closed properly and sealed during handling.

### 2.9.5 Turbidity

Turbidity will be measured with an in situ water quality data sonde (Yellow Springs Instrument 2600 or equivalent) calibrated to a known standard. Calibration records will be kept with the instrument to insure that calibration is maintained, and the most recent date of calibration will be noted upon the sample sheet. When measuring turbidity in situ, it is important to measure a uniform flow from the stream without causing turbidity due to the presence of the meter. If there is insufficient flow to submerge the meter, then turbidity may be measured from a clean container filled at a plunge point within the stream flow.

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1 Reference: Adapted from U.S. EPA (1979b, 1984)

2 Recommended field sample sizes for one laboratory analysis. If additional laboratory analyses are required (e.g., replicates), the field sample size should be adjusted accordingly.

3 Sample preservation should be performed immediately upon sample collection. For composite samples, each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, the samples should be maintained at 4°C until compositing.

4 Immediately means as soon as possible after the sample is collected, within 15 minutes. (U.S. EPA 1984).

### 2.9.6 Field Measurement of pH and Temperature

pH and temperature will be determined as soon as possible after the sample is taken, within 15 minutes if possible. A time lag beyond this 15-minute interval will be logged. A field pH and digital temperature meter calibrated to a standardized laboratory meter will be available to the field crew at all times. The pH and Temperature may be measured directly from the stream at the point of sampling with an in situ water quality data sonde.

### 2.9.7 Sample Shipment Method

All preserved samples should be shipped as soon as possible after completion and preparation of samples. Samples should be shipped in accordance with the following procedures:

- Shipping containers should be in good shape and capable of withstanding rough handling during shipping.
- Samples should be packed tightly.
- Dividers must separate all glass containers.
- Empty space within shipping boxes should be filled so that sample containers are held securely.
- Samples should be packed with sufficient blue ice to ensure proper sample temperature during transport.
- All containers must be leakproof. Adequate absorbent material should be placed in the shipping container in quantities sufficient to absorb all the liquid.
- All samples should be accompanied by a sample analysis request. Variables to be analyzed by the laboratory and total number and kind of samples shipped should be listed on the request sheet. The laboratory must acknowledge receipt of shipment by signing and dating the form, and returning a copy to the shipping person.
- A chain-of-custody record for each shipping container should be filled out completely and signed.
- The original chain-of-custody record and sample analysis request should be protected from damage and placed inside the box. A copy of each record should be returned by the shipping party.
- The custody seal should be attached so that the shipping box cannot be opened without breaking the seal.
- For shipping water samples:
    - A “This End Up” label should be attached to each side of the shipping container to ensure that the sample jars are transported in an upright position.
    - A “Fragile Glass” label should be attached to the top of the shipping box to minimize damage to the samples.
- Shipping containers should be sent out by a carrier that will provide a delivery receipt. This receipt will confirm that the contracted laboratory received the samples and will also serve as a backup to the chain-of-custody record.
- All shipping should be paid when samples are handed over to the carrier to avoid confusion and possible rejection of the package by the laboratory.

For this project, all samples will be held in a cooler within individual waterproof Ziploc-type plastic bags on ice and delivered within 24 hours to a qualified local laboratory for testing.

## 2.10 LABORATORY PROCEDURES

All samples will be analyzed by a laboratory certified by DOH to undertake these analyses. Laboratory procedures for analyses will conform to the Hawai‘i Administrative Rules (HAR), Title 11, Chapter 54, Section 10 and as described in the *Handbook for Analytical Quality Control in Water and Wastewater Laboratories*, EPA 600/4-79-019.

For this project, the following laboratory tests will be conducted:

- TSS
- O&G

# CHAPTER 3 EROSION MONITORING

The area of interest is the project area and the streambed within a distance of approximately 200-feet downstream of the project site. Traditional level survey methods will be used. Six cross sections will be surveyed from four benchmarks set and surveyed into a stable portion of the upper stream bank. Two cross sections will be within the limits of the project area and four cross sections will be located downstream beginning at the lower edge of the project limit. Elevations at the cross sections will be recorded to within 1/100th foot across the stream perpendicular to the stream channel to represent cross-sectional variations as accurately as possible. Plots of the cross sections will be developed based upon this data to serve as a baseline measurement for future evaluation.

One survey will be taken after construction and one survey two years after construction. In the two year monitoring period, survey only after rainfall that causes streamflow for a total maximum of seven surveys. The cross sections developed for each subsequent erosion monitoring survey will be compared against the initial erosion monitoring survey to determine the degree of changes in streambed elevation (see Section 5.2.8 for evaluation methodology).

In addition to cross section elevation data, photographs will be taken during each survey event at each cross section as viewed both upstream and downstream to photo-document the existing geomorphology of the stream.

# CHAPTER 4 REPORTING

## 4.1 FIELD REPORTS (FRS)

Field Reports will be generated immediately following each field visit by site monitoring personnel and will be submitted electronically to the Hawaii Department of Transportation (HDOT) Resident Engineer. The HDOT Resident Engineer will review the field report. If there is no flow in the stream (no samples are taken) and there are no observations of potential pollutant events or suggestions for modifications to physical BMP Plan elements, then the HDOT Resident Engineer will transmit this report to the Oahu District Engineer for review and transmit to the Department of Health Clean Water Branch (DOH-CWB) within one (1) business day of receipt.

The HDOT Resident Engineer reserves the right to raise the Field Report to the level of an Actionable Field Event, at which time the HDOT Resident Engineer may elect to submit the Action Event Report (Field Report with amended recommendations) to the Contractor's Construction Site Manager. The HDOT Resident Engineer will then notify the Contractor's Construction Site Manager and submit the Action Event Report.

Under more typical conditions, an Actionable Field Event will be generated by Field Report observations of a potential pollutant discharge (i.e. grey water flowing downstream) with samples taken for laboratory analyses or carries information that recommends viable and implementable improvements or modifications to physical BMPs on the site. In an instance where a Field Report indicates an Actionable Field Event, this report shall be transmitted both to the HDOT Resident Engineer and the Contractor's Construction Site Manager. The HDOT Resident Engineer shall be the judge of which recommendations are viable and implementable. Upon receipt of an Actionable Field Event Report, the Contractor's Construction Site Manager will then amend the Actionable Field Event Report to include actions taken in response to the event, and transmit this back to the HDOT Resident Engineer. Subsequent information (e.g., laboratory results, additional modifications to BMPs) will also be added to the Actionable Field Event Report and sent to the HDOT Resident Engineer, who will review these items and forward to the DOH-CWB.

**Table 2: Personnel and Qualifications**

| Personnel | Responsibilities relating to water quality | Qualifications |
|---|---|---|
| HDOT Oahu District Engineer | Designated by the HDOT Director as the Authorized Representative (CWB-WQC Application, Item 16c) | Professional Licensed Engineer designated by State as responsible party. |
| HDOT Resident Engineer | Has all the delegated authority of the Oahu District Engineer in matters involving the project work and compliance with WQC 401 requirements | Designated by the HDOT Oahu District Engineer |
| Contractor's Construction Site Manager | Responsible for overall management of construction site | Designated by the Contractor |
| Environmental Professional | Supervises Monitoring Personnel and signs off on | College degree in environmental science or |

| Personnel | Responsibilities relating to water quality | Qualifications |
|---|---|---|
| | Field Reports and Actionable Field Event Reports to DOT Resident Engineer and Contractor.<br>Reviews lab results for compliance with water quality standards. | equivalent, plus at least five years' experience in environmental monitoring. |
| Monitoring Personnel | Conducts field visits obtaining site photographs, work descriptions, and obtains grab samples for water quality analyses. | Trained in site safety, water sampling methodology, and application of BMPs on construction sites. |
| Water Chemistry Laboratory | Conducts TSS and O&G analyses | Recognized by the State as qualified to conduct water quality analyses. (State does not certify private WQ labs) |

## 4.2 ACTIONABLE FIELD EVENT FIELD REPORTS

An Actionable Field Event will consist of a situation where site conditions might lead to potential non-compliance with permit conditions. An Actionable field event will be determined by HDOT Resident Engineer based on field reports. The Actionable Field Event portion of the Field Report will consist of a clear statement of the observed problem, the results of any field observations made, and may contain recommendations for modification to BMPs to rectify the problem. Once laboratory results are received by the Environmental Professional, the results will be interpreted in terms of State Water Quality Standards and construction activities at the project site during the time the sample was taken, amended to the Actionable Field Event Field Report and again transmitted to the HDOT Resident Engineer. The HDOT Resident Engineer will be responsible for alerting the Contractor's Construction Site Manager of apparent water quality violations or other issues of concern and to forward this information to the Oahu District Engineer for his review and transmittal to DOH within one business day.

## 4.3 FINAL REPORT

A Final Report will consist of a summary of all Field Reports and Actionable Field Event Field Reports and will include tabulation and statistical analyses of data referenced to appropriate permit-designated or State Water Quality Standards. A summary section will interpret the data in terms of appropriate standards. The Final Report will be compiled by HDOT and its consultant within 30 days following receipt of the final post-construction Field Reports, Actionable Field Event Field Reports and associated laboratory results from these site visits. This report will be delivered as a printed copy with electronic file backup to DOH-CWB.

# CHAPTER 5 DATA QUALITY OBJECTIVES

The DQO process was developed as a planning tool. The DQO process helps determine when enough data of sufficient quality has been collected to enable accurate decision-making. In the case of work on bridges or other structures within or over the riparian corridor of a stream, the data collected primarily relate to the maintenance of water quality within and downstream of the project boundaries. Alternative data collection scenarios are analyzed using the following seven steps of the DQO process:

1. State the problem to be solved
2. Identify the goal of the study
3. Identify information inputs
4. Identify the boundary of the study
5. Develop the analytic approach
6. Specify performance or acceptance criteria
7. Develop the Plan for obtaining data

This process is detailed below in specific reference to the sampling plan described above for the Aiea Stream Erosion Control project.

## 5.1 STATE THE PROBLEM TO BE SOLVED

The purpose of the construction monitoring effort will be to determine the effectiveness of the BMPs in preventing the introduction of pollutants to the stream outside of the BMPs. The problem at this site is that the stream does not typically flow, and that when it does flow the parameters of interest are likely to vary greatly over time. The pollutants of primary concern are the sediments from the bank which could induce high turbidity in downstream waters, the possible introduction of petroleum products from construction machinery, and the introduction of lime from concrete used at the site which would cause a rise in pH of downstream waters. Each of these pollutants can reasonably be expected to vary significantly during the course of the short stream flow events, and must therefore be monitored above the site to provide a control for the downstream sampling station.

Streams are dynamic by nature and experience has shown that “fixing” an erosion problem at one site may transfer that problem downstream to another site. The purpose of the post-construction erosion monitoring is to verify that erosion rates are not increased in the downstream reach immediately below the project.

## 5.2 IDENTIFY THE GOAL OF THE STUDY

The goal of the program is to document the effectiveness of the project BMPs by monitoring for specifically identified pollutants associated with construction activities in the stream below the site and to provide feedback to the contractor such that activities that may lead to potential pollution events can be modified to prevent pollution events from occurring.

The decision to be made is whether or not the construction activity is contributing significantly to pollution within the stream. The pollutants of primary consideration include lime (a strong base impacting pH), soil (as measured by turbidity and TSS) and petroleum products (as measured by O&G) associated with construction machinery. Field data to be collected include site photographs, turbidity and TSS of upstream and downstream water, pH of upstream and downstream water, and O&G. Since the stream does not typically flow through this reach, neither a regular timetable nor specific action level can be pre-determined for water quality.

Although turbidity measurements can quantify the relative amount of silt in the stream both upstream and downstream of the project area, the equipment needs to be continually submerged, which is not feasible at this site. If during a stream flow event turbidity plumes are noted to emanate from the construction area, then this is an Actionable Field Event and appropriate steps should be taken to identify the source and control these flows both in the current and future flow events. A turbidity plume should be documented photographically, with in-situ measurements, and with a 1-liter grab sample obtained from the center of the plume with a control sample (physical sample and field turbidity measurement) taken from a flow representative of flow above the project.  If turbidity below the site in the visible silt plume exceeds the preconstruction highest turbidity reading plus 10% or the control (upstream) turbidity plus 10%, then this shall be considered an Actionable Field Event to be characterized in the Actionable Field Event Report and acted upon by both the HDOT Resident Engineer and the Contractor’s Construction Site Manager.

In the event that a stream flow event occurs during or within 12-hours following a concrete pour within the streambed or bank, then water quality samples (including pH) shall be taken both above and below the site. A difference in pH of over 0.5 pH units between the upstream and downstream samples will be constituted as an Actionable Field Event.

If O&G are introduced to the construction site and/or to the stream from motorized construction equipment, the O&G is likely to be noted as an oily sheen on the water. The presence of an oily sheen on the water within the construction site is the basis for an Actionable Field Event Report.

Specific remediation actions that result from the Actionable Field Event Report will vary according to the type of event and are discussed but not limited to the options in each section below.

### 5.2.1 Site Photographs

Site photographs will be obtained during each site visit from standardized locations as shown in Figure 1. Additional photographs indicating representative construction activities shall also be included in the report. One purpose of these photographs is to show the presence, maintenance, and impact of site BMPs. Any event that demonstrates the positive or negative effect of a BMP should be documented. Similarly, any failure of a BMP should be documented along with an indication as to how the BMP could be improved. A photograph of a failed or improperly installed BMP shall result in an Actionable Field Event Report whether or not water flow is present in the stream.

### 5.2.2 Water Depth

Since the stream at the project site only flows during active rainfall events, the greatest chance for pollution to downstream (off-project) locations is during these infrequent flow events. However, during these flow events, it is highly likely that water coming into the stream from upstream locations does not meet State Water Quality Standards. It is also likely given the flashy short-term nature of these events that it will not be possible to obtain representative upstream and downstream samples during the majority of these flows. It is important, therefore, to document the frequency and relative magnitude of these flow events. A simple pressure sensor will be installed near the end of the project at the bottom of one of the two bypass pipes and a second pressure sensor will be installed outside the pipe, with both sensors set to record readings at 15-minute intervals. The difference in pressure readings between the two sensors will be related to water depth and therefore the flow within the pipe.

Water depth is not a parameter of direct interest as a potential pollutant.

### 5.2.3 pH

Uncured concrete contains a significant quantity of lime, which has a very high pH, and has the capability to adversely increase the pH of surface water into which it comes in contact. It is important to measure pH in water downstream of the site if a flow event occurs within 12 hours of a significant concrete pour. In the event that a rainfall event shortly after a concrete pour results in ponded water within the project enclosure, this water shall not be discharged into the stream or storm drains. This water may be allowed to infiltrate or be pumped out and trucked to a permitted wastewater treatment facility or infiltration site accepted by the HDOT Resident Engineer. The purpose of downstream monitoring is to assure that high-pH water is contained within the construction barrier.

In the event that the downstream water pH varies more than 0.5 pH units from the ambient pH, the source of the variation must be located, documented, and controlled. A pH increase greater than 0.5 pH units in the downstream water will result in an Actionable Field Event Report.

### 5.2.4 Temperature

Temperature is logged as a basic environmental parameter. There is no State Water Quality Standard or range for temperature.

### 5.2.5 Turbidity

Turbidity results from the suspension of particles in the water. Turbidity from the construction site is most likely to result from soil erosion caused by direct mechanical disturbance or secondary erosion by rainfall over disturbed surfaces. It is very likely that rainfall events will result in highly turbid water within the containment sandbag barrier BMP surrounding the construction site.

The purpose of monitoring is to assure that the turbidity is contained by the BMPs and does not migrate downstream. If the downstream water turbidity is more than 10% greater than the upstream water turbidity or greater than the highest pre-construction turbidity plus 10% then the Actionable Field Event Report shall be triggered.

### 5.2.6 TSS

TSS is quantified in the laboratory by filtering a known quantity of sample through a very fine filter and then weighing the sediment captured on the filter. TSS from the construction site will mirror the turbidity readings obtained. However, TSS measurements are able to quantify the physical amount of sediment released, whereas turbidity is measured in NTUs, which are not directly related to mass or volume of sediment. TSS data obtained from laboratory results will be amended to the Actionable Field Event Report and sent to the HDOT Resident Engineer.

### 5.2.7 O&G

An O&G spill will be defined to have occurred based solely upon visual observation of a sheen on the water outside of the construction sandbagged area. A water sample will be obtained if there is flow in the stream whether or not visual evidence of sheen is present. The presence of a sheen on the water inside or outside the construction area will be documented photographically and will be included in the resultant Actionable Field Event Report. The Actionable Field Event Report shall be amended by the Contractors Construction Site Manager to include information on discussions relative to the likely source of the petroleum contaminant and measures taken to remediate the condition and prevent further spills.

### 5.2.8 Erosion

During the two-year post construction erosion monitoring period, a comparison between the baseline survey and subsequent surveys will be conducted to determine Aiea Stream's rate of erosion. HDOT will evaluate the erosion rate for the two-year, five-year, 10-year and 25-year rainfall event should they occur during the two-year post construction erosion monitoring period. If the erosion rate exceeds the allowable rate of erosion in Table 3, HDOT will evaluate the photo documentation of the cross sections to determine the cause of the additional erosion. HDOT will not be responsible for any cause/effects of erosion resulting from rainfall events in excess of a 2-year 6-hour event, any land use changes upstream or downstream of the project location which may affect the discharge of runoff into Aiea Stream, or any changes to the environment beyond HDOT’s control that may adversely impact Aiea Stream. HDOT’s limit of responsibility is limited to 70 feet downstream of the project’s permanent improvements for a period of 2 years after project completion.

**Table 3. Allowable Erosion Rates**

| **Rainfall Event** | **Aiea Str B/L Sta** | **Velocity (ft/sec)** | **Above Base Rate Erosion (%)** |
|---|---|---|---|
| 2-year Event | 304+50 | 6.28 | 10.0 |
| 5-year Event | 304+50 | 7.86 | 12.5 |
| 10-year Event | 304+50 | 9.01 | 14.3 |
| 25-year Event | 304+50 | 12.71 | 20.2 |

Note: The rate of erosion above Aiea Stream’s base rate for the 5-year, 10-years, and 25-year rainfall events were based on the stream flow velocities at baseline Sta. 304+50 for the various rainfall events.

## 5.3 IDENTIFY INFORMATION INPUTS

Inputs to the decision-making process are documented through photography and supported through in situ sampling to include oil and grease, pH, temperature, TSS and turbidity when there is water flow.

### 5.3.1 Site Photographs

The primary purpose of the site photographs is to document the conditions at the site during monitoring events. Typically, photographs that are taken at a set location during each site visit tend to display long-term trends (vegetation overgrowth, slow erosion, and loss of cover) that may not be evident from single inspections. This information is valuable to site managers to maintain BMPs over the term of the construction project. Other photographs demonstrating BMP successes or failures serve to provide a weekly check for the contractor’s construction site manager and assist the contractor in the development of weekly BMP management and maintenance. During active stream flow events, visual evidence of the absence of turbidity plumes emanating from the construction site can be documented photographically. The photographs will be dated and time stamped and a brief description will be provided.

### 5.3.2 Water Depth

Water depth only serves to document the occurrence and relative magnitude of stream flow events. This metric is only a decision tool in the event that project supervisors do not inform project monitoring personnel when active flow events occur.

### 5.3.3 pH

pH is rarely useful as a decision-making metric because it tends to range widely in low-flow streams and is quickly buffered in high-flow streams. However, because the project involves spraying concrete over a relatively large area on the stream bank, it is reasonable to take precautions.

In the event that there is rainfall within 12 hours of wet concrete being placed, water quality samples, including pH, should be measured at the construction site.

### 5.3.4 Temperature

Temperature is logged as a basic environmental parameter. There is no State Water Quality Standard or range for temperature.

### 5.3.5 Turbidity

Turbidity is used here primarily as an indicator of excess sediment being introduced into the water as a result of construction activities. It is unlikely that the levels of the State Water Quality Standards are ever attained at this location. If the construction activity has little or no impact on stream sediment load then the turbidity of water above the project site should be substantially the same as the turbidity of the water below the site. A turbidity differential of 10% has been selected by DOH-CWB as an adequate difference between upstream and downstream values to warrant action.

### 5.3.6 TSS

TSS measurement is used to quantify the physical amount of sediment present in a sample of water. TSS is measured in the laboratory by filtering a known volume through a very fine filter and then measuring the dry weight of the sediment captured on the filter. By correlating TSS to turbidity, an estimate of TSS can be obtained by the using a field turbidity measurement.

### 5.3.7 O&G

O&G can be introduced to the environment from the construction site or other upstream locations by fuel spills or in wash water from equipment that is lubricated. Because O&G petroleum products are lighter than water and have a different reflective index, they tend to concentrate as a thin film on top of water. This film, as thin as a singular molecular layer, produces a rainbow sheen on the water surface that is highly visible.

## 5.4 IDENTIFY THE BOUNDARY OF THE STUDY

The site is defined as a linear system with two "upstream" and two downstream decision points. The four water quality monitoring stations are as follows (See Appendix A):

- Water Quality Monitoring Location 1 - Due to safety and site conditions, this sample will be obtained at the makai side of the freeway as the flow enters the top end of the by-pass pipes. In the event that safety considerations preclude the use of this site, then the sample will be obtained at the first bridge over the stream on the Mauka side of the freeway.
- Water Quality Monitoring Location 2 – This "upstream" sample will be taken at the end of a 36" pipe before it flows into the box culvert shown in Appendix E, to obtain water coming directly from H-1 Freeway.
- Water Quality Monitoring Location 3 – This "downstream" sample will be taken at the end of the 12" bypass pipe to sample water coming from the box culvert, which includes water flowing from H-1 Freeway and the inlet located in the cul de sac (near the construction entrance).
- Water Quality Monitoring Location 4 – This is the "impact" monitoring station, located immediately (within 30 feet) below the project boundary at a location appropriate for obtaining insitu and grab samples. This station will include water coming from the H-1 Freeway, cul de sac, and project site.

No sampling (other than observational or photographic) is to be conducted within the project boundary or sandbag barrier.

## 5.5 DEVELOP THE ANALYTICAL APPROACH

The rationale for the decisions has been developed in the sections above, with a summary statement provided here.

Any of up to three rainfall events that result in water flow within the stream during any work week shall result in an effort to collect water samples for the analysis of pH, turbidity, and TSS. When water quality results are received back from the laboratory, the results are to be interpreted and forwarded to the Contractor's Construction Site Manager and the HDOT Oahu District Engineer as an amended actionable field event report. Every Actionable Field Event Report sent to the DOH-CWB by the HDOT Oahu District Engineer shall include documentation of related communication with the Contractor's Construction Site Manager and any actions supported by the report evidence.

### 5.5.1 Site Photographs

Site photographs will document site conditions during the monitoring event. These may provide additional information if an actionable event is identified.

### 5.5.2 Water Depth

If water level data indicates that there have been significant flow events during working hours, then this information will be included in the Field Report, but will not necessarily generate an Actionable Field Event Report.

### 5.5.3 pH

If the pH of water in the streambed below and outside the containment BMP is outside of 10% of the upstream pH, then the Actionable Field Event Report shall detail efforts to deduce the source of the pH variance and efforts on the part of the contractor’s construction site manager to mitigate any problems noted.

The water within the containment barrier may not be discharged into the stream or storm drains but may be dewatered into a containment truck for permitted disposal at a wastewater treatment facility or infiltrated at an appropriate site.

### 5.5.4 Temperature

Temperature is not a variable controlled by State Water Quality Standards. No field readings of temperature will result in an Actionable Field Event Report. Temperature readings are used in conjunction with other readings to produce an overall water quality picture of the site.

### 5.5.5 Turbidity

If, during a stream flow event, the turbidity of water downstream of the containment sandbag barrier varies above 10% of the upstream turbidity, then the Actionable Field Event Report shall document efforts to discern any sources of additional turbidity, and efforts on the part of the contractor’s construction site manager to mitigate the observed problem.

### 5.5.6 TSS

TSS data is obtained from laboratory analyses approximately 1-2 weeks after each Actionable Field Event. This data will be amended to the Actionable Field Event Report and forwarded to the HDOT Oahu District Engineer, who will forward this information to the DOH-CWB.

### 5.5.7 O&G

O&G measurement will be used to verify visual sitings and quantify petroleum product pollutant events on the project site. Results of O&G analyses, typically received 2-4 weeks following an event, will be amended to the Actionable Field Event Report and forwarded to the HDOT Oahu District Engineer, who will forward this information to the DOH-CWB.

## 5.6 SPECIFY PERFORMANCE OR ACCEPTANCE CRITERIA

Once all effort has been made to minimize error, all error has not been eliminated, but has only been reduced as much as possible. From here, it is important to understand that error is still associated with the sampling and analysis plan and with the natural variability inherent in the systems. The decision to take action based upon a measurement (or series of measurements) is based upon the confidence of that measurement and the consequences of taking action. In this monitoring and assessment plan the consequence of exceeding one of the parameter limits is relatively limited: an Actionable Field Event Report is filed, instead of a field report.

Therefore the consequence of a false positive is relatively minor. Actual consequences in expended time, equipment, and funds will be dependent upon subsequent analyses by the Contractor’s Construction Site Manager in consultation with the HDOT Oahu District Engineer as to the appropriate response to limit future Actionable Field Events of a similar nature. The performance criteria which this monitoring and action plan seeks to attain are;

- Field report photographs will document the condition of BMPs observable from the stream bed and changes to these observable BMPs will be recorded.
- The mere presence of water in the stream during construction on one of three field days per week will trigger an Actionable Field Event Report requiring the Contractor’s Construction Site Manager to take action to assure the condition of the BMPs
- Deviations in water quality between upstream and downstream greater than 10% in turbidity or pH will trigger additional requirements on the part of the Contractor’s Construction Site Manager to report on steps taken to identify and eliminate any potential sources of pollutants leading to this difference. Given the propensity of natural streams to vary 10% between subsequent readings taken at the same location over short time periods, the criteria is likely to lead to a significant number of false positives.

Errors are inevitable when conducting a sampling and analysis project. Human error, to some degree, occurs throughout the process. Error in automated techniques for analyzing samples is also inevitable. Proper calibration of analytical instruments, proper handling of samples in the laboratory, and carefully following laboratory procedures are of vital importance. The steps necessary to minimize errors and produce good quality data have evolved into QA/QC programs that give guidelines for minimizing error in sampling and analysis projects. QA is a set of operating principles that are designed to produce data of known and defensible quality. QC programs include certification of operator competence, analysis of externally supplied turbidity and pH standards to ensure concentrations are what they should be, calibration with standards, and analysis of duplicates (commonly 10% replication of the total sample number).

Once all effort has been made to minimize error, all error has not been eliminated, it has only been reduced as much as possible. From here, it is important to understand that error is still associated with the sampling and analysis plan and with the natural variability inherent in natural systems.

## 5.7 DEVELOP THE PLAN FOR OBTAINING THE DATA

Data will be obtained from each field visit in the form of a site data sheet and associated photographs documenting field conditions. If there is water flow in the stream, then additional data will be obtained from insitu water quality measurements (immediately recorded in the field visit form) and data from the water quality data. Laboratory data will not be available for a minimum of two weeks, and will be amended to a revised field report when it becomes available.

Data tracking will be achieved by archiving individual field data sheets electronically in a data-base format for ease of retrieval. No preliminary data collection plan should be considered to be without fault or without room for improvement. As the construction plan progresses, some of the weekly photograph locations will need to change. In the event of a change in construction plans or unanticipated runoff control issues, the sample sites will likely change or new sample sites will likely be added. Each change in the sampling plan design will be documented in the weekly reports and discussed in the final report and will require written approval from DOH Clean Water Branch.

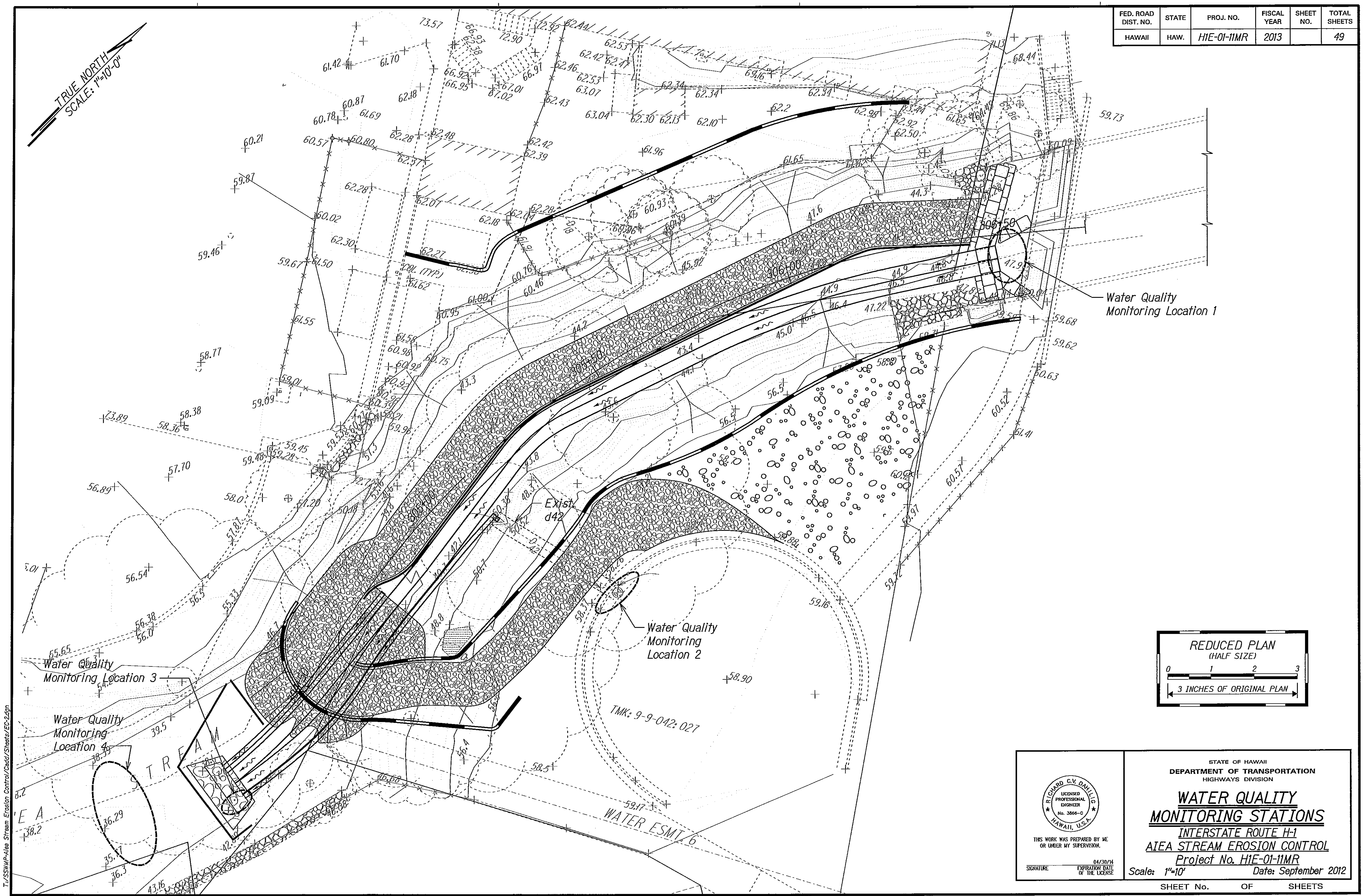
# CHAPTER 6 REFERENCES

| | |
|---|---|
| EPA 2004 | Managing Uncertainty and Systematic Planning for Environmental Decision Making. DQO training course. |
| EPA 2006 | Guidance on Systematic Planning Using the Data Quality Objectives Process EPA QA/G-4 |
| Oceanit 2009 | Aiea Stream Field Report: Wetland and Ordinary High Water Mark Survey. 11/6/2009 |
| State of Hawaii 2009 | Hawaii Administrative Rules. Department of Health Water Quality Standards Title 11 Chapter 54 |

# APPENDIX A

# WATER QUALITY MONITORING STATIONS

| FED. ROAD DIST. NO. | STATE | PROJ. NO. | FISCAL YEAR | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|---|
| HAWAII | HAW. | H1E-01-11MR | 2013 | | 49 |



ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

T:/SSWMP-Aiea Stream Erosion Control/Cadd/Sheets/EC-2.dgn

RICHARD C.V. DAHLIG
LICENSED PROFESSIONAL ENGINEER
No. 3866-C

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

SIGNATURE

04/30/14
EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

## WATER QUALITY MONITORING STATIONS

INTERSTATE ROUTE H-1
AIEA STREAM EROSION CONTROL
Project No. H1E-01-11MR
Scale: 1"=10' Date: September 2012

SHEET No. OF SHEETS

# APPENDIX B

# LOG SHEET

# Field Sample Log Sheet

Date: / /20__ Collected by: ______________________

Project Title: Aiea Stream Water Quality Monitoring

| Pre | During | Post | Construction Monitoring |
|---|---|---|---|

Project No./File No.: ______________________

WQC File No.: ______________________

Contractor's Work in Progress: ______________________

Rain fall Present: __________ Past 24 Hrs: __________ % Clouds: __________ Wind mph: __________

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Insitu Meter | Calibration | Date Last | | Standard | Reading | | Reading |
| | pH | / /20 | Field Calibrated?--> | pH=7 | | pH=10 | |
| | Turbidity | / /20 | | NTU=0 | | NTU=100 | |

| Sample No. | Time | Location | Type | Size | Description |
|---|---|---|---|---|---|
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Samples held in: Ice Refrigerator Air Other: ______________________

Samples to Laboratory (name): ______________________ On (da/time) / /20 @ : Hr

Lab Chain of Custody # ______________________

Notes: ______________________

# APPENDIX C

# SAMPLE CHAIN OF CUSTODY FORM

innovation through engineering & scientific excellence

# Environmental Analytical Services

## Chain of Custody Form

**Please Print Legibly.**

Client: ____________________ Acct. #: ____________________

Project Name / #: ____________________ Phone #: ____________________

Contact Person: ____________________ Email: ____________________

Sampler: ____________________ Quote #: ____________________

| | | | | | Matrix | | | | Total # of Containers | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample Identification | Date Collected | Time Collected | Grab. | Comp. | Soil | Water | Air | Other | | Analyses Requested |
| sdfsdgagee | | | | | | | | | | |
| agesagaeg | | | | | | | | | | |
| egeareafd | | | | | | | | | | |
| sdgaefeag | | | | | | | | | | |
| adgag | | | | | | | | | | |
| asdgeafea | | | | | | | | | | |
| adfegat | | | | | | | | | | |
| ageagae | | | | | | | | | | |

Turnaround time requested (please check one): ☐ Normal ☐ Rush

Rush results requested by (please check one): ☐ Fax ☐ Phone

Fax #: ____________________

Phone #: ____________________

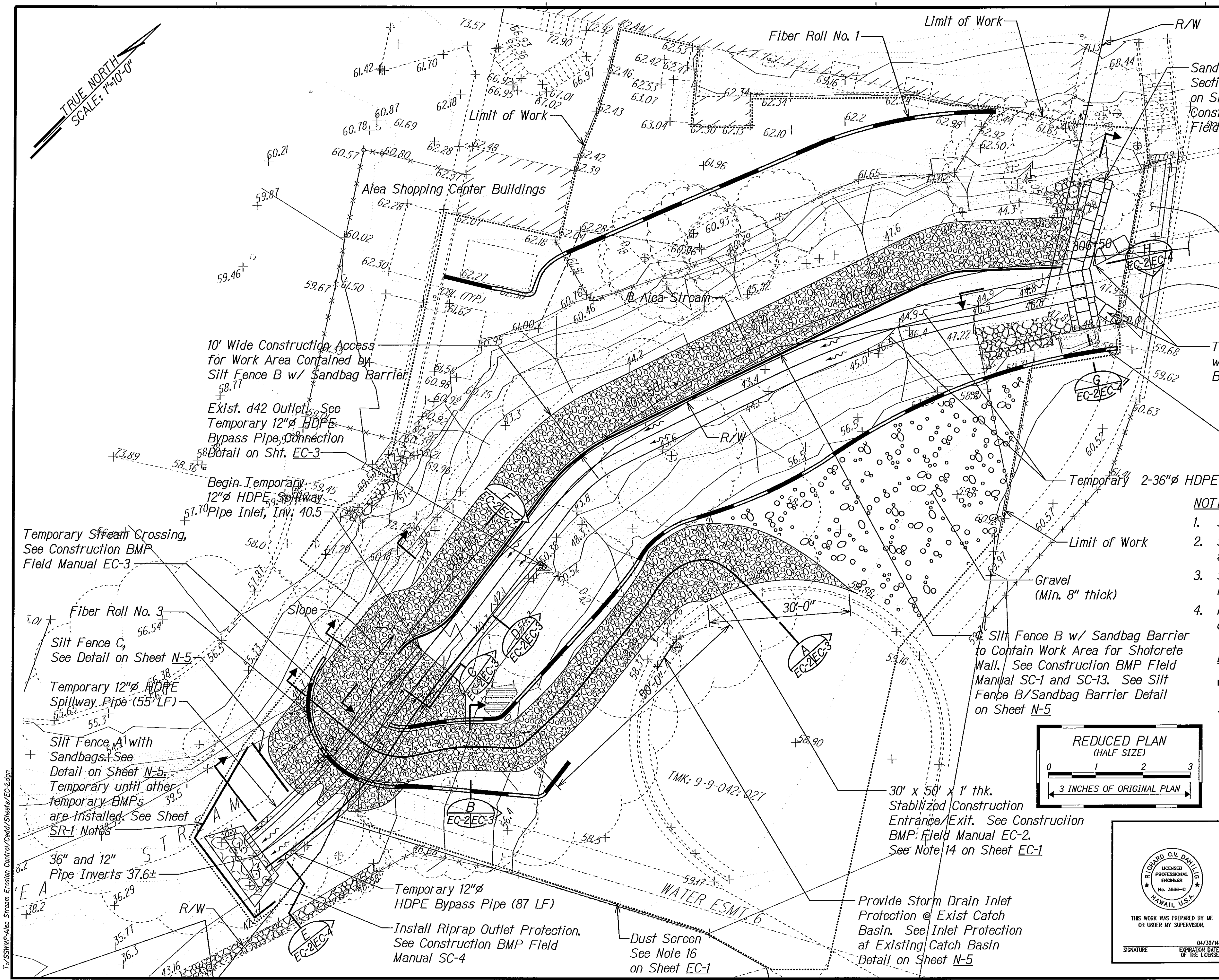
| Relinquished by: | Date | Time | Received by: | Date | Time |
|---|---|---|---|---|---|
| | | | | | |
| Relinquished by: | Date | Time | Received by: | Date | Time |
| | | | | | |
| Relinquished by: | Date | Time | Received by: | Date | Time |
| | | | | | |

Address: 1001 Bishop St., ASB Tower, Suite 2970 Honolulu, HI 96813 Phone: (808) 531-3017 Fax: (808) 531-3177

# APPENDIX D

# EROSION CONTROL PLAN

| FED. ROAD DIST. NO. | STATE | PROJ. NO. | FISCAL YEAR | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|---|
| HAWAII | HAW. | H1E-01-11MR | 2013 | 41 | 49 |



## NOTES:

1. See Sheet EC-1 for Erosion Control Notes.
2. See Sheet N-2 and N-3 for Water Pollution and Erosion Control Notes.
3. See Sheet N-4 for Best Management Practice Notes.
4. Provide concrete washout area in vicinity of the cul-de-sac.

## LEGEND:

| | |
|---|---|
| ▬ | Fiber Roll |
| ┈ | Limit of Work |
| ⤳ | Flow Direction |

1"=10' 10 0 10 20
SCALE IN FEET

LICENSED PROFESSIONAL ENGINEER
No. 3866-C
RICHARD C.V. DAHILIG

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

SIGNATURE
04/30/14
EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
**DEPARTMENT OF TRANSPORTATION**
HIGHWAYS DIVISION

# EROSION CONTROL PLAN

## INTERSTATE ROUTE H-1
## AIEA STREAM EROSION CONTROL
## Project No. H1E-01-11MR

Scale: 1"=10'
Date: September 2012

SHEET No. EC-2 OF 4 SHEETS

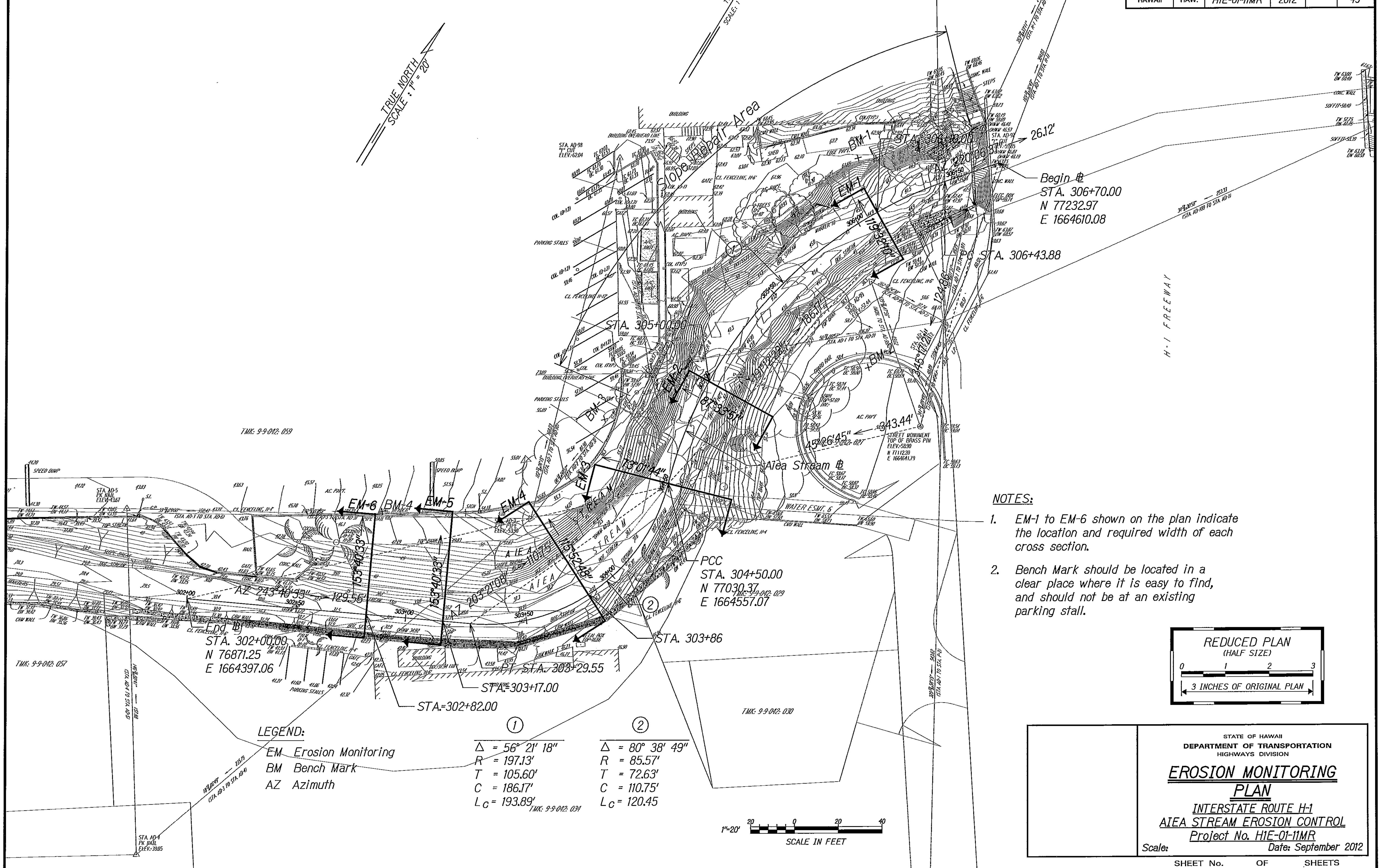
| | | |
|---|---|---|
| ORIGINAL PLAN | SURVEY PLOTTED BY | DATE |
| | DRAWN BY | " |
| NOTE BOOK | TRACED BY | " |
| | DESIGNED BY | " |
| | QUANTITIES BY | " |
| No. | CHECKED BY | " |

T:/SSWMP-Aiea Stream Erosion Control/Cadd/Sheets/EC-2.dgn

# APPENDIX E

# EROSION MONITORING PLAN

| FED. ROAD DIST. NO. | STATE | PROJ. NO. | FISCAL YEAR | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|---|
| HAWAII | HAW. | H1E-01-11MR | 2012 | | 49 |



NOTES:

1. EM-1 to EM-6 shown on the plan indicate the location and required width of each cross section.
2. Bench Mark should be located in a clear place where it is easy to find, and should not be at an existing parking stall.

REDUCED PLAN
(HALF SIZE)
0 1 2 3
3 INCHES OF ORIGINAL PLAN

LEGEND:

| | |
|---|---|
| EM | Erosion Monitoring |
| BM | Bench Mark |
| AZ | Azimuth |

①

$\Delta$ = 56° 21' 18"
$R$ = 197.13'
$T$ = 105.60'
$C$ = 186.17'
$L_C$ = 193.89'

②

$\Delta$ = 80° 38' 49"
$R$ = 85.57'
$T$ = 72.63'
$C$ = 110.75'
$L_C$ = 120.45

1"=20' 20 0 20 40
SCALE IN FEET

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

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SHEET No. OF SHEETS

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
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