Applicable Monitoring and Assessment Program Maipalaoa Bridge Project Māʻili, Oʻahu, Hawaiʻi

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Introduction

This applicable monitoring and assessment program (AMAP) is written for the Maipalaoa Bridge Repair Project. The Hawaiʻi Department of Transportation (HDOT) is proposing to replace the existing Maipalaoa Bridge over Māʻili Stream with a four-lane bridge to include widened shoulders and sidewalks. The project includes in-water work in Māʻili Stream estuary located in leeward Oʻahu, approximately 1.5 mi (2.4 km) south of Māʻiliʻili Stream (Fig. 1).

The AMAP describes the water quality monitoring requirements and data quality objectives for the program. This program was prepared in accordance with water quality regulations promulgated in Hawaiʻi Administrative Rules (HAR) Chapter 11-54 (HDOH, 2014), Chapter 11-55 (HDOH, 2013) and the General Monitoring Guideline for Section 401 Water Quality Certification Projects (HDOH, 2000). This document outlines the monitoring requirements and data quality objectives that will be followed during water quality monitoring for construction activities and dewatering in order to meet the requirements of HAR 11-54 and 11-55 App. G.

The intent of the AMAP is to conduct water quality sampling and analysis to monitor potential impacts caused by project construction work and dewatering operations. The AMAP includes baseline (preconstruction), during-construction, and post construction water quality monitoring at four stations. Data collected as part of the AMAP will be used to assess the adequacy of Best Management

Practices (BMPs) applied during construction and dewatering operations and will facilitate assessing the impacts of the project on State waters. If shown to be necessary by the monitoring data, BMPs will be modified during construction to protect water quality.

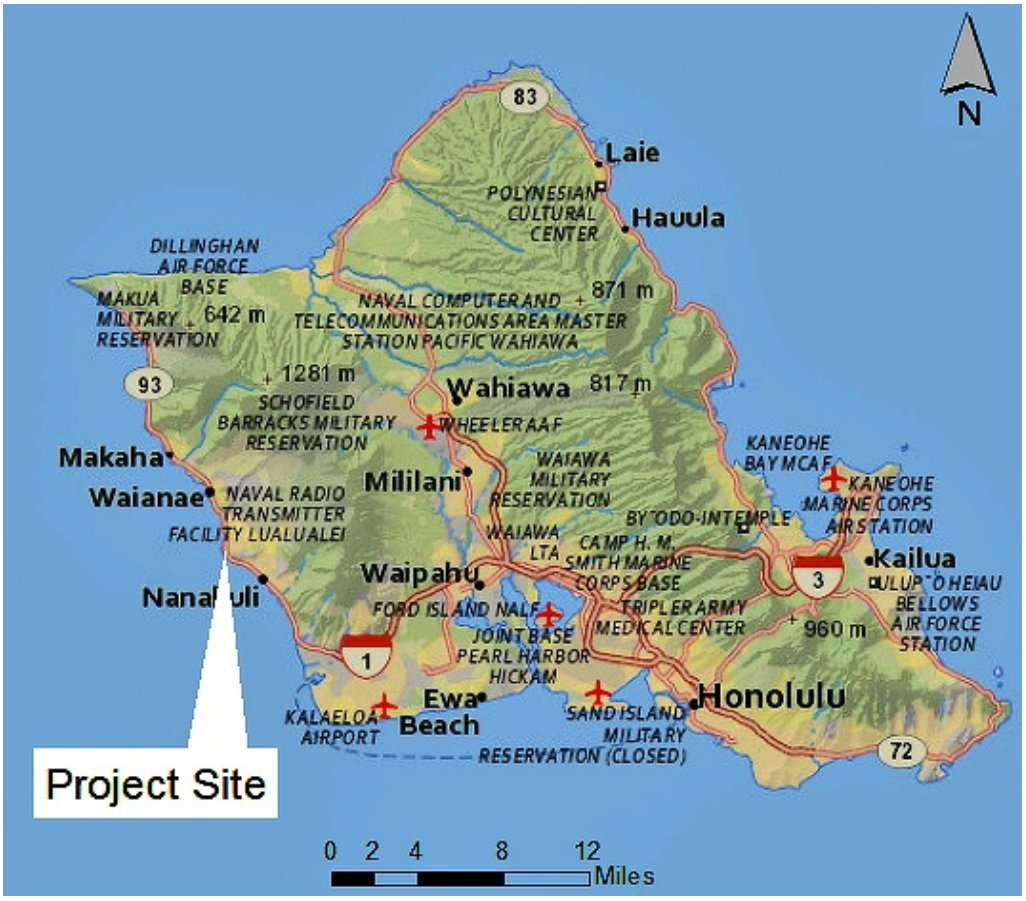

Figure 1. Project location on the Island of Oʻahu.

Background Information

The project proposes to replace the existing bridge in about two years utilizing three phases of in-water work. The general configuration, length, width, and orientation of the existing stream channel will not be modified from the existing conditions. The project plans are included as an exhibit in the WQC application.

Māʻili Stream is classified as a Class 2 inland water body by State of Hawaiʻi water quality standards (HDOH, 2014). As stated in the water quality standards, the objective of Class 2 waters is to protect their use for recreational purposes, to support and propagate aquatic life, agricultural and industrial water supplies, shipping, and navigation. The stream is tidally influenced at the project site and has an open (perhaps only seasonally) surface connection to the ocean. As such, the state water quality criteria for estuaries are applicable (Table 1).

Table 1. State of Hawaiʻi water quality criteria for estuaries from HAR §11-54-05.2d(1) (HDOH, 2014).

Parameter units	Turbidity (NTU)	Total Nitrogen (µg N/l)	Nitrate + Nitrite (µg N/l)	Ammonia (µg N/l)	Total Phosphorus (µg P/l)	Chl. α (µg/l)
Geometric mean not to exceed given value	1.5	200.0	8.0	6.0	25.0	2.0
Value not to be exceeded more than 10% of the time	3.0	350.0	25.0	10.0	50.0	5.0
Value not to be exceeded more than 2% of the time	5.0	500.0	35.0	20.0	75.0	10.0

- pH – shall not deviate more than 0.5 units from ambient and not be lower than 7.0 nor higher than 8.6.
- Dissolved oxygen – not less than 75% saturation.
- Temperature – shall not vary more than 1 °C from ambient.

Māʻili Stream is not listed on the HDOH 2014 list of impaired waters in Hawaiʻi, prepared under Clean Water Act §303(d) (HDOH, 2014). Nearby Maipalaoa Beach (Station HI280966) is listed on the report, having attained State criteria compliance levels for *Enterococcus* bacteria, however impairment status for other typically monitored parameters is unknown at the nearshore marine station.

Organization and Responsibilities

The construction contractor has not been selected for the project, but responsibilities and qualifications of those chosen to conduct monitoring are presented in Table 2. This AMAP is written using *AECOS*, Inc. monitoring (sampling and analytical) protocols. If another laboratory is hired to conduct sampling and analysis for this AMAP, this document should be revised to include information specific to that firm prior to the start of pre-construction monitoring.

The construction contractor's assigned representative will perform daily visual inspections and take photographs of the construction site to ensure that the construction activities do not result in adverse impacts to State waters. Personnel from the selected monitoring entity will perform visual inspections of water quality and take photographs of stream conditions at each monitoring station and note the condition of project BMPs during each sampling event.

Information recorded by the contractor's representative and the monitoring personnel will include at a minimum: date, time, stream flow, weather conditions, precipitation, and description of the construction activity ongoing during sampling. Notes will include any other observed activities, which may or may not be related to construction activities but may affect water quality. A copy of the contractor's daily observations and photographs will be provided to monitoring personnel and HDOT for use in preparing the final reports. Observations by the monitoring personnel will be included with the individual sampling reports. Contractor observations will be available on-site while the project is on-going.

Table 2. Summary of responsibilities and qualifications.

Name	Responsibility	Qualification
Snookie Mello *AECOS*, Inc	Water Quality Monitoring (WQC) Project Manager	Project management, laboratory, and field sampling experience in 401 WQC and monitoring.
AECOS, Inc	Collect samples and perform field measurements. Photographs of water quality stations and long term monitoring stations.	Trained and experienced in collecting water samples and performing field measurements in aquatic environments, and monitoring construction contractors working in aquatic environments.
TBD (Construction contractor representative to be determined by contractor)	Notify monitoring firm when in-water construction will start with enough time to collect preconstruction samples prior to starting work. Make daily visual observations of BMPs and construction activity to be logged in a notebook (SM, 1998). Take photographs (with date/time stamp and description) and provide notebook and photographs to monitoring entity and HDOT to be used as part of the assessment process. Investigate water quality exceedances, take corrective actions, and report findings to HDOT.	Knowledgeable of construction activities as they relate to aquatic environments. Knowledgeable of monitoring requirements for this project.

Parameters to be Measured

Receiving water quality parameters to be measured in Māʻili Stream are: temperature, dissolved oxygen (DO), pH, salinity, turbidity, and total suspended solids (TSS). Turbidity, TSS, pH and oil&grease will be sampled from the construction dewatering discharge. Photographs of the work site, sampling stations, and project BMPs will be taken by monitoring personnel during each scheduled sampling event. Photographs will include a date and time stamp or that information will be embedded in the metadata associated with the digital

photograph files. Visual inspections of project BMPs will also be made by field samplers at the time of sampling.

Sampling Locations

Two impact stations and two control stations will be monitored for water quality throughout the project (Fig. 2). Due to the shallow depth of the streams at the project site, water samples will only be collected from the stream's surface. Impact stations will be located 3 ft (1 m) from the project silt curtains. Control stations will be located approximately 50 ft (15 m) upstream and downstream from project silt curtains. Dewatering effluent (Sta. Dewatering) will be sample from a location downstream from all proposed treatment. Approximate latitudinal and longitudinal coordinates for these monitoring stations are presented in Table 3. Once the monitoring program begins, Global Positioning System (GPS) coordinates (with datum) of the sampling stations will be recorded during sampling and provided to HDOT with the field notes.

Figure 2. Sampling stations in Māʻili Stream for the Maipalaoa Bridge project.

Table 3. Coordinates (decimal degrees in WGS84 datum) for water quality monitoring stations.

Station	Latitude	Longitude
Impact 1	21.409021° N	158.176921° W
Impact 2	21.409062° N	158.177297° W
Control 1	21.409000° N	158.176761° W
Control 2	21.409077° N	158.177454° W
Dewatering	tbd	tbd

Sampling Frequency

Project work is anticipated to take place over a two year period. BMPs (silt curtain or sand bags) will be installed and remain in place until the project work is completed.

Preconstruction sampling

Prior to construction, field measurements will be taken and water samples will be collected once per week for ten weeks (or once per day for ten days). Weekly sampling is preferred as it provides a more representative sample of baseline conditions. Samples will be collected from Stas. Impact 1, Impact 2, Control 1 and Control 2 (Fig. 2). Photographs will be taken at each station during each sampling event. An effort must be made to conduct preconstruction sampling at different tidal stages with at least one high tide (preferably > +2.0 ft) and one low tide (preferably < 0.0 ft) sampled within the ten events.

During-construction sampling

Field measurements will be taken and samples collected three days per week throughout the duration of the project. Samples will be collected from Stas. Impact 1, Impact 2, Control 1 and Control 2 (Fig. 2). Photographs will be taken at each station during each sampling event. Additionally dewatering effluent will be sample once per discharge event or a minimum of once per week.

Postconstruction sampling

Postconstruction water sampling will occur once per week for three weeks following the completion of the project and removal of all BMPs. Samples will be collected from Stas. Impact 1, Impact 2, Control 1 and Control 2 (Fig. 2). Photographs will be taken of each station during the sampling event.

Sampling Methods

The monitoring entities' field technicians will record their initials, the date, time, location, and field measurements for each sample. They will note construction activity, unusual site conditions, and condition of any treatment device or facility at the time of sample collection. Samplers will note any non-construction related activity that might impact water quality such as weather conditions, stream flow at the time of sampling, and tidal stage. Photographs of each monitoring station will be taken. Photographs will include a date and time stamp or that information will be embedded in the metadata associated with digital photograph files.

At each station, field technicians will collect surface grab samples for turbidity and total suspended solids. The samples will be collected in 1 L plastic bottles from just below the water surface by facing the bottles up current to fill. Once collected, sample bottles will be tightly capped and placed in a cooler on ice until they are received by the analytical laboratory.

Analytical Methods

Table 4 lists the analytical methods to be used in the monitoring program. Table 5 lists the analytical hold times and field preservation for each method.

Table 4. Analytical methods and instruments to be used for the AMAP.

Analysis	Units	Method	Reference	Instrument*
Temperature	ºC	SM 2550B	SM (1998), YSI manual	YSI DO meter thermistor
Dissolved Oxygen (DO)	mg/L	SM 4500-O G / membrane electrode	SM (1998), YSI manual	YSI DO meter
Oil & Grease	mg/L	EPA 1664	USEPA (1993)	Mettler H31 Balance
pH	standard units	SM4500-H^+	SM (1998)	Hanna pHEP 5 pocket pH meter
Salinity	psu	refractive index or conductivity calculation	SM (1998)	Refractometer or YSI cond calc.
Total Suspended Solids	mg N/l	SM2540D	SM (1998)	Mettler H31 Balance
Turbidity	ntu	EPA 180.1, rev. 2.0	USEPA (1993)	2100Q HACH Turbidimeter

*A typical instrument is listed; other manufacturers may be utilized

Table 5. Analytical hold times and preservative methods for the AMAP.

Analysis	Hold time	Preservation
Temperature	immediate	none
Salinity	immediate	none
Dissolved Oxygen	immediate	none
Oil & grease	28 days	H^2SO^4 or HCl
pH	15 minutes	none
Total Suspended Solids	7 days	chill on ice* to 4ºC
Turbidity	48 hrs	chill on ice* to 4ºC

*wet ice will be used in the field to chill the samples quickly.

Quality Assurance

All instrument calibration procedures will be undertaken prior to field measurements. Temperature, DO, salinity, and pH will be measured in the field. Meter calibration procedures are outlined in the manufacturer instructions and standard operating procedures (SOP) specifically written for the pH and DO meters and refractometer to be used (*AECOS*, Inc. 2005, 2010a, 2010b; HACH 2008a, 2008b; Hanna Instruments, 2005; YSI Incorporated, 2007, 2009). Operation and calibration will only be performed by personnel who have been properly trained in these procedures. Documentation of calibration and any maintenance information will be maintained in appropriate field or log books. All calibrations will be made prior to analyzing the samples.

Any field equipment that has been shown by calibration or otherwise to be defective, is to be taken out of service until it has been repaired. The equipment is placed back in service only after verifying by calibration that the equipment performs satisfactorily. If at any time, calibration and maintenance is beyond the capability of the trained personnel, the Project Manager will be notified. An attempt will be made to solve the problem. If the equipment or instrument still cannot be repaired, the equipment will be taken out of service and sent for repair and replacement equipment will be obtained from the laboratory.

The analytical laboratory will document the procedures used and any relevant Quality Assurance/Quality Control (QA/QC) and instrument calibration information pertaining to the specific analyses. All analytical results and field notes will be entered into a notebook or file established for this purpose, and will be provided in a final report prepared for the monitoring program. This file, including relevant QA/QC results, will be retained in the laboratory records up to 5 years and will be available for inspection by HDOT-authorized personnel during normal business hours. The laboratory will participate annually in US Environmental Protection Agency (USEPA)-certified provider water studies for water pollution and water supply for turbidity and TSS determination.

Chain of Custody Procedures

Once samples have been obtained and site conditions and field measurements have been properly documented in the field notebook, a written record of the chain of custody of the samples must be made for the turbidity and total suspended solids analysis. A chain of custody (COC) form will be filled out and accompany the samples to the laboratory; information on the form will state which analyses are to be performed (Appendix A). The form will identify the

samples, so the laboratory can report the analytical results by correct sample ID. When transferring possession of samples, the sampler will sign and record the date and time on the COC record. Each person who takes custody will fill in the appropriate section of the COC record.

Data Quality Objectives and Criteria for Measurement Data

Data quality objectives (DQOs) are qualitative and quantitative statements developed through a seven-step process based on USEPA guidance for developing DQOs (USEPA, 2006). The project-specific DQOs below describe each step and how it pertains to the monitoring and assessment of water quality during this project.

Step 1: State the problem

The Project will include construction of new bridge crossing Māʻili Stream. Potential impacts from construction include: introducing sediment into State waters, influence of the ambient pH of stream water via introduction of sediment, cement or dewatering effluent.

Step 2: Identify the decision

This AMAP is designed to monitor potential impacts from construction activity to Māʻili Stream by monitoring temperature, pH, dissolved oxygen, salinity, total suspended solids and turbidity during pre-construction, construction, and post construction. The intent of the applicable monitoring and assessment program (AMAP) is to conduct water sampling and analysis that will monitor the proposed work. The intent of this AMAP is to (1) ascertain that the Best Management Practices (BMPs) for the project are adequate to comply with State water quality standards, (2) promptly determine if BMPs are inadequate so that modification of the BMPS can be implemented in a timely manner to bring the activity into compliance; and (3) serve as a basis for self-compliance, so that activities associated with the proposed action can proceed within the parameters required by State water quality standards.

Step 3: Identify the inputs to the decision

The data that are collected as a part of the AMAP will be used in the decision rules to determine if the objectives listed above are being met. Preconstruction monitoring results will be used to assess baseline conditions. Field

measurements, field notes, total suspended solids, and turbidity data will be reported to HDOT with tabulated arithmetic and geometric (as appropriate) means upon completion of preconstruction sampling.

During-construction, data, as they become available, will be transmitted by email or facsimile to HDOT within 24 hours of completion of analysis or the first business day following holidays and weekends.

Postconstruction water quality monitoring will be conducted once per week for three weeks after construction is completed. Data will be tabulated and arithmetic and geometric (as appropriate) means will be calculated. Data will be used in a final construction report to assess impacts to water quality in Māʻili Stream and the drainage channel.

Step 4: Define the study boundaries

Data collection will be limited both spatially and temporally. Temporally, data collection will be limited to two years and three months during three monitoring phases Construction is expected to require two years of project work. Water quality monitoring will occur ten times (once a week for ten weeks, or more frequently if time requires) during the preconstruction sampling phase. During the construction phase, sampling will occur three times weekly at the impact and control stations (see Fig. 2, above). During the postconstruction phase, monitoring will occur three times (once a week for three weeks) at all stations.

Spatially, the monitoring plan will be limited to Māʻili Stream and will extend 50 ft (15 m) up and downstream from the project work areas. Stas. Control 1 and Control 2 will monitor the water quality approximately 50 ft (15m) from the work area and serve as an indicator of the quality of state waters not affected by project work. Stas. Impact 1, and Impact 2 will monitor the water quality in the stream 3 ft (1 m) from the project BMPs and serve as an indicator of their effectiveness.

Project sampling stations are shown in Fig. 2 (above). Data collected will monitor the effects of the project construction on water quality at each station, allowing a determination of the effectiveness of the project BMPs to be made.

Step 5: Develop a decision rule

The results of this study will be evaluated against the decisions outlined during Step 2 of the DQO process. If the measured parameters at the impact stations

exceed the range of preconstruction values, and the exceedance is not related to ambient conditions, it could be necessary to repair or modify the BMPs to improve water quality.

During field sampling, samplers are required to take field notes, which are described in the Sample Collection section. Samplers will note if the stream is flowing. If at any time it is noted that there is a turbidity plume extending beyond the BMPs and the plume is associated with construction, all work should stop until the cause is determined and corrected.

If turbidity at:

- Sta. Impact 1 is outside the range of preconstruction values and is 20% greater than the value at Sta. Control 1; or
- Sta. Impact 2 is outside the range of preconstruction values and is 20% greater than the value at Sta. Control 2; or

if total suspended solids at:

- Sta. Impact 1 is outside the range of preconstruction values and is 20% greater than the value at Sta. Control 1; or
- Sta. Impact 2 is outside the range of preconstruction values and is 20% greater than the value at Sta. Control 2; or

if pH at:

- Stas. Impact 1 or Impact 2 falls outside of the range of 7.0 to 8.6 (estuary criterion) and varies more than 0.5 standard units from the closest control station or the preconstruction means;

then a determination must be made whether the cause is attributable to construction (i.e., BMP failure) or a non-construction activity (i.e., tidal or runoff influence outside of project work). Because the project is located within a tidally influenced reach of Māʻili Stream, tidal stage must be taken into consideration when determining cause (during periods without significant freshwater input, "stream flow" may be upstream as a result of a flooding tide).

The field sampler or laboratory analyst will notify the WQC Project Manager of the exceedances. The WQC Project Manager will notify the contractor's representative. If the field samplers notice a problem in the field, they will

notify the contractor's representative and HDOT directly, or if the representative is not available, the on-site manager. The contractor's representative or on-site manager will attempt to track the cause of the exceedance. If it is determined that construction is causing the problem, then the activity responsible should cease until the problem is corrected. The contractor will verbally notify HDOT of the problem and any corrective action taken. If the discharge event is caused by other factors, then the contractor will report the findings (with material evidence) to HDOT.

Step 6: Specify tolerable limits on decision errors

Environmental decisions are uncertain. Some uncertainty will be the result of sample design errors and some uncertainty will be the result of measurement errors. When examining the data against the decision rules (Step 5), a decision must be made whether the data show the water quality of the stream is within the range of ambient conditions (null hypothesis) or whether the water quality of the stream is affected by construction activities. Two potential decision errors exist, Type I—false rejection of the null hypothesis (conclude a water quality impact has occurred where one has not) or Type II—false acceptance of the null hypothesis (conclude no water quality impact has occurred where one has). The tolerable limit on decision errors is set at >80%, it is assumed that differences in the percent change can be negative or positive (two-sided t-test), and the α significance level is set at 0.05.

To address decision errors that are the result of measurement errors, duplicates will be measured on at least 10% of the field measurements and samples collected for turbidity analysis. Acceptable relative percent differences for field duplicates are 75% or less. Laboratory control limits for quality control samples is established between 90% and 110%. Replicate analysis will be performed in 10% of the samples.

Step 7: Optimize the design

Directed sampling will be employed in the study area. The sampling locations and sampling frequency were developed in accordance with water quality regulations promulgated in Hawaiʻi Administrative Rules (HAR) Chapter 11-54 (HDOH, 2014) and the General Monitoring Guideline for Section 401 Water Quality Certification Projects (HDOH, 2000). This sampling program may be modified based on analysis of data, visual observations, changes in construction, changes in environmental conditions, and other information that may become available during construction. Optimization of the design, if necessary, will improve monitoring and assessment of construction impacts on Māʻili Stream.

Reports and Assessment

A statistical summary of preconstruction monitoring results will be reported to HDOT within 14 days of completion of preconstruction monitoring and analysis and prior to the commencement date of the proposed construction activities. The data will be used to set decision rule limits appropriate for the project. The monitoring entitiy or its assigned representative will fax or e-mail the summary to HDOT.

Draft results of during-construction monitoring data for field measurements and turbidity will be sent via facsimile or email (as a pdf) by the monitoring entity selected monitoring laboratory to HDOT within 24 hours or the first business day following sampling or analysis. Result for total suspended solids will be sent upon analysis, usually within eight days of sampling or on the next business day if the deadline falls on a weekend. Oil & grease result may take up to 28 days but generally are available in 10 business days.

A final report and water quality assessment by the monitoring entity will be required upon completion of the water quality monitoring program. This report will be submitted by construction contractor or its selected monitoring laboratory to HDOT within 60 days following completion of post construction water quality monitoring and analysis. The final report will identify the methods and procedures for analytical measurements and include all data collected as well as statistical summaries of results by station and activity phase (preconstruction, during construction, and post construction). This report will also assess whether water quality was impacted by the construction activity. Upon completion of the monitoring program, the contract laboratory will retain the original data and field notebook for a minimum of five years.

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Appendix A

AECOS, Inc.
Chain of Custody Form

AECOS, Inc.

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CHAIN OF CUSTODY FORM

PROJECT FILE No.

LOG NUMBER [ ]

CLIENT: CONTACT:

ADDRESS: PHONE No.: ☎

Purchase Order No.:

☐ RUSH

☐ SEE REVERSE

SPECIAL INSTRUCTIONS

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COMMENTS:

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PRECAUTIONS:

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AECOS

NOTE: IF ANY INFORMATION IS PROVIDED ON THIS SIDE OF FORM, CHECK THE "SEE REVERSE" BOX ON THE FRONT SIDE OF FORM

ADDITIONAL CUSTODY RECORD
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DRAW MAP OR DIAGRAM OF SAMPLE SITES HERE

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