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OFFICE OF ENVIRONMENTAL QUALITY CONTROL

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

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IN REPLY REFER TO:
HWY-DS 2.9396

TO: THE HONORABLE GARY HOOSER, DIRECTOR
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

FROM: GLENN M. OKIMOTO, Ph.D.
DIRECTOR OF TRANSPORTATION

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT (DEA) FOR
HAWAII BELT ROAD
REHABILITATION OF UMAUMA STREAM BRIDGE
FEDERAL AID PROJECT NO. BR-019-2(61)

The State of Hawaii, Department of Transportation has reviewed the DEA for the subject project, and anticipates a Finding of No Significant Impact. Please publish notice in the next available Office of Environmental Quality Control (OEQC) Environmental Notice.

We have enclosed the following:

- a completed OEQC Publication Form
- one (1) copy of the document in pdf format on a CD;
- one (1) hardcopy of the DEA.

Should you have any questions, please contact our Project Manager, Mr. Eddie Chiu at 692-7547, Technical Design Services Office, Design Branch, Highways Division or by email at eddie.k.chiu@hawaii.gov.

Enclosures

Project Name: Rehabilitation of Umauma Stream Bridge Project No. BR-019-2(61)

Publication Form
The Environmental Notice
Office of Environmental Quality Control

Applicable Law: EIS law (Ch. 343, HRS and 11-200, HAR)
Type of Document: Draft Environmental Assessment
Island: Hawai'i
District: North Hilo
TMK: State Right-of-Way; Construction Staging on TMK (3) 3-1-01:15
Permits Required: Office of Planning, Coastal Zone Management Consistency Certification; Department of Health (DOH), Section 401, Clean Water Act, Water Quality Certification; DOH Noise Permit; DOH Noise Variance; Hawai'i Commission on Water Resources, Stream Channel Alteration Permit; County of Hawai'i, Grading and Grubbing construction permits; Army Corps of Engineers, Department of Army Permit, Section 404, Clean Water Act, Nationwide Permit

Applicant or Proposing Agency: State of Hawai'i, Department of Transportation, Highways Division
Address: 601 Kamokila Boulevard, Room 688, Kapolei, Hawai'i 96707
Contact & Phone: Eddie Chiu, 808-692-7547

Approving Agency/ Accepting Authority: State of Hawai'i, Department of Transportation, Highways Division
Address: 601 Kamokila Boulevard, Room 688, Kapolei, Hawai'i 96707
Contact & Phone: Eddie Chiu, 808-692-7547

Consultant: Bow Engineering & Development, Inc
Address: 1953 S. Beretania Street, PH-A, Honolulu, Hawaii 96826
Contact & Phone: Brian Campbell, 808-941-8853 ext. 115

Project Summary:

The State of Hawai'i, Department of Transportation, Highways Division (DOT), with funding assistance from the Federal Highway Administration (FHWA), plans to construct bridge widening and structural rehabilitation of the existing historic Umauma Bridge. Improvements include construction of concrete support columns to be placed within and adjacent to the existing steel support towers, widening of the bridge deck and roadway shoulders, and construction of a new concrete railing. The identified objectives of the project are to rehabilitate the deteriorating, steel framed Umauma Bridge while satisfying State Historic Preservation historical requirements, and to bring the bridge roadway in compliance with FHWA regulations and current safety standards.

The project site is located on the Hawai'i Belt Road (Highway No. 19) at approximately milepost 16.02 in the North Hilo District, Hawai'i Island. The Umauma Stream Bridge carries the Hawai'i Belt Road over Umauma Stream, along the Hāmākua Coast. The bridge is located entirely within the State right-of-way.

Construction activities would have a short-term effect on air quality, water quality, traffic, and ambient noise levels. Compliance with applicable State Department of Health Rules, site-specific BMPs, and mitigation measures contained in the EA would minimize potential impacts from construction. No significant long-term environmental impacts would occur from construction and operation of the proposed project.

DRAFT ENVIRONMENTAL ASSESSMENT

REHABILITATION OF UMAUMA STREAM BRIDGE PROJECT

District of North Hilo, Island of Hawai'i
Federal Project No. BR-019-2(61)

State of Hawai'i
Department of Transportation, Highways Division

October 2011

Rehabilitation of Umauma Stream Bridge Project
Federal-Aid Project No. BR-019-2(61)
District of North Hilo, Hawai‘i Island, Hawai‘i Belt Road

Draft Environmental Assessment

This environmental document has been prepared pursuant to
Chapter 343, Hawai‘i Revised Statutes
and Hawai‘i Administrative Rules, Title 11, Chapter 200

Proposing Agency:

State of Hawai‘i
Department of Transportation, Highways Division
601 Kamokila Boulevard, Room 688
Kapolei, Hawai‘i 96707

October 2011

PROJECT SUMMARY INFORMATION

PROJECT:	Hawai‘i Belt Road, Rehabilitation of Umauma Stream Bridge, District of North Hilo, Island of Hawai‘i, Federal-Aid Project No. BR-019-2(61)
PROPOSING AGENCY:	State of Hawai‘i Department of Transportation, Highways Division 601 Kamokila Boulevard, Room 688 Kapolei, Hawai‘i 96707 Contact: Eddie Chiu, 808-692-7547
FEDERAL AUTHORITY:	Federal Highway Administration (FHWA)
LOCATION:	Hawai‘i Belt Road, District of North Hilo, Island of Hawai‘i, approximately at Milepost 16.02, State Right-of-Way. Construction Staging on TMK (3) 3-1-01:15
PROPOSED PROJECT:	The proposed project is to construct bridge widening and structural rehabilitation of the existing historic Umauma Bridge. The existing bridge would remain open and in use as the improvements are constructed.
HRS CH. 343 TRIGGER:	Use of state lands and state funds; historic site
STATE LAND USE DESIGNATION:	Conservation
EXISTING ZONING:	State Right-of-Way through areas zoned Agricultural District (AG-20)
SPECIAL MANAGEMENT AREA:	Within SMA
ANTICIPATED DETERMINATION	Finding of No Significant Impact (FONSI)

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1 INTRODUCTION

1.1 PURPOSE OF THE ENVIRONMENTAL ASSESSMENT

The evaluation of projects to determine their effects on the environment is required by the Hawai'i Revised Statutes (HRS), Chapter 343. An Environmental Assessment (EA) is a "written evaluation to determine whether an action may have a significant effect" (HRS §343-2). The agency with primary responsibility over the project (the proposing agency) is required to prepare an EA and makes a final determination according to significant impacts, or lack of significance. As stated in HRS §343-1:

> An environmental review process will integrate the review of environmental concerns with existing planning processes of the State and counties, and alert decision makers to significant environmental effects which may result from the implementation of certain actions. …The process of reviewing environmental effects is desirable because environmental consciousness is enhanced, cooperation and coordination are encouraged, and public participation during the review process benefits all parties involved and society as a whole.

As described above, the basic purpose of an EA is to provide information to the public and decision makers on proposed actions. The EA must also disclose: potential significant adverse environmental impacts, the expected primary and secondary consequences, and the cumulative as well as the short and long-term effects of the action.

1.2 PROJECT OVERVIEW AND PROJECT NEED

The State of Hawai'i, Department of Transportation, Highways Division (DOT), with funding assistance from the Federal Highway Administration (FHWA), plans to construct bridge widening and structural rehabilitation of the existing historic Umauma Bridge. Improvements include construction of concrete support columns to be placed within and adjacent to the existing steel support towers, widening of the bridge deck and roadway shoulders, and construction of a new concrete railing.

The existing Umauma Bridge was constructed in 1911. In the early 1950s, the bridge, including the trestles, was widened to support a two-lane highway for vehicular traffic. The bridge was retrofitted in the early 2000s to resist updated earthquake design loads. Umauma Bridge is a historic bridge and under the jurisdiction of the State Historic Preservation Division (SHPD). The steel framed Umauma Bridge is showing signs of steel deterioration. Repair and maintenance projects have been completed and are currently in progress to minimize steel deterioration. The proposed rehabilitation project would install new concrete towers that would support bridge loads, and existing steel towers would become non-structural, as the new concrete piers would be the primary load carrying elements.

The proposed project would also improve safety and correct existing roadway deficiencies. The removal of the existing sidewalks and bridge railings, the widening of the bridge deck and constructing new bridge railings (which conform to current acceptable standards) along both

sides of the bridge would improve the safety for high-speed vehicular traffic by eliminating a vaulting hazard that a sidewalk would present. Also, wider shoulders and taller bridge railings along both sides of the bridge would improve the safety for bicyclists and pedestrians.

The State DOT has identified the following objectives of the Rehabilitation of Umauma Stream Bridge Project:

- To rehabilitate the deteriorating, steel framed Umauma Bridge while satisfying SHPD historical requirements.
- To bring the bridge roadway in compliance with FHWA regulations and current safety standards.

1.3 FEDERAL AND STATE AUTHORITY

The proposed action will utilize funding from both federal and state agencies, including the FHWA and DOT. There will be an 80 percent contribution by FHWA funds, and 20 percent contribution by the State. Because there is both federal and state funding for the project, it is subject to both federal and state environmental laws and regulations.

Environmental review procedures required by the State of Hawai‘i include compliance with HRS §343, and Hawai‘i Administrative Rules (HAR), Title 11, Department of Health. A Categorical Exclusion (CE) pursuant to the National Environmental Policy Act of 1969 (NEPA), as amended, is anticipated for this project.

1.4 STEPS IN THE ENVIRONMENTAL REVIEW PROCESS

Following completion of the Draft EA, the environmental document is submitted the State Office of Environmental Quality Control (OEQC). OEQC will notify government agencies and the public when the Draft EA is available for review. The announcement is made in a bimonthly bulletin called the OEQC *Environmental Notice*, which is available in print and online. Publication in the *Environmental Notice* marks the beginning of a 30-day comment period during which government agencies and the public can review and comment on the environmental document and its findings. After the 30-day review period, DOT will consider all comments and determine whether a Finding of No Significant Impact (FONSI) is appropriate.

1.5 PERMITS AND APPROVALS REQUIRED OR POTENTIALLY REQUIRED

Government permits required or potentially required to implement the proposed action are listed below:

STATE OF HAWAI‘I

Department of Transportation

- Preparation and approval of an Environmental Assessment – The DOT will act as the approving agency for the proposed action and will have authority to determine if the EA is adequate and whether a FONSI is appropriate.

Office of Planning

- Coastal Zone Management (CZM) Federal Consistency Certification – Consistency Verified August 26, 2011

State Department of Land and Natural Resources (DLNR), Office of Conservation and Coastal Lands (OCCL)

- Conservation District Use Application (CDUA) (**not required**) – The majority of the work would take place within the State right-of-way, and the staging area is on the mauka side of the road and is outside of OCCL jurisdiction. Further, rehabilitation of the bridge appears to be the continued use of a nonconforming structure, and a CDUA would not be required.

Department of Health

- Section 401, Clean Water Act (CWA) – anticipated Water Quality Certification for Nationwide Permit 14
- National Pollutant Discharge Elimination System (NPDES) General Permit for Construction Stormwater Activities (**not required**) – since construction activities would disturb approximately 0.87 acres (less than one acre of total land area), including construction staging area, an NPDES permit would not be required.
- Noise Permit
- Noise Variance

Hawai‘i Commission on Water Resources

- Stream Channel Alteration Permit (SCAP)

COUNTY OF HAWAI‘I

- Construction Permits – Grading and Grubbing
- Special Management Area Permit (SMA) (**not required**) – the proposed bridge rehabilitation project would be considered repair of a highway within an existing right-of-way, and would be considered exempt from SMA permit requirements.

FEDERAL

U.S. Army Corps of Engineers

- Department of Army Permit, Section 404, Clean Water Act – Nationwide Permit Verification issued August 17, 2011.

2 PROJECT DESCRIPTION

2.1 ENVIRONMENTAL SETTING

PROJECT LOCATION

The project site is located on the Hawai‘i Belt Road (Highway No. 19) at approximately milepost 16.02 in the North Hilo District, Hawai‘i Island (see Figure 1). The Umauma Stream Bridge carries the Hawai‘i Belt Road over Umauma Stream, along the Hāmākua Coast (see Photo 1). The bridge is located entirely within the State right-of-way.

EXISTING CONDITIONS

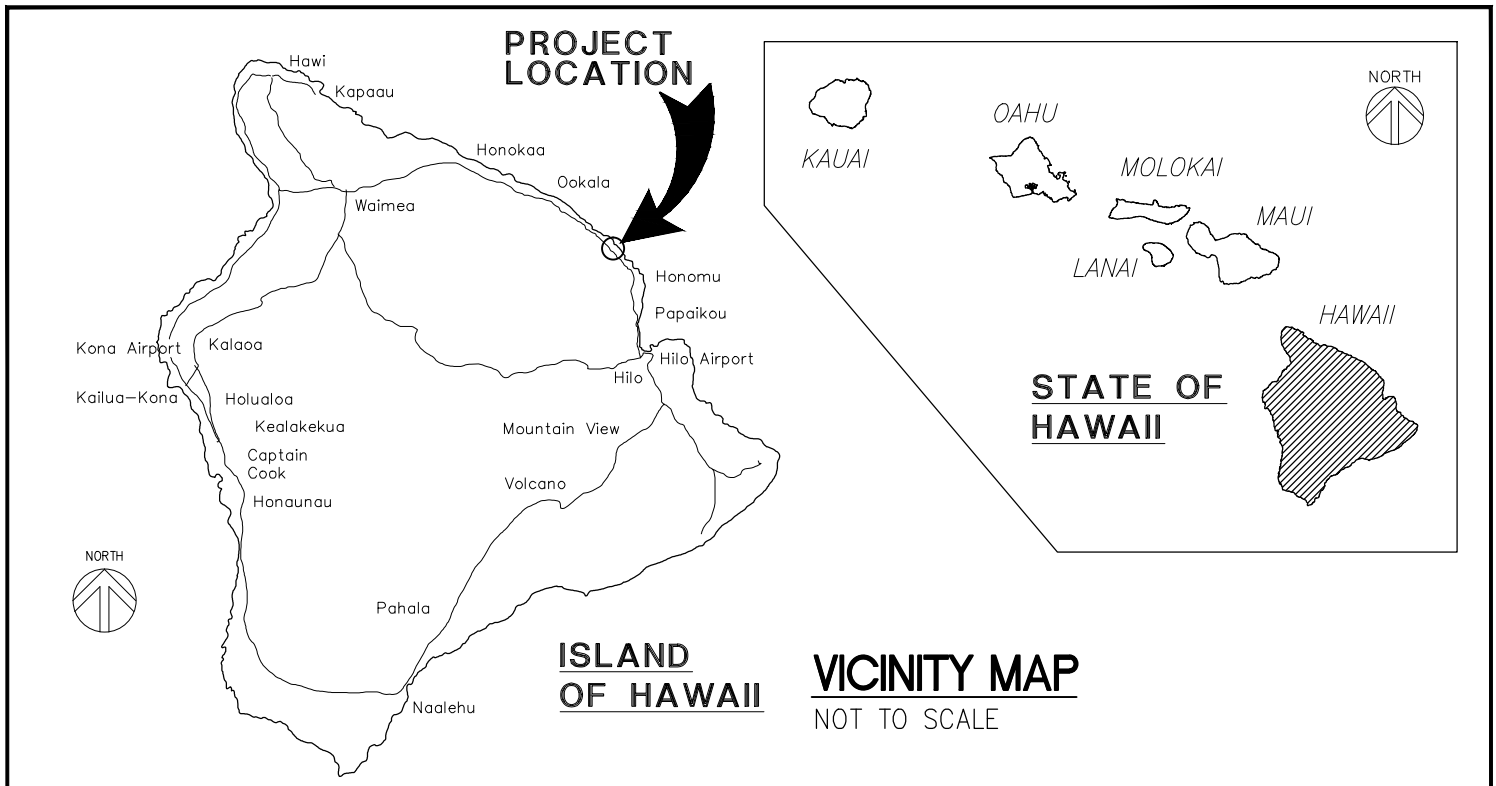
Umauma Bridge is a steel girder and trestle bridge (see Photo 2) built over Umauma Stream. The superstructure is concrete deck on steel girder and the substructure is steel girder on circa 1912 steel railroad trestle with concrete abutments. Open horizontal concrete rail and cap were added as parapets in 1955. Concrete endposts, also added in 1955, have an incised bridge name and date of construction.

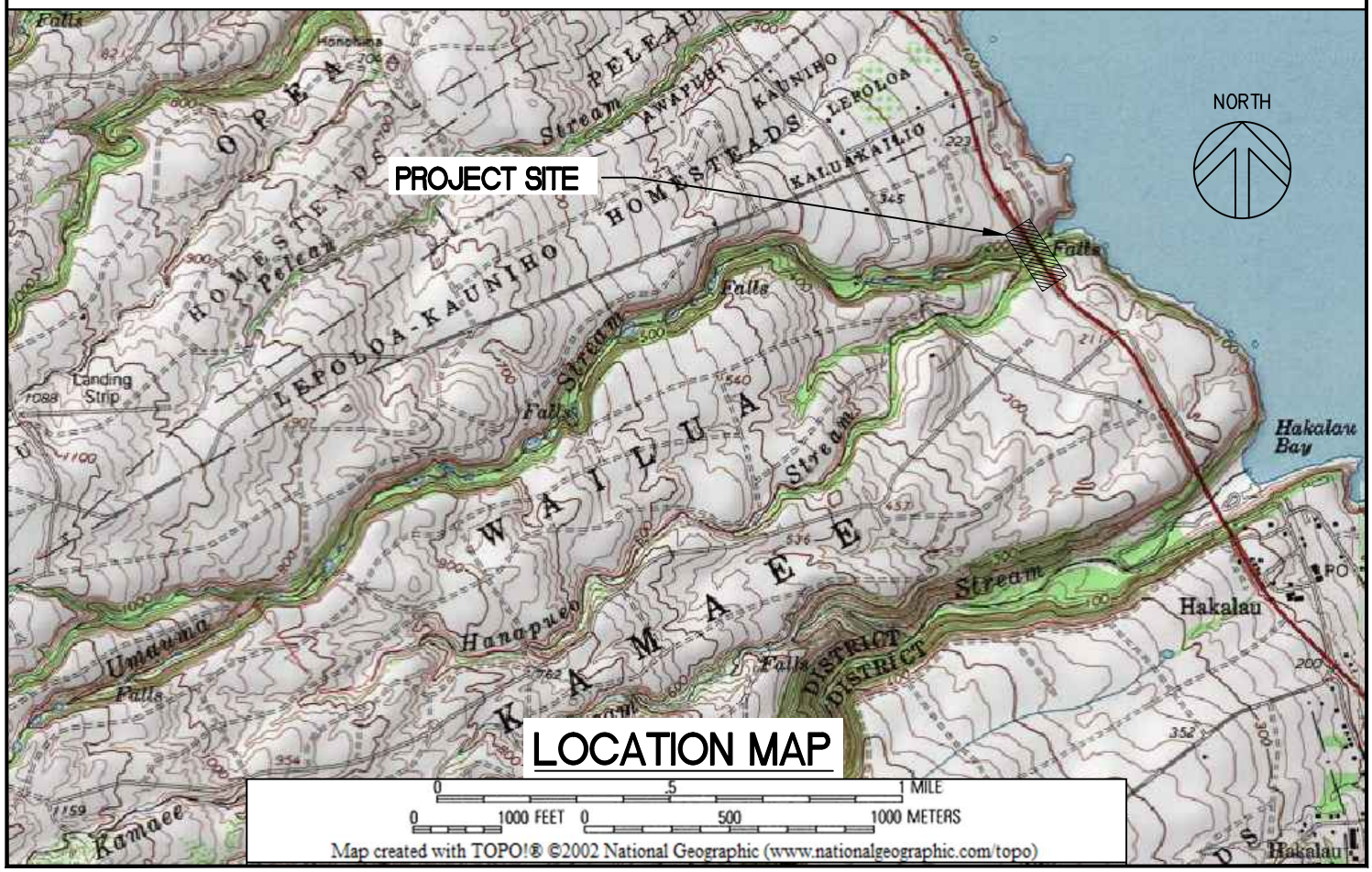
The existing bridge is approximately 110 feet tall. The bridge is 28 feet wide (curb-to-curb) and 38.5 feet wide (out-to-out) with a bridge deck half section consisting of a 12-foot wide asphaltic concrete (AC) travel lane, 2-foot wide AC shoulder, 3.5-foot wide concrete sidewalks (raised 6 inches from the roadway), and a 1-foot wide by 2.5-foot high railing (see Figure 2 for existing bridge plan and profile).

Adjacent land uses include rural residential and agricultural uses. The Umauma stream flows in a predominantly west to east direction with open ocean located to the east of the bridge.

Historical Value

Umauma Bridge is part of a National Register eligible multiple property nomination of “Steel Trestle Bridges on the Hāmākua Coast” written by Spencer Lieneweber in cooperation with the Hawai‘i DOT. The SHPD and DOT are currently working toward an agreement on the bridge inventory and finalizing documentation for the National Register. The bridge is significant under National Register criteria for its association with the Hilo Railroad Company, which played a major role in the development of the Hāmākua Coast for sugar plantations and as one of the few remaining steel girder and trestle bridges that represent the work of John Mason Young. The period of significance extends from 1911 when the rail trestle bridges were first constructed to 1953 when Territorial Highways engineer William Bartels converted the bridges to highway bridges to accommodate the change in transportation methods.





F-1

HAWAII BELT ROAD - REHABILITATION OF UMAUMA STREAM BRIDGE

VICINITY AND LOCATION MAP

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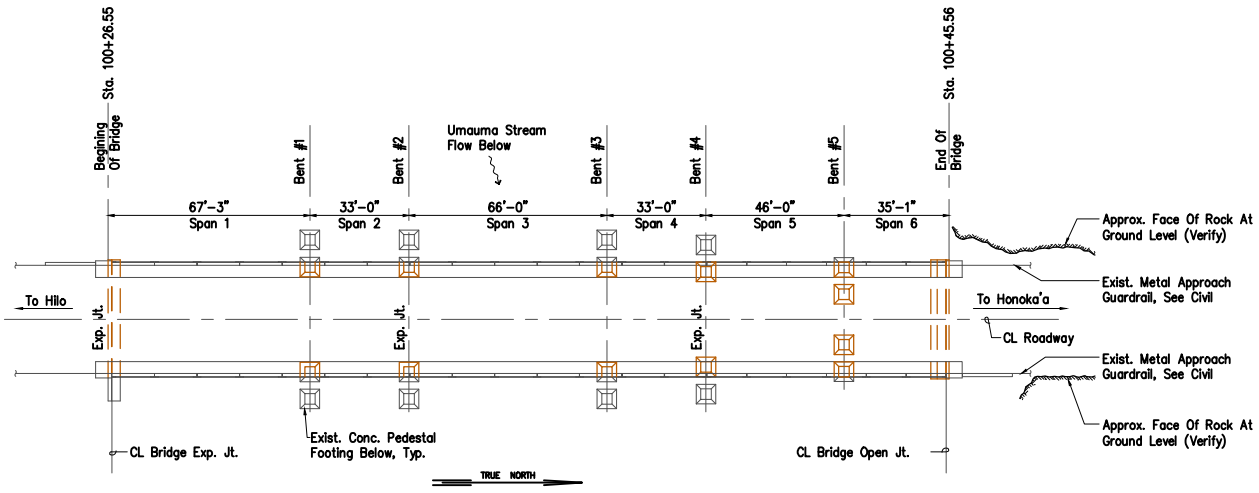
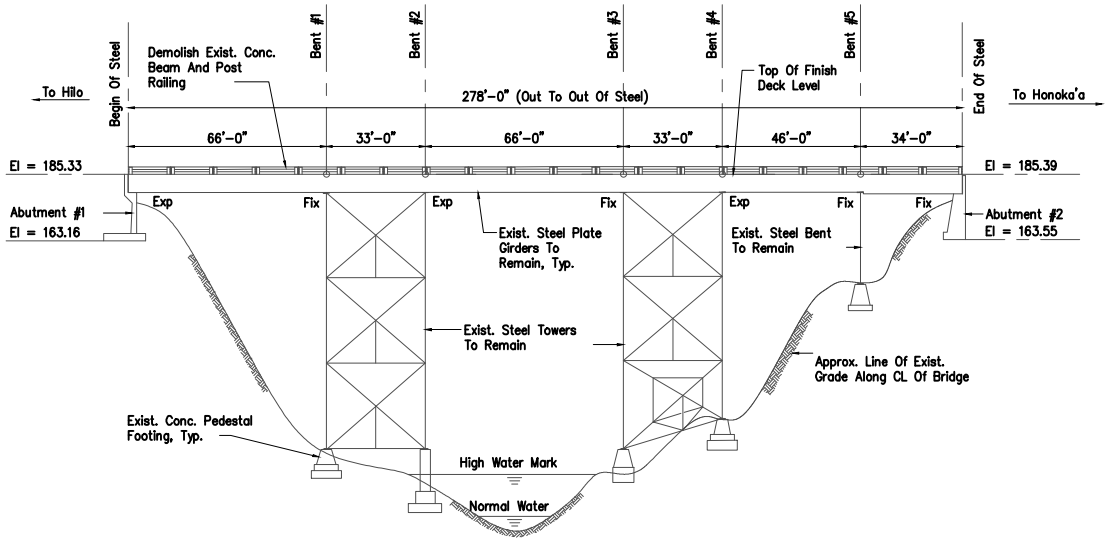


EXISTING BRIDGE PLAN

SCALE: 1" = 64'



EXISTING BRIDGE PROFILE

SCALE: 1" = 64'

GRAPHIC SCALE

20' 0 20' 40' 60'

1/64" = 1'-0"

F-2

HAWAII BELT ROAD - REHABILITATION OF UMAUMA STREAM BRIDGE

EXISTING PLAN AND PROFILE

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Photo 1: View of bridge along roadway

Photo 2: Steel girder and trestle

2.2 DESCRIPTION OF THE PROPOSED ACTION

The proposed project would include construction of concrete support columns to be placed within and adjacent to the existing steel support towers, widening of the bridge deck and roadway shoulders, and construction of a new concrete railing.

CONCRETE TOWERS

The proposed project would reinforce the deteriorating steel structure of the bridge by constructing two main concrete towers and one smaller concrete tower within the existing steel towers (see Figure 3). The towers would be constructed within the steel towers to preserve the historically significant bridge structure (see Photo 3). The new concrete pier caps would be constructed over the new towers, and the existing steel members would be encased within the new concrete pier caps. Due to constructability challenges and structural load requirements, spread footings are the foundation system that would most likely be used at Pier 1 (adjacent to stream on Hilo side) and Pier 2 (adjacent to stream on Honoka‘a side). Spread footings consist of reinforced concrete at the same ground elevation as existing pedestal footings. Micropiles would likely be used at Pier 3. A micropile is an approximate 7-inch diameter reinforced concrete pile that extends to the rock layer below existing grade, which varies from 10 to 50 feet below existing grade. Drilled shafts would be used at two abutments.

BRIDGE DECK, END POSTS, AND ROADWAY IMPROVEMENTS

To comply with Federal Highway Administration (FHWA) regulations, the bridge deck would be widened to 40 feet (curb-to-curb) and 44 feet (out-to-out). The proposed bridge deck would be entirely AC with 12-foot travel lanes and 8-foot shoulders (see Figure 4 for existing and proposed sections). The existing raised sidewalk would be removed. The new concrete railing would be raised to 4-foot-2-inches to comply with the FHWA bike safety regulations. The lower 2-foot-8-inches section of railing would be tapered to a 2-foot-6-inch base at the bottom to comply with FHWA vehicular barrier regulations. The widened bridge shoulders would taper back to the existing shoulders as soon as feasible along the roadway to avoid any major grading into the adjacent embankments. Roadway improvements on both sides of the bridge would extend approximately 20 feet beyond the bridge approach slab to provide a transition from the existing roadway to the new bridge.

The bridge end posts at the Honoka‘a end of the bridge would terminate directly into the existing cut slope to negate the need for guardrails. The bridge end post on the Hilo downstream end of the bridge would be protected via guardrail extending from the new end post and terminating into the existing cut slope (same as existing condition). Sand barrels would protect the bridge end post on the Hilo upstream end of the bridge since there is not adequate space to provide a guardrail with crashworthy end terminal while still providing access to the adjacent maintenance yard.

STORMWATER AND DRAINAGE

The proposed concrete towers would be constructed outside of the normal stream flow of Umauma Stream. The existing bridge deck drain inlets currently discharge through a section of

4-inch pipe with an outlet approximately 4-feet below the bridge deck, allowing stormwater to discharge to the atmosphere and fall to the ground/stream below (see Photos 4 and 5). The proposed project would replace the drain inlets with deck drains placed at certain locations to prevent stormwater from falling directly into the stream. By doing so, storm runoff would be filtered through natural vegetation on the stream bank before entering into the stream.

GRADING AND EARTHWORK

The proposed earthwork within the stream bank would be limited to restoration of the grades disturbed by the spread footing construction (see Figure 5 for conceptual grading plan). Because of the steepness of the existing grades, the slope would require stabilization with geotextile fabric and geogrid reinforcement (see Figure 5 section). As a result of the thickness of the spread footing, portions of the concrete would be left exposed and not buried. The proposed earthwork at the bridge deck would consist of minor grading of the approaches to accommodate the widened bridge deck shoulder.

ROCK FALL PREVENTION MEASURES

There is one rock fall potential problem area that has been identified on the *makai*[1] side of the bridge, situated at the lower 40 feet of the slope. While the rock formation is currently fairly stable, the project includes implementation of rock stabilization measures prior to construction. The area of potential rock fall and prevention measures included as part of the proposed action are described in detail in Section 3.1, *Topography and Soils*.

SITE-SPECIFIC BEST MANAGEMENT PRACTICES

The proposed bridge rehabilitation project includes site-specific Best Management Practices (BMPs) to be implemented during project construction to minimize erosion and potential impacts to water quality. These BMPs included as part of the proposed action are described in detail in Section 3.1, *Topography and Soils*.

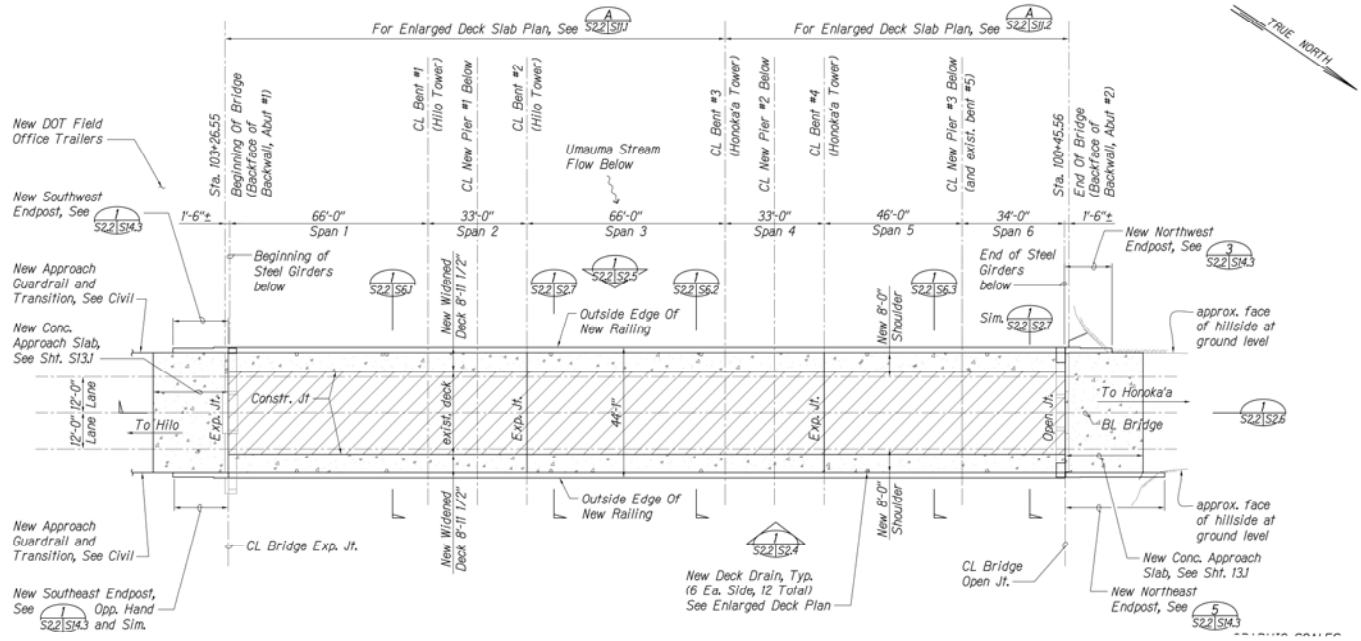
BRIDGE MAINTENANCE

Current bridge maintenance consists of temporary repairs and temporary repainting intended to slow down, but not stop, existing corrosion of steel. Bridge maintenance occurs approximately every 2 years.

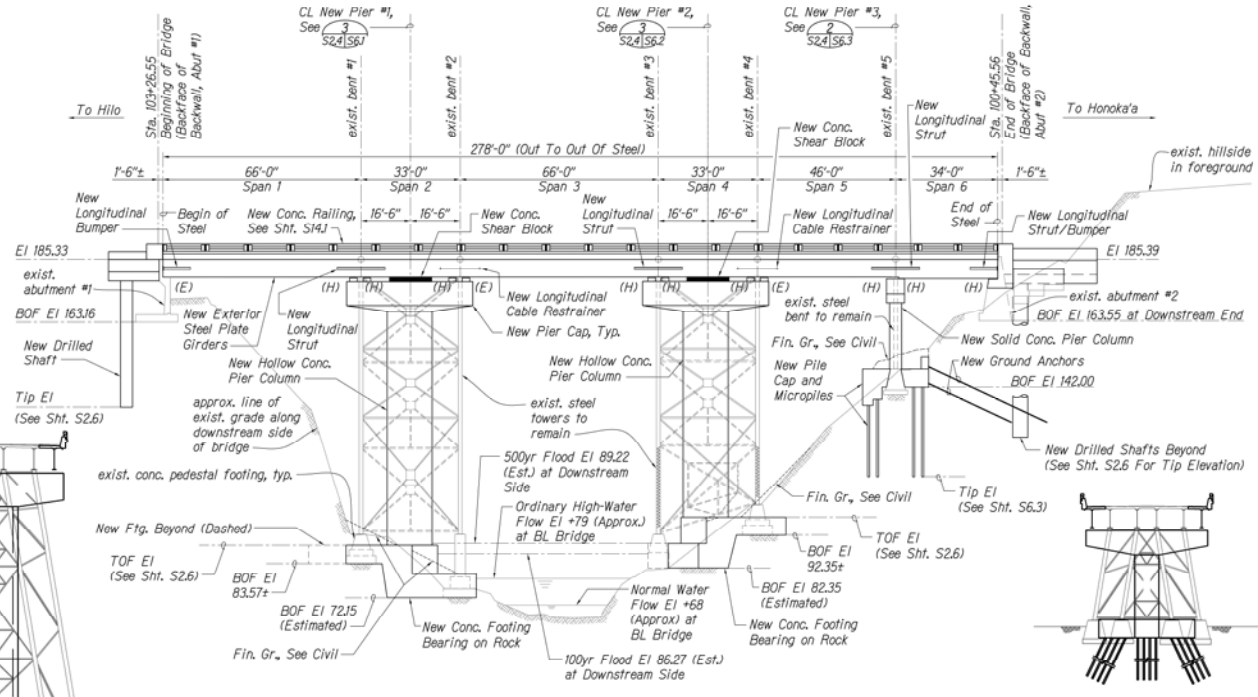
TRAFFIC CONTROL

The State DOT Hawai‘i District construction specifications require that one roadway lane be open at all times (see Photo 6). If it is necessary to close both lanes at the same time, State DOT Hawai’i District attempts to maintain a maximum of 10-minute lane closure. However, a longer closure may occur depending on the construction task.

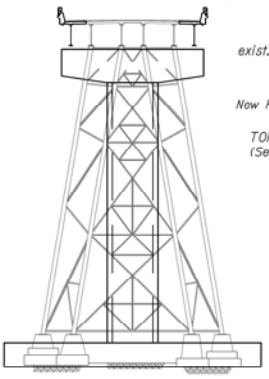
[1] *Makai* – Hawaiian word meaning toward the ocean



PROPOSED BRIDGE PLAN
SCALE: 1" = 64'



PROPOSED BRIDGE PROFILE
SCALE: 1" = 64'



BENT #1
SCALE: N.T.S.

BENT #5
SCALE: N.T.S.

GRAPHIC SCALE

20' 0 20' 40' 60'

1/64" = 1'-0"

F-3

HAWAII BELT ROAD - REHABILITATION OF UMAUMA STREAM BRIDGE

PROPOSED PLAN AND PROFILE

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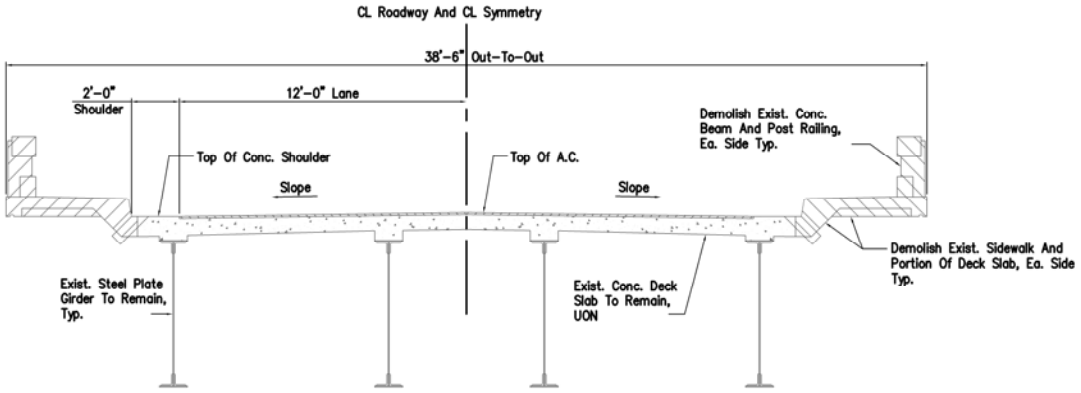
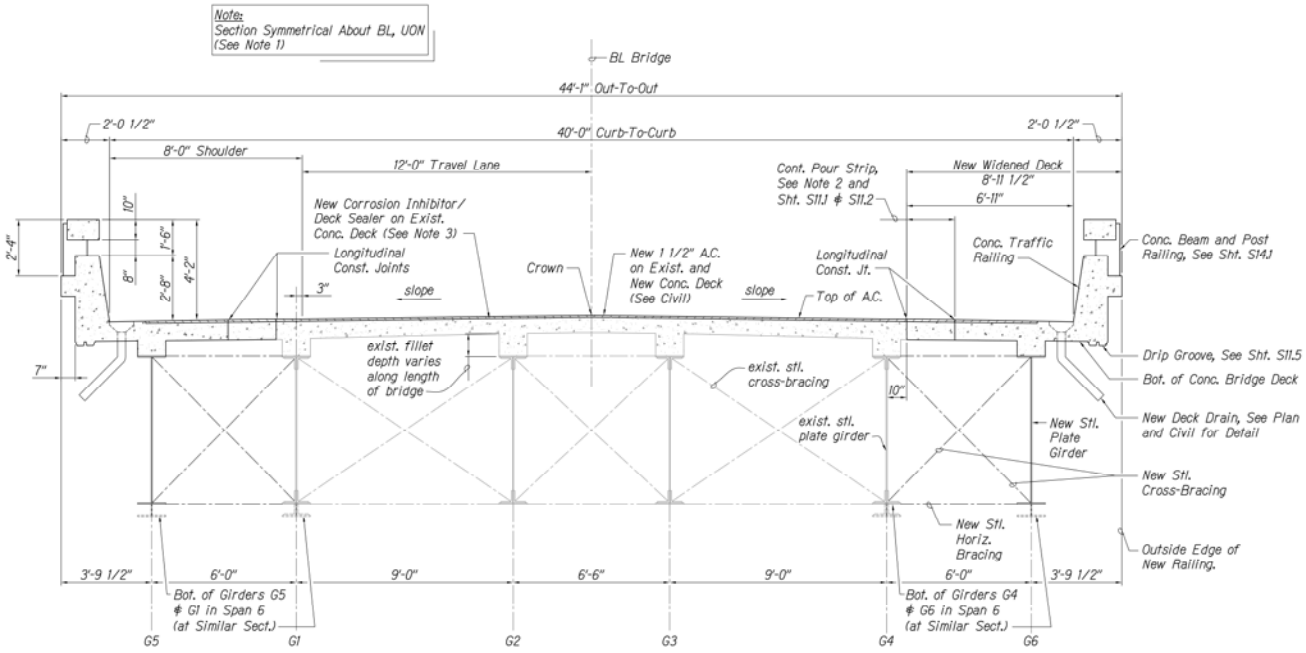


EXISTING CROSS SECTION
SCALE: N.T.S.



PROPOSED CROSS SECTION
SCALE: N.T.S.

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HAWAII BELT ROAD - REHABILITATION OF UMAUMA STREAM BRIDGE

EXISTING AND PROPOSED SECTIONS

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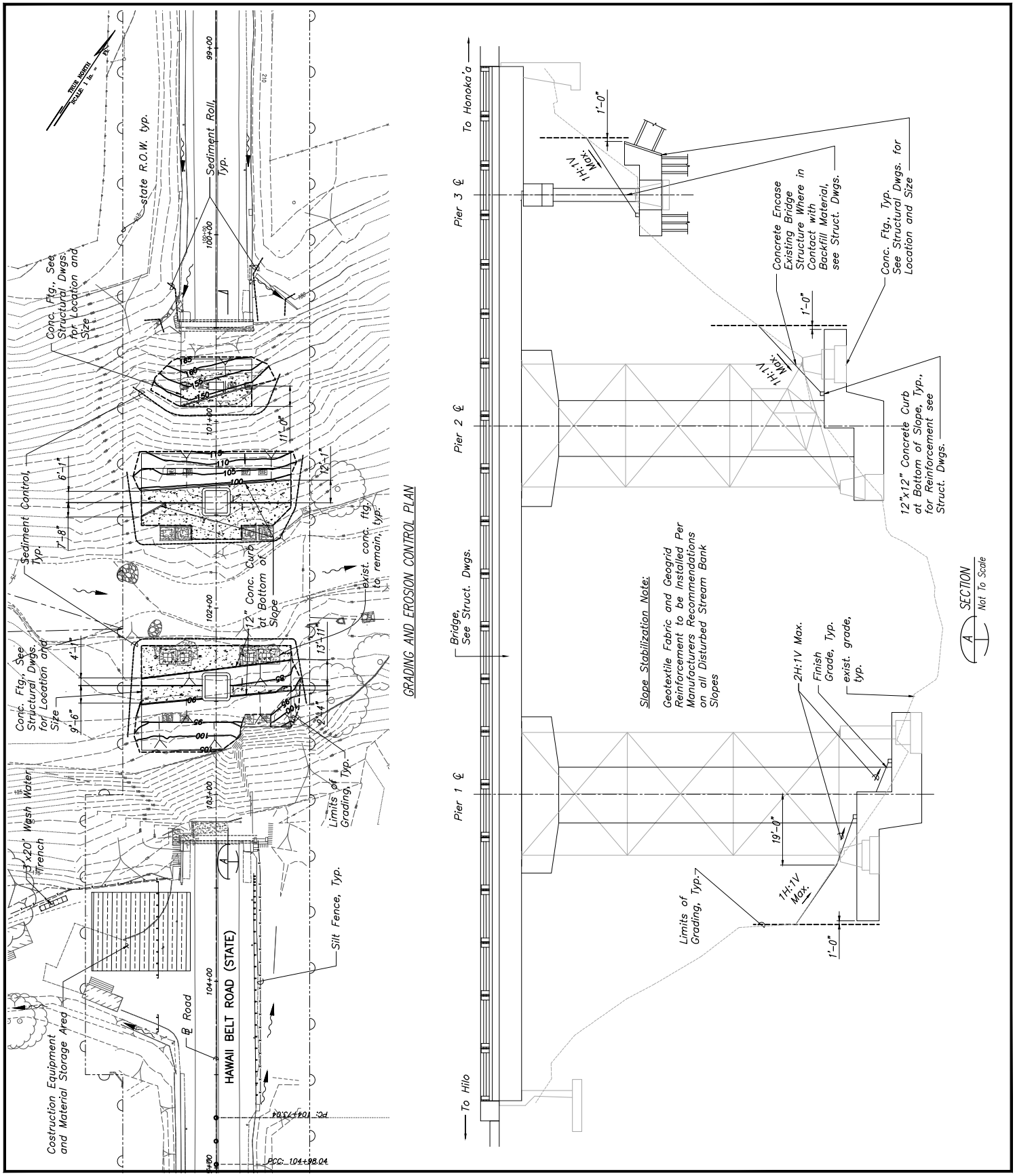
Photo 3: Steel support tower footings

Photo 4: Drain inlet

Photo 5: Drainage outfall

Photo 6: Lane closure during construction



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HAWAII BELT ROAD - REHABILITATION OF UMAUMA STREAM BRIDGE

GRADING AND SECTION

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CONSTRUCTION STAGING

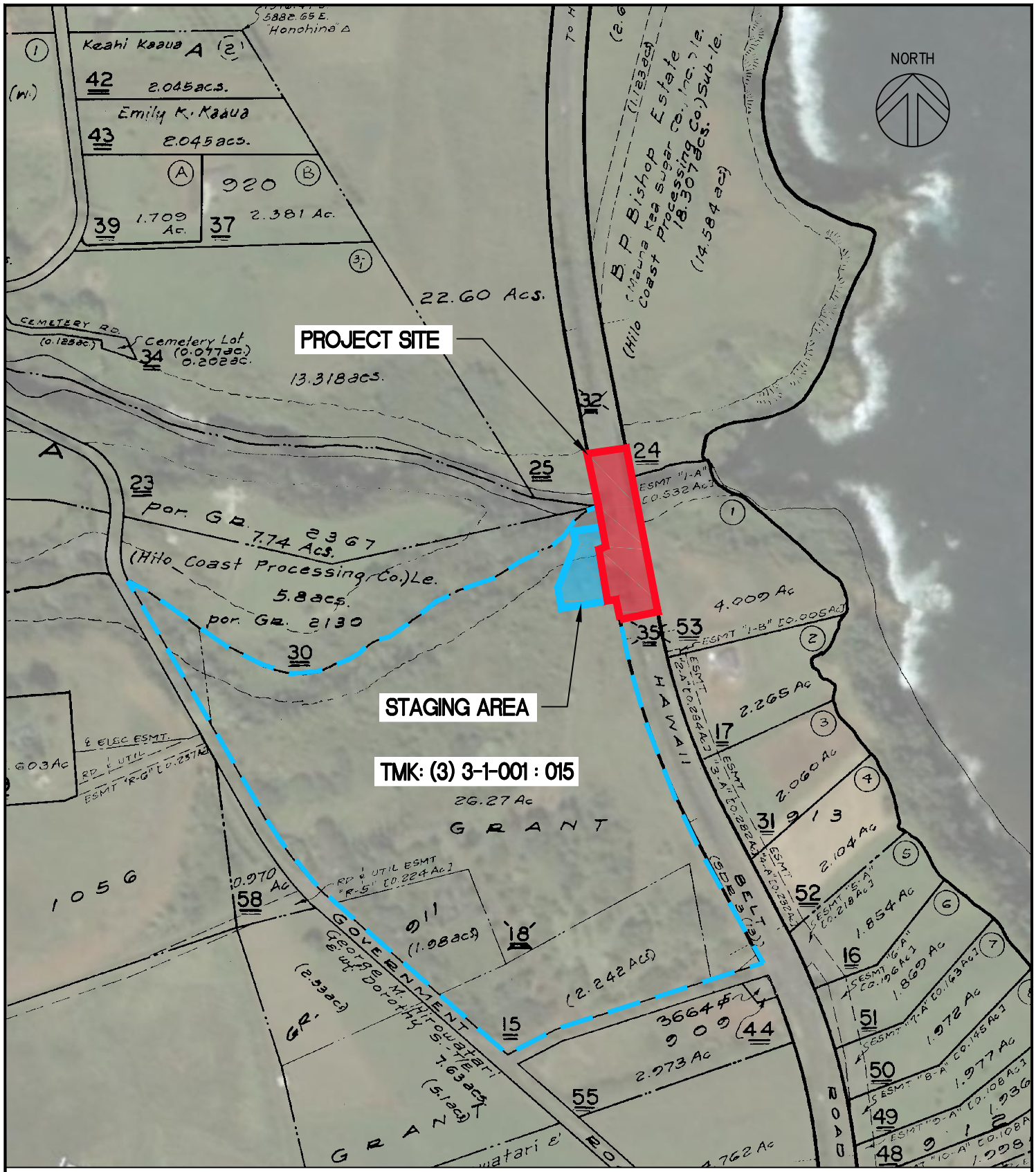
The construction staging area is proposed to be located on the Hilo side of the bridge, *mauka*[2] of the roadway, on an adjacent property to the bridge (TMK (3) 3-1-01:15) (see Figure 6). The Department of Transportation (DOT) currently has several trailers in this staging area for bridge maintenance use (see Photo 7). Construction equipment would also be staged adjacent to the bridge footings and would be within State right-of-way.

PROJECT CONSTRUCTION AND COST

Construction of the bridge rehabilitation improvements is scheduled to begin during early summer 2012. The actual start date would be dependent on obtaining the required permits and approvals. The project would be constructed for the duration of approximately two years.

Construction of the proposed bridge rehabilitation project is estimated to cost $35 million (subject to change), with Federal contribution of 80 percent and State contribution of 20 percent of the total construction cost.

[2] *Mauka* – Hawaiian word meaning toward the mountain



Source: http://www.co.hawaii.hi.us/maps/tmk/zone.htm Date Accessed : 4/15/2011 Last Updated: 2/15/2008

F-6

HAWAII BELT ROAD - REHABILITATION OF UMAUMA STREAM BRIDGE

CONSTRUCTION STAGING AREA

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Photo 7: Construction staging area

3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

The intent of this chapter is to describe the existing physical and social environment that is affected by the proposed action. Potential impacts that may result from implementation of the proposed action and mitigation measures to minimize the adverse impacts are described below.

3.1 TOPOGRAPHY AND SOILS

The existing bridge spans over approximately 280 feet of the Umauma Stream gulch, with a 90 to 100-foot drop from the bridge deck to the stream and embankments below. The sides of the gully are steep, with some areas as steep as near vertical near the bottom of the slope. Most of the slope areas are covered by vegetation. Within the project area, the streambed consists of basaltic bedrock and is generally 50 to 60 feet in width (AECOS 2010). Rock outcrops, along with numerous boulders, are exposed at the bottom of the gully adjacent to the stream.

Predominant soils in the area of the project site as classified by the Natural Resources Conservation Service (NRCS) consist of rough broken land (RB) (see Figure 7). Rough broken land is used to characterize gulches, with slopes 35 to 70 percent (NRCS 2009). Based on soil suitability, the State of Hawai‘i, Department of Agriculture has established the Agricultural Lands of Importance to the State of Hawai‘i (ALISH) system to identify areas of prime farmland. The ALISH system classifies three types of land suitable for agriculture: Prime Lands, Unique Lands, and Other Lands. The project site is located within State right-of-way, and is not considered as agricultural lands of importance (see Figure 8).

Soil borings completed in April 2010 behind the existing abutments encountered fill consisting of mottled brown clayey silt with sand and gravel below the existing pavement section, with 27 feet in thickness on the Hilo side and 12 feet on the Honoka‘a side. Basalt was encountered at depths of about 36 and 47 feet. Borings drilled by the piers encountered basalt at depths ranging from the ground surface at Pier 1 to about 13 feet at Pier 2, and 11 feet at Pier 3. Borings at Pier 1 encountered groundwater at a depth of 29 feet (Hirata & Associates, Inc. 2011).

There were several areas of rock formation identified by DOT to be rock fall potential problem areas. Although there were some problem areas observed on the *mauka* side of the bridge, these problem areas were determined to be adequately set back laterally to not be a concern for the bridge or for workers repairing the bridge. An additional rock fall problem area included a set of nested rocks likely placed during the original construction of the bridge situated at the upper 20 feet of the slope, and on the *makai* side of the bridge. However, these rocks were removed in June 2010 to minimize hazards to the maintenance crew, with no impact to the existing bridge. The remaining identified area of concern is situated at the lower 40 feet of the slope, below and *makai* of the bridge, with the total height of the valley slope estimated at approximately 80 feet high. The slope in this area is generally near vertical. This rock formation appears to consist of massive basalt rock formations, and based on the jointing, the rock formation appears to consist of vertical slices or columns of rock. In general, the thickness (i.e. the distance into the slope) of the rock pieces is much less than the width and the height. Based on observations by the bridge maintenance crew, there appears to be an increased lateral width opening in the vertical joints (DOT email dated 5/12/2010). As part of the proposed bridge rehabilitation project, prior to

initiation of work on the bridge, this rock formation would be bolted in place to minimize potential rock fall hazards.

IMPACTS AND MITIGATION MEASURES

Implementation of the proposed action would result in disturbance of less than 1 acre. The proposed earthwork within the stream bank would be limited to restoration of the grades disturbed by the spread footing construction (see Figure 5 for conceptual grading plan). Because of the steepness of the existing grades, the slope would require stabilization with geotextile fabric and geogrid reinforcement (see Figure 5 section). As a result of the thickness of the spread footing, portions of the concrete would be left exposed and not buried. The proposed earthwork at the bridge deck would consist of minor grading of the approaches to accommodate the widened bridge deck shoulder. All vegetation within the grading limits shown on Figure 5 would be removed during construction and re-grassed following project completion.

There would be a short-term increase in soil erosion during construction since grading associated with construction of the proposed facilities would result in the exposure of bare soil to potential erosion. All grading operations would be conducted in compliance with dust and erosion control requirements of Hawaii County Code Chapter 10, *Erosion and Sedimentation Control*. The proposed action includes a site-specific Best Management Practices (BMP) plan developed as part of the project to minimize erosion and sedimentation during construction. The following measures have been included as part of the proposed action:

1. Implement general Water Pollution and Erosion Control Measures as required by Hawaii County Code Chapter 10, *Erosion and Sedimentation Control*.
2. All work shall be done in such a way as to isolate all work from the stream so that no material removed or replaced during the construction process will fall into or reach the stream.
3. The contractor shall install a rain gage prior to any field work including the installation of any site-specific best management practices. The rain gage shall have a tolerance of at least 0.05 inches of rainfall, and have an opening of at least one-inch in diameter. Install the rain gage on the project site in an area that will not deter rainfall from entering the gage opening. The rain gage installation shall be stable and plumbed. Do not begin field work until the rain gage is installed and site-specific best management practices are in-place.
4. Work within Ordinary High Water Mark (OHWM) as shown on the grading plans:
    a. The work shall be conducted during the dry season or when any affected stream has minimal or no flow, to the extent practicable. The work shall be discontinued during flooding, intense rainfall, storm surge, or high surf conditions where runoff and turbidity cannot be controlled.
    b. The contractor shall install a stream gage in line with the upstream edge of the proposed footings. The gage shall be closely monitored by designated personnel or by an automated alarm system. In the event that the stream elevation reaches 72 feet above mean sea level (MSL) or the stream depth rises more than 1 foot in 30 minutes all work shall be discontinued and

personnel, loose construction materials, and equipment shall be relocated to higher ground (minimum of 10 feet above the OHWM) until the stream levels have subsided to the acceptable level. The above BMP represents a minimum measure and the contractor shall improve upon it as necessary to ensure personnel safety and minimize potential for pollutant and debris discharge to the stream.

c. The contractor shall closely monitor the site rain gage. All work shall be discontinued and personnel/loose construction materials and equipment shall be relocated to higher ground (minimum of 10 feet above the OHWM) during intense rainfall of 0.5 inches or greater within a 24-hour period.

d. The contractor shall check with the National Weather Service to keep abreast of approaching severe weather in order to take appropriate precautionary measures to secure the project site.

e. At the end of each work day all loose construction material and equipment shall be relocated to higher ground (minimum of 10 feet above the OHWM).

f. All footing form braces shall be constructed within the footing limits and shall not be located on the stream side of the forms. The contractor shall design the forms to withstand stream flow forces resulting from a 1-year recurrence interval storm, which is estimated to have a stream flow elevation of 79.5 MSL at the upstream edge of the proposed footings and a stream flow velocity of 35 feet per second.

5. No project-related materials (fill, revetment rock, pipe etc.) shall be stockpiled within the stream banks.
6. No fueling of project-related vehicles and equipment shall take place within the stream banks.
7. The contractor shall not allow personnel or equipment to enter or cross the wetted portions of the streambed.
8. Dewatering effluent shall not be discharged to the stream or any other tributary that will discharge to a stream, pond, or the ocean. Every effort should be made to allow ground water or storm water to naturally percolate into the ground. In the event that dewatering activities are absolutely necessary, dewatering effluent shall be hauled and disposed of at a DOH approved facility.
9. During work being performed above the stream banks and/or stream (e.g. chipping, removal of concrete or iron, painting, concrete pouring, etc.) netting, filter cloth, or similar materials shall be suspended below the work area in such a fashion as to capture any falling debris and prevent contamination of the stream and/or stream banks.

The grading permit application shall specify the best management practices included as part of the project. Prior to the initiation of construction, the County would review proposed grading plan for consistency with County requirements and good engineering practice. The contractor would implement engineering measures to control soil erosion and storm runoff during construction. The project would not result in a significant impact due to soil erosion and off-site

sediment transport. For a discussion of drainage on the project site, see Section 3.2, *Hydrology and Water Quality*.

For placement of the proposed bridge footings, minor excavation of rock would be required. The excavated rock material would be removed and transported for land disposal. A Foundation Investigation report has been prepared and includes engineering characteristics of existing soils, the subsurface conditions at the site, and geotechnical recommendations for the design of new foundations, including seismic considerations, resistance to lateral pressures, and site grading (Hirata & Associates, Inc. 2011). All measures set forth in the site geotechnical report shall be adhered to during project construction. To ensure all measures are implemented, a qualified geotechnical engineer shall be retained for construction monitoring. The geotechnical engineer shall:

- Observe the construction of drilled shafts and micropiles, including all drilling and concrete placement operations, as well as load testing;
- Observe probing and grouting operations in foundation areas;
- Observe footing excavations prior to placement of reinforcing steel and concrete;
- Observe structural fill and backfill fill placement and perform compaction testing;
- Review and/or perform laboratory testing on import borrow to determine its acceptability for use in compacted fills; and,
- Provide geotechnical consultation as required.

Implementation of the recommended measures in the Foundation Investigation report would minimize impacts from soil hazards.

In addition, the proposed action includes a rock fall protection system to minimize identified potential rock fall hazards. Prior to initiation of work on the bridge, the rock formation of concern identified above would be bolted in place to minimize potential rock fall hazards. Preliminary design recommendations include bolting the formation with 10 to 15-foot deep grouted double-corrosion protected anchors spaced at 5 feet on-center. The final design of the rock fall protection system will be included prior to construction.

Source: USDA NRCS Web Soil Survey Date Accessed : 3/31/2011

Map Unit Legend

Island of Hawaii Area, Hawaii (HI801)	
Map Unit Symbol	Map Unit Name
HoC	Hilo silty clay loam, 0 to 10 percent slopes
HoD	Hilo silty clay loam, 10 to 20 percent slopes
RB	Rough broken land

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HAWAII BELT ROAD - REHABILITATION OF UMAUMA STREAM BRIDGE

SOILS MAP

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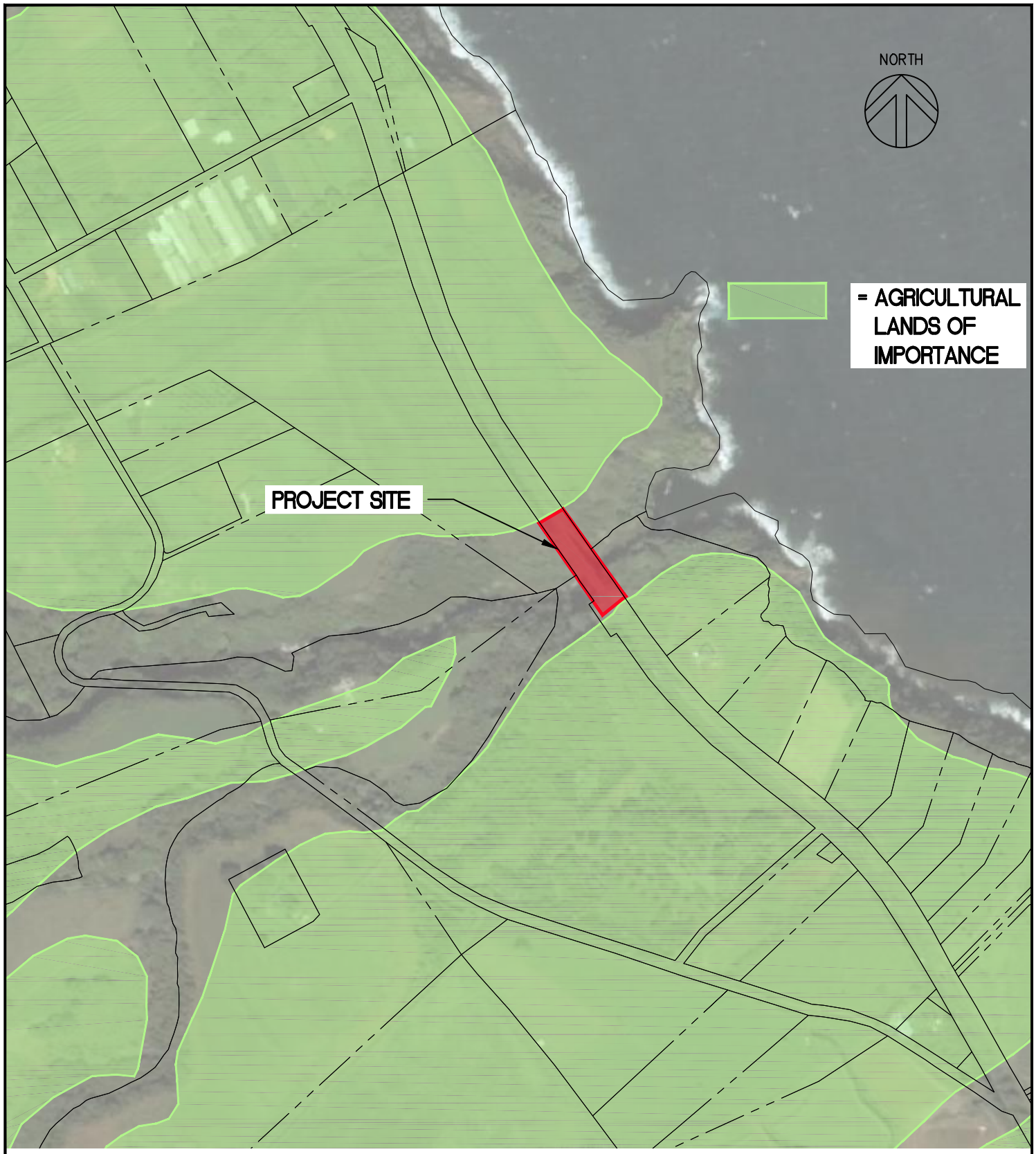

Source: http://www.state.hi.us/dbedt/gis/download.htm Date Accessed : 4/6/2011

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HAWAII BELT ROAD - REHABILITATION OF UMAUMA STREAM BRIDGE

AGRICULTURAL LANDS OF IMPORTANCE

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3.2 HYDROLOGY AND WATER QUALITY

Umauma Stream originates on the eastern slopes of Mauna Kea at an elevation above 12,000 feet, passes through the Hakalau Forest National Wildlife Refuge, and reaches its coastal outlet into the Pacific Ocean as a waterfall into a small bay northwest of Hakalau Bay. The Umauma watershed is 21.5 square miles, and is large, narrow, and steep in the upper watershed. There are several tributaries in the watershed, including Hanapueo Stream, which joins Umauma Stream just above the project site at Māmalahoa Highway (State Highway 19). (AECOS Inc. 2010; DAR 2008)

Umauma Stream is a perennial stream and is classified as Class-2 inland, flowing waters by the State of Hawai‘i, Division of Aquatic Resources (DAR). Protected uses of Class 2 waters include recreational use, support and propagation of fish and other aquatic life, and agricultural and industrial water supply. Umauma Stream is not included on the Hawai‘i Department of Health 2006 list of impaired waters prepared under the Clean Water Act §303(d) (*AECOS*, Inc. 2010).

Water quality and biological surveys were completed for a 1,200-foot segment of Umauma Stream on July 21, 2010 to identify aquatic biota and assess water quality (see Appendix C). Water samples were collected at three locations in the project vicinity and analyzed for selected parameters. The nutrient concentrations of ammonia, nitrate-nitrite, total nitrogen, and total phosphorus were all low relative to state water quality criteria. Total nitrogen and phosphorus at the sampled levels depict clean stream waters typically found only in the least developed watersheds of Hawai‘i (*AECOS*, Inc. 2010).

The existing bridge deck drain inlets currently discharge through a section of 4-inch pipe with an outlet approximately 4-feet below the bridge deck, allowing stormwater to discharge to the atmosphere and fall to the ground/stream below.

IMPACTS AND MITIGATION MEASURES

Construction activities disturbing one or more acres are regulated under the National Discharge Elimination System (NPDES) stormwater program and are required by the State to obtain a NPDES permit. Because the project would disturb approximately 0.87 acres (less than one acre), including the construction staging area, a construction NPDES permit would not be required. However, construction activities could result in adverse impacts to water quality, including erosion, sedimentation, and turbidity within Umauma Stream. The proposed action includes a site-specific Best Management Practices (BMP) plan developed as part of the project to minimize any environmental effects to water quality in the vicinity of the project site during construction. With implementation of best management practices, the construction of the project would not result in a violation of water quality standards. For a discussion of impacts due to soil erosion and off-site sediment transport, see Section 3.1, *Topography and Soils* above.

A portion of one proposed footing is within the ordinary high water mark (OHWM) of jurisdictional waters of the United States. The “footprint” of these footings would extend slightly beyond the “footprint” of the existing columns – the footprint would be larger in area and deeper into bedrock. No dredging of the stream is proposed with implementation of the proposed project. Since the Umauma Stream is a waterway subject to federal jurisdiction, construction of

the footing within the ordinary high water mark (OHWM) of the stream would require a permit from the U.S. Army Corps of Engineers (USACE). A USACE permit application was submitted for the proposed bridge rehabilitation project, and a Nationwide Permit Verification was issued for the project. Nationwide permits are general permits issued nationwide to authorize categories of minor activities. In addition to the General Conditions of the Nationwide Permit, the following special conditions would be required:

- Minimize disturbances to stream banks and place footing foundations outside of the floodplain.
- Specific erosion control measures in road construction plans shall be developed to avoid potential impacts to the environment.
- Casting of road materials shall be avoided.
- Roadway and associated stormwater collection systems shall be maintained properly.
- Any earth work shall be conducted during the dry season and construction equipment shall be staged away from stream banks on high ground when ever possible.
- Stormwater drain outlets shall be designed to avoid scouring and erosion of vegetated areas.

A Water Quality Certification (WQC), issued by the State Department of Health (DOH) pursuant to Section 401 of the Clean Water Act is required for any activity including, but not limited to, the construction or operation of facilities, which may result in any "discharge" into navigable waters. This certification is in place to regulate water quality during and after the construction phase of the project to assure discharge will meet State Water Quality Standards. It is anticipated that the project will be covered under a WQC for Nationwide Permits. Consultation with DOH to confirm WQC requirements has been initiated.

The Hawaii Commission on Water Resources requires Stream Channel Alteration permits (SCAP) for alteration of stream channels. Because there is work within the streambed, a SCAP would be required for the proposed project.

Implementation of the proposed bridge rehabilitation project would result in a slight increase in the quantity of stormwater runoff due to the increased impervious surface of the bridge deck widening. The proposed project would replace the drain inlets with deck drains placed at certain locations to prevent stormwater from falling directly into the stream. By doing so, storm runoff would be filtered through natural vegetation on the stream bank before entering into the stream and would result in a beneficial effect to stormwater quality. A scour analysis was completed for the project drainage. To prevent scouring, a concrete cut-off wall is included in the project design at the upstream / Honoka‘a corner of Pier #2 spread footing foundation. Further, due to the height and size of the drain outlets, the stormwater stream would be dispersed by the air prior to hitting the ground, and scouring and erosion of vegetated areas would be avoided. The storm drains would be constructed in accordance with FHWA drainage standards Roadway runoff in Hawai‘i County does not require additional permitting, such as an individual NDPES permit (HDOH 2011).

The proposed project includes continued maintenance of the historic bridge consisting of temporary repairs and repainting. Repainting and bridge maintenance would continue to occur approximately every two years. BMPs required for these maintenance activities would be implemented to minimize any potential discharge into the stream, and no additional adverse effects would occur.

3.3 NATURAL HAZARDS

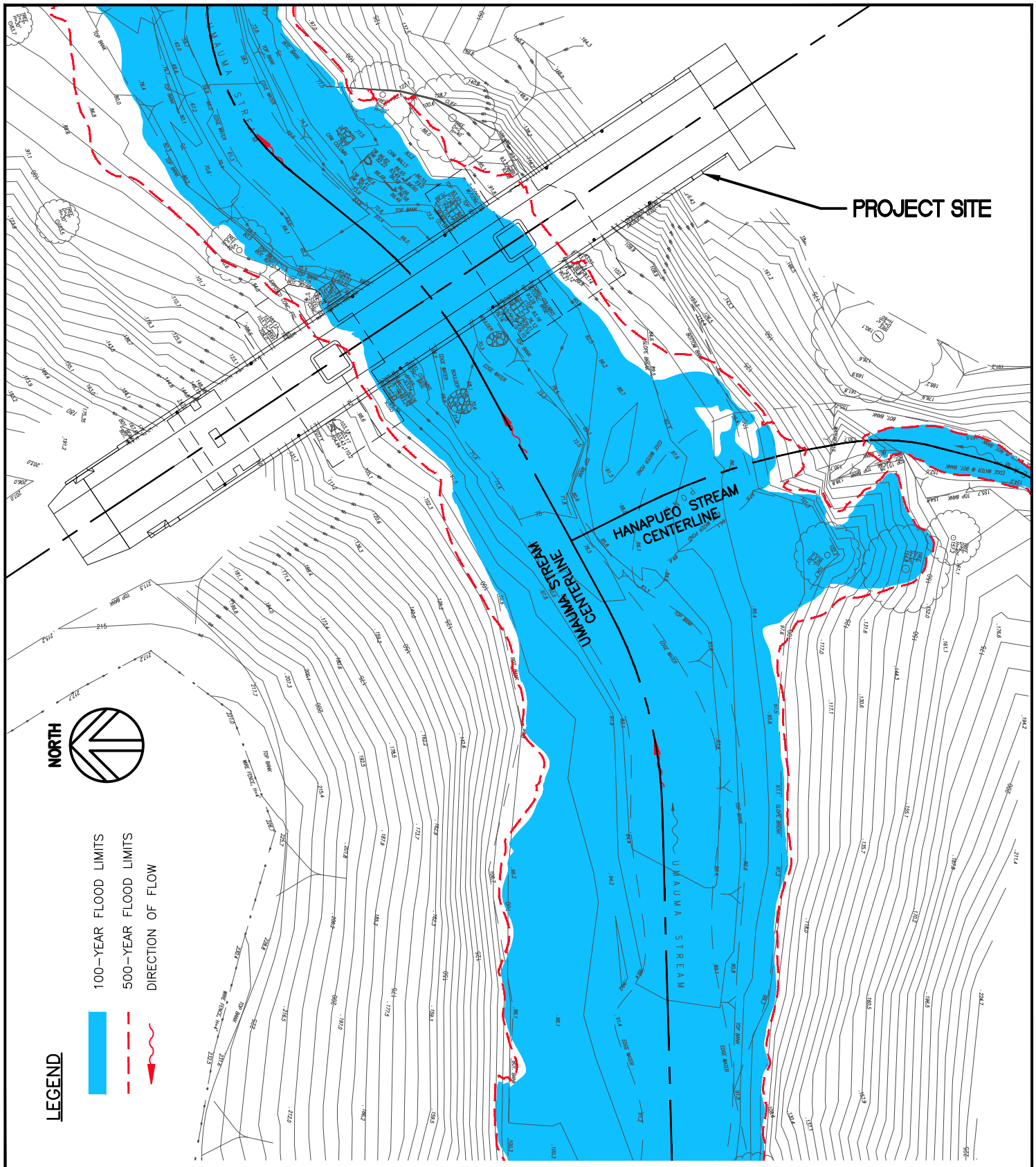
Natural hazards in Hawai‘i include floods, hurricanes, volcanoes, and earthquakes. The project site is in an area that is not mapped by the Federal Emergency Management Agency (FEMA) and is identified an area of minimal tsunami inundation. Due to the lack of available stream flow data, the stream flows will be calculated using the regression equation developed under the publication “Flood-Frequency Estimates for Streams on Kauai, Oahu, Molokai, Maui, and Hawaii, State of Hawaii” dated 2010, developed by the USGS in cooperation with DOT. The 100-year recurrence interval storm water runoff rates for Umauma Stream are shown in Figure 9. Along with the hazardous effects of strong winds, Hawai‘i is also subject to the threat of approaching tropical storms and hurricanes. The project area is not located adjacent to any active volcanoes. For a discussion of potential hazards from rock falls, see Section 3.1, *Topography and Soils*.

IMPACTS AND MITIGATION MEASURES

During construction, stream flood events, or flash flooding, could result in potential hazards to workers and construction equipment located in the flood hazards area. Site-specific BMPs included as part of the project include measures to be taken in the event of intense rainfall, weather, or increased stream flows. These measures include relocation of personnel and construction materials and equipment to higher ground (a minimum of 10 feet above the OHWM). With implementation of these BMPs, potential hazards to construction workers would be minimized, and no mitigation would be required.

Construction of the proposed bridge rehabilitation project would not result in increased flooding or hazards from flooding in surrounding areas. While the proposed bridge footings would be within a flood hazard zone, they are designed to withstand stream flood flows. During stream flood events, the average velocity of the stream is not uniform across the channel section: the higher velocity flows occur in the center of the stream, and the lower velocities will occur at the banks. Debris is typically transported through the center of the stream due to the higher velocities. Therefore, it is not anticipated that the footing forms would be subjected to heavy debris impacts during a stream flood event.

While there is no FEMA map for the project area showing tsunami inundation areas, the maximum elevation run-ups are around 17 feet MSL for tsunami inundation on FEMA maps near Hilo. Since the bridge footings are located near 70 feet MSL, it is unlikely a tsunami event would affect the bridge structure.



Source: "Storm Drainage Analysis for Hawai'i Belt Road Rehabilitation of Uma'uma Sream Bridge" by Bow Engineering Date: October 2010

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HAWAII BELT ROAD - REHABILITATION OF UMAUMA STREAM BRIDGE

FLOOD LIMITS

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The proposed concrete footing design would minimize damage during tropical storm, hurricane, or strong wind events, and earthquake events. The maximum design wind velocity applied was 105 miles per hour in accordance with HDOT Highways Division "Design Criteria for Bridges and Structures" (Oct 20, 2010 edition). Prior to the initiation of construction, the County would review proposed construction plans for consistency with County requirements and good engineering practice. No significant environmental effects would result, and no mitigation would be necessary.

3.4 BIOLOGICAL RESOURCES

Water quality and biological surveys were completed for a 1,200-foot segment of Umauma Stream on July 21, 2010 to identify aquatic biota and assess water quality (see Appendix C). This section summarizes the biological findings of the report.

Vegetation: The stream gorge margins are steep and covered in vegetation. Most of the species of flowering plants and fern observed along the stream banks are recently naturalized species and Polynesian introductions, including sourbush (*Pluchea carolinensis*), Guinea grass (*Urocloa maxima*), torpedo grass (*Panicum repens*), and Hilo grass (*Paspalum conjugatum*) (AECOS, Inc. 2010). Of the 23 species observed, only one species, *neke* (*Cyclosorus interuptus*) is indigenous[3] to the Hawaiian Islands.

Aquatic biota: Umauma Stream provides habitats for three species of ʻoʻopu, two of which (*L. concolor and S. stimpsoni*) are endemic to the Hawaiian Islands. Two species of endemic crustaceans (*A. bisulcata* and *M. grandimanus*) were observed during the field survey, and a native limpet and sponge have also been reported within the stream (DAR 2008). None of the aquatic species observed during the survey is listed as threatened or endangered by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973, as amended, or by the State of Hawaiʻi under its endangered species program (*AECOS* Inc. 2010).

Wildlife Species: Based on data compiled by the Hawaii Biodiversity and Mapping Program, and the Hawaii GAP Program, the federally endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*) and Hawaiian hawk (*Buteo solitarius*) have been observed in the vicinity of the proposed project. There is no federally designated critical habitat on the project site (USFWS consultation letter dated June 6, 2011 – see Appendix A).

IMPACTS AND MITIGATION MEASURES

The proposed project would enlarge bridge footings and would result in the removal of all existing vegetation within the grading limits shown on Figure 5; these areas would be re-grassed following construction to prevent erosion, and would later be re-colonized by localized grasses and plants. The enlarged footings would result in long-term loss of a few square feet of natural habitat. No adverse long-term effect to natural habitat would occur with project implementation.

[3] Occurs naturally in a particular region or environment, but may occur elsewhere.

Hawaiian hoary bats roost in woody vegetation and leave their young in trees and shrubs when they forage. The Hawaiian hawks also nest in woody vegetation. To minimize potential impacts to the endangered Hawaiian hoary bat and Hawaiian hawk, the following measures would be required:

- During construction, woody plants greater than 15 feet tall shall not be removed or trimmed during the bat-birthing and pup-rearing season (May 15 through August 15).
- Brush and tree clearing for construction should be avoided during the Hawaiian hawk-breeding season (March through September). If clearing should occur during the Hawaiian hawk-breeding season, a biological survey shall be conducted to determine if Hawaiian hawk nests are in the vicinity. A qualified biologist shall conduct these surveys or ornithologist in accordance with USFWS survey methodology.

During construction, site-specific BMPs developed as part of the project would minimize erosion and sedimentation and potential adverse effects to aquatic biota down stream of the project site. No adverse long-term effects to aquatic biota would occur with project implementation, and no mitigation would be necessary.

3.5 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

HISTORICAL PERSPECTIVE

Hāmākua Area History

Early Cultural History

The cultural history of the Hāmākua area includes legend of three gods native to Hawai‘i Island: Pele, Poli‘ahu, and Kamapua‘a. Kamapua‘a lived in Kohala, Pele in the crater of Kilauea, and Poli‘ahu on the summit of Mauna Kea. The battles of Poli‘ahu and Pele resulted in eruptions and earthquakes, which gave shape to the Hāmākua landscape (County of Hawai‘i 2010).

The largest early Hawaiian settlements in the Hāmākua area were located in Waimanu and Waipi‘o Valleys. Most settlements included small villages where wet land taro was grown. There were six *moku* (districts) and many separate land divisions, or *ahupua‘a* (land division usually extending from the uplands to the sea), within the island. Connecting all *moku* was a system of trails. There are several sacred sites in the Hāmākua area, and heiau (temple) were known to exist in Waipunalei, the vicinity of Laupāhoehoe, Kukuihaele area, and at Lalakea, among others. An archaeological study of Waipi‘o Valley and Hāmākua conducted in 1977 found that there is a scarcity of visible prehistoric habitation sites along the Hāmākua coast due to agricultural practices, although some subsurface deposits may still exist (County of Hawai‘i 2010).

Historic Activities and Land Uses

From the onset of western interest, there were several trade markets on the island of Hawai‘i, including sandalwood trade until the 1820’s, whalers after 1810, and cattle ranching. In Hāmākua, dairies and other agricultural activities were important. Sugar was the most prominent agricultural crop, and plantation areas cropped up in Hāmākua. The sugar industry resulted in new infrastructure, including extensive flume systems, railways, and bridge trestles spanning

large gulches. Sugar was the dominant agricultural crop in the area until 1994, when the last sugar plantation in Hāmākua closed (County of Hawai‘i 2010).

Project Site History

The existing Umauma Bridge was originally built in 1911 to support railroad tracks and consisted of two main steel trestles (or towers) supporting six spans of riveted steel plate girders. In the early 1950's, the bridge and the trestles were widened to support a two-lane highway for vehicular traffic. The widened bridge consisted of a concrete bridge deck, sidewalks, and an open beam and post type railings. In the early 2000's, the bridge was retrofitted to resist updated earthquake design loads.

AREA HISTORIC, CULTURAL, AND ARCHAEOLOGICAL RESOURCES

Umauma Bridge was included in two different historic bridge inventories – one done in 1987, which was accepted by the SHPD ("The Historic Bridge Inventory and Evaluation of the Island of Hawaii" prepared for the State of Hawaii, Department of Transportation, Highway Division (SDOT), July 1987) and the other current one is a draft statewide bridge inventory ("State of Hawaii Historic Bridge Inventory and Evaluation" prepared for the State of Hawaii, Department of Transportation, Highway Division (SDOT), prepared by the Heritage Center, School of Architecture, University of Hawaii at Manoa in 2008). Both inventories show the Umauma Bridge has been identified as eligible for listing on the Hawaii and National Register of Historic Places.

Umauma Bridge is part of a National Register eligible multiple property nomination of "Steel Trestle Bridges on the Hāmākua Coast" written by Spencer Lieneweber in cooperation with the Hawai‘i DOT. The SHPD and DOT are currently working toward an agreement on the bridge inventory and finalizing documentation for the National Register. The bridge is significant under National Register criteria for its association with the Hilo Railroad Company, which played a major role in the development of the Hāmākua Coast for sugar plantations and as one of the few remaining steel girder and trestle bridges that represent the work of John Mason Young.

A field inspection of the project area was conducted by Robert B. Rechtman, Ph.D. of Rechtman Consulting, LLC on March 11, 2010. Based on this inspection, it was determined that the footing areas for the new concrete columns have already been significantly impacted as a result of the original bridge construction, and that no archaeological or cultural resources are present.

Cultural practices such as fishing and gathering may occur on some areas of Umauma stream; however, Umauma stream gulch is largely inaccessible from the bridge, as the sides of the gully are steep, with some areas as steep as near vertical near the bottom of the slope. Most of the slope areas are covered by vegetation. There is no public access to the stream at the project location.

IMPACTS AND MITIGATION MEASURES

As described above, the footing areas for the new concrete columns are located on basaltic bedrock and have already been significantly impacted as a result of the original bridge

construction. No archaeological or cultural resources are present. Therefore, the placement of the new concrete columns would have no effect on archaeological resources. While cultural practices such as fishing and gathering may occur on some areas of Umauma stream, implementation of the proposed project would not result in any long-term adverse affects to these activities. For a discussion of potential short-term impacts to water quality, see Section 3.2, *Hydrology and Water Quality*.

Section 106 of the National Historic Preservation Act (NHPA) requires that the head of any Federal department having authority to license any undertaking shall, prior to the issuance of any authorization, take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. Under Section 106 of the NHPA, the FHWA is required to consult with the State Historic Preservation Officer (an official appointed in each State or territory to administer the National Historic Program) in order to determine a project's potential to impact resources of historic or cultural significance.

Formal consultation with the State Historic Preservation Division (SHPD) has been conducted in accordance with Section 106 of the National Historic Preservation Act and HRS Section 6E-8. FHWA has determined the project to have "no adverse effect with conditions", and the SHPD has concurred with those findings (see letter in Appendix A). The conditions include:

1. The trestles and steel girders are retained.
2. Color the center concrete column a color such that the trestles will be more visually dominant.
3. Paint the trestles with a coating more long term to alleviate the corrosion problems necessitating the rehabilitation project.
4. Additional girders will resemble, but to the trained eye not duplicate, the originals.
5. The look and feel of the bridge is maintained as presented to SHPD.
6. DOT will provide the requested additional photographic documentation.
7. Submit the Steel Trestle Bridges of the Hāmākua Coast multiple property nomination to the Hawaii Historic Places Review Board for consideration within one year of this letter.
8. Retain the Hamilton & Chambers plaque that is affixed to the bridge's present superstructure.
9. Continue to consult with the Hawaii SHPO throughout the schematic, design development and final design stages to ensure the work conforms to the Secretary of Interior's Standards for Rehabilitation.

While there is low probability of encountering archaeological sites in this area, in the event that historic resources, including human skeletal remains, are identified during the construction activities, all work would cease in the immediate vicinity of the find, the find would be protected from additional disturbance, and the State Historic Preservation Division, Oahu Section, would be contacted immediately. With implementation of these conditions, no adverse effect to cultural, historic, or archaeological resources would occur.

3.6 AIR QUALITY AND CLIMATE

The project site is located along the Hāmākua coast on the northeastern shore of Hawai‘i Island. This area lies nearly perpendicular to the prevailing flow of the trade winds, and is moderately rainy, with frequent trade wind showers. Rainfall in the project area ranges from 160 inches annually at the coastal elevations to over 240 inches in the areas upslope of the project site (County of Hawai‘i 2010). Temperatures are generally uniform and mild, with daytime temperatures commonly in the 70’s to 80’s and nighttime temperatures are in the 60’s to 70’s.

The Department of Health, Clean Air Branch, monitors the ambient air in the State of Hawai‘i for various gaseous and particulate air pollutants. The U. S. Environmental Protection Agency (EPA) has set national ambient air quality standards (NAAQS) for six criteria pollutants: carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, ozone, and particulate matter (PM_{10} and $PM_{2.5}$). Hawai‘i has also established a state ambient air standard for hydrogen sulfide. The primary purpose of the statewide monitoring network is to measure ambient air concentrations of these pollutants and ensure that these air quality standards are met.

The closest monitoring station to the project area is located in Hilo, mainly to monitor air quality impacts from fugitive dust and hydrogen sulfide. According to the State of Hawai‘i Department of Health Annual Summary 2009 Air Quality Data, criteria and pollutant levels in the State of Hawai‘i remained well below all federal and state ambient air quality standards (Hawaii DOH, 2009).

IMPACTS AND MITIGATION MEASURES

Construction of the proposed bridge rehabilitation project could result in temporary air quality effects, including exhaust emissions from construction vehicles and dust generated by short-term construction related activities. Components of construction emissions include employee trips, exhaust emissions from construction equipment, and fugitive dust emissions. Grading and earthwork within the project area could generate airborne dust particulates.

Dust control measures such as watering and sprinkling shall be implemented as needed to minimize wind-blown dust. To minimize construction-related exhaust emissions, project contractors shall ensure that all internal combustion engines are maintained in proper working order. In addition, the work shall be in conformance with the air pollution control standards contained in HAR, Title 11, Chapters 59, “Ambient Air Quality Standards,” and Chapter 60, “Air Pollution Control.” With re-grassing of exposed areas following construction, wind-blown dust in the project area would be minimized.

Once constructed, the proposed bridge rehabilitation project and associated concrete footings would not result in any air emissions, and there would be no long-term adverse air quality impacts associated with the proposed action. Other than passing vehicles on the highway and over the bridge, there are no air contaminant sources in the project area.

3.7 NOISE

The project site is located in a rural area of northeast Hawai‘i Island. Surrounding noise levels in the vicinity of the project site are considered relatively low. Existing noise sources are from occasional vehicular traffic crossing the bridge, in addition to the sound of flowing stream water. There are four rural residential properties within a quarter mile of the nearest construction area.

IMPACTS AND MITIGATION MEASURES

Noise impacts from a project can be categorized as those resulting from construction and those from operational activities. Construction noise would have a short-term effect; operational noise would continue throughout the lifetime of the project. Implementation of the proposed bridge rehabilitation project could temporarily increase noise levels during demolition of the existing bridge deck and construction of the new bridge deck and footings above maximum allowable limits. Typical heavy construction equipment would include but may not be limited to crane, excavator, hydraulic hammer, pneumatic compactor, cold planer, paving skid, concrete truck, and haul truck. It is anticipated that there would be some type of hammering or drilling for approximately 18 months of the 24-month total construction duration.

Construction-period noise would be minimized by project compliance with HAR Chapter 11-46, “Community Noise Control” of the State Department of Health. According to these rules, a noise permit would be required if construction noise is expected to exceed allowable limits. As established in HAR §11-46-4 and 11-46-6, the maximum permissible sound level during construction in the project area is 70 dBA[4]. Construction noise typically varies between 70 and 96 dBA, which exceed permissible levels established in HAR §11-46-4.

During certain construction phases, highway travel lanes would need to be closed, resulting in one-way traffic. In order to minimize adverse traffic impacts, work requiring lane closure is proposed to be at night. Construction noise exceeding permissible sound levels outside the time period of 7 am-6 pm Monday through Friday, or 9 am-6 pm on Saturday, or any time on Sundays and holidays would require a noise variance (HRS §342F). Therefore, in addition to the noise permit, a noise variance would be requested to extend work hours into the evenings and on weekends.

A single-family residence is located approximately 400 feet from the construction work area, and could be adversely affected from nighttime construction activity. To minimize adverse noise effects, the nearby residents would be contacted via phone call or visit and informed of the schedule and proposed construction activities.

There would be no long-term increase in noise during project operations since the project includes rehabilitation of an existing bridge, which is considered a passive structure. Further, the project would not generate additional traffic and associated noise.

[4] An A-weighted decibel is a decibel corrected for the variation in frequency response of the typical human ear at commonly encountered noise levels. For this reason, environmental noise usually is measured in dBA. Generally, a three-dBA increase in ambient noise levels represents the threshold at which most people can detect a change in the noise environment.

3.8 AESTHETIC AND VISUAL RESOURCES

The project site consists of a roadway bridge spanning Umauma Stream gulch. Surrounding land uses are rural agricultural. From the highway while driving, there are limited scenic views for motorists both *mauka* and *makai* of the stream and ocean. Motorists often stop in the area to view the falls from the bridge.

The Hāmākua Heritage Corridor follows Māmalahoa Highway (State Route 19) from Hilo to the Waipi‘o lookout. Umauma Falls at the World Botanical Gardens is identified as a scenic site along the corridor. While the Heritage Corridor does not have legal status at this time (July 2011), Hawai‘i County Code §25-6-60 established a means to designate scenic corridors. The scenic byways program is intended to provide for the enhancement of important scenic, historic, recreational, cultural, and/or natural resources accessed from identified scenic corridors.

IMPACTS AND MITIGATION MEASURES

During construction, workers, materials, and equipment would be visible from the bridge and highway. Most of the proposed repair work would be out of site for visitors viewing the falls from the bridge since the work would be underneath the bridge. As an already existing roadway and bridge, the bridge rehabilitation project would not significantly change the scenic and visual character of the surrounding area.

3.9 SOCIAL CHARACTERISTICS

Population

The year 2010 population in Hawai‘i County consisted of 185,079 persons, with a 24.5 percent increase from 2000 to 2010 (Census 2010). Population forecasts as set forth by the State Department of Business Economic Development and Tourism (DBEDT) indicate a projected population of approximately 279,700 residents by the year 2035, with an average annual growth rate of 1.3 percent (DBEDT 2009).

Economy

Agriculture is an important industry in the project area. In addition to agriculture, people in the greater project area are employed in a variety of industries not located in the project area. The annual average wage in private employment for Hawai‘i County in 2008 was $33,267, compared to $38,466 in the State. Due to the rural nature of the project area, residents generally must travel to Hilo or Waimea to obtain social and health services.

Recreation

The roadway and bridge are located in a dedicated public right-of-way. Umauma stream gulch is largely inaccessible from the bridge, as the sides of the gully are steep, with some areas as steep as near vertical near the bottom of the slope. There is no public access to the stream at the project location.

IMPACTS AND MITIGATION

Implementation of the proposed action would not displace any residents or businesses since construction would occur within the existing State right-of-way. While construction employment would be created during the project construction phase, needed employees could be expected to be provided by the local labor pool, without the importation of significant amounts of new labor. The Hawai‘i Belt Road is important for the movement of people and goods in a safe an efficient manner, and the proposed bridge rehabilitation project would have a beneficial effect to this end.

3.10 UTILITIES AND PUBLIC SERVICES

UTILITIES

There are no utilities that span the bridge. There are utility/electrical lines on suspended over the gulch on both *mauka* and *makai* sides of the bridge. The *mauka* utility line may need to be temporarily relocated to allow for use of a crane during construction.

POLICE, FIRE, AND EMERGENCY MEDICAL SERVICES

The County Fire Department provides fire fighting, emergency medical service, search and rescue, hazard materials response, and life guarding services. There are fire stations located at Honoka‘a and Laupāhoehoe, together with the fire stations in Hilo. Police patrol the area

Hale Ho‘ola Hāmākua (HHH) serves the healthcare needs of the communities of Hāmākua, North Hawai‘i, and South Kohala. Other medical facilities that serve the general project area population include North Hawai‘i Community Hospital (Waimea), Waiakea Health Center (Hilo), and Hilo Medical Center.

IMPACTS AND MITIGATION

During construction, there may be increased calls or complaints to the police from motorists due to traffic disruption, noise, and temporary lane closures. The proposed improvements would not result in an increase in service demands from police and fire protection or other public services. No significant adverse impacts to existing utilities and public services are expected, and no mitigation would be necessary.

3.11 TRAFFIC AND TRANSPORTATION

The Umauma Stream Bridge carries the Hawai‘i Belt Road, also known as Māmalahoa Highway (Highway No. 19), over Umauma Stream. Hawai‘i Belt Road is a two-lane regional arterial roadway that provides primary access to the area. As reported by DOT in April 2011, the Average Daily Traffic (two-way) is estimated at 8,100 in 2011 and estimated to increase to 11,300 in 2031. A traffic accident analysis for Umauma Bridge from the State of Hawai‘i, Department of Transportation, Traffic Branch did not identify any potential areas of concern within the limits of the project (September 13, 2011).

IMPACTS AND MITIGATION

Construction of the proposed bridge rehabilitation project would result in short-term impacts on traffic. During certain construction phases, one highway travel lane would need to be closed, resulting in one-way traffic and temporary delays. Temporary lane closure is proposed to occur during nighttime hours to minimize impacts to traffic. Providing notification of any temporary closures would minimize impacts to the public. Emergency services (police, fire, and ambulance services) and area residents would be given adequate notice of potential delays prior to construction. A temporary construction staging area is proposed be located on an adjacent property to the bridge to minimize illegal parking and ensure safety.

There would be no direct increase in operational traffic due to implementation of the proposed bridge rehabilitation project. While there were no areas of concern identified in the traffic accident analysis for Umauma Bridge, the proposed improvements would bring the bridge roadway in compliance with FHWA regulations and current safety standards. The removal of the existing sidewalks and bridge railings, the widening of the bridge deck and constructing new bridge railings (which conform to current acceptable standards) along both sides of the bridge would improve the safety for high-speed vehicular traffic by eliminating a potential vaulting hazard that a sidewalk could present. No additional vehicular lanes are proposed that could increase roadway capacity.

The bridge is regularly used as a viewing point by pedestrians for the waterfalls on Umauma Stream, creating a potential hazard to both motorists crossing the bridge and pedestrians stopping to view the falls. The proposed project includes wider shoulders and taller bridge railings along both sides of the bridge, which would improve the safety for bicyclists and pedestrians.

3.12 LAND USE CONTROLS

Sate and County policy, and land use and community plans and controls are established to address the long-term physical, social, economic, and environmental needs in Hawai‘i. State and County land use controls for the Rehabilitation of Umauma Stream Bridge project are described below.

STATE OF HAWAI‘I

The Hawai‘i State Plan, as codified in HRS Chapter 226, established a set of goals, objectives, and policies that serve as long-range guidelines for the growth and development of the State. The following discussion evaluates the general consistency of the proposed bridge rehabilitation project with the Hawai‘i State Plan goals and policies.

Table 1	Consistency of the Proposed Rehabilitation of Umauma Stream Bridge Project with Adopted Hawai‘i State Plan Objectives and Policies
§226-12 Objective and policies for the physical environment--scenic, natural beauty, and historic resources.	
Objective:	(a) Planning for the State’s physical environment shall be directed towards achievement of the objective of enhancement of Hawaii's scenic assets, natural beauty, and multi- cultural/historical resources.
Policy:	(1) Promote the preservation and restoration of significant natural and historic resources.
Policy:	(3) Promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscapes, and other natural features.
	The proposed bridge rehabilitation project is designed to minimize potential impacts to historic impacts. There would be no adverse impacts to the aesthetic environment with implementation of the proposed project.
§226-13 Objectives and policies for the physical environment--land, air, and water quality.	
Objective:	(1) Maintenance and pursuit of improved quality in Hawaii's land, air, and water resources.
Policy:	(3) Promote effective measures to achieve desired quality in Hawaii's surface, ground, and coastal waters.
Policy:	(5) Reduce the threat to life and property from erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters.
	The proposed project includes site-specific BMPs to minimize potential sedimentation and erosion in the project area. The proposed improvements would bring the bridge roadway in compliance with FHWA regulations and current safety standards. The removal of the existing sidewalks and bridge railings, the widening of the bridge deck and constructing new bridge railings (which conform to current acceptable standards) along both sides of the bridge would improve the safety for high-speed vehicular traffic by eliminating a vaulting hazard that a sidewalk would present.
§226-17 Objectives and policies for facility systems--transportation.	
Policy:	(10) Encourage the design and development of transportation systems sensitive to the needs of affected communities and the quality of Hawaii's natural environment;
	The proposed project is designed with sensitivity to the natural environment. The project would provide short-term construction employment and would ensure the continued movement of people and goods in a safe and efficient manner.

Hawai‘i State Environmental Policy

The identified purpose of the State Environmental Policy (HRS Chapter 344) is to “encourage productive and enjoyable harmony between people and their environment, promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity, and enrich the understanding of the ecological systems and natural resources important to the people of Hawaii” (HRS §344-1). The following policies and guidelines from the State Environmental Policy apply to the proposed bridge rehabilitation project:

Table 2	**Consistency of the Proposed Rehabilitation of Umauma Stream Bridge Project with State Environmental Policy Policies**
§344-3 Environmental policy. It shall be the policy of the State, through its programs, authorities, and resources to:	
(1)	Conserve the natural resources, so that land, water, mineral, visual, air and other natural resources are protected by controlling pollution, by preserving or augmenting natural resources, and by safeguarding the State's unique natural environmental characteristics in a manner which will foster and promote the general welfare, create and maintain conditions under which humanity and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of the people of Hawaii.
	The proposed project includes site-specific BMPs to minimize potential sedimentation and erosion in the project area. The proposed improvements would bring the bridge roadway in compliance with and current safety standards and is designed to minimize potential impacts to historic resources. There would be no long-term adverse impacts to natural resources and the environment with implementation of the proposed project.
§344-4 Guidelines. In pursuance of the state policy to conserve the natural resources and enhance the quality of life, all agencies, in the development of programs, shall, insofar as practicable, consider the following guidelines:	
(2)	Land, water, mineral, visual, air, and other natural resources.
(A)	Encourage management practices which conserve and fully utilize all natural resources.
	The proposed project includes site-specific BMPs to minimize potential sedimentation and erosion in the project area and is designed with sensitivity to the natural environment.
(4)	Parks, recreation, and open space.
(A)	Establish, preserve and maintain scenic, historic, cultural, park and recreation areas, including the shorelines, for public recreational, educational, and scientific uses;
	The proposed project is designed to minimize potential impacts to historic resources (see section 3.5 of this document).

State of Hawai'i, Land Use Commission – State Land Use Districts

The HRS Chapter 205 establishes four major land use district in which all lands in the State are placed. These districts include: urban, rural, agricultural, and conservation. The land *makai* of the bridge appears to be located within the "Conservation" District Resource Subzone classification. According to consultation with the Office of Conservation (OCCL), it is unclear if the bridge actually lies within the Conservation District or Agricultural District, as the roadway marks the boundary between these designations. The bridge appears to be a nonconforming structure, constructed after 1912 and improved upon in 1955, prior to Conservation District rules (1964). HRS §183C-5 allows for the continued use of nonconforming structures. Further, since the majority of the work would take place within the right-of-way, which is outside of OCCL jurisdiction, a Conservation District Use Permit would not be required.

Coastal Zone Management Program

In October 1972, the Congress passed the Coastal Zone Management Act for the purpose of establishing a national program for the management, beneficial use, protection, and development of land and water resources of the coastal areas of the United States. The Hawaii Coastal Zone Management (CZM) Program (HRS Chapter 205A) was promulgated in 1977 in response to the Federal Coastal Zone Management Act of 1972. The objectives and policies of the CZM are to

provide recreational resources; protect historic, scenic, and coastal ecosystem resources; provide economic uses; reduce coastal hazards; and manage development in the coastal zone. An application for a Federal Consistency Review for the CZM Program was submitted for the proposed project, and concurrence of CZM consistency was issued on August 26, 2011. A brief discussion of the project's conformance with the CZM objectives is included below.

Table 3	**Consistency of the Proposed Rehabilitation of Umauma Stream Bridge Project with Hawaii Coastal Zone Management (CZM) Program Objectives**
RECREATIONAL RESOURCES	
Objective:	Provide coastal recreational opportunities accessible to the public. The roadway and bridge are located in a dedicated public right-of-way. Umauma stream gulch is largely inaccessible from the bridge, as the sides of the gully are steep, with some areas as steep as near vertical near the bottom of the slope. There is no public access to the stream at the project location.
HISTORIC RESOURCES	
Objective:	Protect, preserve, and where desirable, restore those natural and man-made historic and pre-historic resources in the coastal zone management area that are significant in Hawaiian and American history and culture. The bridge has been determined eligible for listing in both the Hawaii state and National Register of Historic Places. The proposed rehabilitation project would conform to the Secretary of Interior's Standards for Rehabilitation, and the State Historic Preservation Division has concurred with the determination of "no adverse effect with conditions".
SCENIC AND OPEN SPACE RESOURCES	
Objective:	Protect, preserve and where desirable, restore or improve the quality of coastal scenic and open space resources. The bridge project is not directly adjacent or abutting a scenic landmark, how Umauma Falls can be seen from the bridge and highway near the bridge and visitors stop in this area to view the falls. As an already existing roadway and bridge, the bridge rehabilitation project would not significantly change the scenic and visual character of the surrounding area.
COASTAL ECOSYSTEMS	
Objective:	Protect valuable coastal ecosystems from disruption and minimize adverse impacts on all coastal ecosystems. A portion of one proposed footing is within the jurisdictional waters (OHWM) of the U.S. and a USACE permit application has been submitted. Clearing and grubbing would occur adjacent to the highway for construction staging and near the stream beneath the bridge above the OHWM for construction staging. Site-specific BMPs have been prepared to minimize adverse effects to project waterways.
ECONOMIC USES	
Objective:	Provide public or private facilities and improvements important to the State's economy in suitable locations. Rehabilitation of the Umauma Stream Bridge is vital to maintaining the viability of the Hawai'i Belt Road, which connects Hilo to Hāmākua, Waimea, and Kailua-Kona. The Hawai'i Belt Road is important for the movement of people and goods in a safe an efficient manner, and the proposed bridge rehabilitation project would have a beneficial effect to this end.

Table 3	**Consistency of the Proposed Rehabilitation of Umauma Stream Bridge Project with Hawaii Coastal Zone Management (CZM) Program Objectives**
COASTAL HAZARDS	
Objective:	Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, and subsidence. Construction of the proposed bridge rehabilitation project would not result in increased flooding or hazards from flooding in surrounding areas. While the proposed bridge footings would be within a flood hazard zone, they are designed to withstand stream flood flows.
MANAGING DEVELOPMENT	
Objective:	Improve the development review process, communication, and public participation in the management of coastal resources and hazards. Details of the proposed project were provided to elected leaders and federal, state, and county agencies for early consultation. The opportunity for public review will occur with issuance of the DEA and the USACE permit public notice. Site-specific BMPs would be required of the contractor to prevent adverse effects to state coastal waters.
PUBLIC PARTICIPATION	
Objective:	Stimulate public awareness, education, and participation in coastal management. See above.
BEACH PROTECTION	
Objective:	Protect beaches for public use and recreation. The proposed bridge footing is approximately 275 feet inland of the shoreline and approximately 75 feet above mean sea level. The footing would be embedded in solid rock. Because of the nature of the work and the distance from the shoreline, there is no risk of coastal erosion.
MARINE RESOURCES	
Objective:	Implement the State's ocean resources management plan. A conservation ethic and stewardship would be applied in the proposed project through the application of the site-specific BMPs. No marine or coastal resources are affected because of the BMPs and the distance of the project from the shoreline.

Special Management Area Designation

The CZM outlines controls and policies within an area along the shoreline called the Special Management Area (SMA). The objectives of the SMA were "the maintenance, restoration, and enhancement of the overall quality of the coastal zone environment, including, but not limited to, its amenities and aesthetic values, and to provide adequate public access to publicly owned or used beaches, recreation areas and national reserves." The purpose of the SMA Permit is to regulate any use, activity or operation that qualifies as a "development" and is administered at the County level. The project area is located within the SMA boundary. However, because "[r]epair or maintenance of roads and highways within existing rights-of-way" are not considered "development" according to HRS Chapter 205A-22 and Planning Commission Rule 9-4(e)(2)(B), the proposed bridge rehabilitation project would be considered exempt, and further review of the project according to SMA rules and regulations would not be required.

COUNTY LAND USE PLANS AND POLICIES

County of Hawaii General Plan

The *County of Hawaii General Plan* (2005) is a long range, generalized planning policy document to guide development of the County. It serves as a basis for an implementation program to effectuate desired changes and improvements in the social, economic, and environmental atmosphere of the County. Topics addressed in the General Plan include goals and policies regarding population, land use, the environment, cultural resources, economic activity, housing and urban design, transportation, social infrastructure, and government. The General Plan identifies viewpoints of Umauma gulch both mauka and makai from the bridge as examples of natural beauty in the North Hilo District. A goal of the General Plan is to "[p]rotect scenic vistas and view planes from becoming obstructed." The proposed project is rehabilitation of an existing bridge and highway, and would not conflict with this goal.

County of Hawai'i Zoning Designation

The proposed bridge rehabilitation project is located within the State right-of-way. Since the proposed alignment falls within existing right-of-way, there are no specific zoning standards or requirements that would require discretionary review. Property adjacent to the project are zoned Agricultural District.

Hāmākua Community Development Plan (CDP)

The project site is located in the planning area of the Hāmākua Community Development Plan (CDP). The Hāmākua CDP is currently (July 2011) in the planning process and has not yet been adopted. In the Hāmākua CDP Draft Community Profile (December 2010), the viewpoint of falls in Umauma gulch both *mauka* and *makai* is identified as a natural beauty site and a scenic resource of the area. The proposed bridge rehabilitation project is also identified as one of the proposed and funded capital road improvements in the Planning Area under the State Transportation Improvements Plan (STIP) (FY2011-2014) and State Capital Improvements Program (CIP).

4 ALTERNATIVES TO THE PROPOSED ACTION

This chapter considers alternatives to the proposed action, including the No Action Alternative. The alternatives were rejected for their inability to meet the project objectives or because attainment of the objectives were achieved at a higher cost, either financially or environmentally.

4.1 PROPOSED ALTERNATIVES

NO ACTION ALTERNATIVE

Under the No Action Alternative, the Umauma Stream Bridge would continue under current operations and maintenance schedule. Current maintenance consists of temporary repairs and temporary repainting intended to slow down, but not stop, existing corrosion of steel. Maintenance painting and repairs occur approximately every 2 years. Even with temporary repairs and repainting, the condition of the existing bridge would continue to deteriorate, and eventually the bridge would become unsafe. Further, this alternative would not meet any of the project objectives, including:

- To rehabilitate the deteriorating, steel framed Umauma Bridge while satisfying SHPD historical requirements.
- To bring the bridge roadway in compliance with FHWA regulations and current safety standards.

ALTERNATIVE 1: REPAIR AND REPAINT THE EXISTING STEEL TOWERS EVERY 8 YEARS FOR NEXT 75 YEARS

Alternative 1 is a more long-term repair and repainting plan than the No Action Alternative, and is estimated to last up to about 8 years. While it would extend the life of the bridge over the No Action Alternative, the cost and effort of doing a long-term repair/repainting cycle is substantially greater than cost/effort to do a temporary repair/repainting cycle. In addition, the following objectives would not be met:

- To rehabilitate the deteriorating, steel framed Umauma Bridge while satisfying SHPD historical requirements.
- To bring the bridge roadway in compliance with FHWA regulations and current safety standards.

ALTERNATIVE 2: BUILD NEW CONCRETE TOWERS WITHIN EXISTING STEEL TOWERS AND KEEP EXISTING BRIDGE SUPERSTRUCTURE (NO WIDENING).

This alternative would include building new concrete towers within the existing steel towers similar to the proposed action. Therefore, the project would meet the identified objective of rehabilitating the bridge while satisfying SHPD historical requirements. However, it would not

include improvements to the bridge roadway, including widening of the roadway. The following objective would not be met:

- To bring the bridge roadway in compliance with FHWA regulations and current safety standards.

ALTERNATIVE CONSIDERED BUT ULTIMATELY REJECTED: REPLACE EXISTING BRIDGE

One alternative considered but ultimately rejected included replacing the existing bridge in its entirety. This alternative was rejected due to significant and unavoidable adverse effects to historic resource, since it would result in the demolition of a significant historic resource.

4.2 LIFE CYCLE COST ANALYSIS OF ALTERNATIVES

To assist in the selection of the most cost-effective alternative, a life cycle cost analysis was performed for several of the alternatives (see table below). The cost analysis assumes a 75-year life cycle and 2007 dollars.

Alternative 1: Repair and repaint	$112,000,000
Alternative 2: Build new concrete towers – no widening	$51,000,000

The initial construction cost for Alternative 2 was estimated at $33 million, which is less than the proposed project cost of $35 million. However, as stated above, Alternative 2 would not meet the project-identified objective to bring the bridge roadway in compliance with FHWA regulations and current safety standards.

A cost analysis of a new parallel bridge next to the existing bridge was not considered due to its effect on realigning the existing roadway through the existing hillside at each end of the bridge. By inspection, the cost for this option would exceed the cost of all the other options already presented.

5 FINDINGS AND DETERMINATION

As set forth in HAR, Title 11, Department of Health, Chapter 200, §11-200-12, in considering the significance of potential environmental effects, an agency must "consider every phase of a proposed action, the expected consequences, both primary and secondary, and the cumulative as well as the short-term and long-term effects of the action." The proposed action is not expected to have a significant effect on the environment. The recommended preliminary determination for the Rehabilitation of Umauma Stream Bridge Project is a Finding of No Significant Impact (FONSI). The findings supporting this determination are discussed below.

(1) Involves an irrevocable commitment to loss or destruction of any natural or cultural resource.

The proposed project would rehabilitate an existing bridge to preserve the historic integrity and improve roadway safety. The proposed project has been designed to avoid potential impacts to natural or cultural resources. Environmental impacts would be minimized by constructing the proposed improvements within the existing right-of-way and with implementation of mitigation measures and BMPs contained in this document.

(2) Curtails the range of beneficial uses of the environment.

The proposed improvements would not curtail the range of beneficial uses at the project site; implementation of the proposed rehabilitation project would be consistent with its current use as a bridge and roadway.

(3) Conflicts with the state's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders.

The proposed project is consistent with the environmental goals, policies, and guidelines established in HRS Chapter 344 as discussed in Section 3.12 of this document. The project objective is to rehabilitate Umauma Bridge while maintaining its historical aspects and bring the bridge roadway in compliance with current safety standards.

(4) Substantially affects the economic or social welfare of the community or state.

The proposed action would have a positive effect on the economic and social welfare of the community and the state. Proposed improvements would support the safe movement of people and goods for the local community, as well as inter-island residents and visitors.

(5) Substantially affects public health.

Construction activities may temporarily increase fugitive dust and noise levels in the project vicinity. However, these impacts would cease upon completion of construction. No long-term negative impact on public health is anticipated with implementation of the proposed action. All bridge and roadway improvements would be constructed in accordance with all health and safety regulations.

(6) Involves substantial secondary impacts, such as population changes or effects on public facilities.

The proposed action is intended to serve the existing population and travelling public. The proposed action is not expected to generate population change since it would not increase the capacity of the roadway, and the bridge rehabilitation project would not create secondary demands and impacts on public facilities and services.

(7) Involves a substantial degradation of environmental quality.

There would be no long-term impacts associated with the proposed action. Construction activities may temporarily increase dust, noise, and traffic inconvenience in the project vicinity. However, these impacts would cease upon completion of construction. The project includes a small increase in impervious surfaces, which would increase stormwater runoff; however, project design includes the construction of storm drainage improvements that would redirect drainage from emptying directly into the stream. Storm runoff would be filtered through natural vegetation on the stream bank before entering into the stream. The proposed project also includes site-specific BMPs to minimize erosion and sedimentation effects to water quality. Additional mitigation measures included in Chapter 3 would minimize potential construction-related impacts.

(8) Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions.

The proposed action is limited to rehabilitation of Umauma Stream Bridge to preserve the historic quality of the bridge and bring the roadway into compliance with current safety regulations. The proposed action does not involve a commitment for larger action.

(9) Substantially affects a rare, threatened, or endangered species, or its habitat.

The proposed improvements would occur at the existing bridge and roadway alignment. With implementation of mitigation and BMPs described in Section 3.4 of this document, no substantial adverse effects would occur to rare, threatened, or endangered species, or its habitat.

(10) Detrimentally affects air or water quality or ambient noise levels.

Construction activities would have a short-term effect on air quality, water quality, and ambient noise levels. Mitigation included in Chapter 3 would minimize these potential impacts. No additional long-term impacts would occur.

(11) Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters.

There is no flood insurance map or flood hazard classification for the project area from the U.S. Federal Emergency Management Agency (FEMA). The project site is subject to minimal tsunami inundation. During construction, stream flood events, or flash flooding, could result in

potential hazards to workers and construction equipment located in the flood hazards area. Site-specific BMPs included as part of the project include measures to be taken in the event of intense rainfall, weather, or increased stream flows. With implementation of these BMPs, potential hazards to construction workers would be minimized, and no mitigation would be required. Construction of the proposed bridge rehabilitation project would not result in increased flooding or hazards from flooding in surrounding areas. Prior to the initiation of construction, the County would review proposed construction plans for consistency with County requirements and good engineering practice.

(12) Substantially affects scenic vistas and viewplanes identified in county or state plans or studies.

As an already existing roadway and bridge, the bridge rehabilitation project would not significantly change the scenic and visual character of the surrounding area.

(13) Requires substantial energy consumption.

There would be energy consumption associated with construction of the proposed bridge rehabilitation project. The amount of energy that would be consumed with project implementation is not considered substantial.

6 INDIVIDUALS, COMMUNITY GROUPS, AND AGENCIES CONSULTED

6.1 CONSULTATION

Preliminary consultation with agencies, organizations, and individuals were conducted during preparation of the Draft EA for the Rehabilitation of Umauma Stream Bridge project. Agencies, organizations, and individuals followed by an asterisk (*) provided written comments for the project Draft EA, as included in Appendix A of this document.

Federal Agencies

US Army Corps of Engineers
US EPA, Region 9
* U.S. Fish and Wildlife Services
* National Marine Fisheries Services

State Agencies

* Department of Health (DOH)
Department of Agriculture
* Department of Defense
* Department of Education
Department of Human Services
Department of Labor and Industrial Relations
Housing Finance & Development Corporation
* Department of Accounting and General Services (DAGS)
Department of Business, Economic Development and Tourism (DBEDT), Office of Planning
DBEDT, Energy Office
University of Hawai‘i Environmental Center
* Office of Hawaiian Affairs (OHA)
* Department of Hawaiian Home Lands (DHHL)
Department of Land and Natural Resources (DLNR)
* DLNR, State Historic Preservation Division
DLNR, Division of Aquatic Resources
DLNR, Division of Conservation and Resource Enforcement
DLNR, Division of Forestry and Wildlife
DLNR, Land Division
* DLNR, Office of Conservation and Coastal Lands

County Agencies

* Department of Planning
* Department of Public Works
Department of Water Supply, Water Quality Assurance Branch
Department of Parks and Recreation
* Fire Department
* Police Department
* Department of Environmental Management
Department of Research and Development
Office of Housing and Community Development

Elected Officials

Senator Akaka
Senator Inouye
Congresswoman Hanabusa, 1st District
Congresswoman Hirono, 2nd District
William P. Kenoi, Mayor, County of Hawai‘i
Malama Solomon, 1st Senatorial District
Mark M. Nakashima, 1st Representative District
Dominic Yagong, Hawaii County Councilmember, District 1

Community

North Hilo Community Council

Utility Companies

Hawaii Electric Light Company
Hawaiian Telcom

Libraries

Laupahoehoe Public Library
Hilo Public Library

News Media

Hawaii Tribune Herald
West Hawaii Today

6.2 ENVIRONMENTAL ASSESSMENT PREPARATION

This Draft Environmental Assessment (EA) was prepared for DOT by RMBJ Consulting and Bow Engineering & Development, Inc. The following consultants were involved in the preparation of this document:

Raadha M. B. Jacobstein	Project Planner, RMBJ Consulting
William H. Q. Bow, P.E.	President, Bow Engineering & Development, Inc.
Brian Campbell	Project Engineer, Bow Engineering & Development, Inc.

7 REFERENCES

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Hirata & Associates 2011. DRAFT Foundation Investigation, Umauma Stream Bridge Rehabilitation. Route 19, M.P. 16.02. North Hilo, Hawaii. Dated February 18, 2011.

NRCS 2009. U.S. Department of Agriculture, Natural Resources Conservation Service. Soil Survey, Island of Hawaii Area, Hawaii. Version 3, Sep 21, 2009. Accessed at <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx> on March 31, 2011.

U.S. Department of Agriculture, Natural Resources Conservation Service. See NRCS.

APPENDIX A

EARLY CONSULTATION AND CORRESPONDENCE

APPENDIX A

The following correspondences include responses to early consultation requests from the following agencies. The content of this consultation has been incorporated into the analysis contained in this Draft EA.

Federal Agencies

* U.S. Fish and Wildlife Services
* National Marine Fisheries Services

State Agencies

* Department of Health (DOH)
* Department of Defense
* Department of Education
* Department of Accounting and General Services (DAGS)
* Office of Hawaiian Affairs (OHA)
* Department of Hawaiian Home Lands (DHHL)
* DLNR, State Historic Preservation Division
* DLNR, Office of Conservation and Coastal Lands

County Agencies

* Department of Planning
* Department of Public Works
* Fire Department
* Police Department
* Department of Environmental Management

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850

In Reply Refer To:
2011-TA-0279

Mr. Brian Campbell
Bow Engineering and Development, Inc.
1953 South Beretania Street, PH-A
Honolulu, Hawaii 96826

JUN 0 6 2011

Subject: Technical Assistance for the Preparation of a Draft Environmental Assessment for the Rehabilitation of Umauna Stream Bridge, Hawaii

Dear Mr. Campbell:

On May 6, 2011, we received a letter from Dr. Glenn Okimoto requesting our comments for the preparation of a Draft Environmental Assessment (EA) for the proposed Rehabilitation of Umauna Stream Bridge Project [Federal Aid Project Number BR-019-2(61)]. This project will include installing new concrete piers and replacing existing steel towers which will remain in a non-structural capacity and potentially rockfall mitigation. This response is in accordance with section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 et seq.).

Based on information in our files, including data compiled by the Hawaii Biodiversity and Mapping Program, and the Hawaii GAP Program, the federally endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*) and Hawaiian hawk (*Buteo solitarius*) have been observed in the vicinity of the proposed project. There is no federally designated critical habitat in the project footprint. To assist you in avoiding impacts to listed species we offer the following recommendations.

Hawaiian hoary bats roost in both exotic and native woody vegetation and leave their young unattended in "nursery" trees and shrubs when they forage. If trees or shrubs suitable for bat roosting are cleared during the bat breeding season (May to August), there is a risk that young bats could inadvertently be harmed or killed. To minimize impacts to the endangered Hawaiian hoary bat, woody plants greater than 15 feet (4.6 meters) tall should not be removed or trimmed during the bat-birthing and pup-rearing season (May 15 through August 15).

Hawaiian hawks also nest in both exotic and native woody vegetation. To avoid impacts to Hawaiian hawks we recommend avoiding brush and tree clearing during their breeding season (March through September). If you must clear the property during the Hawaiian hawk breeding season, we recommend conducting biological surveys to determine if Hawaiian hawk nests are in the vicinity. Please contact our office regarding survey methodology.

Implementation of these recommendations does not alleviate your responsibilities pursuant to the ESA if a listed species may be affected by the proposed action. If you have any questions regarding this letter, please contact Dr. Jeff Zimpfer, Fish and Wildlife Biologist, Consultation and Habitat Conservation Planning Program (phone: 808-792-9431; email: jeff_zimpfer@fws.gov).

Sincerely,

for Loyal Mehrhoff
Field Supervisor

U.S. Fish and Wildlife Services
June 6, 2011

This letter relates comments from the U.S. Fish and Wildlife Service in accordance with Section 7 of the Endangered Species Act (ESA). The letter identifies potential impacts to several listed species with implementation of the Rehabilitation of Umauma Stream Bridge project, and identifies recommended measures. The impacts of the proposed project on biological resources and ESA-listed species and required measures are discussed in Section 3.4 of the Draft Environmental Assessment.

Brian Campbell

From: Aydee Camunas-Zielke <Aydee.Camunas-Zielke@noaa.gov>
Sent: Friday, June 03, 2011 4:55 PM
To: eddie.chiu@hawaii.gov
Cc: nmfs.pir.hcd.efh.consult@noaa.gov
Subject: Hawaii Belt Road Rehabilitation of Umauma Stream Bridge Scoping and Pre-Assessment Consultation (Fed Aid Project No. BR-019-(61)

Aloha,

The NOAA Fisheries, Pacific Islands Regional Office, Habitat Conservation Division (HCD) has reviewed the Hawaii Belt Road Rehabilitation of Umauma Stream Bridge Scoping and Pre-Assessment Consultation (Fed Aid Project No. BR-019-(61)) as pursuant to the Magnuson-Steven Fishery Conservation and Management Act; Essential Fish Habitat (EFH). The project is located 16 miles north of Hilo District (Hawaii Island) along the Hamakua Coast. The project sites adjacent land use is mainly rural, residential, and agricultural.

The Umauma stream flows below the bridge, west to east, flowing directly into the Pacific Ocean. The project consist of widening and structural rehabilitation of the historic 110 ft. tall bridge. The existing bridge is approximately 28 ft. wide (curb-to-curb) and 39 ft.
(out-to-out) with the bridge deck half section consisting of 12-ft wide asphaltic concrete (AC) travel lane, 2-foot wide AC shoulder, 3.5 ft .
wide concrete sidewalks (rasied 6 in. from roadway), and a 1 foot wide by 2.5 ft high railing. The existing bridge deck drain inlets currently discharge through a section of 4-inch pipes with a outlet approximately 4-feet below the bridge desk, allowing storm water to discharge to the atmosphere and fall to the ground/stream below.

The proposed project would include construction of support columns to be placed within and adjacent to the existing steel support towers, widening of the bridge deck and roadway shoulders, and construction of a new concrete railing. The deteriorating steel structure would be reinforced by constructing two main concrete and one smaller concrete tower within the existing steel towers to preserve the historically significant of the bridge structure. Constructibility challenges and structural load requirements make spread footing foundation systems the most likely foundation to be implemented for pier 1 and 2 which is adjacent to stream. The proposed concrete towers would be constructed outside of the normal stream flow. The bridge drain outlets will also be replaced with deck drains placed at certain locations to prevent stormwater from falling directly into the stream. The storm water would be filtered through natural vegetation on the stream bank before entering into the stream.

The type and extent of depend on the footing selected by the structural geotechnical engineer. Earth work information will be included in Draft Environmental Assessment (DEA). Other than earthwork from footing, there would be minor earthwork for drainage at the roadway approaches to the bridge. In addition the project includes implementation of rock fall mitigation measures. The area of potential rockfall and prevention measures will be describes in detail in the DEA. The construction staging is propsed to be located on the Hilo side of the bridge, mauka of the roadway. Construction equipment would also be staged adjacent to the bridge footings.

Although the project site is not technically located in EFH, the Umauma Stream connects to the Pacific Ocean within considerable proximity to the bridge. The HCD assumes that coral reef may be present (from surveys that documented coral reef habitat exist near the project site) near the mouth of the stream. When conducting field studies for the Draft EA, the DOT should consider surveying the area to confirm the presence of coral reef habitat. Our main concern with the temporary project construction and permanent structural changes is the potential of erosion smothering coral reef. We encourage that the designs proposed in the DEA include minimizing disturbances to stream banks and placing footing foundations outside of the floodplain. Also, specific erosion control measures in road construction plans should be developed to avoid potential impacts to the environment. Casting of road materials into streams should also be avoided. Roadway and associated stormwater collection systems should be maintained properly. Any earth work should be conducted during the dry season and construction equipment should be staged away from stream banks on high ground when ever possible. In addition, the stormwater drain outlets should be designed to avoid scouring and erosion of vegetated areas. Thank you for the opportunity to comment. Please do not hesitate to contact HCD should you have further questions.

Mahalo,

Aydee Zielke
Natural Resource Specialist
NOAA-Fisheries
Pacific Islands Regional Office
Habitat Conservation Division
808-944-2146
aydee.camunas-zielke@noaa.gov
http://www.fpir.noaa.gov/HCD/hcd_efh.html

National Marine Fisheries Services, NOAA Fisheries, Habitat Conservation Division
June 3, 2011

This letter relates comments from the NOAA Fisheries, Habitat Conservation Division, on their review of the proposed Rehabilitation of Umauma Stream Bridge project. The letter identifies concerns regarding potential impacts to coral reef habitat from erosion during construction. The proposed action includes a site-specific Best Management Practices (BMP) plan developed as part of the project to minimize erosion and sedimentation during construction, as discussed in Draft EA Section 3.1. Further, the conditions outlined in this letter were included as required measures of the Nationwide Permit issued by the Army Corps of Engineers for the project, and are identified in Section 3.2.

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

LORETTA J. FUDDY, A.C.S.W., M.P.H.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
EMD/CWB

06018PSW.11

June 15, 2011

The Honorable Glenn M. Okimoto, Ph.D.
Director
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813-5097

Dear Dr. Okimoto:

SUBJECT: Pre-Assessment Consultation for
Scoping and Rehabilitation of Umauma Stream Bridge,
Federal Aid Project No. BR 019-2(61)
Hilo, Island of Hawaii, Hawaii
TMK: (3) 3-1-001:015

The Department of Health, Clean Water Branch (CWB), has reviewed the document, received May 19, 2011, regarding the subject project and offers these comments. Please note that our review is based solely on the document for the subject project and its compliance with Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. You may be responsible for fulfilling additional requirements related to our program. We recommend that you also read our standard comments on our website at
http://hawaii.gov/health/environmental/env-planning/landuse/CWB-standardcomment.pdf

1. Any project and its potential impacts to State waters must meet the following criteria:

   a. Anti-degradation policy (HAR, Section 11-54-1.1), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected.

   b. Designated uses (HAR, Section 11-54-3), as determined by the classification of the receiving State waters.

   c. Water quality criteria (HAR, Sections 11-54-4 through 11-54-8).

2. You are required to obtain a National Pollutant Discharge Elimination System (NPDES) permit for discharges of wastewater, including storm water runoff, into State surface waters (HAR, Chapter 11-55). For the following types of discharges into Class A or Class 2 State waters, you may apply for NPDES general permit coverage by submitting a Notice of Intent (NOI) form:

a. Storm water associated with construction activities, including clearing, grading, and excavation, that result in the disturbance of equal to or greater than one (1) acre of total land area. The total land area includes a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under a larger common plan of development or sale. This includes areas used for a construction base yard and the storage of any construction related equipment, material, and waste products. An NPDES permit is required before the start of the construction activities.

b. Hydrotesting water,

c. Construction dewatering effluent.

You must submit a separate NOI form for each type of discharge at least 30 calendar days prior to the start of the discharge activity, except when applying for coverage for discharges of storm water associated with construction activity. For this type of discharge, the NOI forms may be picked up at our office or downloaded from our website at http://hawaii.gov/health/environmental/water/cleanwater/forms/genl-index.html

3. For other types of wastewater not listed in Item No. 2 above or wastewater discharging into Class 1 or Class AA waters, an NPDES individual permit will need to be obtained. An application for an NPDES individual permit must be submitted at least 180 calendar days before the commencement of the discharge. The NPDES application forms may be picked up at our office or downloaded from our website at http://hawaii.gov/health/environmental/water/cleanwater/forms/environmental/water/cleanwater/forms/indiv-index.html

4. Please call the Army Corps of Engineers at (808) 438-9258 to determine which Department of the Army (DA) permit(s) shall be required for the subject project. Permits may be required for work performed in, over, and under navigable waters of the United States. Projects requiring a DA permit also require a Section 401 Water Quality Certification (WQC) from our office.

5. Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage and/or 401 WQC are required, must comply with the State's Water Quality Standards. Noncompliance with water quality requirements contained in HAR, Chapter 11-54, and/or permitting requirements, specified in HAR, Chapter 11-55, may be subject to penalties of $25,000 per day per violation.

If you have any questions, please visit our website at http://hawaii.gov/health/environmental/water/cleanwater/index.html, or contact the Engineering Section, CWB, at 586-4309.

Sincerely,

FOR LORETTA J. FUDDY, A.C.S.W., M.P.H.
Director of Health

SW:ml

c: DOH-EPO #11-091[via email only]
Mr. Eddie Chiu, DOT-HWYS [via email eddie.chiu@hawaii.gov only]
Mr. Brian Campbell, Bow Engineering and Development, Inc.
[via email bcampbell@bowengineering.com only]

State of Hawai‘i, Department of Health, Clean Water Branch (CWB)
June 15, 2011

This letter relates comments from the CWB on the proposed Rehabilitation of Umauma Stream Bridge project. The letter provides details on compliance with Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. Potential impacts to water quality as a result of the proposed project are evaluated in Draft EA Section 3.2. As described in this section, since construction activities would disturb approximately 0.87 acres (less than one acre of total land area), including construction staging area, an NPDES permit would not be required. A Department of Army Nationwide Permit Verification was issued for the project on August 17, 2011, and it is anticipated that the project will be covered under a blanket WQC for Nationwide Permits. Consultation with DOH to confirm WQC requirements has been initiated.

NEIL ABERCROMBIE
GOVERNOR

MAJOR GENERAL DARRYLL D. M. WONG
DIRECTOR OF CIVIL DEFENSE

EDWARD T. TEIXEIRA
VICE DIRECTOR OF CIVIL DEFENSE

PHONE (808) 733-4300
FAX (808) 733-4287

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE DIRECTOR OF CIVIL DEFENSE
3949 DIAMOND HEAD ROAD
HONOLULU, HAWAII 96816-4495

May 13, 2011

Mr. Brian Campbell
Bow Engineering & Development, Inc.
1953 South Beretania Street, PH-A
Honolulu, Hawaii 96826

Dear Mr. Campbell:

Hawaii Belt Road
Rehabilitation of Umauma Stream Bridge
Federal Aid Project No. BR-019-2(61)
Scoping and Pre-Assessment Consultation

Thank you for this opportunity to comment during the pre-assessment consultation period for the proposed project to widen and structurally rehabilitate the existing and historic Umauma Bridge.

We recommend that the retrofit design for bridge rehabilitation include measures as appropriate to mitigate flooding risks. Located in a designated conservation area, the Umauma Bridge is also listed on the National Historic Register and the proposed work will include upgrades to deck drains and earthwork for the bridge footings. We defer to the Department of Health, Department of Land and Natural Resources, and the US Army Corps of Engineers in regard to permit requirements and notification(s) of work to be performed and completed.

We are not aware of environmental or social resources associated with the proposed project. We are aware that the University of Hawaii is conducting a Landslide Hazard Mapping project on Hawaii Island, and recommend your staff contact Mr. Peter Nicholson, Associate Professor - Geotechnical Engineering, Department of Civil and Environmental Engineering, University of Hawaii at Manoa, 2540 Dole Street, #383, Honolulu, Hawaii 96822, and (808) 956-2378.

We look forward to a copy of the Environmental Assessment once it is completed. If you have any questions, please have your staff contact Ms. Dawn Johnson at (808) 733-4300.

Sincerely,

EDWARD T. TEIXEIRA
Vice Director of Civil Defense

State of Hawaii, Department of Defense, Office of the Director of Civil Defense
May 13, 2011

This letter in from the Hawai‘i Department of Defense recommends that measures are included to mitigate flood risks. As described in Section 3.3, site-specific BMPs included as part of the project include measures to be taken in the event of intense rainfall, weather, or increased stream flows. These measures include relocation of personnel and construction materials and equipment to higher ground (a minimum of 10 feet above the OHWM). The letter recommends contacting personnel involved in the Landslide Hazard Mapping project on Hawai‘i Island. Attempts at contacting personnel were made in July 2011, though with no response. The project includes rock fall prevention measures for identified areas of concern as described in Section 3.1.

NEIL ABERCROMBIE
GOVERNOR

KATHRYN S. MATAYOSHI
SUPERINTENDENT

STATE OF HAWAI`I
DEPARTMENT OF EDUCATION
P.O. BOX 2360
HONOLULU, HAWAI`I 96804

OFFICE OF THE SUPERINTENDENT

May 23, 2011

Mr. Brian Campbell
Bow Engineering & Development, Inc.
1953 South Beretania Street, PH-A
Honolulu, Hawai`i 96826

Dear Mr. Campbell:

Subject: Hawaii Belt Road, Rehabilitation of Umauma Stream Bridge, Federal Aid Project No. BR-019-2(61), Scoping and Pre-Assessment Consultation

The Department of Education (DOE) has reviewed the scoping and pre-assessment consultation request for the rehabilitation of Umauma Stream Bridge.

The DOE has no comment regarding this project.

Thank you for the opportunity to provide comments. If you have any questions, please call Jeremy Kwock of the Facilities Development Branch at 377-8301.

Very truly yours,

Kathryn S. Matayoshi
Superintendent

KSM:jmb

c: Randolph Moore, Assistant Superintendent, OSFSS
Valerie Takata, CAS, Hilo/Laupahoehoe/Waiakea Complex Areas

State of Hawai‘i, Department of Education
May 23, 2011

This letter indicates that the Department of Education has no comment regarding this project.

NEIL ABERCROMBIE
GOVERNOR

BRUCE A. COPPA
COMPTROLLER

RYAN T. OKAHARA
DEPUTY COMPTROLLER

(P)1107.1

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810-0119

MAY 2 4 2011

MEMORANDUM

TO: The Honorable Glen M. Okimoto, Ph. D
Department of Transportation

FROM: Bruce A. Coppa
State Comptroller

SUBJECT: Hawaii Belt Road
Rehabilitation of Umauma Stream Bridge
Federal Aid Project No. BR-019-2(61)
Scoping and Pre-Assessment Consultation

This is in response to your letter, dated May 5, 2011 regarding the subject project. The proposed project does not impact any of the Department of Accounting and General Services' projects or existing facilities, and we have no comments to offer at this time.

If you have any questions, please call me at 586-0400, or have your staff call Mr. David DePonte of the Public Works Division at 586-0492.

c: Mr. Brian Campbell, Bow Engineering and Development
Mr. Jerry Watanabe, DAGS-Hawaii

State of Hawai‘i, Department of Accounting and General Services
May 24, 2011

This letter indicates that the Department of Accounting and General Services has no comment regarding this project.

PHONE (808) 594-1888

FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

HRD11/5725

May 24, 2011

Brian Campbell
Bow Engineering & Development, Inc.
1953 South Beretania Street, PH-A
Honolulu, Hawai'i 96826

Re: Umauma Steam Bridge Rehabilitation Project
Island of Hawai'i

Aloha e Brian Campbell,

The Office of Hawaiian Affairs (OHA) is in receipt of a May 5, 2011 letter from the State of Hawai'i-Department of Transportation (HDOT) seeking comments ahead of the proposed Umauma Stream Bridge Rehabilitation Project (project) on the Island of Hawai'i. Project activities include the widening and structural rehabilitation of the existing Umauma Steam Bridge (bridge) and possibly rock fall mitigation. A variety of State and County of Hawai'i permits and approvals will be required to facilitate this project. Because funding from the Federal Highways Administration will be utilized, provisions of the National Historic Preservation Act (NHPA) and National Environmental Policy Act (NEPA) are applicable.

This bridge is eligible for listing on the National Register of Historic Places under multiple criteria. OHA advocates that NHPA consultation be initiated with interested parties to develop appropriate mitigation for any adverse effects this project will have on the bridge. OHA does not assign religious or cultural significance to this bridge and thus, will defer NHPA consultation to other consulting parties with expertise and interest in this matter. We do seek assurances that an appropriate level effort to identify historic properties within the area of potential effect (APE) for this project be conducted pursuant to the requirements of the NHPA. After a review of our records, we are unaware of any historic properties of religious or cultural significance to the Native Hawaiian people which may be impacted by this project at this time.

OHA advocates that best management practices be implemented and employed for the duration or project activities to protect stream and near-shore water quality and species. If re-vegetation efforts are a component of this project, we respectfully suggest you consider using native plant species which are common and adapted to the project area.

Thank you for the opportunity to provide comments at this early stage of the project. We look forward to seeing this project completed as it will contribute to the safety of the Hawai'i Island community traveling along the Hāmākua and Hilo coastline. We appreciate the detailed

information which is included in the HDOT letter regarding the permits and approvals which will be required for the project and the scope of work which is proposed. OHA acknowledges that a NEPA Categorical Exclusion is anticipated for this project. Should you have any questions or concerns, please contact Keola Lindsey at 594-0244 or keolal@oha.org.

'O wau iho nō me ka 'oia'i'o,

Clyde W. Nāmu'o
Chief Executive Officer

C: OHA- East Hawai'i COC
Pat Phung, FHWA
Eddie Chiu, HDOT-Technical Design Services Office

State of Hawai‘i, Office of Hawaiian Affairs (OHA)
May 24, 2011

This letter from OHA recommends that appropriate consultation be conducted to ensure historic resources are protected. OHA states that their records do not indicate any historic properties of religious or cultural significance to the Native Hawaiian people would be impacted with project implementation. Potential impacts to historic and cultural resources are described in Section 3.5 of the EA, and mitigation measures are included to avoid adverse affects to the historic bridge.

The letter also recommends that stream and near-shore water quality and species are protected during construction, and that native plant species are used for re-vegetation. The proposed action includes a site-specific Best Management Practices (BMP) plan developed as part of the project to minimize erosion and sedimentation during construction, as discussed in Draft EA Section 3.1. Potential impacts to water quality as a result of the proposed project are evaluated in Draft EA Section 3.2. As discussed in Section 3.4, the proposed project would result in the removal of all existing vegetation within the grading limits shown on Figure 5 of the Draft EA; these areas would be re-grassed following construction to prevent erosion, and would later be re-colonized by localized grasses and plants.

NEIL ABERCROMBIE
GOVERNOR
STATE OF HAWAII

ALBERT "ALAPAKI" NAHALE-A
CHAIRMAN
HAWAIIAN HOMES COMMISSION

ROBERT J. HALL
DEPUTY TO THE CHAIRMAN

STATE OF HAWAI'I

DEPARTMENT OF HAWAIIAN HOME LANDS

P.O. BOX 1879
HONOLULU, HAWAII 96805

June 2, 2011

TO: The Honorable Glenn M. Okimoto, Ph.D.
Director of Transportation

From: Albert "Alapaki" Nahale-a
Chairman

Subject: HAWAII BELT ROAD
REHABILITATION OF UMAUMA STREAM BRIDGE
FEDERAL AID PROJECT NO. BR-019-2(61)
SCOPING AND PRE-ASSESSMENT CONSULTATION

Mahalo for the opportunity to review the subject document.

The department understands the importance of rehabilitating our Hawaii Belt Road system for the movement of people and goods, particularly between our homestead communities, in a safe and efficient manner. The proposed highway bridge improvement will have positive impacts for this objective.

If you have any questions, please contact our Planning Office at 620-9481.

cc: Mr. Brian Campbell
Bow Engineering & Development, Inc.
1953 South Beretania Street, PH-A
Honolulu, Hawaii 96826

State of Hawai‘i, Department of Hawaiian Home Lands (DHHL)
June 2, 2011

This letter indicates that the DHHL recognizes the importance of this project for transportation safety and efficiency, and notes the positive impacts from the proposed improvements.

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RUSSELL Y. TSUJI
FIRST DEPUTY

KEN C. KAWAHARA
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

May 17, 2010

Mr. Domingo Galicinao
Federal Highway Administration
Hawaii Division
P.O. Box 50206
Honolulu, Hawaii 96850

LOG NO:2010.1889
DOC NO:1005MA10

Architecture

Dear Mr. Galicinao:

SUBJECT: Section 106 and Section 6E-8, HRS Review
Rehabilitation of Umauma Stream Bridge
State of Hawaii, Department of Transportation
TMK: 3-1-001: no plat number as a bridge

On April 29, 2010, we received the State Department of Transportation's (DOT) memorandum of April 27, 2010, concerning the rehabilitation of Umauma Bridge on the island of Hawaii's Hamakua Coast, and we thank you for the opportunity to comment on this partially federally funded undertaking. The bridge appears to meet the criteria for listing in the Hawaii and National Registers of Historic Places, and has been so identified in a 1987 Hawaii Island bridge inventory undertaken by the DOT in 1987 and in the DOT's more recent draft statewide inventory of historic bridges. The Area of Potential Effect is the bridge structure and the lands upon which the steel trestles sit.

We have reviewed the potential effects, by consulting the attached preliminary drawings, draft multiple property National Register nomination form, and information contained in DOT's cover memorandum. Based on our examination, we concur with FHWA's determination that, Pursuant to 800.5 (b), the project will result in **"no adverse effect" provided the FHWA ensures the following conditions are fulfilled:**

1. The trestles and steel girders are retained.
2. Color the center concrete column a color such that the trestles will be more visually dominant.
3. Paint the trestles with a coating more long term to alleviate the corrosion problems necessitating the rehabilitation project.
4. Additional girders will resemble, but to the trained eye not duplicate, the originals.
5. The look and feel of the bridge is maintained as presented in Option 1.
6. DOT provide the requested additional photographic documentation.
7. Submit the Steel Trestle Bridges of the Hamakua Coast multiple property nomination to the Hawaii Historic Places Review Board for consideration within one year of this letter.
8. Retain the Hamilton & Chalmers plaque that is affixed to the bridge's present superstructure.

9. Continue to consult with the Hawaii SHPO throughout the schematic, design development and final design stages to ensure the work conforms to the Secretary of Interior's Standards for Rehabilitation.

While there is low probability of encountering archaeological sites in this area, in the event that historic resources, including human skeletal remains, are identified during the construction activities, all work needs to cease in the immediate vicinity of the find, the find needs to be protected from additional disturbance, and the State Historic Preservation Division, Oahu Section, needs to be contacted immediately.

With the above conditions in mind, the office concurs with this proposed project in accordance with Section 6E-8, HRS.

Should you have any questions regarding architectural concerns, please contact Nancy A. McMahon at (808) 692-8015.

Aloha,

Nancy A. McMahon

Nancy A. McMahon (Deputy SHPO)
State Historic Preservation Officer

cc. National Park Service
Attention: Mr. Frank Hays
Box 50165
Honolulu, HI 96850

Henry Kennedy
Hawaii Department of Transportation
555 Kamokila Boulevard
Kapolei, Hawaii 96707

Tonia Moy
Fung Associates
1833 Kalakaua Avenue, Suite 1008
Honolulu, Hawaii 96815

George Gutierrez Jr.
Nagamine Okawa Engineers, Inc.
1003 Bishop Street
Pauahi Tower, suite 2025
Honolulu, Hawaii 96813

State of Hawaii, Department of Land and Natural Resources, State Historic Preservation Division
May 17, 2011

This letter relates comments from the SHPD, on their review of the proposed Rehabilitation of Umauma Stream Bridge project. The letter concurs that the project would result in "no adverse effect" with implementation of conditions. Potential impacts to historic and cultural resources are described in Section 3.5 of the Draft EA, and conditions as outlined in this letter are included to avoid adverse affects to the historic bridge.

From: Kimberly.Mills@hawaii.gov
Subject: **Re: Rehabilitation of Umauma Bridge**
Date: July 7, 2011 6:35:22 PM EDT
To: Raadha Jacobstein <raadhabj@gmail.com>
Cc: Sam.J.Lemmo@hawaii.gov
2 Attachments, 5.1 MB

Kimberly.Mills@ha...
Not In Address Book

Hi,

It is unclear if the bridge actually lies in the Conservation District as it appears the roadway is the boundary between CD and another State land use district. The land makai of the bridge appears to lie within the Conservation District, resource subzone.

The bridge appears to be a nonconforming structure, created after 1912 and improved upon in 1955, prior to Conservation District rules (1964). 183C-5, HRS allows for the continued use of nonconforming structures.

As the majority of work shall take place within the Right of Way and the staging area is on the mauka side of the road, both these areas are outside of our jurisdiction, therefore we have no comments.

~Tiger
Kimberly K. Tiger Mills, Staff Planner
State of Hawaii
Department of Land & Natural Resources
Office of Conservation and Coastal Lands
P.O. Box 621
Honolulu, Hawaii 96809
www.hawaii.gov/dlnr/occl

Raadha Jacobstein <raadhabj@gmail.com>

07/07/2011 10:45 AM

To kimberly.mills@hawaii.gov
cc
Subject Rehabilitation of Umauma Bridge

Tiger,
enclosed is a draft of the letter that would have gone to your office, in addition to a project description to assist you in your review. Please let me know if you have any questions.

OCCL copy o...pdf (63.9 KB) PD Umauma ....pdf (5.0 MB)

State of Hawai‘i, Department of Land and Natural Resources, Office of Conservation and Coastal Lands (OCCL)
July 7, 2011

This letter from OCCL states that because the majority of work will take place within the Right of Way, and the staging area is not located within the Conservation District, both areas are outside of OCCL jurisdiction. Permits and approvals required to implement the proposed action are outlined in Section 1.5 of the Draft EA. A discussion of land use controls applicable to the project is included in Section 3.12 of the Draft EA.

DIR 0719

William P. Kenoi
Mayor

BJ Leithead Todd
Director

Margaret K. Masunaga
Deputy

SP

County of Hawai'i

PLANNING DEPARTMENT

Aupuni Center • 101 Pauahi Street, Suite 3 • Hilo, Hawai'i 96720
Phone (808) 961-8288 • Fax (808) 961-8742

2011 JUN -7 A 8:41
DIRECTOR'S OFFICE
DEPT. OF
TRANSPORTATION

May 26, 2011

Mr. Glenn M. Okimoto, Director
Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813-5097

Dear Mr. Okimoto:

SUBJECT: Scoping and Pre-Assessment Consultation for Draft Environmental Assessment
Project: Rehabilitation of Umauma Stream Bridge
TMK: (3) 3-1-001:015; Kamae'e, North Hilo, Hawai'i

Thank you for your letter dated April 29, 2011 requesting comments from this office regarding the preparation of a Draft Environmental Assessment (EA).

The Umauma Bridge carries the Hawai'i Belt Road over Umauma Stream, along the Hāmākua Coast. The proposed project is to construct bridge widening and structural rehabilitation of the existing historic Umauma Bridge. The existing bridge would remain open and in use as the improvements are constructed. The bridge is located entirely within the State right-of-way. The construction staging area is proposed to be located on the subject property. Construction equipment would also be staged adjacent to the bridge footings and would be within State right-of-way.

The subject parcel and surrounding properties are zoned A-20a (Agricultural-20 acre minimum lot size). The properties are situated within the State Land Use Agricultural and Conservation districts. The project area is within the Special Management Area (SMA).

According to Hawaii Revised Statutes (HRS) Chapter 205A-22 and Planning Commission Rule 9-4(e) (2) (B) relating to Special Management Area, "development" does not include "*Repair or maintenance of roads and highways within existing rights-of-way.*" Therefore, we have determined that the proposed bridge rehabilitation is

considered exempt from the definition of "development". Further review of the project against the Special Management Area rules and regulations will not be required.

The project site is located in the Hāmākua Community Development Plan (CDP) planning area. The Hāmākua CDP has not yet been adopted and is currently in the planning process. However, should it be adopted prior to the preparation of the Draft EA, please include a discussion about the project in relationship to the objectives, goals, and policies of the Hāmākua CDP.

Please also note that this bridge is regularly frequented by pedestrians viewing the waterfalls on Umauma Stream. Although the rehabilitation will create wider shoulders and new concrete railing for increased vehicular and bike safety, we have great concern for the safety of the pedestrians that will continue to use the bridge as a viewing point. Please consider the pedestrian safety when finalizing the design and the design alternatives.

We have no further comments to offer, at this time. However, please keep us informed and provide our department with a copy of the Draft Environmental Assessment for our review and comment.

If you have any questions or if you need further assistance, please feel free to contact Bethany Morrison of this office at 961-8138.

Sincerely,

for BJ LEITHEAD TODD
Planning Director

BJM:cs
P:\wpwin60\Bethany\EA-EIS Review\preconsultdrafteaUmaumabridgerehabilitation.doc

County of Hawai‘i, Planning Department
May 26, 2011

This letter from the County Planning Department states that the project is located within the Special Management Area (SMA); however, the Planning Department has determined that the proposed bridge rehabilitation project considered exempt from the definition of “development,” and SMA rules would not apply. The County requests that the Draft EA include a discussion of the project in relation to the Hāmākua Community Development Plan should it be adopted prior to release of the Draft EA. Permits and approvals required to implement the proposed action are outlined in Section 1.5 of the Draft EA. A discussion of land use controls applicable to the project is included in Section 3.12 of the Draft EA.

The letter also notes that pedestrians are known to frequent the bridge for views of the waterfalls, and their safety should be considered in the design of the project. As noted in the Draft EA Section 1.2, one of the identified project objectives is to bring the roadway up to current safety standards while also satisfying State Historic Preservation Division historical requirements.

DIR 0694

William P. Kenoi
Mayor

William T. Takaba
Managing Director

Warren H. W. Lee
Director

Brandon A. K. Gonzalez
Deputy Director

County of Hawai'i
DEPARTMENT OF PUBLIC WORKS
Aupuni Center
101 Pauahi Street, Suite 7 • Hilo, Hawaii 96720-4224
(808) 961-8321 • Fax (808) 961-8630

June 2, 2011

DIRECTOR'S OFFICE
DEPT. OF
TRANSPORTATION
2011 JUN -7 P 12: 39

Glenn M. Okimoto, Ph.D.
Director of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, HI 96813-5097

SUBJECT: REHABILITATION OF UMAUMA STREAM BRIDGE
Hawaii Belt Road - Federal Aid Project No. BR-019-2(61)
Scoping and Pre-Assessment Consultation
Construction Staging - Tax Map Key: (3) 3-1-01: 015

We have reviewed the subject project as described in your letter dated May 5, 2011 and offer the following comments for your consideration.

The subject project is in an area that is not mapped by the Federal Emergency Management Agency (FEMA) and is identified as an area of "Minimal Tsunami Inundation." The National Flood Insurance Program does not have any regulations for developments within the Minimal Tsunami Inundation areas and Zone X.

All earthwork activity, including grading and grubbing, shall conform to Chapter 10, Erosion and Sedimentation Control, of the Hawaii County Code.

We note that there are no planned projects by this department within the subject project's vicinity.

Questions may be referred to Mr. Kelly Gomes, P.E. of the Engineering Division at (808) 961-8327.

Kelly Gomes
for BEN E. ISHII, Division Chief
Engineering Division

County of Hawai‘i, Department of Public Works
June 2, 2011

This letter from the County Department of Public Works states that the project is located in an area not mapped by the Federal Emergency Management Agency. The letter also states that all earthwork activity shall conform to Hawai‘i County Code Chapter 10, Erosion and Sedimentation Control. Potential flooding at the project site is discussed in Section 3.3 of the Draft EA. The proposed action includes a site-specific Best Management Practices (BMP) plan developed as part of the project to minimize erosion and sedimentation during construction, in addition to compliance with Hawai‘i County Code, as discussed in Draft EA Section 3.1.

DIR 0450

William P. Kenoi
Mayor

Darryl J. Oliveira
Fire Chief

Glen P. I. Honda
Deputy Fire Chief

County of Hawai'i
HAWAI'I FIRE DEPARTMENT
25 Aupuni Street • Suite 2501 • Hilo, Hawai'i 96720
(808) 932-2900 • Fax (808) 932-2928

May 12, 2011

DIRECTOR'S OFFICE
DEPT. OF
TRANSPORTATION
2011 MAY 23 P 2:09

Mr. Glenn M. Okimoto, Ph.D.
State of Hawai'i
Department of Transportation
869 Punchbowl Street
Honolulu, Hawai'i 96813-5097

SUBJECT: SCOPING AND PRE-ASSESSMENT CONSULT
HAWAI'I BELT ROAD, REHABILITATION OF UMAUMA STREAM BRIDGE,
FEDERAL AID PROJECT NO. BR-019-2 (61)

We have no comments to offer at this time in reference to the above-mentioned project.

DARRYL OLIVEIRA
Fire Chief

GA:lpc

DEPT OF TRANSPORTATION
2011 MAY 24 A 9:22
HIGHWAYS DIVISION

County of Hawai‘i, Hawai‘i Fire Department
May 12, 2011

This letter indicates that the Hawai‘i Fire Department has no comment regarding this project.

William P. Kenoi
Mayor

Harry S. Kubojiri
Police Chief

Paul K. Ferreira
Deputy Police Chief

County of Hawai'i
POLICE DEPARTMENT
349 Kapiolani Street • Hilo, Hawai'i 96720-3998
(808) 935-3311 • Fax (808) 961-8865

May 9, 2011

Mr. Brian Campbell
Bow Engineering & Development, Inc.
1953 South Beretania Street, PH-A
Honolulu, HI 96826

Dear Mr. Campbell:

SUBJECT: HAWAII BELT ROAD
REHABILITATION OF UMAUMA STREAM BRIDGE
FEDERAL AID PROJECT NO. BR-019-2(61)
SCOPING AND PRE-ASSESSMENT CONSULTATION

Staff has reviewed the above-referenced document and does not anticipate any significant impact to traffic and/or public safety concerns.

If you have any questions, please contact Captain Mitchell Kanehailua of the North Hilo and Hamakua Districts at (808) 775-7533.

Sincerely,

SAMUEL THOMAS
ACTING ASSISTANT POLICE CHIEF
AREA I OPERATIONS BUREAU

MK:lli

cc: Glenn M. Okimoto, Ph.D., Director of Transportation

County of Hawai‘i, Police Department
May 9, 2011

This letter indicates that the County Police Department does not anticipate significant impacts to traffic or public safety as a result of this project. A discussion of potential impacts to traffic is included in Section 3.11 of the Draft EA.

From: "Henry, Sharron" <shenry@co.hawaii.hi.us>
Date: May 18, 2011 2:33:24 PM HST
To: "eddie.chiu@hawaii.gov" <eddie.chiu@hawaii.gov>, Brian Campbell <BCampbell@bowengineering.com>
Subject: **Hawaii Belt Road - Co. of HI input**

SUBJECT: Hawai‘i Belt Road
Rehabilitation of Umauma Stream Bridge
Federal Aid Project No. BR-019-2(61)
Scoping & Pre-Assessment Consultation

The Department of Environmental Management has no knowledge of any environmental or social resources via our department associated with this project.

Sharron Henry
Secretary to the Director
County of Hawai`i
Department of Environmental Management
Mailing Address: 25 Aupuni Street
Physical Address: Puainako Town Center,
2100 Kanoelehua
Hilo, HI 96720
Phone: 808.961.8083 or 808.981.8398
Fax: 808.961.8086 or 808.981.2092
Email: schenry@co.hawaii.hi.us
cohdem@co.hawaii.hi.us
http://co.hawaii.hi.us/directory/dir_envmng.htm

County of Hawai‘i, Department of Environmental Management
May 18, 2011

This letter indicates that the Department of Environmental Management has no knowledge of environmental or social resources associated with the project, and therefore has no comment regarding this project.

APPENDIX B

FOUNDATION INVESTIGATION, UMAUMA STREAM BRIDGE REHABILITATION. ROUTE 19, M.P. 16.02. NORTH HILO, HAWAII HIRATA & ASSOCIATES, APRIL 28, 2011

FOUNDATION INVESTIGATION
UMAUMA STREAM BRIDGE
REHABILITATION
ROUTE 19, M.P. 16.02
NORTH HILO, HAWAII

for

NAGAMINE OKAWA ENGINEERS, INC.

HIRATA & ASSOCIATES, INC.
W.O. 10-4890
April 28, 2011

Hirata & Associates

Geotechnical Engineering

Hirata & Associates, Inc.
99-1433 Koaha Pl
Aiea, HI 96701
tel 808.486.0787
fax 808.486.0870

April 28, 2011
W.O. 10-4890

Mr. Norman Nagamine
Nagamine Okawa Engineers, Inc.
1003 Bishop Street
Pauahi Tower, Suite 2025
Honolulu, Hawaii 96813

Dear Mr. Nagamine:

Our report, "Foundation Investigation, Rehabilitation of Umauma Stream Bridge, Route 19, M.P. 16.02, North Hilo, Hawaii" dated April 28, 2011, our Work Order 10-4890 is enclosed. This investigation was conducted in general conformance with the scope of work presented in our proposal dated May 14, 2008.

Our borings drilled behind the existing abutments encountered fill consisting of mottled brown clayey silt with sand and gravel below the existing pavement section. The clayey silt was in a medium stiff condition, and extended to depths of about 27 feet on the Hilo side of the bridge and to about 12 feet on the Honoka'a side. Portions of the clayey silt fill also appear to be mixed with volcanic ash. Underlying the fill was brown to mottled brown completely weathered rock in a medium stiff/medium dense to dense condition. Hard basalt was encountered at depths of about 36 and 47 feet, extending down to the maximum depths drilled.

Borings drilled near the piers encountered basalt at depths ranging from ground surface at Pier 1, to about 13 feet and 11 feet at Piers 2 and 3, respectively. The basalt was hard, fractured, and moderate to slightly weathered with occasional highly weathered seams. Overlying the basalt was brown to mottled brown clayey silt derived from volcanic ash.

Spread footing foundations are recommended for support of the new Piers 1 and 2. Due to the location of Pier 3, micropiles are recommended for support of the new pier. 5-foot diameters drilled piers behind the abutments are recommended to provide increased lateral support for the abutments.

We appreciate this opportunity to be of service. Should you have any questions concerning this report, please feel free to call on us.

Very truly yours,

HIRATA & ASSOCIATES, INC.

Paul S. Morimoto

Paul S. Morimoto President

PSM:CCT

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FOUNDATION INVESTIGATION
UMAUMA STREAM BRIDGE REHABILITATION
ROUTE 19, M.P. 16.02
NORTH HILO, HAWAII

INTRODUCTION

This report presents the results of our foundation investigation performed for the proposed rehabilitation of Umauma Stream Bridge in North Hilo, Hawaii. Our services for this study included the following:

- A visual reconnaissance of the site to observe existing conditions which may affect the project. The general location of the project site is shown on the enclosed Location Map, Plate A2.1.

- A review of available in-house soils information pertinent to the site and the proposed project.

- Drilling and sampling 5 exploratory test borings to depths ranging from about 48 to 76.5 feet. A description of our field investigation is summarized on Plates A1.1 and A1.2. The approximate exploratory test boring locations are shown on the enclosed Boring Location Plans, Plates A2.2 and A2.3, and the soils encountered in the borings are described on the Boring Logs, Plates A4.1 through A4.14.

- Laboratory testing of selected soil samples. Testing procedures are presented in the Description of Laboratory Testing, Plates B1.1 through B1.3. Test results are presented in the Description of Laboratory Testing, on the Boring Logs, Consolidation Test reports (Plates B2.1 through B2.3), Direct Shear Test reports (Plates B3.1 through B3.6), Modified Proctor Test reports (Plates B4.1 through B4.3), California Bearing Ratio Test reports (Plates B5.1 and B5.2), Sieve Analysis Test report (Plate B6.1), R-value Test reports (Figures B7.1 and B7.2), and Rock Core Unconfined Compression Test report (Plate B8.1).

- Engineering analyses of the field and laboratory data.

- Preparation of this report presenting geotechnical recommendations for the design of new foundations, including seismic considerations, resistance to lateral pressures, and site grading.

PROJECT CONSIDERATIONS

The existing Umauma Stream Bridge was initially built in 1911 and subsequently widened on both the upstream and downstream sides in 1949. The bridge is presently approximately 280 feet long and 35 feet wide. The structure is supported by 2 concrete abutments and 3 steel towers. The maximum span length is about 66 feet.

The steel towers are deteriorating, and the proposed rehabilitation concept consists of designing new concrete piers to structurally replace the existing towers. The new piers will be constructed within the towers and the existing steel structures will remain.

The rehabilitation will also include widening the bridge to allow for 12-foot lanes and 8-foot shoulders. Grading for the project will consist primarily of excavations necessary for construction of the new foundations.

Based on the bottom of footing elevations of the existing bridge foundations and boring logs on the 1949 as-built plans, the footings are expected to be founded on decomposed rock, soft and hard rock, except for Abutment No. 1 which might be founded on a layer of fill underlain by decomposed rock at shallow depths.

SITE CONDITIONS

Umauma Stream Bridge is located along Hawaii Belt Road (Route 19), between its intersection with Kauniho and Leopolino Roads in North Hilo. The bridge is approximately 280 feet in length, with Umauma Stream flowing about 115 feet below the bridge deck. The sides of the gully are steep, generally sloping at gradients of about 5/8H:1V, with some areas as steep as near vertical located at the bottom of the slope. Most of the slope areas are covered by a moderate growth of vegetation. The upper section of the slope faces generally expose weathered rock in areas that are bare, while steeper areas in the lower sections expose slight to moderately weathered

basalt. Rock outcrops, along with numerous boulders are visible at the bottom of the gully, adjacent to the stream.

Existing cut slopes along the highway behind Abutment No. 2 generally stand at gradients on the order of 1/2H:1V or steeper and expose completely to highly weathered rock at the slope face.

SOIL CONDITIONS

Borings B1 and B2 drilled behind the existing abutments encountered fill consisting of mottled brown clayey silt with sand and gravel below the existing pavement section. The clayey silt was in a medium stiff condition and extended to depths of about 27 feet on the Hilo side of the bridge and to about 12 feet on the Honoka'a side.

Portions of the clayey silt fill also appear to be mixed with volcanic ash. Volcanic ash is generally characterized as having low dry density, high insitu moisture contents, and poor workability.

Underlying the fill was brown to mottled brown completely weathered rock. Completely weathered rock is defined as rock which has decomposed to soil, but with its fabric and structure preserved. The weathered rock encountered in the borings were in a medium stiff or medium dense to dense condition.

Basalt was encountered at depths of about 36 and 47 feet, extending down to the maximum depths drilled. The basalt was hard, fractured, and moderate to slightly weathered with occasional highly to completely weathered seams.

Borings B3 through B5, drilled near the piers, encountered basalt at depths ranging from ground surface at boring B3 (Pier 1), to depths of about 13 feet at boring B4 (Pier 2), and about 11 feet at boring B5 (Pier 3). The basalt was hard, fractured, and

moderate to slightly weathered with occasional highly weathered seams and clinker down to the maximum depths drilled. Overlying the basalt was brown to mottled brown clayey silt derived from volcanic ash. The soil was in a medium stiff condition and mixed with sand and gravel.

Boring B3 drilled adjacent to the stream encountered groundwater at a depth of 29 feet. Neither groundwater nor seepage water was encountered in the remainder of the borings.

CONCLUSIONS AND RECOMMENDATIONS

Based on our test borings, and the existing topography, spread footings are recommended for support of new foundations at Piers 1 and 2. Since, Pier 3 is situated on at small flat area on a steep slope, micropile foundations are recommended for support of the new concrete pier.

Although cavities were not encountered in our test borings, we recommend, as a precautionary measure, that a probing and grouting program be implemented prior to construction of the foundations at Piers 1 and 2. All footing excavations should be probed to depths at least twice the footing width or to a minimum depth of 10 feet, measured from the bottom of footing elevation. All probe holes should be filled with sand-cement grout.

Underpinning and/or shoring of existing foundations may be required for construction of new foundations. Shoring of cuts extending into existing slopes may also be required for construction of the new foundations at Piers 1 and 2, and the pile cap at Pier 3.

Abutments

Foundations - We understand that existing abutment foundations will be re-used for the widened bridge. The existing abutment footings vary from about 10 to 14 feet in width. Abutment No. 1 is expected to be founded on a thin layer of fill underlain by completely weathered rock/clayey silt at shallow depths, and Abutment No. 2 is expected to be founded on completely weathered rock. The existing footings may be evaluated using bearing values of 6,000 and 13,000 pounds per square foot for strength limit states and extreme event limit states, respectively. A bearing value of 4,000 pounds per square foot may be assumed for service limit states.

We believe that settlement of existing abutment foundations due to loading from the existing bridge deck is complete. Additional settlement due to the added weight of

the widened bridge deck is expected to be about 1 inch or less. Much of the settlement is expected to occur during construction, upon initial application of loads.

Lateral Design - Resistance to lateral loading may be provided by friction acting at the base of abutment foundations and by passive earth pressure acting on the buried portions of foundations.

Coefficients of friction of 0.45 and 0.53 may be used with the dead load forces to compute the friction acting at the base of foundations for strength limit state and extreme event limit state, respectively.

Passive earth pressure may be computed as an equivalent fluid having a density of 220 and 440 pounds per cubic foot for strength limit state and extreme event limit state, respectively. The recommended passive earth pressure values are for level ground fronting the foundation. The passive earth pressure should be reduced or disregarded where the ground fronting the foundations slopes downward. Unless covered by pavement or concrete slabs, the upper 12 inches of soil should not be considered in computing lateral resistance.

For active earth pressure considerations, equivalent fluid pressures of 40 and 55 pounds per cubic foot per foot of depth may be used for freestanding level backfill and restrained level backfill conditions, respectively.

For dynamic lateral earth pressure considerations, a dynamic lateral force of $22H^2$ pounds per lineal foot of wall length may be used for level backfill conditions where walls are free to move laterally up to 1 to 2 inches or rotate in the event of an earthquake. The dynamic lateral force may be assumed to act through the mid-height of the wall.

Abutment Stiffness - An abutment backfill stiffness of 4 kips per square foot per inch of deflection may be assumed for resistance to lateral loads in the longitudinal direction during a seismic event. Maximum lateral resistance of the abutment backfill should be limited to 5 kips per square foot.

Drilled Shafts - Drilled shafts may also be used to provide additional lateral resistance at the abutments. Recommendations are based on the use of 5-foot diameter drilled shafts. Based on preliminary design, a row of 4 drilled shafts will be constructed behind Abutment No. 1 and a row of 3 drilled shafts will be constructed behind Abutment No. 2. The drilled shafts at Abutment No. 1 will be spaced about 14 and 18.5 feet apart, and the drilled shafts at Abutment No. 2 will be spaced 12.5 feet apart.

Although the drilled shafts will be connected to the abutments, we understand that the intent of the drilled shafts is primarily to provide additional lateral support to the abutment in a seismic event.

Based on our test borings, hard basalt was encountered at depths of approximately 36 and 47 feet below road grade, and in order to avoid potential rigid body behavior of short shaft under lateral loads, we recommend that the drilled shafts be socketed a minimum 10 feet into hard basalt. The actual lengths of the drilled shafts will need to be determined during construction. For cost estimating purposes, drilled shaft lengths of about 40 and 50 feet may be assumed at Abutments Nos. 1 and 2, respectively.

Lateral capacities of the drilled shafts will depend on the stiffness of the surrounding soil, the stiffness of the drilled shaft, the boundary condition at the top of the drilled shafts, and the acceptable horizontal displacement of the shafts.

Lateral capacities of the drilled shaft in the direction pushed into the slope will be different from those pushed away from slope in the longitudinal direction. In addition, due to the close proximity of the drilled shafts to the abutment walls and footings, the passive wedge of the abutments and drilled shafts will overlap when pushed into the slope. As a result, for our analysis, soil resistance along the portion of drilled shaft above the existing abutment footings was reduced in computing the lateral resistance of the drilled shaft when pushed into the slope. However, lateral capacities of drilled shaft, ignoring the potential effects from the passive wedge of the abutment walls and footings are also provided for comparison.

For our analysis, an axial load of 75 kips was assumed. In addition, a concrete compressive strength of 5,000 psi and a cracked section equal to 50% of the gross uncracked section were used in the analysis.

Results of lateral load analyses for deflection of 0.5, 1, and 1.5 inches at the top of drilled shaft are presented on Plates C1.1 and C1.2.

Drilled Shaft Construction - Excavations for the drilled shafts can be expected to extend through surface soil, weathered rock, and hard rock. Rock drilling and coring equipment, as well as tools necessary for removal of the cored material, may be required for drilled shaft excavations extending into the hard basalt.

We do not expect that casing will be required for construction of the drilled shafts. However if the excavated walls of the drilled shafts are sloughing and subject to collapse, temporary, non-corrugated steel casing should be used. The use of permanent casing will not be allowed.

The bottom of the drilled hole should be cleaned prior to placement of concrete. The concrete should be placed as soon as practical upon completion of the drilled shaft excavations. If water was allowed to accumulate at the bottom of the drilled shaft

excavation, concrete placed below the water level should be tremied through a pipe discharging below the surface of fresh concrete

Load Testing - Since the drilled shafts will not need to support axial loads, static load testing of the drilled shafts will not be required.

Integrity Testing - Crosshole Sonic Logging (CSL) tests should be performed on all production drilled shafts as part of the quality control for drilled shaft construction. The downhole CSL method is a non-destructive integrity test that is based on the propagation of sound waves through concrete to assess the homogeneity of the drilled shafts, and to determine the location of anomalies, if any, in the concrete. The test should be performed in general accordance with ASTM D 6760.

To facilitate the CSL testing, access tubes should be embedded into the drilled shaft to allow the CSL probes, designed for receiving and transmitting ultrasonic waves, to enter the shaft. For the 60-inch diameter drilled shafts, we recommend a minimum of 5 equally spaced and parallel access tubes per drilled shaft. The access tubes should consist of standard steel pipe with a minimum inside diameter of 2 inches extending from the bottom of the drilled shaft reinforcing cage to at least 3 feet above the top of the drilled shaft. The couplings and bottom cap of the access tubes should be watertight. The joints constructed along the full length of the access tubes should not hinder the passage of the CSL probes. The tubes should be filled with potable water as soon as possible but no later than 4 hours after concrete placement. We also recommend that the top of the tubes be covered with removable caps to keep out debris which may obstruct the free passage of the CSL probes.

The CSL testing should be performed after the concrete of the drilled shaft has cured for at least 4 days. However, in order to reduce the potential for undesirable loss of ultrasonic energy due to de-bonding between the access tube and the surrounding concrete, we recommend that CSL tests be performed no later than 14 days after the

concrete placement. The access tubes should be filled with grout of the same strength as the drilled shaft after completion of the CSL tests.

In the event anomalies are detected by CSL testing, coring of the drilled shaft may be required to further evaluate the integrity of the concrete in the drilled shaft.

Piers 1 and 2

Foundations - Spread footings founded on hard basalt may be used to support the proposed concrete pier structures. Foundations may be designed for a bearing value of 13,000 pounds per square foot under strength limit state and 30,000 pounds per square foot under extreme event limit state. A bearing value of 10,000 pounds per square foot may be used to evaluate the design of the foundations at service limit state.

Footings should be embedded a minimum 12 inches into the stratum of hard basalt. The bottom of footing excavations should be thoroughly cleaned of loose material prior to placement of reinforcing steel and concrete. Less hard, completely weathered material exposed at the bottom of footing excavations should be removed down to hard rock and replaced with concrete. Footings located on, or near the top of slopes, should be embedded such that a minimum horizontal distance of 5 feet is maintained between the bottom edge of footing and slope face.

Settlement of footings founded directly on hard basalt is expected to be negligible.

Lateral Design - Resistance to lateral loading may be provided by friction acting at the base of foundations and by passive earth pressure acting on the buried portions of foundations.

Coefficients of friction of 0.6 and 0.7 may be used with the dead load forces to compute the friction acting at the base of foundations for strength limit state, and

extreme event limit state, respectively. Passive earth pressure for hard basalt may be computed as an equivalent fluid having a density of 400 and 800 pounds per cubic foot for strength limit state and extreme event limit state, respectively. Unless covered by pavement or concrete slabs, the upper 12 inches of rock should not be considered in computing lateral resistance.

The recommended coefficients of friction and passive pressures assumed that the footing is poured neat against the hard basalt.

Probing and Grouting - Although not encountered in our test borings, cavities or voids can be expected in the underlying basalt strata. As precautionary measure, we therefore recommend that a probing and grouting program be implemented prior to construction of the foundations.

All footing excavations should be probed with a drill or air track hammer. Probe holes should be drilled for every 100 square feet of foundation area. The holes should be a minimum 2 inches in diameter and extend to depths at least twice the footing width or a minimum 10 feet below the bottom of footings.

All probe holes should be filled with low strength sand-cement grout pumped under low to moderate pressure discharged through a grout pipe starting at the bottom of the probe hole. Placement of thin-wall plastic pipes in probe holes may be necessary to prevent holes from caving. Areas encountering large clinker pockets or voids that consume large quantities of grout may require additional probe holes. Voids encountered at the bottom of foundation excavations should be exposed and filled with lean concrete.

Pier 3

Foundations - Although hard basalt was encountered in our test boring at a depth of about 11 feet at the site of Pier 3, the use of a spread footing is not recommended

since the pier is situated on a steep slope. As a result, micropiles embedded into hard basalt are recommended for support of the new pier.

In general, micropiles consist of small-diameter, drilled, and grouted in-place piles. The load bearing capacity of a micropile is provided structurally by the steel reinforcement, and geotechnically by the soil-grout bond zone. The steel reinforcement may consist of standard concrete reinforcing steel bars, continuous-threaded steel bars, continuous-threaded hollow-core steel bars, steel pile casing, or a combination of steel casings and reinforcing steel bars. Construction of micropile foundations generally consist of drilling a borehole, placing the reinforcement, and grouting the bore hole.

For this project, 7-inch diameter (outside diameter) micropiles with permanent steel casing and a reinforcing bar at the center are recommended. The micropiles should extend through the surface clayey silt and completely weathered rock, and be embedded into the underlying hard basalt layer.

The permanent steel casing should have a minimum thickness of 0.45 inch. The steel casing should extended from the top of pile to about 36 inches into the bearing layer or a minimum 10 feet, and uncased thereafter. The intent of the steel casing is to provide confinement to the cement grout and added flexural stiffness to the micropile where the bending moment and shear stresses are expected to be high. The micropiles will derive most of their load bearing capacity in friction from rock-grout bond in the uncased section extending into the hard basalt. 7-inch diameter micropiles with 15 feet of rock-grout bond length may be designed to support axial bearing loads of 150 kips and 220 kips for strength limit state and extreme event limit state, respectively. The micropiles may be also designed for an uplift load resistance of 75 kips and 150 kips for strength limit state and extreme event limit state, respectively.

The micropiles should be spaced a minimum of 30 inches on centers. As indicated earlier, the micropiles should extend a minimum 18 feet into the hard basalt (3 feet cased length plus 15 feet rock-grout bond length). The actual piles lengths can be expected to vary between pile locations, however, for preliminary cost estimating purposes, a pile length of 25 feet may be assumed.

Settlement of micropiles embedded into hard basalt is expected to be negligible.

Micropile Construction - Hard basalt with occasional highly weathered seams and clinkers are expected underlying site at shallow depths. The selected micropile system should be able to drill through the surface soil and the underlying hard basalt. The micropile installation should include drilling and casing the hole to the tip elevation, cleaning out all loose material in the drilled hole, installation of the reinforcing bar, grouting under pressure, and pull-out of the casing in the bottom 15 feet of the hole.

The reinforcing bar should be centered in the micropile drilled hole by centralizers and should extend through the cased section down to the bottom of the hole. The drilled hole and casing should be completely grouted using a tremie pipe. Each micropile should be constructed in one continuous pour.

Micropile Load Tests - Prior to construction of production micropiles, we recommend that static load tests be performed on sacrificial micropiles to confirm the load bearing capacity of the subsurface soils, as well as to verify the adequacy of the contractor's drilling, installation, and grouting operations. Based on the project requirements, we recommend one pre-production uplift and one pre-production compression load test be performed.

The pile load tests, which tests the micropile in compression and tension, should be conducted in general conformance to ASTM D1143 "Quick" test procedures, and the

pile should be loaded to at least 100 percent of the design compression and uplift loads at extreme event limit state. The location of the load test pile can be determined after review of the micropile layout plan. In addition, at least 10 percent of the production micropiles should also be proof tested during construction.

Lateral Design - Resistance to lateral loading at Pier 3 may be provided by the lateral resistance of the micropiles. In addition to vertical micropiles, battered micropiles are recommended to provide increase lateral support. We understand that 1H:2V battered micropiles will be used to provide lateral support in the transverse direction. Results of lateral load analyses based on load combinations and pile group configuration provided by the project structural engineer are presented on Plates C2.1 through C2.8. The project structural engineer should verify the structural capacity of the micropile to support the induced shear, moment, and stresses.

We understand that lateral support of the Pier 3 foundation in the longitudinal direction will be provided by horizontal ground anchors in the away from slope direction and by passive earth pressure in the into slope direction. Passive earth pressure may be computed as an equivalent fluid having a density of 220 and 440 pounds per cubic foot for strength limit state and extreme event limit state, respectively. The backfill around the pile cap should be well compacted or the concrete of the pile cap should be poured neat against undisturbed on site materials.

Ground Anchors - As indicated above, horizontal ground anchors will be used to provide lateral support in the longitudinal, out of slope direction. Based on our test borings, we anticipate that ground anchors installed behind Pier 3 will encounter the surface soil, weathered rock, and hard, moderately weathered basalt. An average soil-grout bond strength of 1,500 pounds per square foot and a resistance factor of 0.7 may be assumed for design. We recommend that ground anchors be designed with a minimum unbonded length of 15 feet. The anchor bond length should also be a

minimum 15 feet in length. A minimum anchor spacing of 5 feet on centers is recommended. Anchors should be designed at a minimum declination of 15 degrees from horizontal. All ground anchors should be proof tested during construction.

Seismic Design

Recommendations for Site Class classification and design response spectrum are presented on Plates D1.1 and D1.2.

Bridge Approach Slabs

Approach slabs behind the bridge abutments are recommended. The slabs should be underlain by at least 6 inches of aggregate base course. The base course and subgrade should be compacted to a minimum 95 percent compaction as determined by AASHTO T-180 (ASTM D 1557).

Design Scour at Piers 1 and 2

Based on our laboratory test results, a D_{50} of 1 millimeter and a D_{90} of 38 millimeters may be assumed for the surface soil above the hard basalt at Piers 1 and 2. Based on our borings, the average Rock Quality Designation (RQD) of the basalt cores in the upper section of the basalt layer is greater than 50 percent and the unconfined compression strength of the rock core is generally greater than 5000 psi. Based on the 1991 memorandum for FHWA titled "Scourability of Rock Formation", it is our opinion that the hard basalt at Piers 1 and 2 has a low erodibility potential.

Reinforced Soil Slopes

Temporary cuts into the existing steep slopes will be required for construction of the pier foundations and the cuts will be backfilled after construction of the foundations. Due to the area constrains, fill slope gradients as steep as 1H:1V will be required in order for the fill slope transitioned into the existing steep slopes. Based on the

grading plans, the fill slopes, constructed over the pier foundations, will generally be on the order of about 15 to 18 feet in height and about 50 to 80 lineal feet in width.

In order to improve the stability of the backfill slopes, we recommend that the fill slopes be reinforced with geogrids. In general, geogrid reinforced slopes consist of fill slope with layers of geogrids used to strengthen the fill soil. Recommended geogrids for the new fill slope will consist of primary reinforcement and intermediate geogrids. The primary reinforcement geogrids will be used to strengthen the new fill slope and should have a minimum allowable tensile strength of 1,000 pounds per foot, such as the Tensar's UX1000HS or equivalent. The geogrids, spaced about 3 feet in vertical spacing, should be a minimum 12 feet in length or extending to the back of the fill slope which ever is less.

Intermediate geogrid layers, consisting of geogrids such as the Tensar's biaxial BX1100 or equivalent, should be a minimum 4 feet in length and sandwiched between the primary reinforcement layers. The intent of the intermediate geogrid layers is to ensure stability at the slope face.

The geogrids should be handled with care and placed in accordance with the manufacturer's recommendations. To provide continuity in reinforcement, the geogrids should be connected or spliced following the manufacturer's guidelines. Tracked construction equipment should not be operated directly on the geogrids. In general, a minimum of 6 inches of fill over the geogrids is recommended prior to operating any construction equipment over the geogrids.

The reinforced fil should consist of imported granular structural fill material with angle of internal friction of at least 34 degrees.

Site Grading

Site Preparation - The project site should be cleared of all vegetation, large tree roots, and other deleterious material. Prior to placement of fill, the existing ground should first be scarified to a depth of six inches, moistened to about 2 percent above optimum moisture content, and compacted to a minimum 90 percent compaction as determined by AASHTO T-180 (ASTM D 1557). Due to the relatively high in-situ moisture contents and the poor workability associated with volcanic ash, compaction of the clayey silt derived from volcanic ash to the conventional 90 percent compaction will be difficult. In lieu of this, we recommend a minimum compaction standard for the subgrade soil, equivalent to 100 percent of the wet density determined at the soil's in-situ moisture content in areas exposing the clayey silt/volcanic ash at subgrade level. Underlying soft or loose soils, indicated by pumping conditions, should be removed and replaced with either approved onsite material or imported granular structural fill.

Structural Excavation - Temporary cuts exposing the clayey silt and completely weathered rock should be stable at gradients of 1H:1V or flatter for temporary conditions. Cuts extending into the underlying hard basalt should be able to stand at a steeper slope gradient of about 1/4H :1V or flatter. However, the contractor should be responsible for conforming to OSHA safety standards for excavations.

The excavation adjacent to existing foundations should be adequately shored to reduce the potential for damage to the structures caused by earth movement toward the excavation or loss of support due to undermining.

Onsite Fill Material - Due to its relatively high in-situ moisture contents and poor workability, the onsite surface clayey silt/volcanic ash will not be acceptable for reuse in structural fills and backfills for structures. Reuse of the onsite clayey silt/volcanic ash should be limited to general fill areas. All rock fragments larger

than 6 inches in maximum dimension should be removed prior to reuse of the material.

Imported Fill Material - Imported structural fill should be well-graded, non-expansive granular material. Specifications for imported granular structural fill should indicate a maximum particle size of 3 inches, and state that between 8 and 20 percent of soil by weight shall pass the #200 sieve. In addition, the plasticity index (P.I.) of that portion of the soil passing the #40 sieve shall not be greater than 10. Imported fill should also have a minimum CBR value of 20 and a CBR expansion potential no greater than 1.0 percent when tested in accordance with AASHTO T-193 (ASTM D 1883).

Compaction - All fill placement should be in accordance with the Hawaii Standard Specifications for Road and Bridge Construction. Fill placed in areas which slope steeper than 5H:1V should be continually benched as the fill is brought up in lifts.

ADDITIONAL SERVICES

We recommend that we perform a general review of the final design plans and specifications. This will allow us to verify that the foundation design and earthwork recommendations have been properly interpreted and implemented in the design plans and construction specifications.

For continuity, we recommend that we be retained during construction to (1) observe the construction of drilled shafts and micropiles, including all drilling and concrete placement operations, as well as load testing, (2) observe probing and grouting operations in foundation areas, (3) observe footing excavations prior to placement of reinforcing steel and concrete, (4) observe structural fill and backfill fill placement and perform compaction testing, (5) review and/or perform laboratory testing on import borrow to determine its acceptability for use in compacted fills, and (6) provide geotechnical consultation as required. Our services during construction will

allow us to verify that our recommendations are properly interpreted and included in construction, and if necessary, to make modifications to those recommendations, thereby reducing construction delays in the event subsurface conditions differ from those anticipated.

LIMITATIONS

The boring logs indicate the approximate subsurface soil conditions encountered only at those times and locations where our test borings were made, and may not represent conditions at other times and locations.

This report was prepared specifically for Nagamine Okawa Engineers, Inc. and their sub-consultants for design of the Rehabilitation of Umauma Stream Bridge in North Hilo, Hawaii. The boring logs, laboratory test results, and recommendations presented in this report are for design purposes only, and are not intended for use in developing cost estimates by the contractor.

During construction, should subsurface conditions differ from those encountered in our test borings, we should be advised immediately in order to re-evaluate our recommendations, and to revise or verify them in writing before proceeding with construction.

Our recommendations and conclusions are based upon the site materials observed, the preliminary design information made available, the data obtained from our site exploration, our engineering analyses, and our experience and engineering judgement. The conclusions and recommendations are professional opinions which we have strived to develop in a manner consistent with that level of care, skill, and competence ordinarily exercised by members of the profession in good standing, currently practicing under similar conditions in the same locality. We will be responsible for those recommendations and conclusions, but will not be responsible

for the interpretation by others of the information developed. No warranty is made regarding the services performed under this agreement, either express or implied.

Respectfully submitted,

HIRATA & ASSOCIATES, INC.

Con C. Truong, P.E.

CON C. TRUONG
LICENSED PROFESSIONAL ENGINEER
No. 9019-C
HAWAII, U.S.A.

This work was prepared by me or under my supervision
Expiration Date of License:
April 30, 2012

APPENDIX A

FIELD INVESTIGATION

DESCRIPTION OF FIELD INVESTIGATION

GENERAL

The site was explored between March 2, 2010 and April 7, 2010, by performing a visual site reconnaissance and drilling 5 exploratory test borings to depths ranging from about 48 to 76.5 feet with a CME 55 truck-mounted drill rig and portable drilling equipments..

During drilling operations, the soils were continuously logged by our field engineer and classified by visual examination in accordance with the Unified Soil Classification System. The boring logs indicate the depths at which the soils or their characteristics change, although the change could actually be gradual. If the change occurred between sample locations, the depth was interpreted based on field observations. Classifications and sampling intervals are shown on the boring logs. A Boring Log Legend is presented on Plate A3.1; the Unified Soil Classification and Rock Weathering Classification Systems are shown on Plates A3.2 and A3.3, respectively. The soils encountered are logged on Plates A4.1 through A4.14.

Boring locations were located in the field by measuring/taping offsets from existing site features shown on the plans. The accuracy of the boring locations shown on Plates A2.2 and A2.3 are therefore approximate, in accordance with the field methods used. Ground surface elevations at boring locations were estimated using a topographic survey map prepared by ControlPoint Surveying, Inc.

SOIL SAMPLING

Representative soil samples and core samples of basalt and boulders were recovered from the borings for selected laboratory testing and analyses. Representative samples were recovered by driving a 3-inch O.D. split tube sampler a total of 18 inches with a 140-pound hammer dropped from a height of 30 inches. The number of blows required to drive the 3-inch O.D. split tube sampler the final 12 inches as well as

blows counts from standard split spoon sampler are recorded at the appropriate depths on the boring logs, unless noted otherwise.

Core samples were obtained by drilling with an NX core barrel having an inside diameter of 2.1 inches. The depths and recovery percentages for each core run are shown on the enclosed Boring Logs. The rock quality designation (RQD) for each core run is also shown on the Boring Logs. This is a modified core recovery percentage which takes into account the number of fractures observed in the core samples. Only pieces of core 4 inches in length or longer, as measured along the centerline, were included in the determination of this modified core recovery percentage. Fractures caused by drilling or handling were ignored.

The following is a general correlation between RQD percentages and rock quality.

RQD (%)	Description of Rock Quality
0 - 25	Very Poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

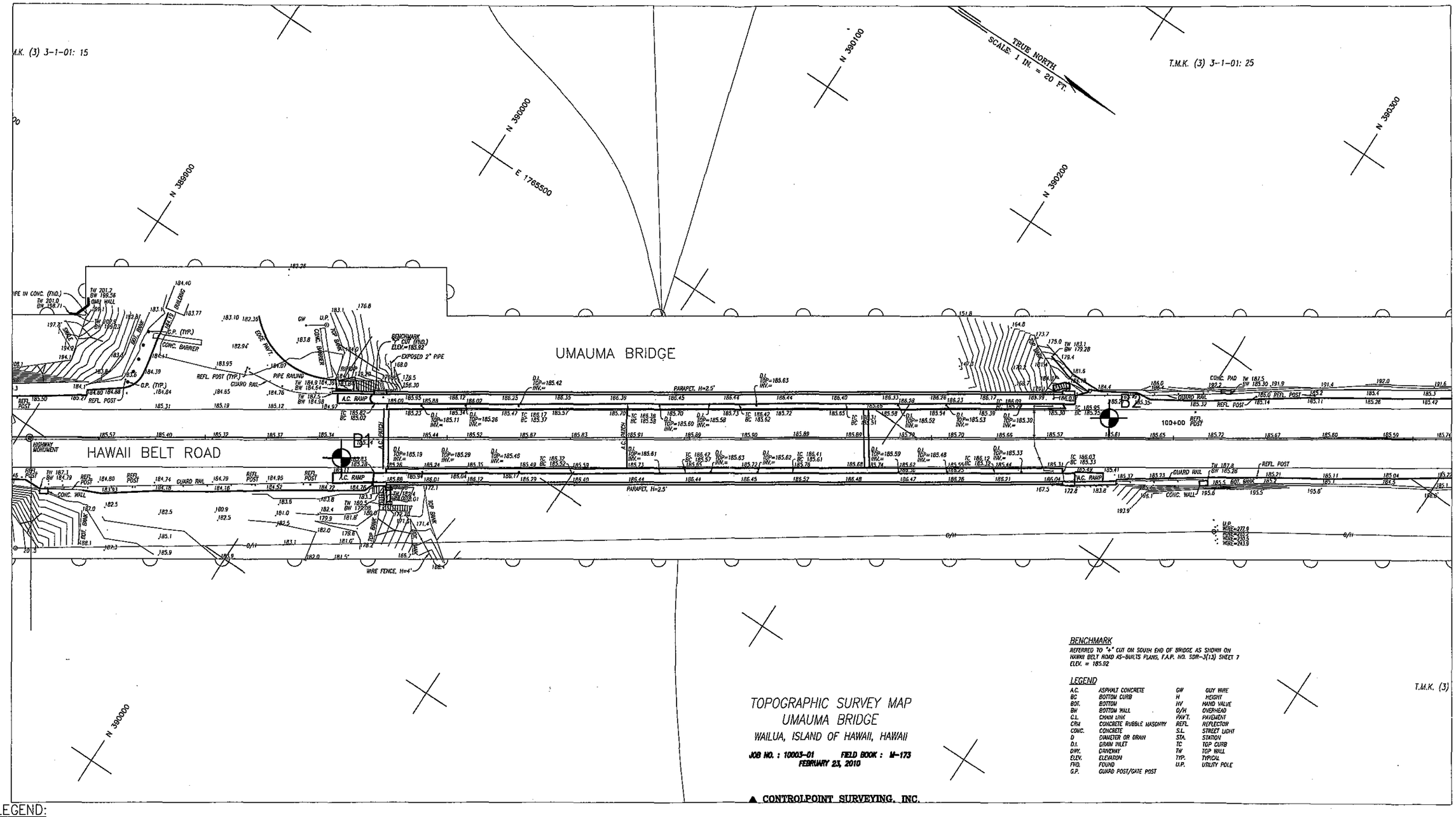
Reference: Tunnel Engineering Handbook, Second Edition, edited by J.O. Bickel, T.R. Kuesel, and E.H. King, 1996.

2000 1000 0 2000 FT.

GRAPHIC SCALE

Reference: Topographic quadrangle map prepared by the United States Department of the Interior Geologic Survey Papaaloa Quadrangle, Hawaii County, Hawaii. 1980.

W.O. 10-4890	Umauma Stream Bridge Rehabilitation, North Hilo
Hirata & Associates, Inc.	LOCATION MAP Plate A2.1



TOPOGRAPHIC SURVEY MAP
UMAUMA BRIDGE
WAILUA, ISLAND OF HAWAII, HAWAII

JOB NO. : 10003-01 FIELD BOOK : M-173
FEBRUARY 23, 2010

▲ CONTROLPOINT SURVEYING, INC.

BENCHMARK

REFERRED TO "+" CUT ON SOUTH END OF BRIDGE AS SHOWN ON HAWAII BELT ROAD AS-BUILTS PLANS, F.A.P. NO. SDR-3(13) SHEET 7
ELEV. = 185.92

LEGEND

A.C.	ASPHALT CONCRETE	GW	GUY WIRE
BC	BOTTOM CURB	H	HEIGHT
BOT.	BOTTOM	HV	HAND VALVE
BW	BOTTOM WALL	O/H	OVERHEAD
C.L.	CHAIN LINK	PAV'T.	PAVEMENT
CRM	CONCRETE RUBBLE MASONRY	REFL.	REFLECTOR
CONC.	CONCRETE	S.L.	STREET LIGHT
D	DIAMETER OR DRAIN	STA.	STATION
D.I.	DRAIN INLET	TC	TOP CURB
DWY.	DRIVEWAY	TW	TOP WALL
ELEV.	ELEVATION	TYP.	TYPICAL
FND.	FOUND	U.P.	UTILITY POLE
G.P.	GUARD POST/GATE POST		

LEGEND:

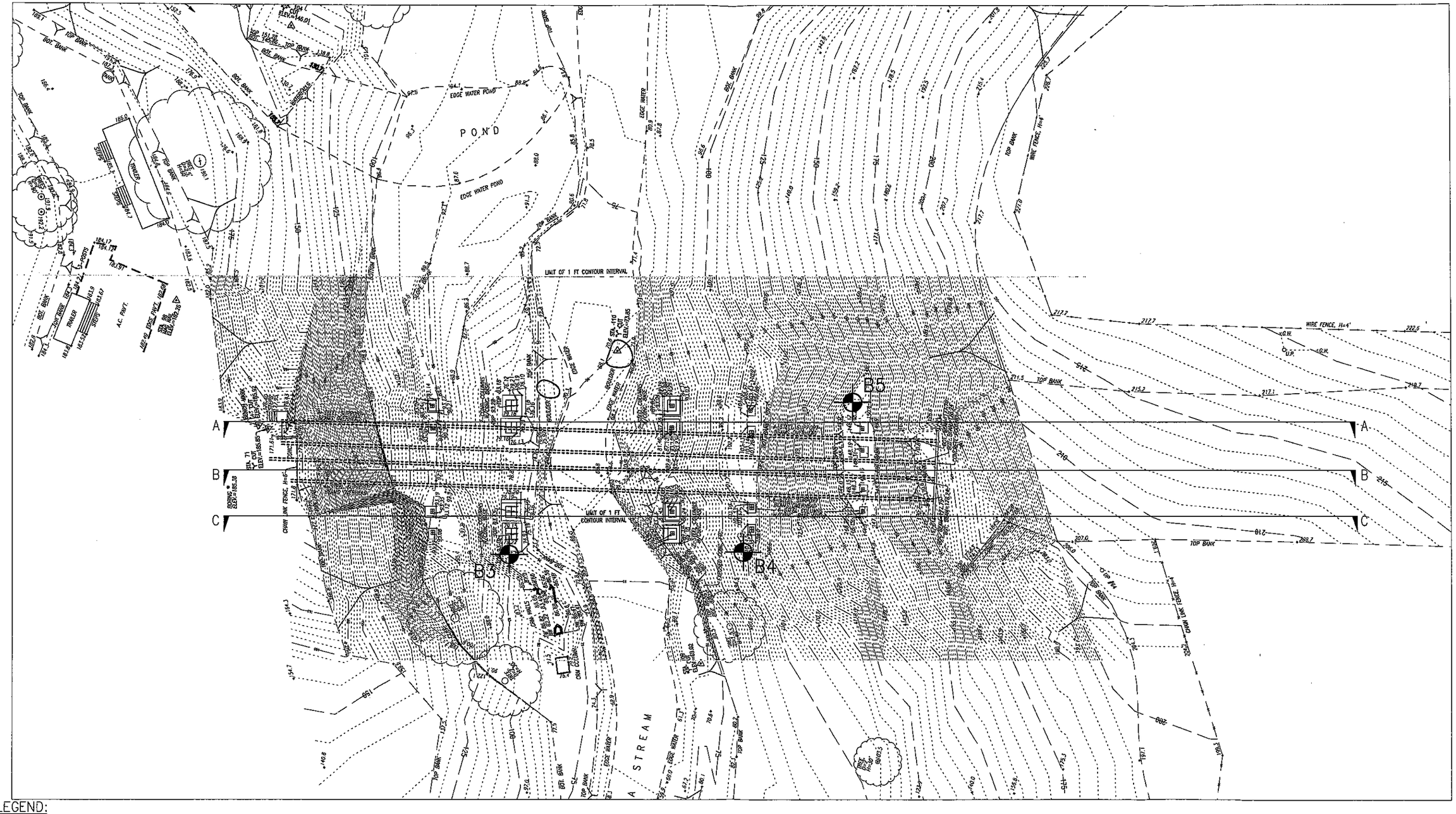
Approximate location of borings

Reference: Topographic Survey Map prepared by ControlPoint Surveying, Inc.

GRAPHIC SCALE:
0 20 40 80 FT.
1" = 40'

W.O. 10-4890	Umauma Stream Bridge Rehabilitation, North Hilo
Hirata & Associates, Inc.	BORING LOCATION PLAN

Plate A2.2



LEGEND:

Approximate location of borings

Reference: Topographic Survey Map prepared by ControlPoint Surveying, Inc.

GRAPHIC SCALE:

0 20 40 80 FT.

1" = 40'

W.O. 01-4890	Umauma Stream Bridge Rehabitation, North Hilo
Hirata & Associates, Inc.	BORING LOCATION PLAN

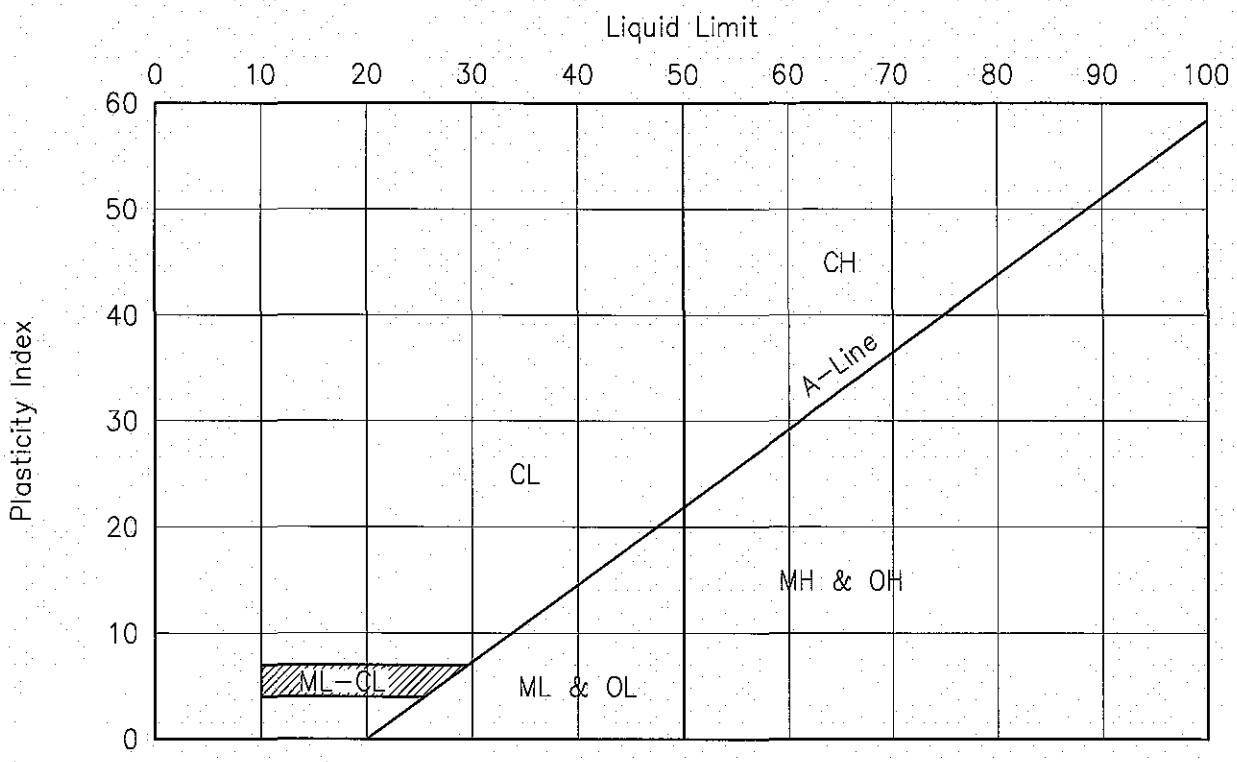
Plate A2.3

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of the material is LARGER than No. 200 sieve size.)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size.)	CLEAN GRAVELS (Little or no fines.)	GW	Well graded gravels, gravel–sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel–sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amt. of fines.)	GM	Silty gravels, gravel–sand–silt mixtures.
			GC	Clayey gravels, gravel–sand–clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size.)	CLEAN SANDS (Little or no fines.)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amt. of fines.)	SM	Silty sands, sand–silt mixtures.
			SC	Clayey sands, sand–clay mixtures.
FINE GRAINED SOILS (More than 50% of the material is SMALLER than No. 200 sieve size.)	SILTS AND CLAYS (Liquid limit LESS than 50.)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50.)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic soils.
				FRESH TO MODERATELY WEATHERED BASALT
				VOLCANIC TUFF / HIGHLY TO COMPLETELY WEATHERED BASALT
				CORAL

SAMPLE DEFINITION		
2" O.D. Standard Split Spoon Sampler	Shelby Tube	RQD Rock Quality Designation
3" O.D. Split Tube Sampler	NX / PQ/ 4" Coring	Water Level

W.O. 10–4890	Umauma Stream Bridge Rehabilitation, North Hilo
Hirata & Associates, Inc.	BORING LOG LEGEND Plate A3.1

PLASTICITY CHART



GRADATION CHART

COMPONENT DEFINITIONS BY GRADATION	
COMPONENT	SIZE RANGE
Boulders	Above 12 in.
Cobbles	3 in. to 12 in.
Gravel	3 in. to No. 4 (4.76 mm)
Coarse gravel	3 in. to 3/4 in.
Fine gravel	3/4 in. to No. 4 (4.76 mm)
Sand	No. 4 (4.76 mm) to No. 200 (0.074 mm)
Coarse sand	No. 4 (4.76 mm) to No. 10 (2.0 mm)
Medium sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and clay	Smaller than No. 200 (0.074 mm)

W.O. 10-4890	Umauma Stream Bridge Rehabilitation, North Hilo
Hirata & Associates, Inc.	UNIFIED SOIL CLASSIFICATION SYSTEM Plate A3.2

Grade	Symbol	Description
Fresh	F	No visible signs of decomposition or discoloration. Rings under hammer impact.
Slightly Weathered	WS	Slight discoloration inwards from open fractures, otherwise similar to F.
Moderately Weathered	WM	Discoloration throughout. Weaker minerals such as feldspar decomposed. Strength somewhat less than fresh rock but cores cannot be broken by hand or scraped by knife. Texture preserved.
Highly Weathered	WH	Most minerals somewhat decomposed. Specimens can be broken by hand with effort or shaved with knife. Core stones present in rock mass. Texture becoming indistinct but fabric preserved.
Completely Weathered	WC	Minerals decomposed to soil but fabric and structure preserved (Saprolite). Specimens easily crumbled or penetrated.
Residual Soil	RS	Advanced state of decomposition resulting in plastic soils. Rock fabric and structure completely destroyed. Large volume change.

Reference: Soils Mechanics, NAVFAC DM-7.1, Department of the Navy, Naval Facilities Engineering Command, September, 1986.

W.O. 10-4890	Umauma Stream Bridge Rehabilitation, North Hilo
Hirata & Associates, Inc.	ROCK WEATHERING CLASSIFICATION SYSTEM Plate A3.3

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 10-4890

BORING NO. B1 DRIVING WT. 140 lb. START DATE 3/2/10

SURFACE ELEV. 185±* DROP 30 in. END DATE 3/4/10

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0						Clayey SILT (MH) – Mottled brown, moist, medium stiff, with sand and gravel. (Fill) Covered by 8 inches of asphaltic concrete over 8 inches of base material.
		☐	11	76	34	
		☐	7	77	32	
5						
		☐	8	76	40	
10						
		☐	12	103	23	
15						
		☐	19	85	23	
20						
		☐	9	105	27	
25						
		☐	9	64	53	Clayey SILT (MH) – Mottled brown, moist, medium stiff. (Completely Weathered Rock)
30						

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 10-4890

BORING NO. B1 (continued) DRIVING WT. 140 lb. START DATE 3/2/10
SURFACE ELEV. 185± DROP 30 in. END DATE 3/4/10

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
30						
			14	62	59	
35						
						BASALT (WS) – Gray, dense to hard, fractured.
40						Begin NX coring at 39 feet. 97% Recovery from 39 to 42 feet. RQD = 56% 80% Recovery from 42 to 47 feet. RQD = 48%
45						Highly weathered from 45.5 feet to 53 feet, dense to medium hard. 25% Recovery from 47 to 52 feet. RQD = 0%
50			35/6" 50/2"			
55						60% Recovery from 53.5 to 58.5 feet. RQD = 45% Moderate to highly fractured from 57 feet.
60						57% Recovery from 58.5 to 63.5 feet. RQD = 20%

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 10-4890

BORING NO. B1 (continued) DRIVING WT. 140 lb. START DATE 3/2/10
SURFACE ELEV. 185± DROP 30 in. END DATE 3/4/10

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
60						Highly fractured, with clinkers from 62 to 72 feet.
65						47% Recovery from 64.5 to 69.5 feet. RQD = 0%
70			35			70% Recovery from 71.5 to 76.5 feet. RQD = 28% moderately weathered, hard from 72 feet.
75						
						End boring at 76.5 feet.
						Neither groundwater nor seepage water encountered.
80						* Elevations based on topographic survey maps prepared by ControlPoint Surveying, Inc., dated February 23, 2010.
85						
90						

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 10-4890

BORING NO. B2 DRIVING WT. 140 lb. START DATE 3/15/10

SURFACE ELEV. 185± DROP 30 in. END DATE 3/17/10

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0						Clayey SILT (MH) – Mottled brown, moist, stiff, with sand and gravel. (Fill) Covered by 7 inches of asphaltic concrete over 10 inches of base material.
		☐	42	96	30	
		☐	22	96	18	
5						Very moist at 6 feet.
		☐	17/6" 50/6"	84	37	
10						
		☐	14	57	62	COMPLETELY WEATHERED ROCK – Mottled brown, moist, medium dense.
15						
		☐	50/2"	Tip Recovery		Moderately weathered, dense to medium hard from 18 to 25 feet.
20						
		☐	32/6" 58/6"	105	16	
25						
		☐	17	76	46	
30						

Plate A4.4

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 10-4890

BORING NO. B2 (continued) DRIVING WT. 140 lb. START DATE 3/15/10

SURFACE ELEV. 185± DROP 30 in. END DATE 3/17/10

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
30						
		☐	25	74	33	
35						
		☐	22	58	82	
40						
		☐	50/3"	60	60	Dense to medium hard at 43 feet.
45						
						BASALT (WS) – Gray, hard, slightly weathered.
						Begin NX coring at 48 feet. 97% Recovery from 48 to 53 feet. RQD = 82%
50						
						60% Recovery from 53 to 58 feet. RQD = 40%
55						Clinker at 55 to 57 feet.
						95% Recovery from 58 to 63 feet. RQD = 72%
60						

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 10-4890

BORING NO. B2 (continued) DRIVING WT. 140 lb. START DATE 3/15/10
SURFACE ELEV. 185± DROP 30 in. END DATE 3/17/10

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
60						
						88% Recovery from 63 to 68 feet. RQD = 50%
65						
						100% Recovery from 68 to 70 feet. RQD = 88%
70						End boring at 70 feet.
						Neither groundwater nor seepage water encountered in the boring.
75						
80						
85						
90						

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 10-4890

BORING NO. B3 DRIVING WT. 140 lb. START DATE 4/5/10

SURFACE ELEV. 76± DROP 30 in. END DATE 4/7/10

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0						BASALT (WS) – Gray, hard, slight to moderately fractured, slightly weathered. Begin NX coring from surface. 97% Percent recovery from 0 to 5 feet. RQD = 68%
5						100% Recovery from 5 to 10 feet. RQD = 72%
10						100% Recovery from 10 to 15 feet. RQD = 72%
						Moderate to highly fractured from 12 to 20 feet.
15						100% Recovery from 15 to 20 feet. RQD = 17%
20						100% Recovery from 20 to 25 feet. RQD = 97%
25						100% Recovery from 25 to 30 feet. RQD = 77%
▽						Brown, highly fractured, moderately weathered at 29 feet.
30						

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 10-4890

BORING NO. B3 (continued) DRIVING WT. 140 lb. START DATE 4/5/10

SURFACE ELEV. 76± DROP 30 in. END DATE 4/7/10

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
30						100% Recovery from 30 to 35 feet. RQD = 75%
35						100% Recovery from 35 to 40 feet. RQD = 82%
40						100% Recovery from 40 to 45 feet. RQD = 43% Moderately fractured, with clinkers from 41 to 50 feet.
45						100% Recovery from 45 to 50 feet. RQD = 42%
50						97% Recovery from 50 to 55 feet. RQD = 52%
						Reddish brown, highly weathered from 52 to 54 feet.
55						88% Recovery from 55 to 60 feet. RQD = 80%
60						

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 10-4890

BORING NO. B3 (continued) DRIVING WT. 140 lb. START DATE 4/5/10
SURFACE ELEV. 76± DROP 30 in. END DATE 4/7/10

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
60						100% Recovery from 60 to 65 feet. RQD = 32% Moderately fractured, with weathered seams from 62 to 64 feet.
65						97% Recovery from 65 to 70 feet. RQD = 72%
70						End boring at 70 feet.
						Groundwater encountered at 29 feet at 10:15 am on 4/8/10.
75						
80						
85						
90						

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 10-4890

BORING NO. B4 DRIVING WT. 140 lb. START DATE 3/29/10

SURFACE ELEV. 100± DROP 30 in. END DATE 3/31/10

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0						Clayey SILT (MH) – Brown, moist, medium stiff, with gravel. (Volcanic Ash)
			10	53	47	
5			10	66	41	
			12	85	21	
10						Boulder at 11 feet.
15						BASALT (WS) – Gray, hard, slightly weathered. Begin NX coring at 12.5 feet. 76% Recovery from 12.5 to 17.5 feet. RQD = 47% Moderately fractured from 12.5 to 17.5 feet.
						93% Recovery from 17.5 to 22.5 feet. RQD = 52%
20						
						98% Recovery from 22.5 to 27.5 feet. RQD = 83%
25						
						100% Recovery from 27.5 to 32.5 feet. RQD = 95%
30						

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 10-4890

BORING NO. B4 (continued) DRIVING WT. 140 lb. START DATE 3/29/10
SURFACE ELEV. 100± DROP 30 in. END DATE 3/31/10

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
30						
						100% Recovery from 32.5 to 36.5 feet. RQD = 100%
35						
						100% Recovery from 37.5 to 42.5 feet. RQD = 100%
40						
						100% Recovery from 42.5 to 47.5 feet. RQD = 95%
45						
						100% Recovery from 47.5 to 52.5 feet. RQD = 95%
50						
						100% Recovery from 52.5 to 57.5 feet. RQD = 92%
55						
						Reddish brown, moderate to highly weathered from 56 to 63 feet.
						100% Recovery from 57.5 to 62.5 feet. RQD = 28%
60						

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 10-4890

BORING NO. B4 (continued) DRIVING WT. 140 lb. START DATE 4/5/10
SURFACE ELEV. 100± DROP 30 in. END DATE 4/7/10

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
60						100% Recovery from 62.5 to 67.5 feet, RQD = 82%
65						
						End boring at 67.5 feet.
70						Neither groundwater nor seepage water encountered.
75						
80						
85						
90						

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 10-4890

BORING NO. B5 DRIVING WT. 140 lb. START DATE 3/23/10

SURFACE ELEV. 147± DROP 30 in. END DATE 3/25/10

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0						Clayey SILT (MH) – Mottled brown, moist, medium stiff, with gravel. (Volcanic Ash)
			9	64	55	
5			5	53	72	
			17/6"	49	88	
10			35/6"			WEATHERED ROCK (WC) – Mottled brown, moist, medium dense to dense, completely weathered.
						BASALT (WS) – Gray, hard, slightly weathered. Highly to moderately weathered from 10.5 to 12 feet.
						Begin NX coring at 13 feet. 88% Recovery from 13 to 18 feet. RQD = 83%
15						
						100% Recovery from 18 to 23 feet. RQD = 33% Brown, highly weathered at 19 feet.
20						
						100% Recovery from 23 to 28 feet. RQD = 90%
25						
						92% Recovery from 28 to 33 feet. RQD = 47% Moderately fractured at 29 feet.
30						

Plate A4.13

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 10-4890

BORING NO. B5 (continued) DRIVING WT. 140 lb. START DATE 3/23/10
SURFACE ELEV. 147± DROP 30 in. END DATE 3/25/10

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
30						
						98% Recovery from 33 to 38 feet. RQD = 75%
35						
						100% Recovery from 38 to 43 feet. RQD = 37% Moderate to highly fractured, moderately weathered from 38 to 45 feet.
40						
						100% Recovery from 43 to 48 feet. RQD = 78%
45						
						End boring at 48 feet.
50						Neither groundwater nor seepage water encountered.
55						
60						

APPENDIX B

LABORATORY TESTING

DESCRIPTION OF LABORATORY TESTING

CLASSIFICATION

Field classification was verified in the laboratory in accordance with the Unified Soil Classification System. Laboratory classification was determined by visual examination. The final classifications are shown at the appropriate locations on the Boring Logs, Plates A4.1 through A4.14.

MOISTURE-DENSITY

Representative samples were tested for field moisture content and dry unit weight. The dry unit weight was determined in pounds per cubic foot while the moisture content was determined as a percentage of dry weight. Samples were obtained using a 3-inch O.D. split tube sampler. Test results are shown at the appropriate depths on the Boring Logs, Plates A4.1 through A4.14.

CONSOLIDATION

Selected representative samples were tested for their consolidation characteristics. Test samples were 2.42 inches in diameter and 1 inch high. Porous stones were placed in contact with the top and bottom of test samples to permit addition and release of pore fluid. Loads were then applied in several increments in a geometric progression, and the resulting deformations recorded at selected time intervals. Test results are plotted on the Consolidation Test Reports, Plates B2.1 through B2.3.

SHEAR TESTS

Shear tests were performed in the Direct Shear Machine which is of the strain control type. Each sample was sheared under varying confining loads in order to determine the Coulomb shear strength parameters, cohesion and angle of internal friction. Test results are presented on Plates B3.1 through B3.6.

PROCTOR TESTS

Modified Proctor tests were performed in general accordance with ASTM D 1557 on bulk samples of near surface soils at selected boring locations. The test is used to determine the optimum moisture content at which the soil compacts to 100 percent density. Results are shown on Plates B4.1 through B4.3.

CALIFORNIA BEARING RATIO TESTS

CBR tests were performed on bulk samples of near surface soils. The tests were performed in general accordance with ASTM D 1883 but compacted to the soil's maximum wet density at its insitu moisture content. Results are shown on Plates B5.1 and B5.2.

SIEVE ANALYSIS

A sieve analysis test was performed on a representative soil sample in general accordance with ASTM D 422. Test results are presented on Plate B6.1.

R-VALUE TESTS

R-Value tests were performed on bulk samples of near surface soils. The tests were performed by Signet Testing Labs, Inc. in Hayward, California, in general accordance with ASTM D 2844. Test results are shown on Figures B7.1 and B7.2.

UNCONFINED COMPRESSION TESTS OF ROCK CORE

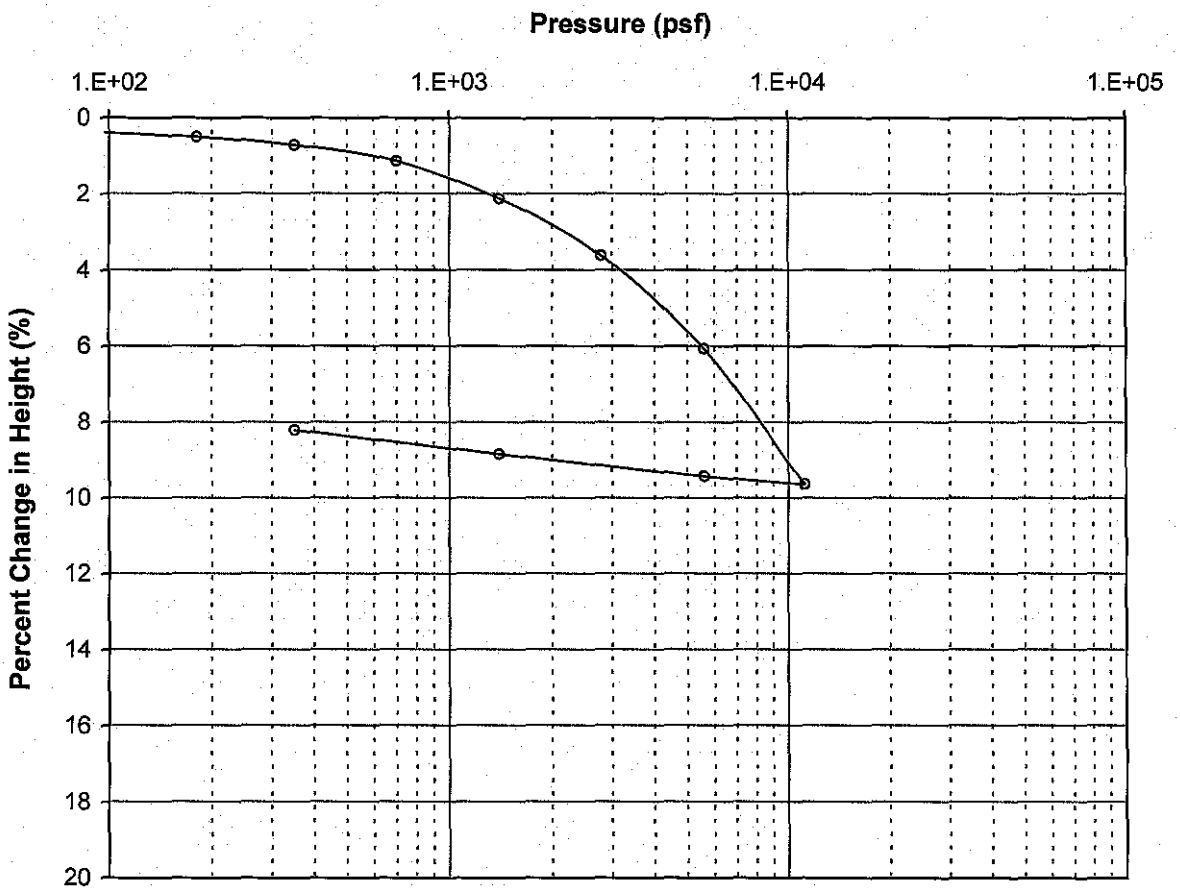
Unconfined compression tests were performed on selected basalt and boulder rock cores. The tests were performed by Construction Engineering Labs in Pearl City, Hawaii, in general accordance with ASTM D 2938. Test results are shown on Plate B8.1.

RESISTIVITY, pH, CHLORIDES, AND SULFATES TESTS

Four soil samples were tested for resistivity, pH, chlorides, and sulfates. The tests were performed by TestAmerica in Aiea, Hawaii. The following is a summary of the test results.

Sample	Resistivity (ohm-cm)	pH	Chlorides (ppm)	Sulfaces (ppm)
B2 @ 28'	11,800	7.25	14	16
B4 @ 4'	8,660	7.10	18	29
B4 @ 8'	9,280	7.32	11	11
B5 @ 4'	6,690	6.57	29	33

Consolidation Test Results



Sample Description

Boring No.: B1 Depth (ft): 28

Soil Description: Mottled brown clayey silt

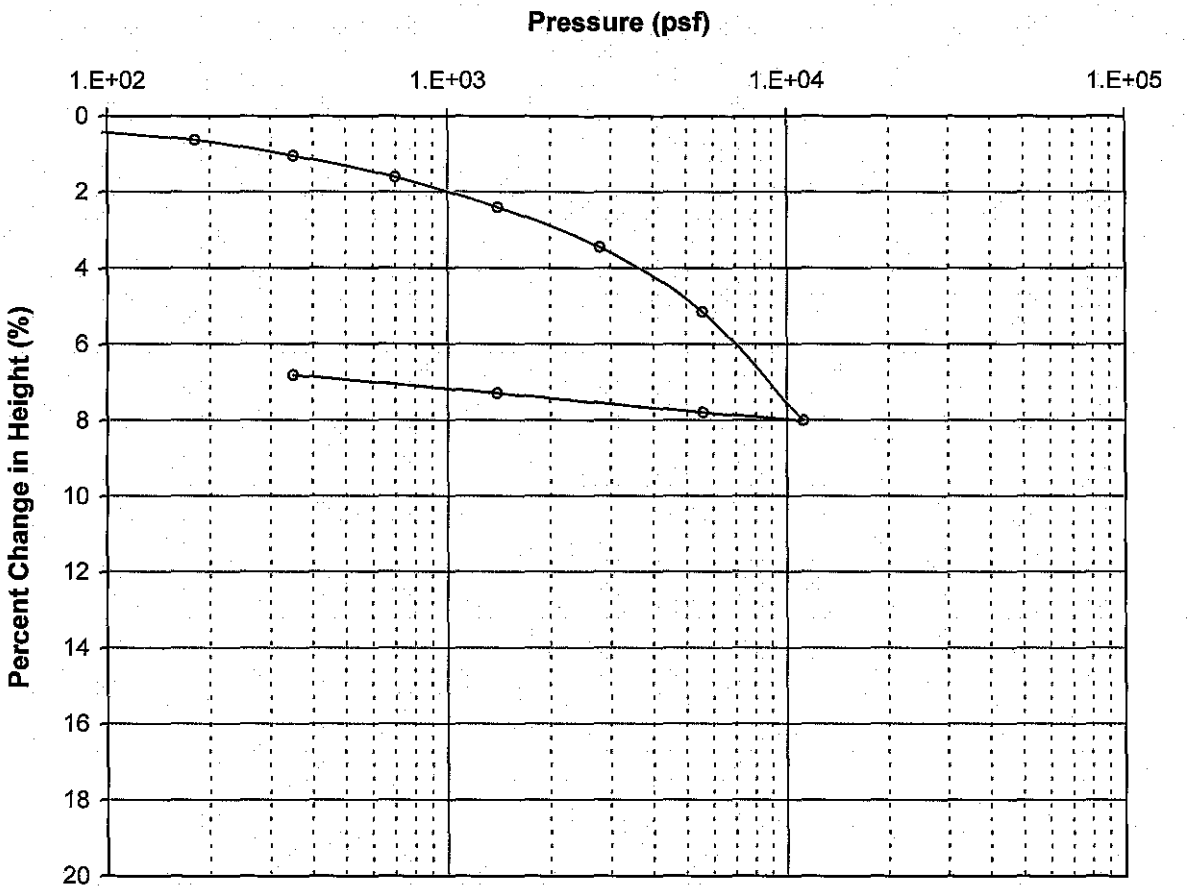
	Moisture Content (%)	Dry Density (pcf)
Initial	52.8	64.1
Final	48.7	69.8

Remark: 04/11/10

W.O. 10-4890	Umauma Stream Bridge Rehabilitation,North Hilo
Hirata & Associates, Inc.	**CONSOLIDATION TEST**

Plate B2.1

Consolidation Test Results



Sample Description

Boring No.: B2 Depth (ft): 13

Soil Description: Mottled brown completely weathered rock

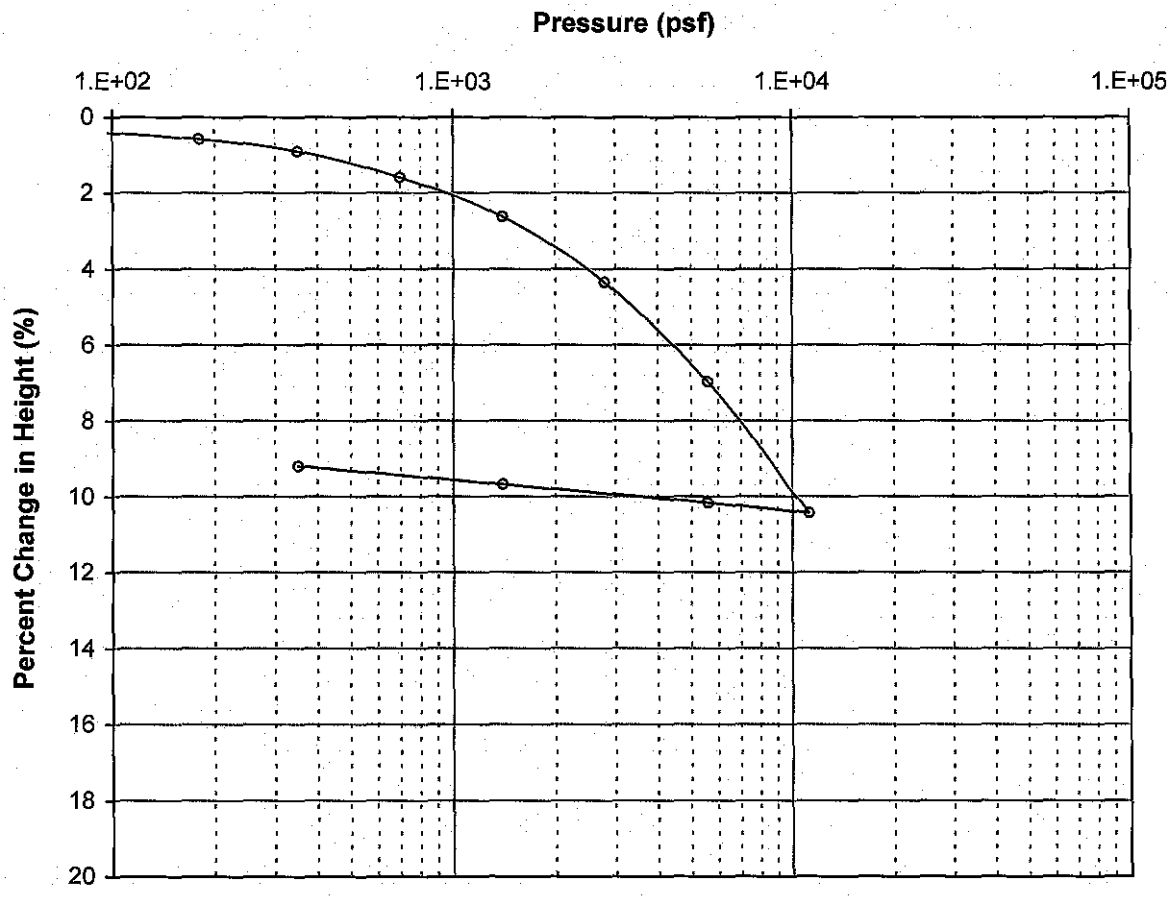
	Moisture Content (%)	Dry Density (pcf)
Initial	61.8	57.4
Final	54.0	61.6

Remark: 03/24/10

W.O. 10-4890	Umauma Stream Bridge Rehabilitation, North Hilo
Hirata & Associates, Inc.	**CONSOLIDATION TEST**

Plate B2.2

Consolidation Test Results



Sample Description

Boring No.: B4 Depth (ft): 4

Soil Description: Brown clayey silt

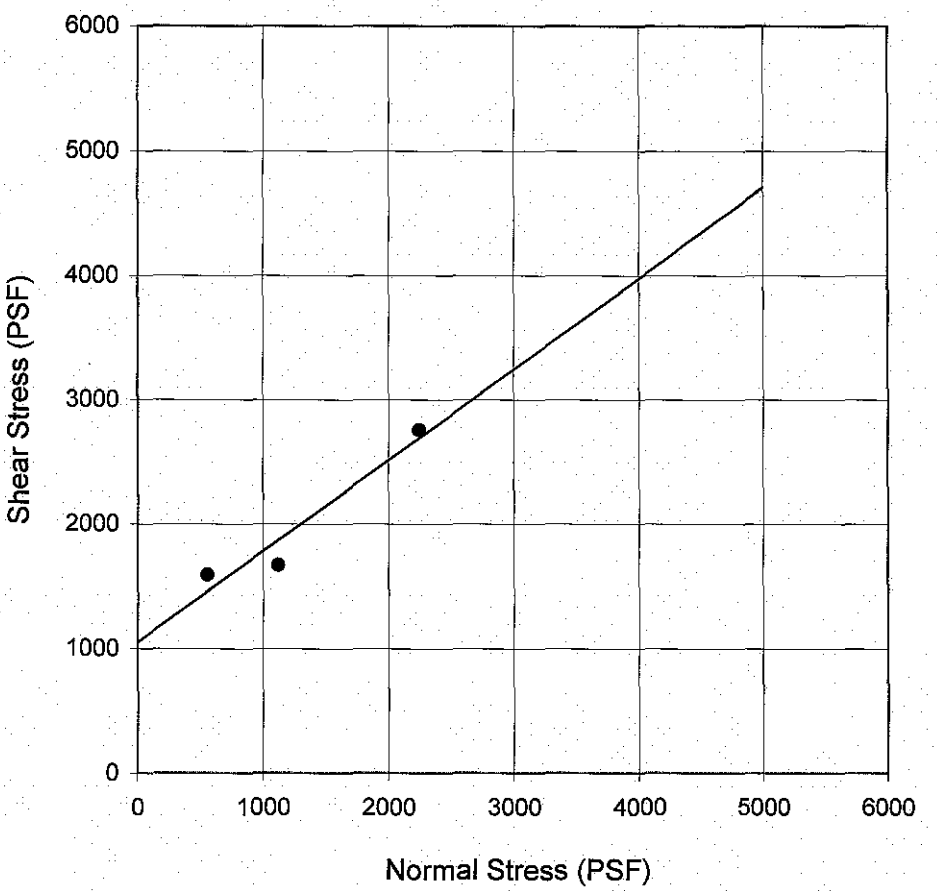
	Moisture Content (%)	Dry Density (pcf)
Initial	41.1	66.2
Final	35.6	72.9

Remark: 04/15/10

W.O. 10-4890	Umauma Stream Bridge Rahabilitation, North Hilo
Hirata & Associates, Inc.	**CONSOLIDATION TEST**

Plate B2.3

Direct Shear Test Results



Sample Description

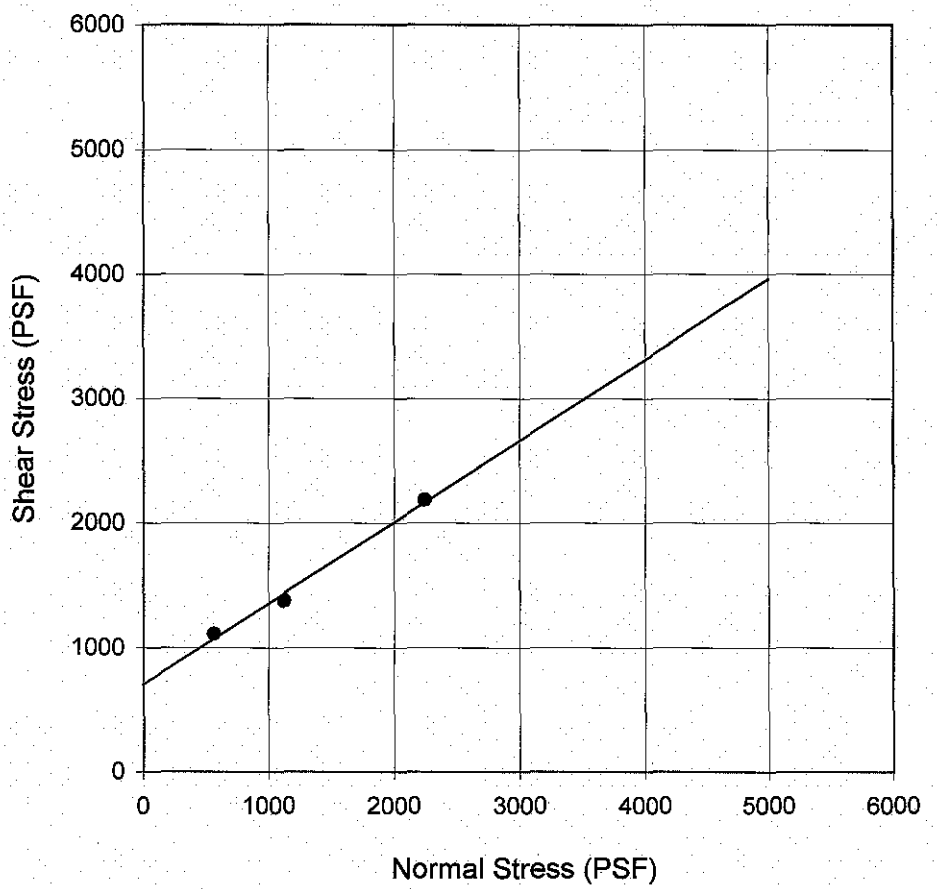
Boring No.: B1 Depth (ft): 13
Soil Description: Mottled brown clayey silt with sand and gravel
Strength Intercept (C): 1052.4 PSF
Friction Angle (ϕ): 36.2 DEG

Remark: 03/16/10

W.O. 10-4890	Umauma Stream Bridge Rehabilitation, North Hilo
Hirata & Associates, Inc.	DIRECT SHEAR TEST

Plate B3.1

Direct Shear Test Results



Sample Description

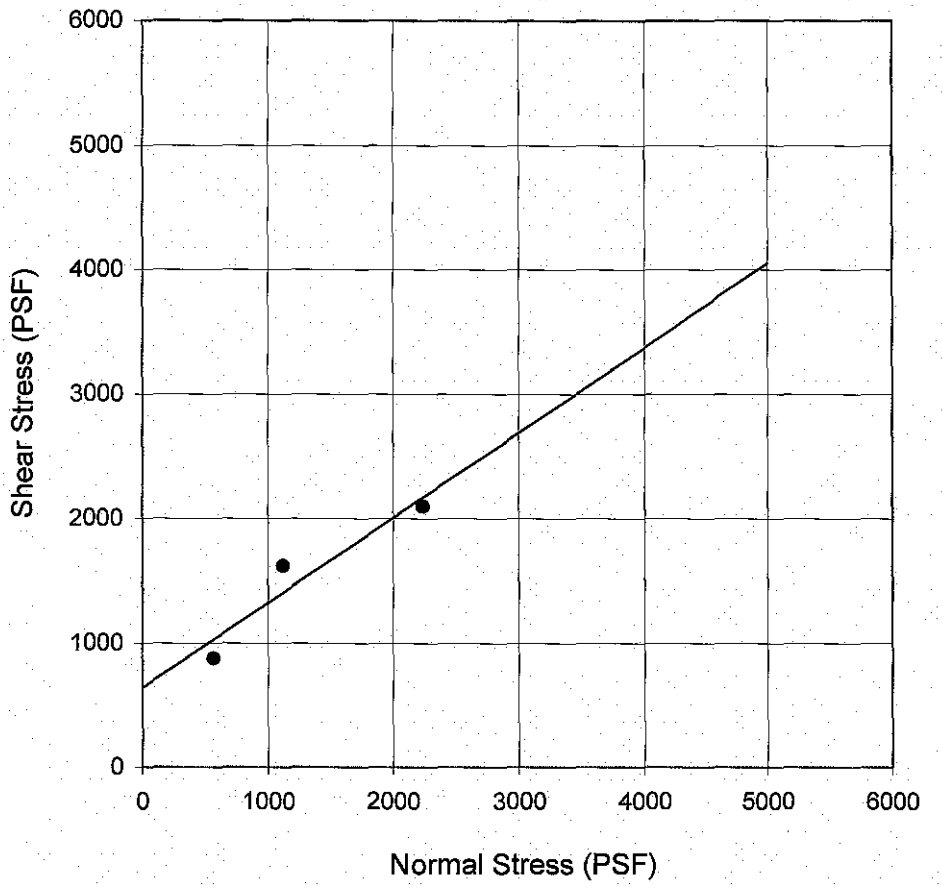
Boring No.: B1 Depth (ft): 33
Soil Description: Mottled brown clay silt
Strength Intercept (C): 705.0 PSF
Friction Angle (ϕ): 33.1 DEG

Remark: 03/16/10

W.O. 10-4890	**Umauma Stream Bridge Rehabilitation, North Hilo**
Hirata & Associates, Inc.	**DIRECT SHEAR TEST**

Plate B3.2

Direct Shear Test Results



Sample Description

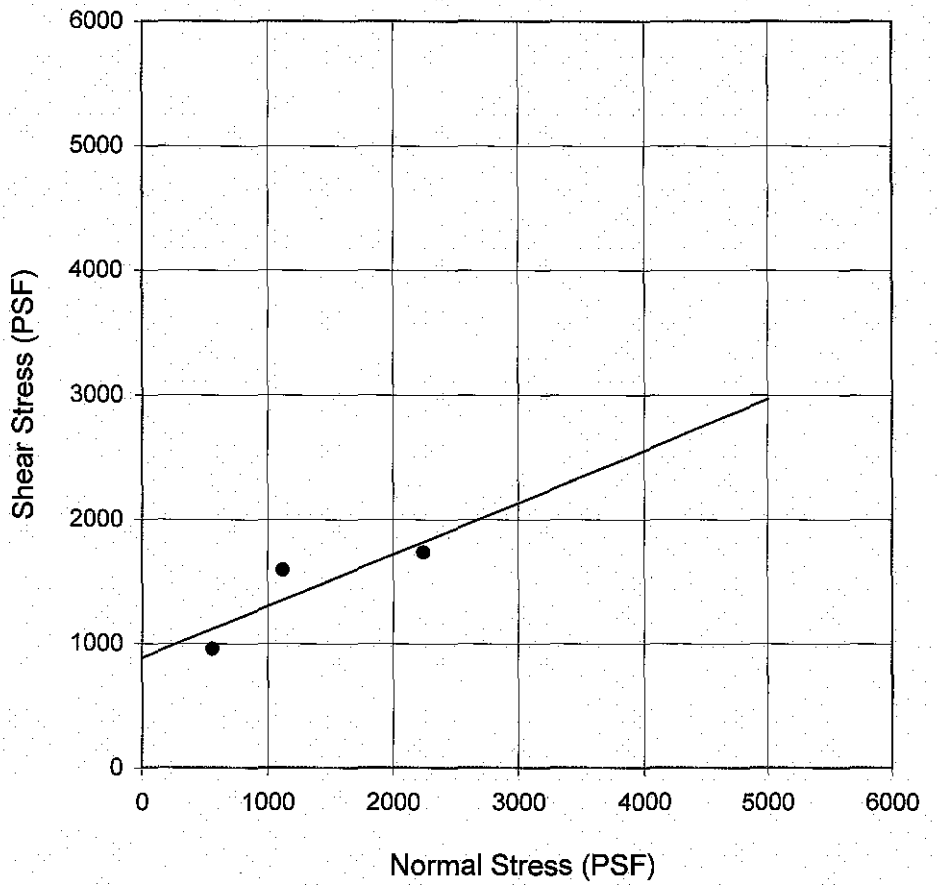
Boring No.: B2 Depth (ft): 4
Soil Description: Mottled brown clayey silt with gravel
Strength Intercept (C): 643.1 PSF
Friction Angle (ϕ): 34.3 DEG

Remark: 03/25/10

W.O. 10-4890	Umauma Stream Bridge Rehabilitation, North Hilo
Hirata & Associates, Inc.	DIRECT SHEAR TEST

Plate B3.3

Direct Shear Test Results



Sample Description

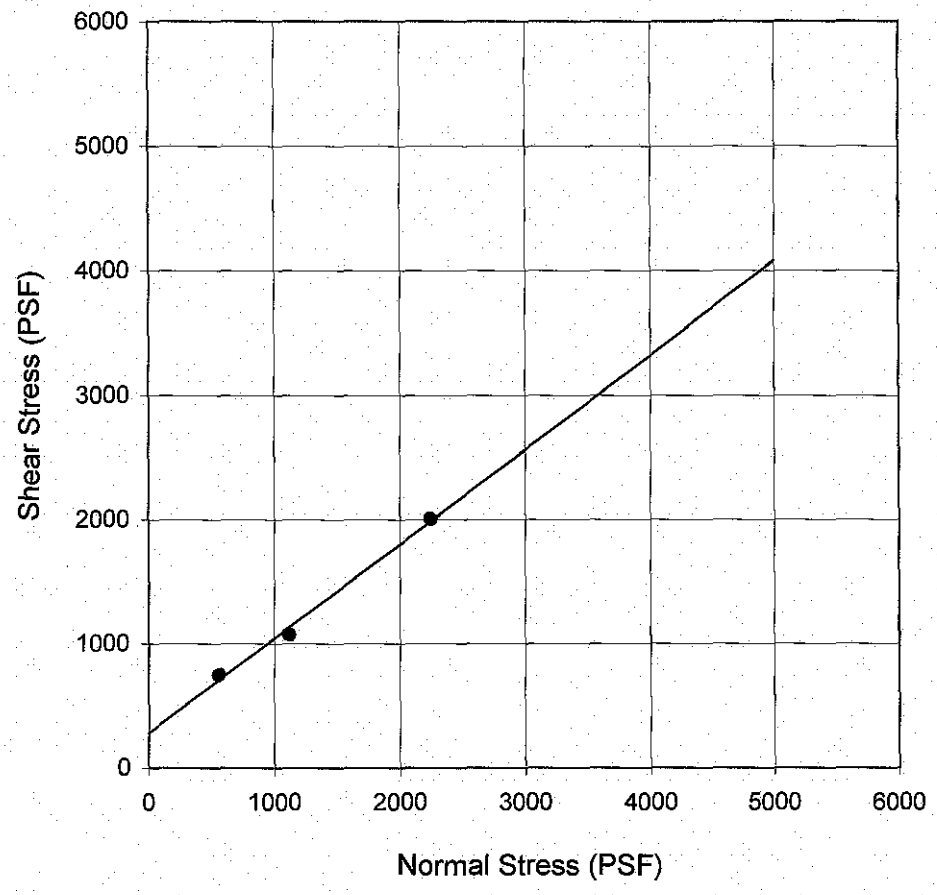
Boring No.: B2 Depth (ft): 28
Soil Description: Mottled brown completely weathered rock
Strength Intercept (C): 885.8 PSF
Friction Angle (ϕ): 22.6 DEG

Remark: 03/25/10

W.O. 10-4890	Umauma Stream Bridge Rehabilitation, North Hilo
Hirata & Associates, Inc.	**DIRECT SHEAR TEST**

Plate B3.4

Direct Shear Test Results



Sample Description

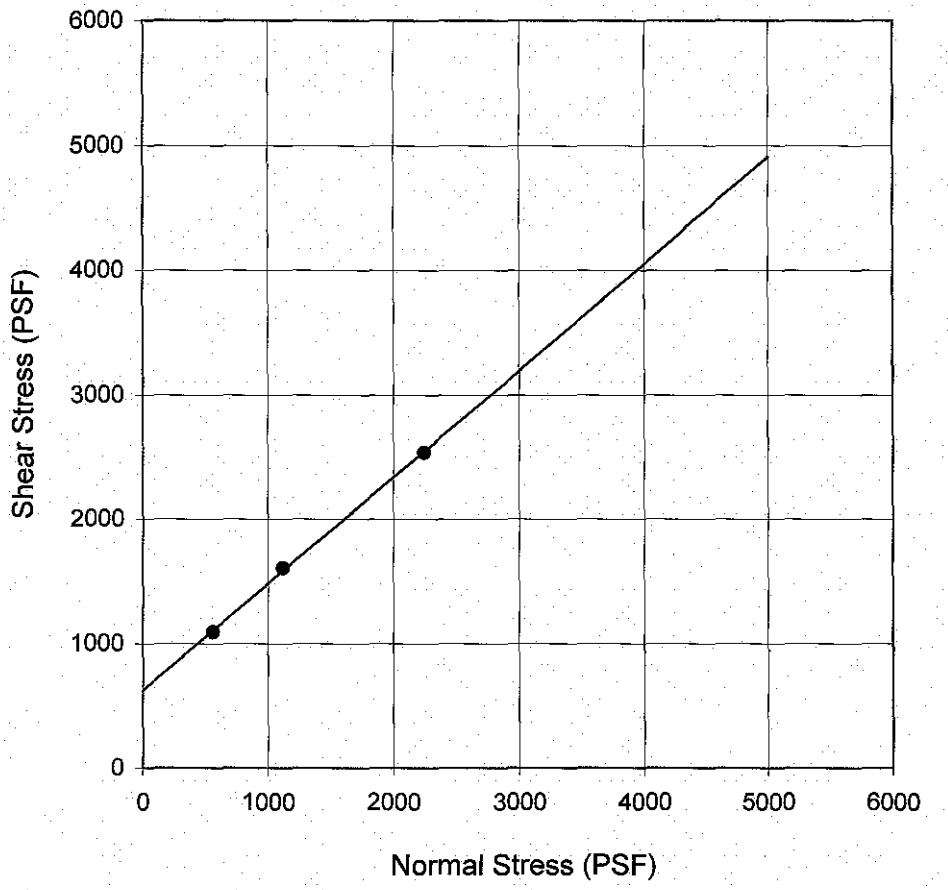
Boring No.: B4 Depth (ft): 2
Soil Description: Brown clayey silt with gravel
Strength Intercept (C): 281.4 PSF
Friction Angle (ϕ): 37.2 DEG

Remark: 04/14/10

W.O. 10-4890	Umauma Stream Bridge Rehabilitation, North Hilo
Hirata & Associates, Inc.	DIRECT SHEAR TEST

Plate B3.5

Direct Shear Test Results



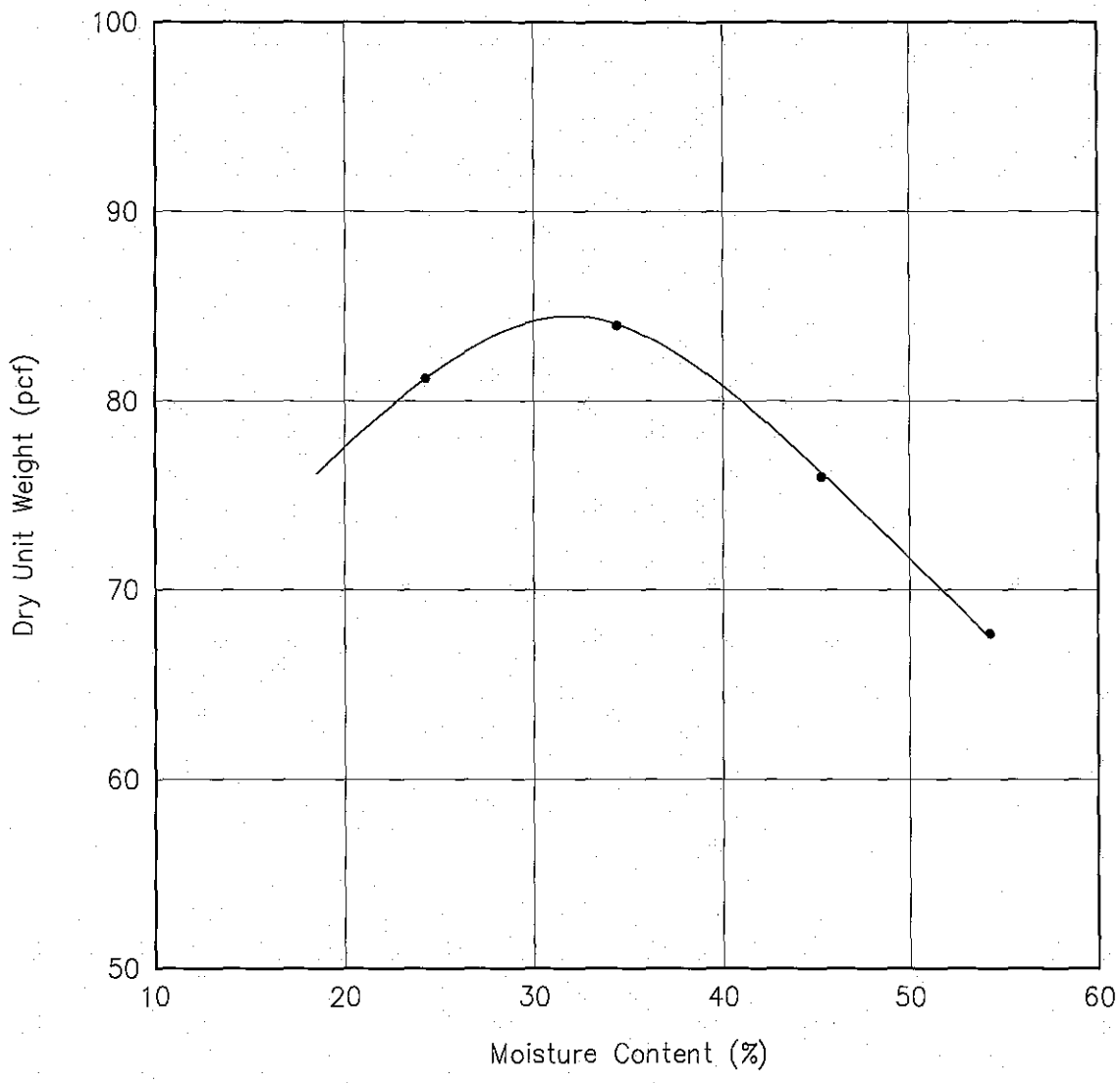
Sample Description

Boring No.: B5 Depth (ft): 2
Soil Description: Mottled brown clayey silt with gravel
Strength Intercept (C): 624.1 PSF
Friction Angle (ϕ): 40.6 DEG

Remark: 04/08/10

W.O. 10-4890	Umauma Stream Bridge Rehabilitation, North Hilo
Hirata & Associates, Inc.	DIRECT SHEAR TEST

Plate B3.6



Soil Data

Location: Boring B1 at 2 to 4 ft

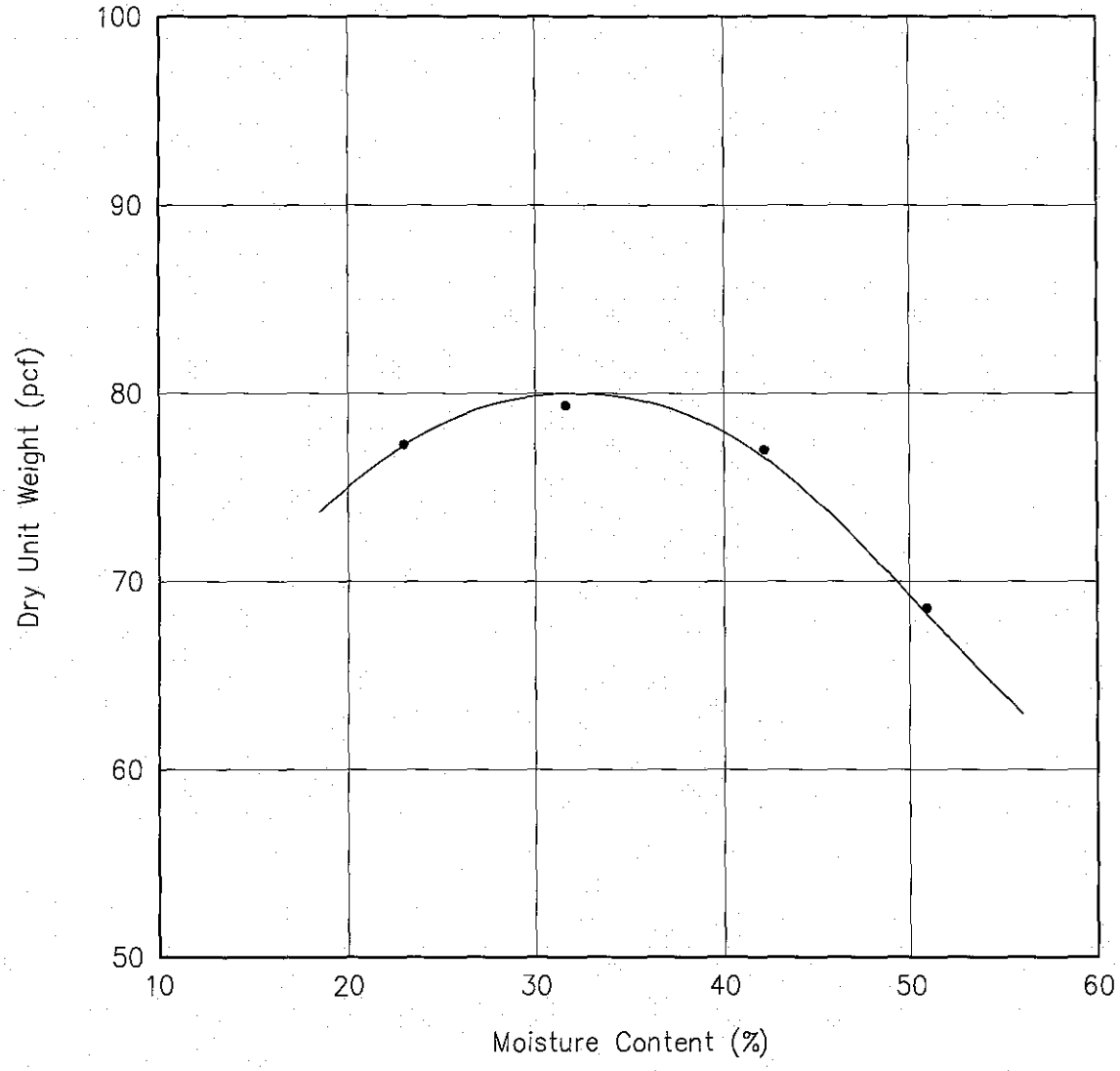
Description: Brown clayey silt with sand

Test Results

Maximum Dry Density: 84.5 pcf

Optimum Moisture Content: 32%

W.O. 10-4890	Umauma Stream Bridge Rehabilitation, North Hilo
Hirata & Associates, Inc.	MODIFIED PROCTOR CURVE Plate B4.1



Soil Data

Location: Boring B2 at 2 to 4 ft

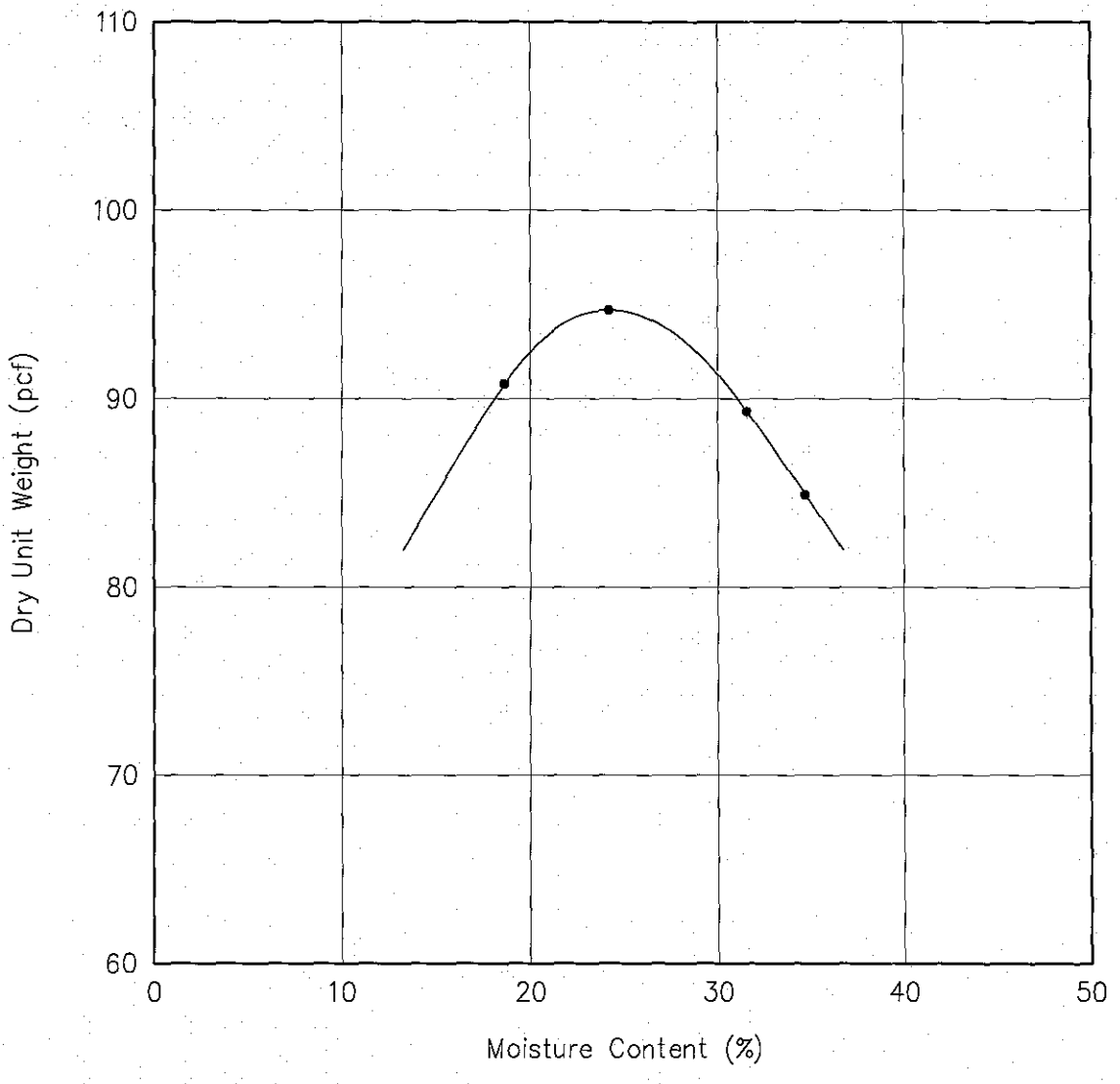
Description: Brown clayey silt with sand

Test Results

Maximum Dry Density: 80 pcf

Optimum Moisture Content: 32%

W.O. 10-4890	Umauma Stream Bridge Rehabilitation, North Hilo
Hirata & Associates, Inc.	MODIFIED PROCTOR CURVE Plate B4.2



Soil Data

Location: Boring B4 at near surface

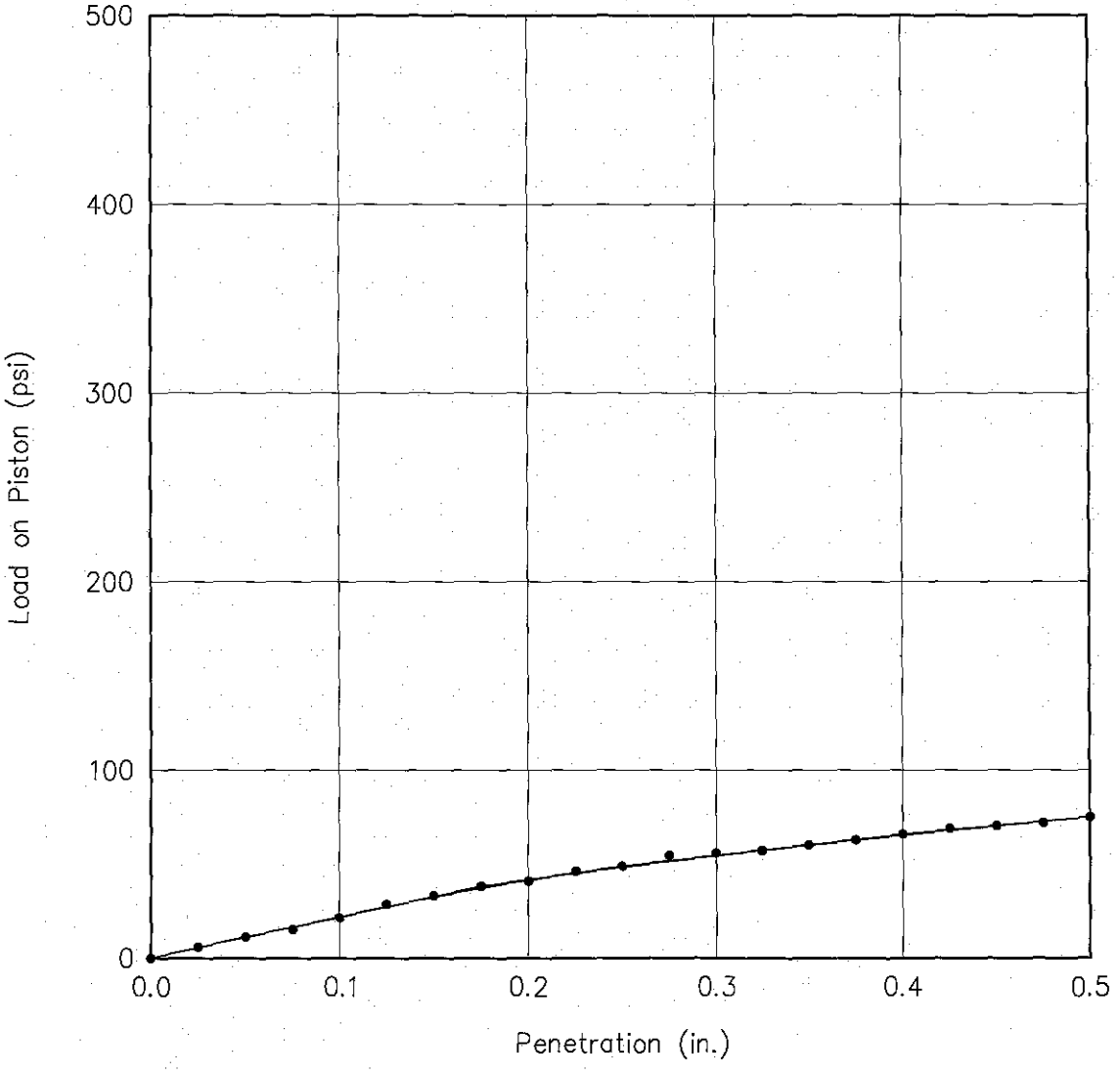
Description: Brown clayey silt with weathered rock fragments

Test Results

Maximum Dry Density: 95 pcf

Optimum Moisture Content: 25%

W.O. 10-4890	Umauma Stream Bridge Rehabilitation, North Hilo
Hirata & Associates, Inc.	MODIFIED PROCTOR CURVE Plate B4.3



Soil Data

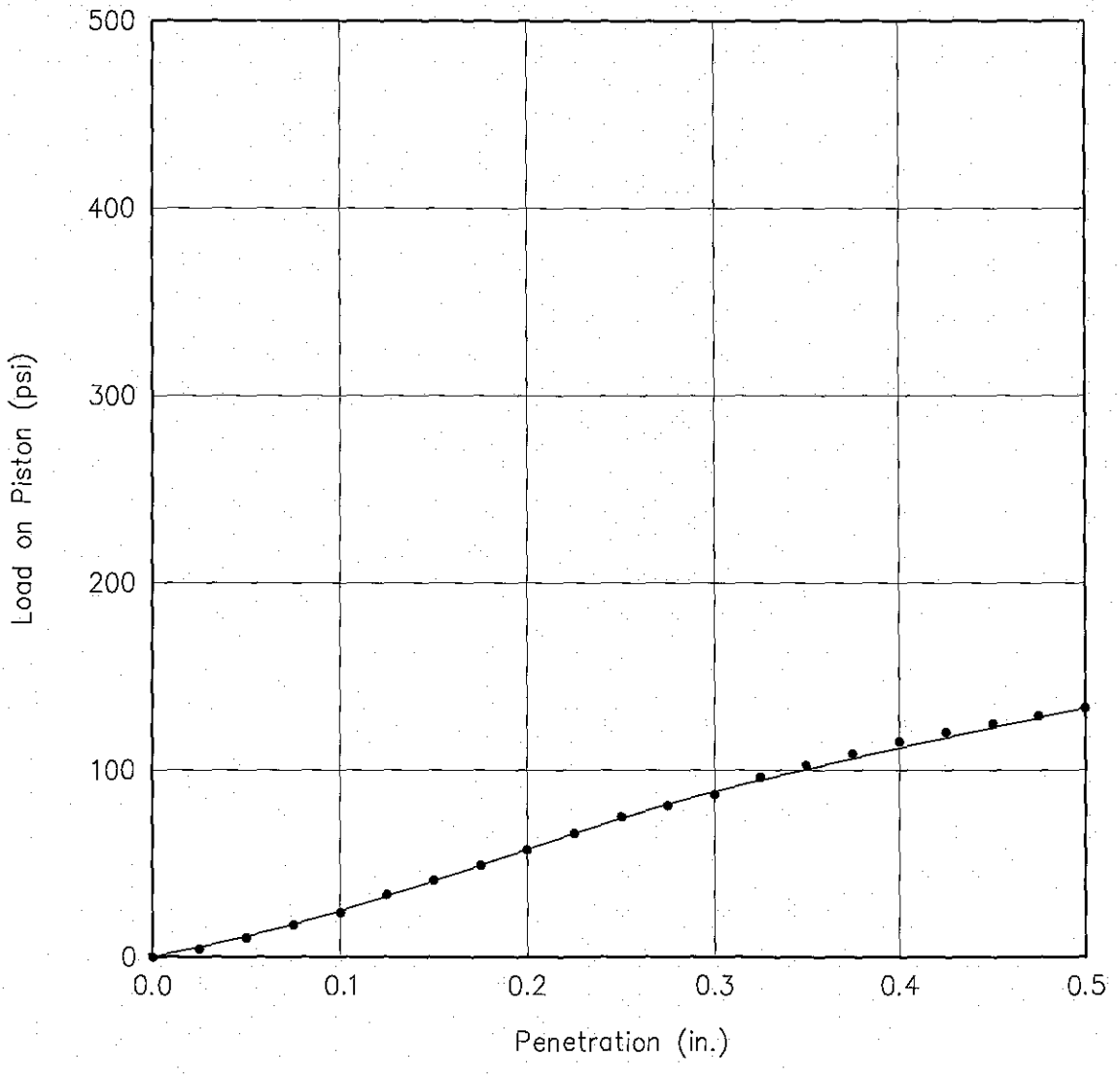
Location:	Boring B1 at 2 to 4 ft
Description:	Brown clayey silt
Sample Dry Density:	74 pcf
Sample Moisture Content:	45%

Test Results

CBR Value:	2.2%
Expansion:	0.4%

Note: Test performed at insitu moisture content of soil sample.

W.O. 10-4890	Umauma Stream Bridge Rehabilitation, North Hilo
Hirata & Associates, Inc.	CBR STRESS PENETRATION CURVE Plate B5.1



Soil Data

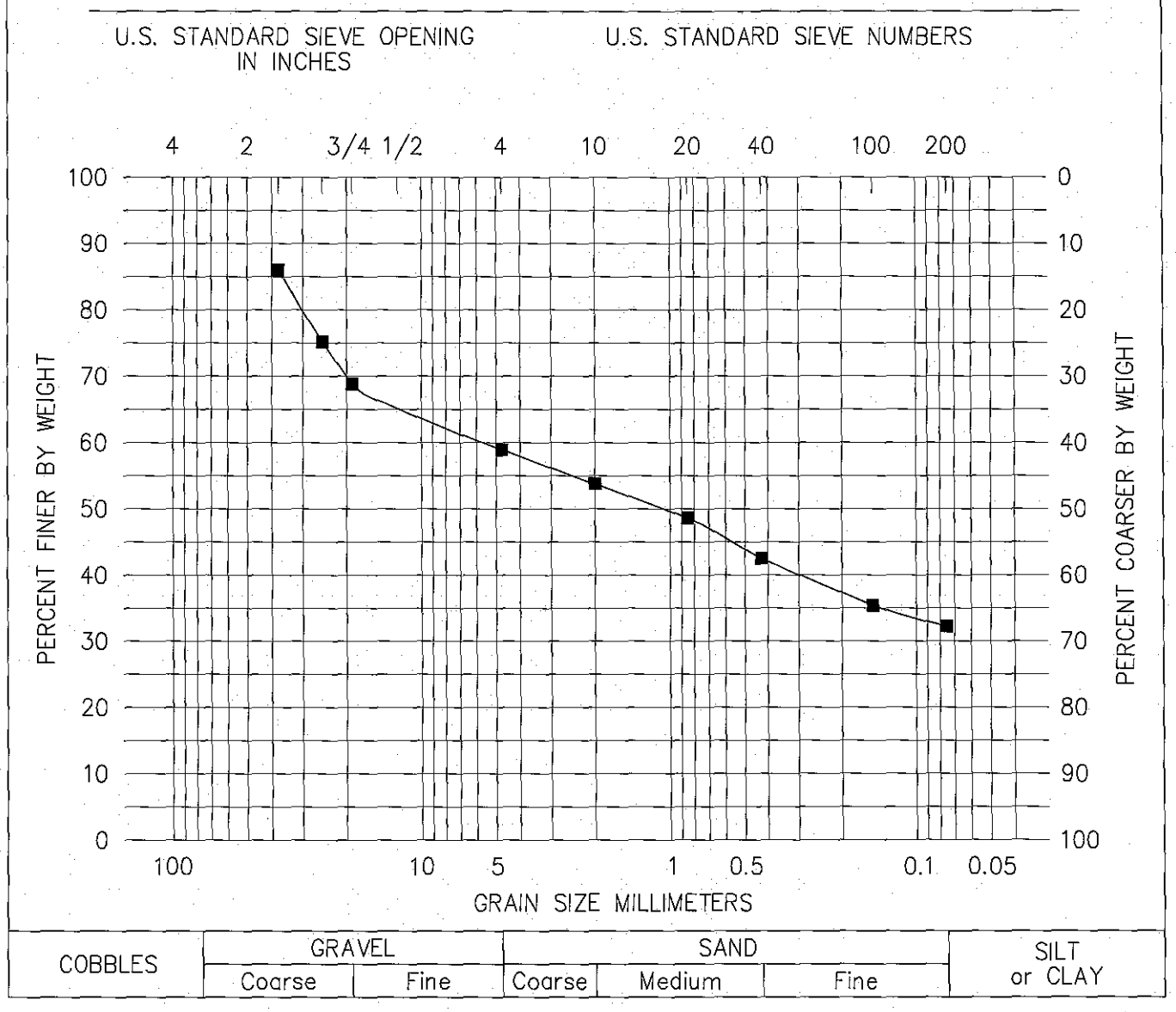
Location:	Boring B2 at 2 to 4 ft
Description:	Brown clayey silt
Sample Dry Density:	74 pcf
Sample Moisture Content:	43%

Test Results

CBR Value:	2.4%
Expansion:	1.4%

Note: Test performed at insitu moisture content of soil sample.

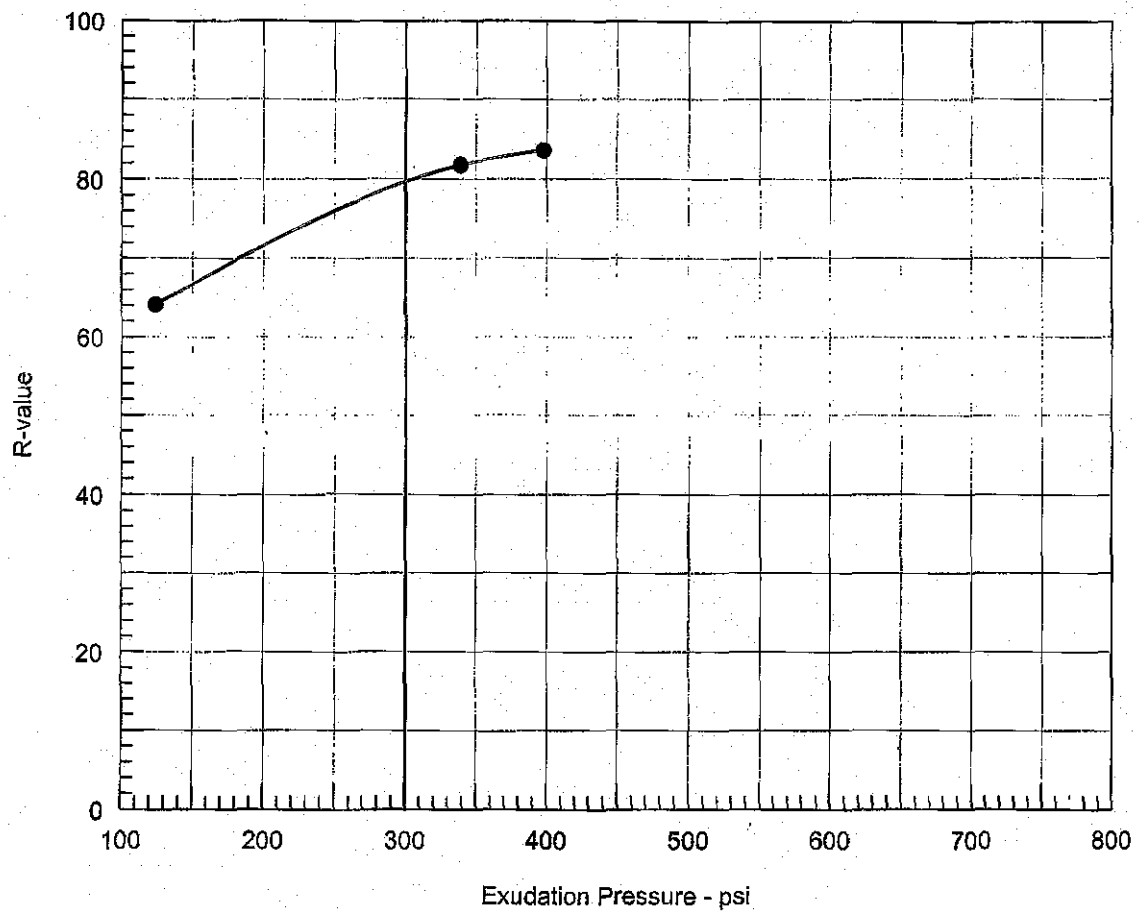
W.O. 10-4890	Umauma Stream Bridge Rehabilitation, North Hilo
Hirata & Associates, Inc.	CBR STRESS PENETRATION CURVE Plate B5.2



	Location	Description
■ Sample #2	Boring B4 at 8 ft	Brown clayey silt with sand and gravel

W.O. 10-4890	Umauma Stream Bridge Rehabilitation, North Hilo
Hirata & Associates, Inc.	GRADATION CURVES Plate B6.1

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - ASTM D 2844

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	250	117.9	17.2	0.00	42	2.50	124	64	64
2	350	118.2	16.4	0.00	17	2.44	398	84	84
3	325	118.1	16.7	0.00	20	2.48	339	82	82

Test Results	Material Description
R-value at 300 psi exudation pressure = 80	Brown gravelly sandy silt, B1, sample received 4/22/2010

Project No.: 0020078
Project:
Location: Umauma Stream Bridge Rehab, WO #10-4890
Sample Number: 2110-1 (SL397) **Depth:** 2'-4'
Date: 4/28/2010

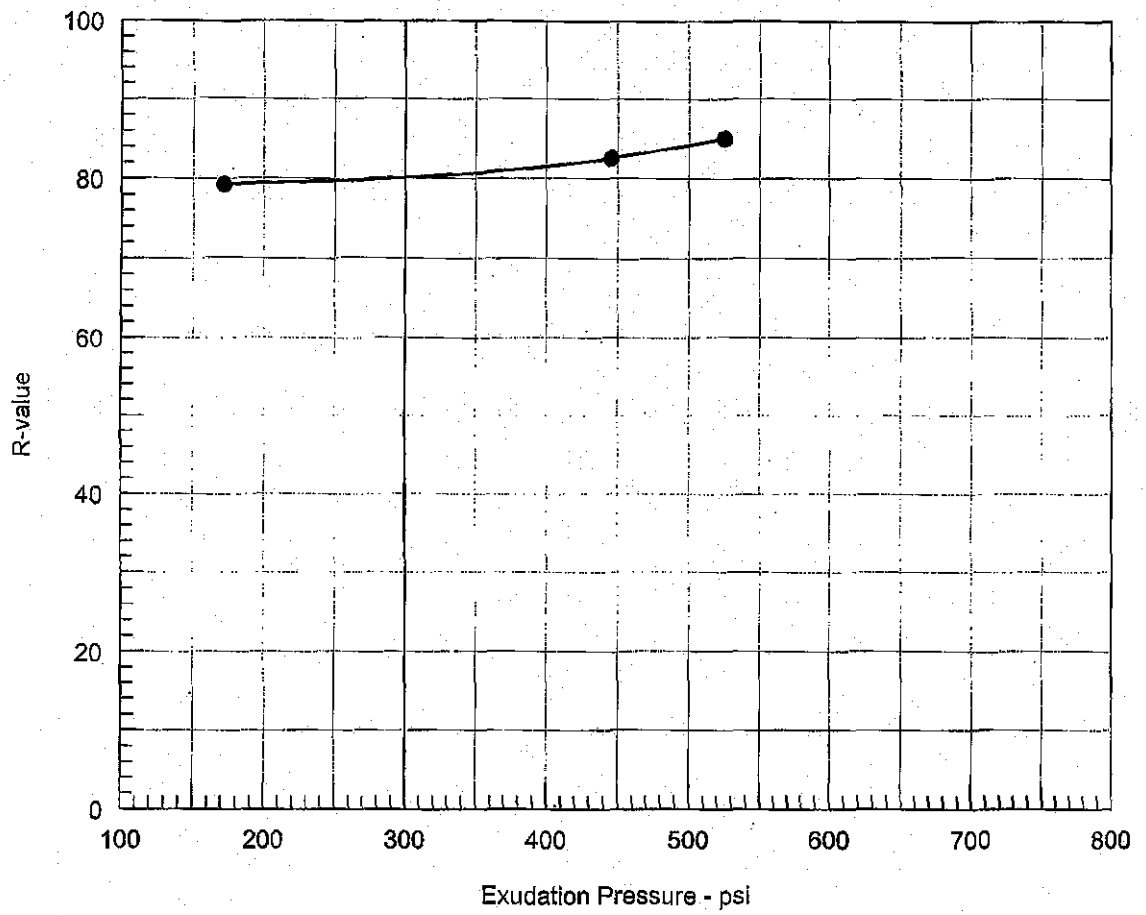
Tested by: DTN
Checked by: LKL
Remarks:
B1

R-VALUE TEST REPORT

SIGNET TESTING LABS, INC.

Figure B7.1

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - ASTM D 2844

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	350	113.0	18.0	0.21	17	2.44	525	86	85
2	350	113.5	18.9	0.00	24	2.46	172	79	79
3	350	113.9	18.4	0.00	19	2.42	446	83	83

Test Results	Material Description
R-value at 300 psi exudation pressure = 80	Reddish brown gravelly sandy silt, B2, sample received 4/22/2010

Project No.: 0020078
Project:
Location: Umauma Stream Bridge Rehab, WO #10-4890
Sample Number: 2110-2 (SL397) **Depth:** 2'-4'
Date: 4/28/2010

Tested by: DTN
Checked by: LKL
Remarks:
B2

R-VALUE TEST REPORT

SIGNET TESTING LABS, INC.

Figure B7.2

Construction Engineering Labs

Hirata & Associates, Inc.
99-1433 Koaha Pl.
Aiea, Hawaii 96701

Date: 11/24/10
Report: 23508

TEST REPORT

Project: Umauma Stream Bridge Rehab (Job #10-4890)	W.O. No. 23508
Client: Hirata & Associates	Received: 11/19/10
Description of material: Rock Cores	Tech: HL
Source: See Below	Sample #: 23508

Core Identification	Test Method	Compressive Strength (psi)
B1 at 39'-42'	ASTM D 2938	13024
B2 at 48'-50'	ASTM D 2938	11332
B2 at 50'-52'	ASTM D 2938	9832
B3 at 5'-10'	ASTM D 2938	5741
B3 at 10'-15'	ASTM D 2938	18625
B4 at 12'-17'	ASTM D 2938	10258
B5 at 13'-18'	ASTM D 2938	6940

Please contact our office if you have any questions or need more information.

Respectfully,
CONSTRUCTION ENGINEERING LABS, INC.

By: Ronald A. Pickering II
Its: President

96-1173 Waihona St., Unit B-7, Pearl City, Hawaii 96782
Phone: 808-455-1522, Fax: 808-455-1384, Email cel@hawaii.rr.com

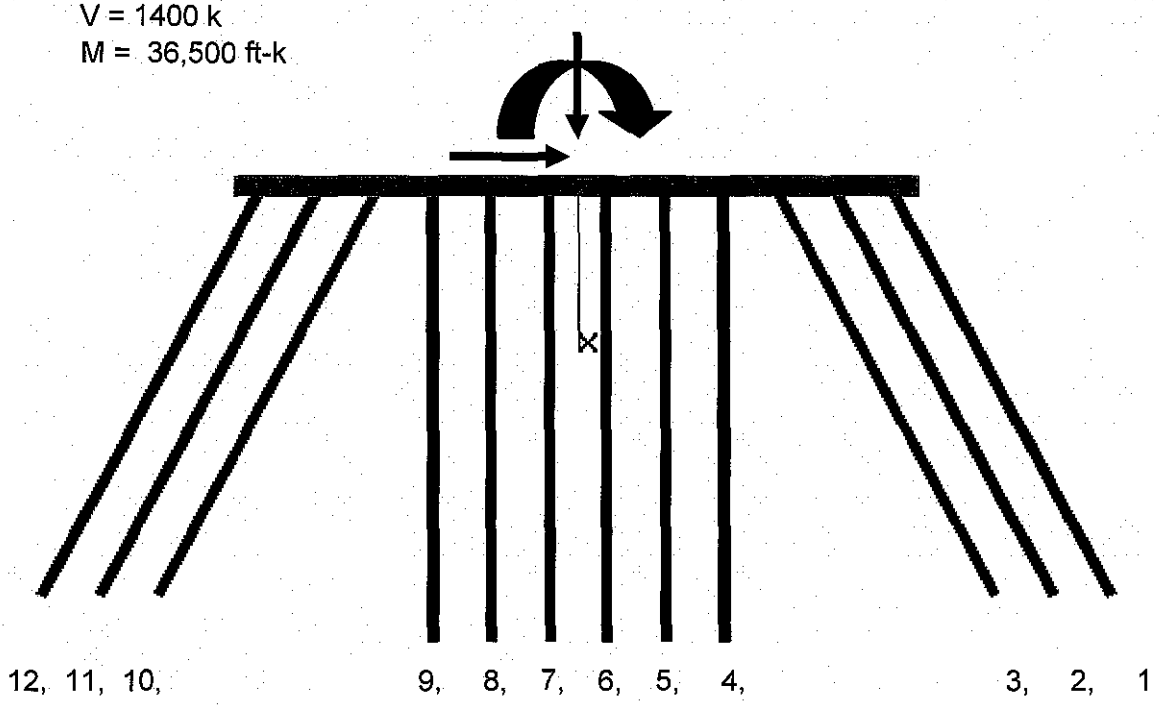
APPENDIX C

LATERAL LOAD ANALYSIS

Lateral Resistance of 5-Ft Diameter Drilled Shafts At Abutment #1			
Deflection at top	0.5 in	1 in.	1.5 in
Longitudinal Direction - Free head condition (Into slope direction)	55 Kips	95 kips	135 kips
Longitudinal Direction - Free head condition (Into slope direction, ignore potential effects from adjacent abutment walls and footings)	95 kips	145 kips	190 kips
Longitudinal Direction - Free head condition (Away from slope direction)	40 kips	75 kips	115 kips
Transverse Direction - Fixed head condition	195 kips	345 kips	485 kips

Lateral Resistance of 5-Ft Diameter Drilled Shafts At Abutment #2			
Deflection at top	0.5 in	1 in.	1.5 in
Longitudinal Direction - Free head condition (Into slope direction)	70 kips	105 kips	135 kips
Longitudinal Direction - Free head condition (Into slope direction, ignoring potential effects from adjacent abutment walls and footings)	100 kips	145 kips	175 kips
Longitudinal Direction - Free head condition (Away from slope direction)	45 kips	65 kips	85 kips
Transverse Direction - Fixed head condition	145 kips	220 kips	295 kips

Applied Load at Pile cap in transverse direction
P = 2300 k
V = 1400 k
M = 36,500 ft-k

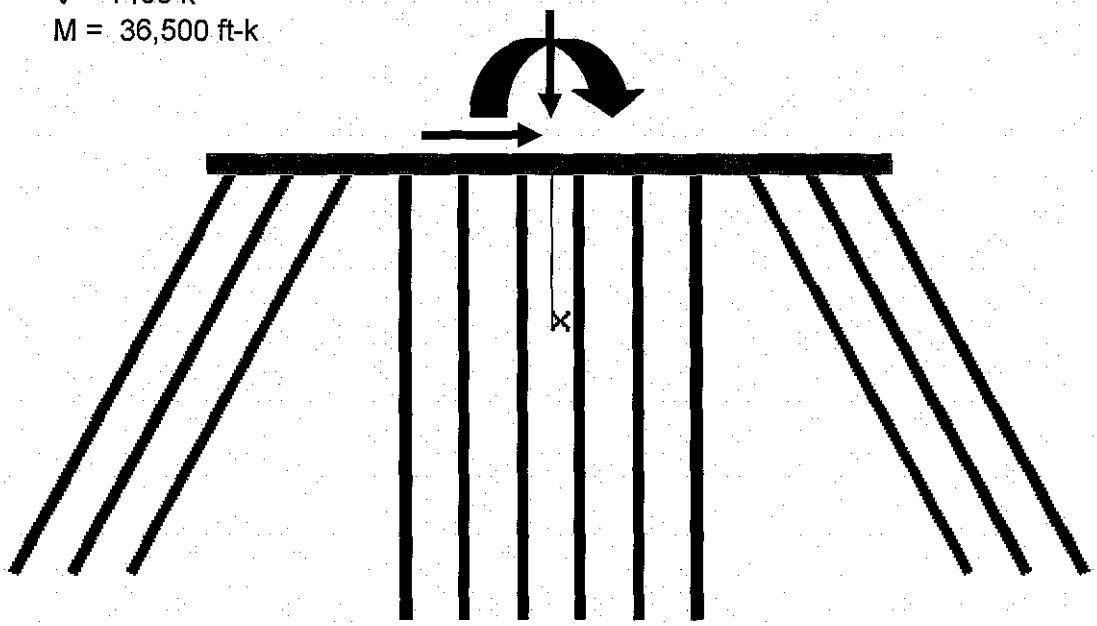


Note: each row has 4 (7-in diameter) micropiles

Row No.	Verical Load (kips)	Lateral Load (kips)	Axial Load (kips)	Shear (kips)	Bending Moment (ft-kips)
1	157	80.9	176.6	2.2	3.37
2	144.7	75	163	2.4	3.83
3	132.5	69.1	149.4	2.5	4.28
4	91.1	4	91.1	4	8.04
5	75.9	4	75.9	4	8.04
6	60.7	4	60.7	4	8.05
7	45.5	4	45.5	4	8.05
8	30.3	4	30.3	4	8.05
9	15.2	4	15.2	4	7.97
10	-47	27.8	-54.5	3.8	7.28
11	-59.3	33.7	-68.1	3.7	6.86
12	-71.5	39.7	-81.7	3.5	6.44

Pile Cap Deflection = 0.06 inch

Applied Load at Pile cap in transverse direction
P = 1500 k
V = 1400 k
M = 36,500 ft-k

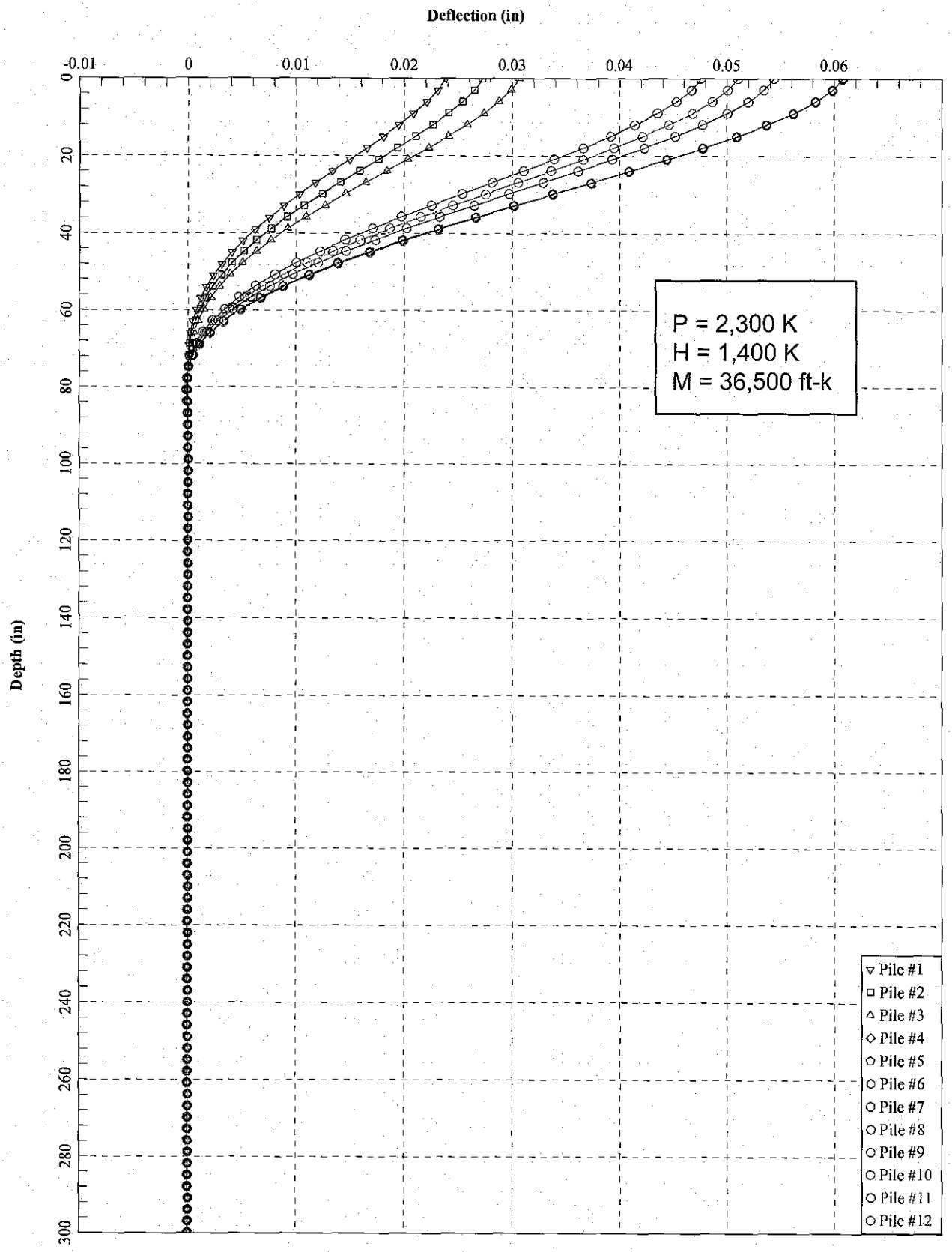


12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1

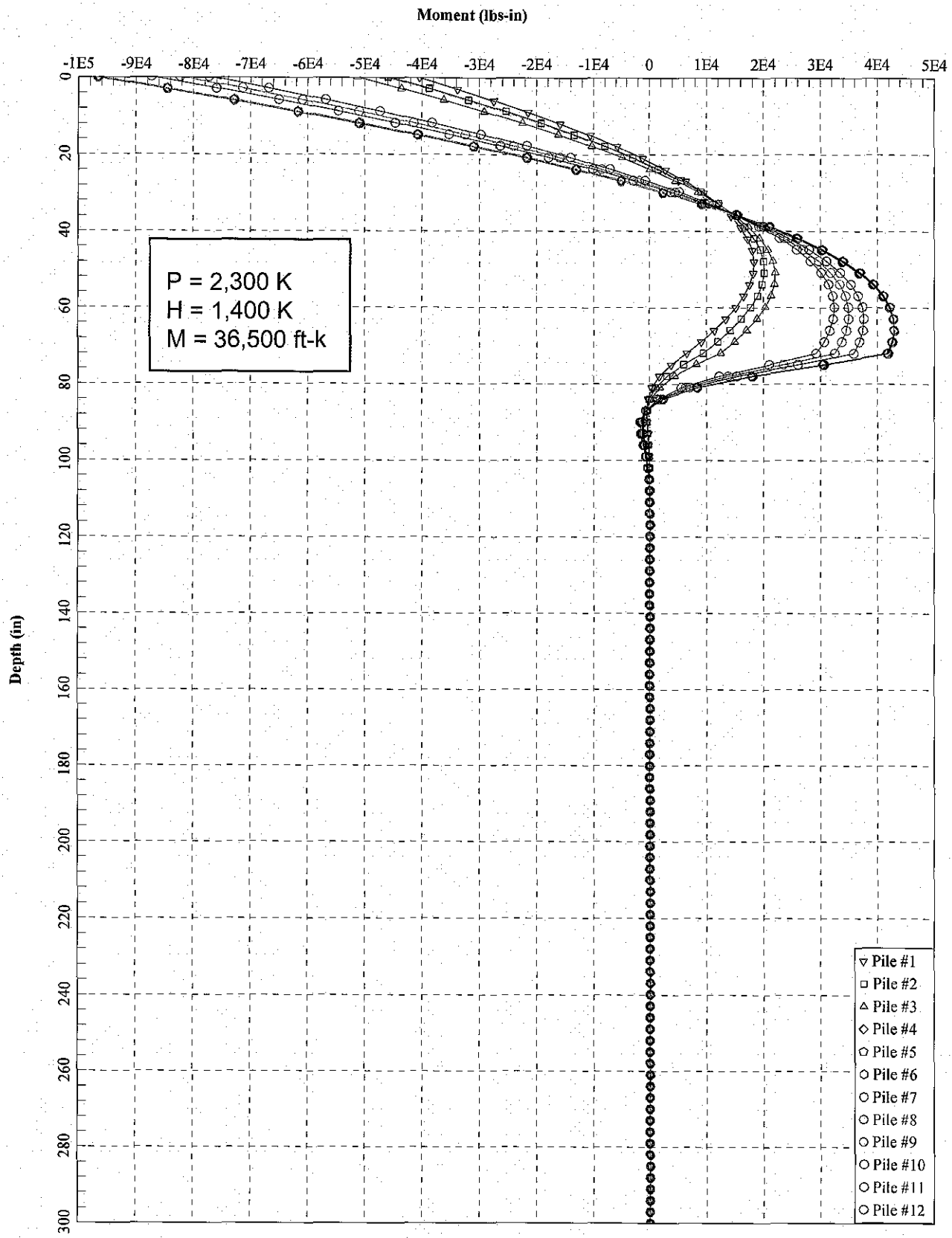
Note: each row has 4 (7-in diameter) micropiles

Row No.	Vertical Load (kips)	Lateral Load (kips)	Axial Load (kips)	Shear (kips)	Bending Moment (ft-kips)
1	142.1	73.7	160.0	2.4	3.90
2	129.8	67.8	146.4	2.6	4.35
3	117.6	61.8	132.8	2.7	4.79
4	72.7	4	72.7	4	8.02
5	57.5	4	57.5	4	8.02
6	42.3	4	42.3	4	8.02
7	27	4	27	4	8.02
8	11.8	4	11.8	4	8.02
9	-3.3	4	-3.3	4	8.03
10	-61.9	35	-71	3.6	6.74
11	-74.1	40.9	-84.6	3.5	6.32
12	-86.4	46.9	-98.2	3.3	5.89

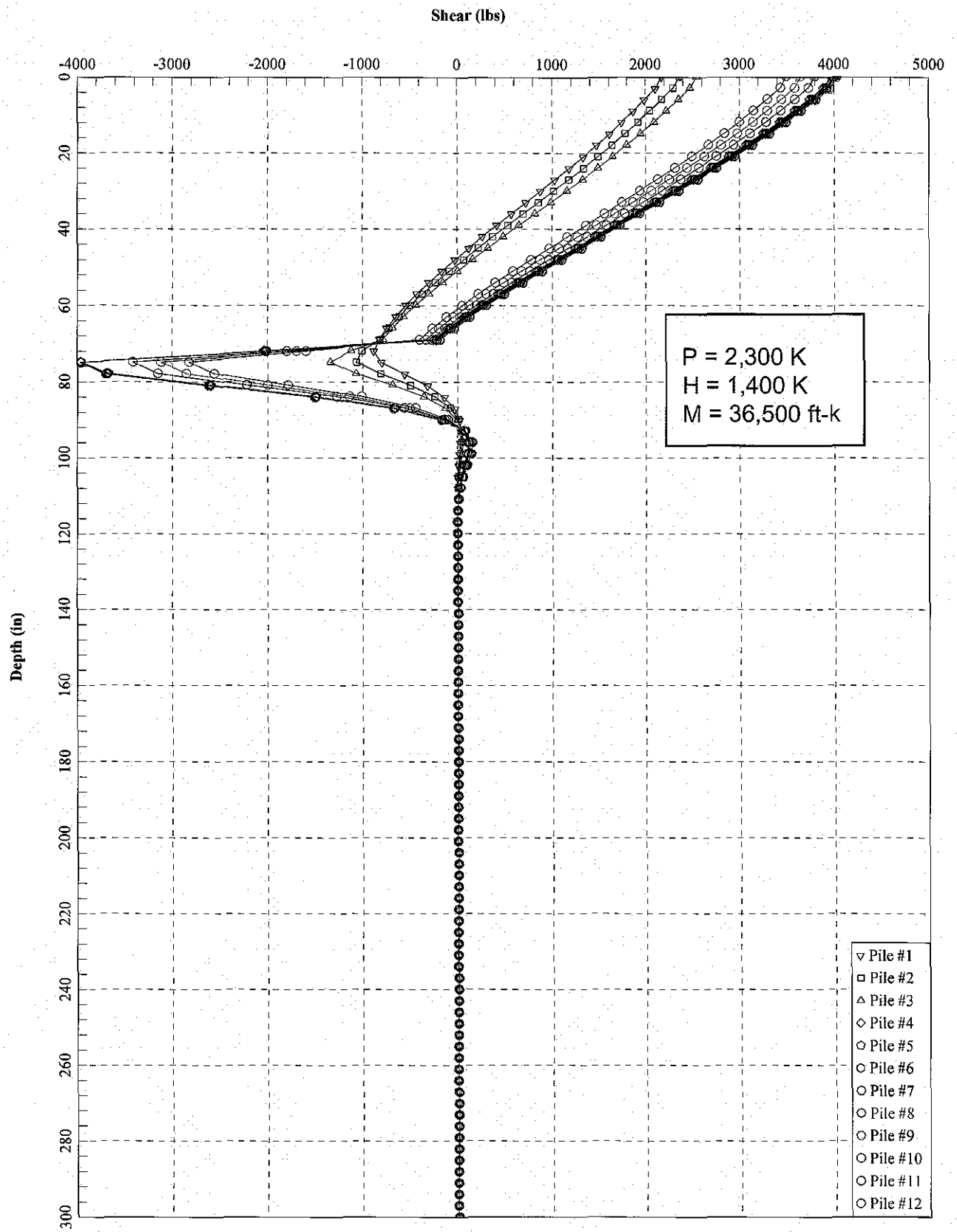
Pile Cap Deflection = 0.06 inch



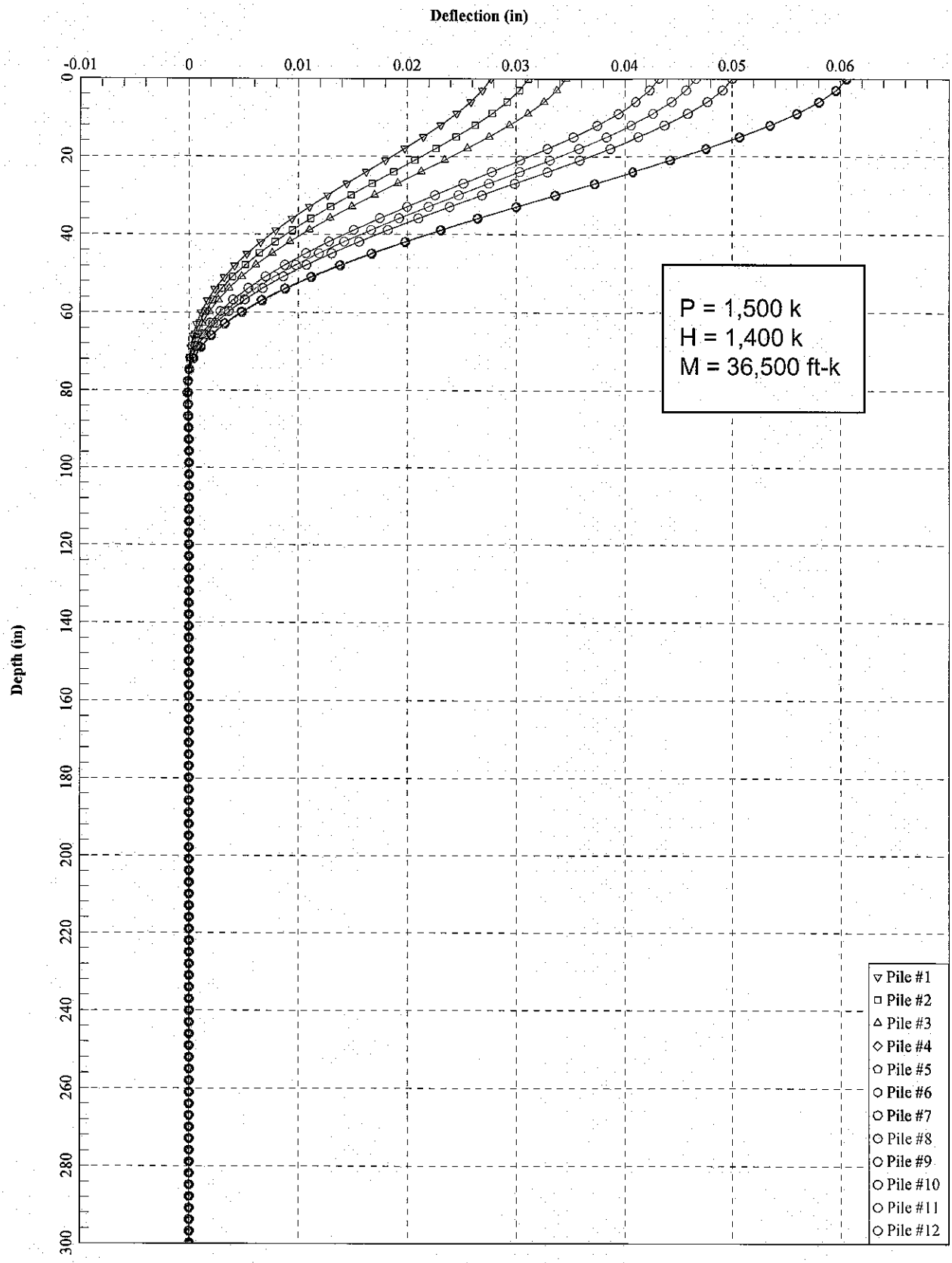
W.O. 4890 Umauma Stream Bridge Pier 3, 7-inch diameter micropiles transverse 4/20/11



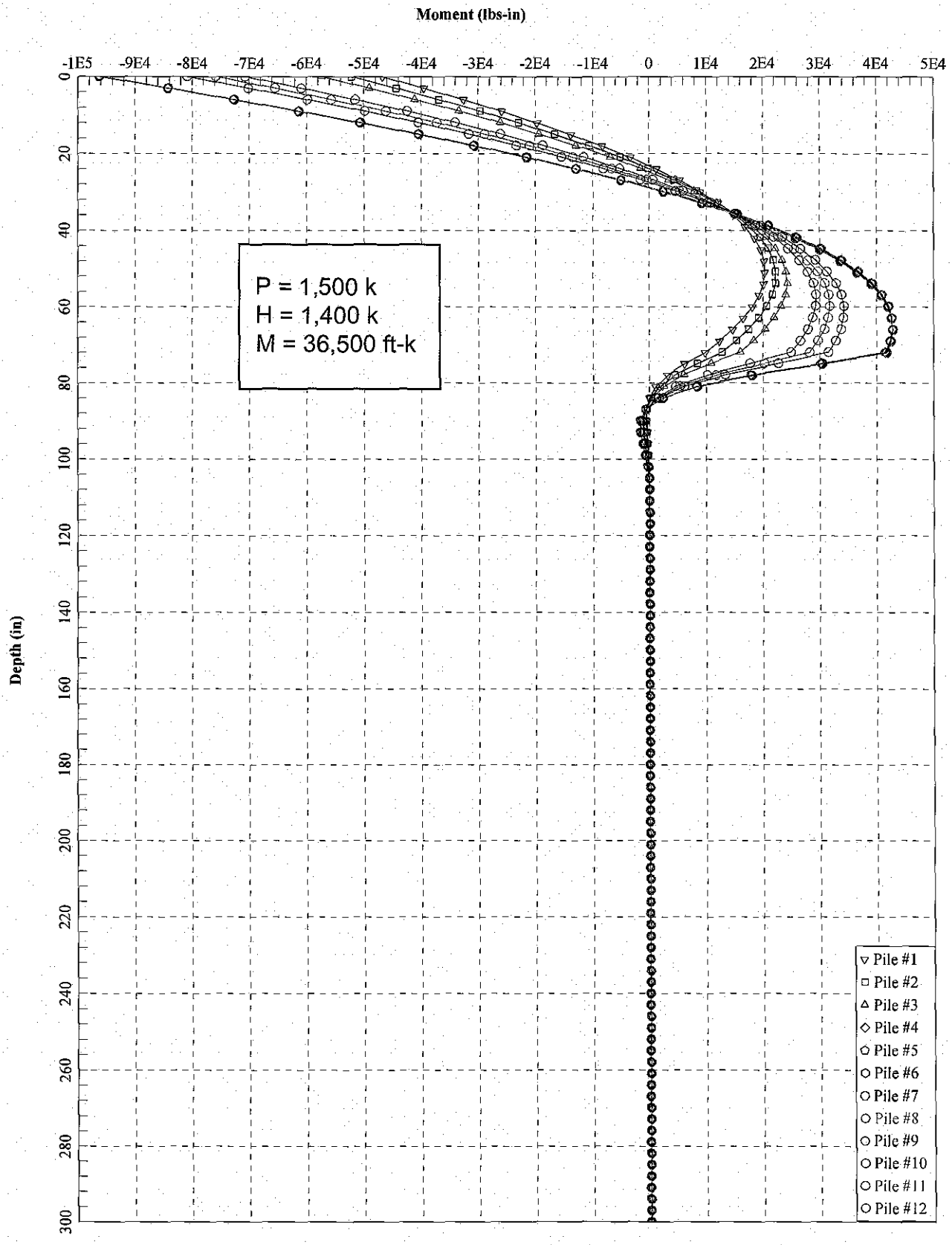
W.O. 4890 Umauma Stream Bridge Pier 3, 7-inch diameter micropiles transverse 4/20/11



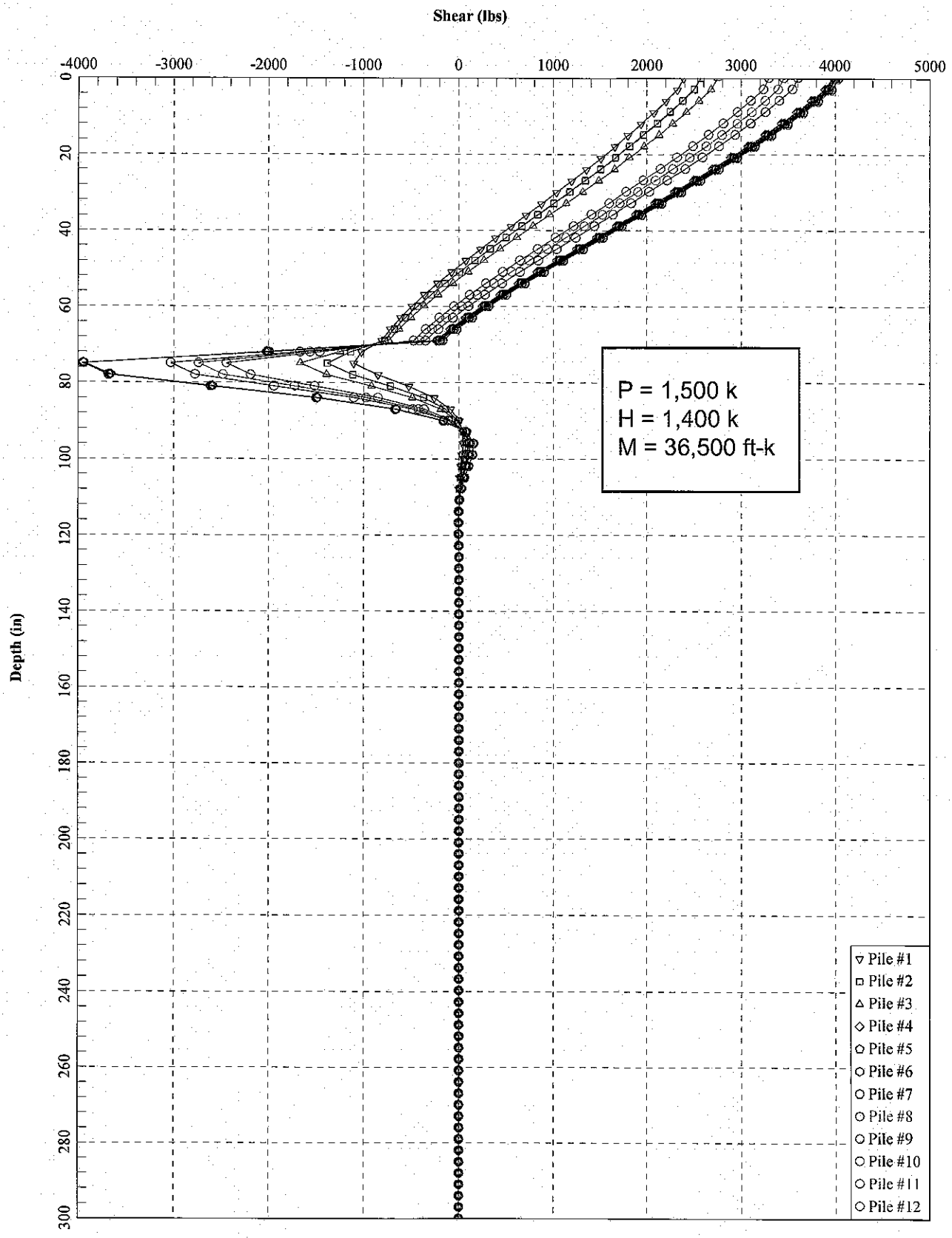
W.O. 4890 Umauma Stream Bridge Pier 3, 7-inch diameter micropiles transverse 4/20/11



W.O. 4890 Umauma Stream Bridge Pier 3, 7-inch diameter micropiles transverse 4/20/11



W.O. 4890 Umauma Stream Bridge Pier 3, 7-inch diameter micropiles transverse 4/20/11



W.O. 4890 Umauma Stream Bridge Pier 3, 7-inch diameter micropiles transverse 4/20/11

APPENDIX D

SITE CLASS CLASSIFICATION

AND

DESIGN RESPONSE SPECTRUM

Applied Geosciences, LLC

• 2922 Kahaloa Drive, Honolulu, HI 96822 • Phone: (808) 221-0104 • ags@pixi.com

February 8, 2011

Con Truong, P.E.
Ernest K. Hirata & Associates, Inc.
99-1433 Koaha Place
Aiea, HI 96701-3279

Project No. SRSS00210

Re: Design Response Spectrum, Umauma Stream Bridge

Dear Con:

Attached find the design response spectrum for the Umauma Stream Bridge Rehabilitation project.

Approach

The spectrum was developed in accordance with the *AASHTO LRFD Bridge Design Specifications, 2010, 5th Edition*. It represents the conditions to be expected at the location of the project with a 7% probability of excedance in 75 years (5% of critical damping). This represents a return period of approximately 1,000 years. A review of borings B1, B2 and related subsurface geophysical measurements taken nearby indicates interpreted average shear wave velocities in the upper 100 feet of about 1,000 ft/s for boring B1 and about 1,700 ft/s for boring B2. This suggests a site class D for boring B1 and site class C for boring B2. A uniform conservative site class C was assumed to develop the design spectrum. The computed spectral acceleration values are shown in tabular and graphical form in the Figure 1.

Discussion

The AASHTO code procedure takes the site-specific soil conditions into account in a simple manner, but it does so based on experience gained primarily in the continental U.S. It is not entirely clear how basaltic rock and weathered volcanic soils may affect ground motions. The calculated spectral values are therefore correspondingly conservative. On the other hand, the ASHTO method assumes a level ground surface and makes no allowance for topographic effects. Given the steep nature of the Umaumu gulch, this is potentially a significant factor. In general, amplification of motions occurs as a result of topographic highs (bridge abutments), whereas de-amplification occurs in concave shapes (gulch bottom). This is only a general rule of thumb and more elaborate numerical site response analyses would have to be conducted to evaluate surface ground motions along the entire alignment of the bridge.

If you have any questions, do not hesitate to contact me.

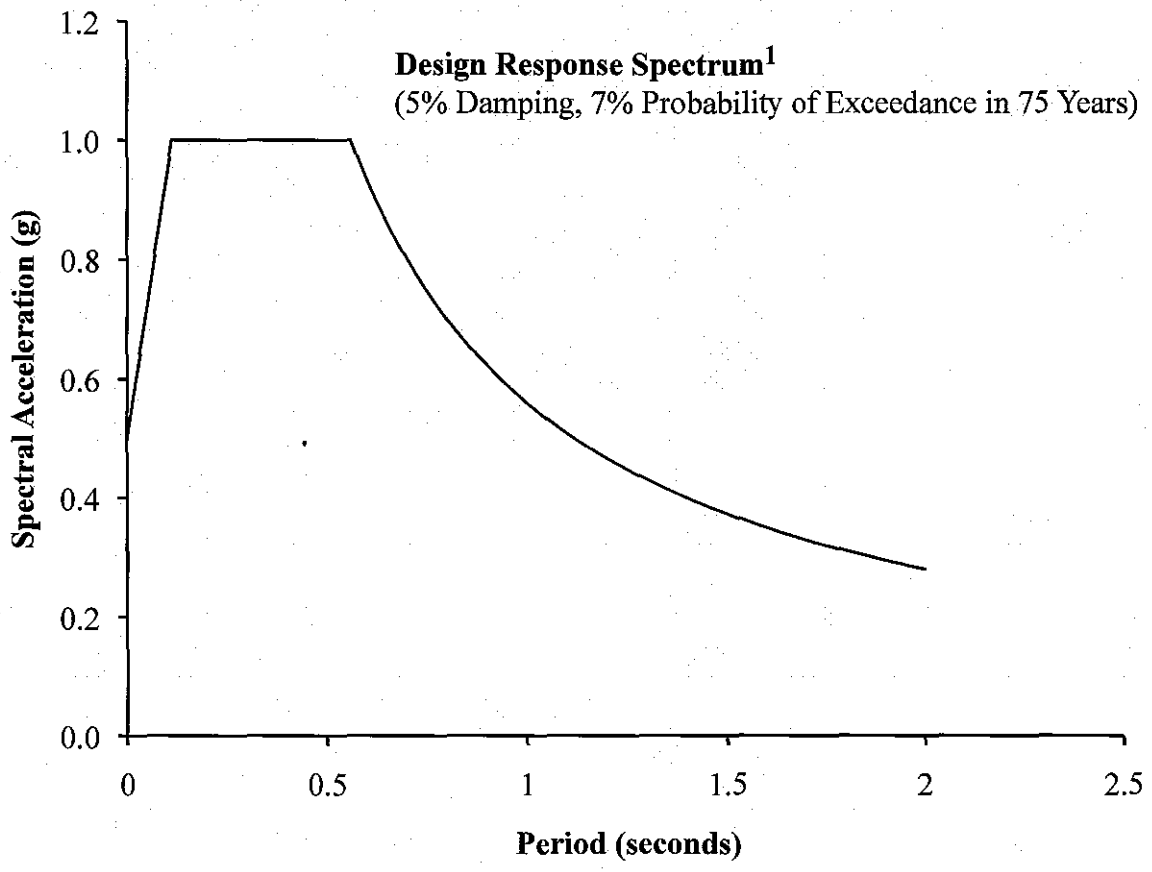
Sincerely,

Horst Brandes

Horst G. Brandes, Ph.D., P.E.
President

Att: Figure 1 (Design Response Spectrum)

HORST G. BRANDES
LICENSED PROFESSIONAL ENGINEER
No. 9336
HAWAII, U.S.A.



[1]AASHTO LRFD Bridge Design Specifications, 2010

Period (sec)	Spectral Acceleration (g)	Period (sec)	Spectral Acceleration (g)	Period (sec)	Spectral Acceleration (g)	Period (sec)	Spectral Acceleration (g)
0.00	0.50	0.40	1.00	1.00	0.56	1.50	0.37
0.01	0.54	0.45	1.00	1.02	0.55	1.52	0.37
0.02	0.59	0.50	1.00	1.04	0.54	1.54	0.36
0.03	0.63	0.56	1.00	1.06	0.53	1.56	0.36
0.04	0.68	0.58	0.97	1.08	0.52	1.58	0.35
0.05	0.72	0.60	0.93	1.10	0.51	1.60	0.35
0.06	0.77	0.62	0.90	1.12	0.50	1.62	0.35
0.07	0.81	0.64	0.88	1.14	0.49	1.64	0.34
0.08	0.86	0.66	0.85	1.16	0.48	1.66	0.34
0.09	0.90	0.68	0.82	1.18	0.47	1.68	0.33
0.10	0.95	0.70	0.80	1.20	0.47	1.70	0.33
0.11	0.99	0.72	0.78	1.22	0.46	1.72	0.33
0.11	1.00	0.74	0.76	1.24	0.45	1.74	0.32
0.12	1.00	0.76	0.74	1.26	0.44	1.76	0.32
0.13	1.00	0.78	0.72	1.28	0.44	1.78	0.31
0.14	1.00	0.80	0.70	1.30	0.43	1.80	0.31
0.15	1.00	0.82	0.68	1.32	0.42	1.82	0.31
0.16	1.00	0.84	0.67	1.34	0.42	1.84	0.30
0.17	1.00	0.86	0.65	1.36	0.41	1.86	0.30
0.18	1.00	0.88	0.64	1.38	0.41	1.88	0.30
0.19	1.00	0.90	0.62	1.40	0.40	1.90	0.29
0.20	1.00	0.92	0.61	1.42	0.39	1.92	0.29
0.25	1.00	0.94	0.60	1.44	0.39	1.94	0.29
0.30	1.00	0.96	0.58	1.46	0.38	1.96	0.29
0.35	1.00	0.98	0.57	1.48	0.38	1.98	0.28
						2.00	0.28

Applied Geosciences, LLC

AASHTO Design Response Spectrum
Umauma Stream Bridge Rehabilitation

Figure 1

APPENDIX C

STREAM BIOLOGICAL AND WATER QUALITY SURVEYS FOR THE UMAUMA STREAM BRIDGE REHABILITATION PROJECT NEAR HAKALAU, HAWAI'I

AECOS, INC., SEPTEMBER 21, 2010

AECOS No. 1237

Stream biological and water quality surveys for the Umauma Stream Bridge Rehabilitation Project near Hakalau, Hawaiʻi.

Prepared by:

AECOS Inc.
45-939 Kamehameha Hwy, Suite 104
Kāneʻohe, Hawaiʻi 96744-3221

September 21, 2010

Stream biological and water quality surveys for the Umauma Stream Bridge Rehabilitation Project near Hakalau, Hawaiʻi.

September 21, 2010 | ***Draft Copy*** | *AECOS* No.1237

Chad Linebaugh
AECOS, Inc.
45-939 Kamehameha Hwy, Suite 104
Kāne'ohe , Hawai'i 96744
Phone: (808) 234-7770 Fax: (808) 234-7775 Email: aecos@aecos.com

Introduction

In July 2010, *AECOS*, Inc. biologists conducted biological and water quality surveys in Umauma Stream, located 14 mi (23 km) north of Hilo, along the Hāmākua Coast, on the island of Hawaiʻi (Fig. 1). The existing Māmalahoa Highway (State Hwy. 19; also known as Hawaiʻi Belt Road) bridge crossing Umauma Stream is scheduled for rehabilitation. *AECOS*, Inc. was contracted by Pacific Environmental Planners, Inc.[1] to ascertain aquatic resources and assess water quality for the proposed project. This report details findings of those surveys.

Stream Description

Umauma Stream originates on the eastern slopes of Mauna Loa, between the Puʻu Kanakaleonui cinder cone and Puʻu ʻUlaʻula at an elevation above 12,000 ft (3,660 m). Nauhi Stream originating around 8,050 ft (2,450 m) and Honohina Stream originating at 7,500 ft (2,290 m) represent two major tributaries to Umauma in the upper reaches of the watershed. Several smaller unnamed tributaries join both flows before the confluence of Nauhi and Honohina at 1,700 ft (520 m) within the confines of the Hakalau Forest National Wildlife Refuge. Hanapueo Stream joins the system just above the project site at Māmalahoa Highway. Approximately 250 ft (75 m) downstream from the highway, Umauma Stream reaches its coastal outlet into the Pacific Ocean as a

[1] This document will be incorporated into the Environmental Assessment (EA) for the Umauma Stream Bridge Rehabilitation Project and will become part of the public record.

waterfall into a small bay, northwest of Hakalau Bay on the Hāmākua Coast of the Island of Hawai'i (Fig. 1). The watershed for Umauma Stream is large (21.5 mi^2 or 55.7 km^2) and steep with areas upslope of the project site receiving in excess of 250 in (650 cm) of rainfall annually (Climate Source, 2010; HSCO, 2010). The result is a stream course characterized by highly eroded, steep stream banks with numerous cascades and waterfalls.

Figure 1. General location of the project site, northwest of Hakalau, Hawai'i.

Survey Methods

AECOS, Inc. biologists surveyed a 1200-ft (365-m) segment of Umauma Stream on July 21, 2010. The purpose of the survey was to identify aquatic biota present and assess water quality within the survey area surrounding the Umauma Stream bridge crossing. Stream flow was brisk with clear stream

water flowing through the survey area. Water quality field measurements and samples were collected from three stations near the project site. Table 1 lists analytical methods and instrumentation used in the analyses. Macro-algae samples were collected for microscopic examination and identification from three locations near the project site.

Table 1. Analytical methods and instruments used for water quality analyses of Umauma Stream water sampled on July 21, 2010.

Analysis	**Method**	**Reference**	**Instrument**
Ammonia	EPA 350.1 M	EPA (1993)	Technicon AutoAnalyzer II
Conductivity	SM 2510-B	Standard Methods, 20th Edition (1998)	Hydach pH/conductivity meter
Dissolved Oxygen	SM 4500-O G	Standard Methods 20th Edition (1998)	YSI Model 550A Dissolved Oxygen Meter
Nitrate + Nitrite	EPA 353.2 Rev 2.0	EPA (1993)	Technicon AutoAnalyzer II
pH	SM 4500 H+	Standard Methods 20th Edition (1998)	Hannah pocket pH meter
Temperature	thermister calibrated to NBS. Cert. thermometer SM 2550 B	Standard Methods 20th Edition (1998)	YSI Model 550A Dissolved Oxygen Meter
Total Nitrogen	persulfate digestion/EPA 353.2	Grasshoff et al (1986)/ EPA (1993)	Technicon AutoAnalyzer II
Total Phosphorus	EPA 365.1 Rev 2.0	EPA (1993)	Technicon AutoAnalyzer II
Total Suspended Solids	Method 2540 D	Standard Methods 20th Edition (1998)	Mettler H31 balance
Turbidity	EPA 180.1 Rev 2.0	EPA (1993)	Hach 2100N Turbidimeter

Station "Upstream" was located in a large pool approximately 175 ft (53 m) upstream of the Māmalahoa Highway bridge, upstream from the Umauma-Hanapueo confluence. Station "Bridge" was located a few meters downstream from the bridge. Station "Downstream" was located in a pool just above the waterfall near the ocean shore, about 200 ft (60 m) downstream from the bridge. All water samples were collected on July 21, 2010 and delivered to *AECOS*, Inc. in Kaneʻohe, Oʻahu for laboratory analyses (*AECOS* Log No 26469).

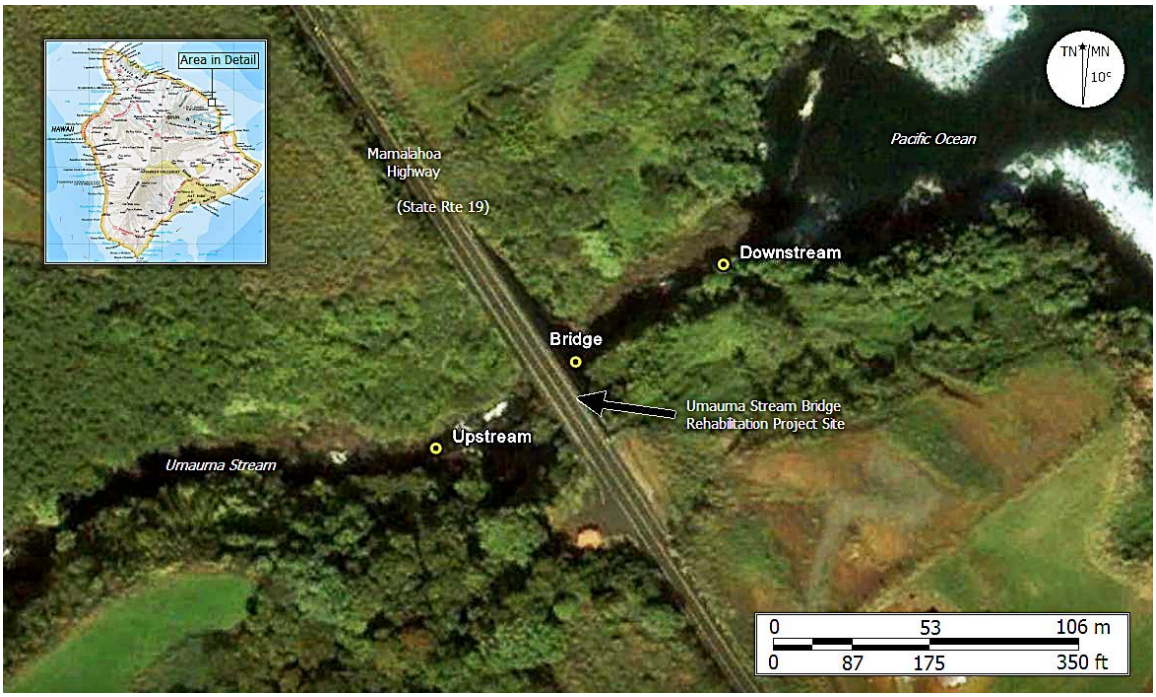


Figure 2. Location of water quality stations (yellow circles) sampled on July 21, 2010.

Survey Results

Within the survey area, the stream bed consists of basaltic bedrock and is generally 50 to 60 ft (10 to 30 m) in width, except at the confluence with Hanepueo where total width exceeds 100 ft (33 m). Sediment is present only in deeper pools which are uncommon near the bridge. The stream gorge margins are steep, in excess of 100 ft (33m) high, and covered with vegetation. Of the 23 species of flowering plants and fern observed along stream banks in the survey area, only one species, *neke* (*Cyclsorus interruptus*) is indigenous to the main Hawaiian Islands. The bulk of the species present are recently naturalized species in addition to a few Polynesian introductions. The most commonly observed plants at the project site include: sourbush (*Pluchea carolinensis*), *neke*, Guinea grass (*Urochloa maxima*), torpedo grass (*Panicum repens*), and Hilo grass (*Paspalum conjugatum*).

Water Quality

Table 2 lists water quality results for all analyzed parameters from Umauma Stream samples collected July 21, 2010. Field measurements for temperature, pH, and dissolved oxygen reflect only minor variability between stations near the project site. Total suspended solid concentrations and turbidity levels are low, reflecting the clear stream waters observed during sampling. Likewise, the nutrient concentrations of ammonia, nitrate-nitrite, total nitrogen and total phosphorus are all low. Low ammonia concentrations, like those found in Umauma Stream during the survey, are indicative of constant water flow preventing accumulation of biotic waste from aquatic life. The presence of high, oxidized nitrogen (nitrate-nitrite) in stream waters generally occur only when significant amounts of groundwater are contributing to the stream's flow. Levels of nitrate-nitrite found at all three stations on July 21, 2010 may indicate some input from ground water sources, like seeps and springs. Total nitrogen and total phosphorus at their respective levels depict clean stream waters typically found only in the least developed watersheds of the Hawaiian Islands.

Table 2. Water quality characteristics of Umauma Stream on July 21, 2010.

Station	Time	Temp. (°C)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (% sat.)	pH --	Conductivity (μmhos/cm)
Downstream	1225	25.4	8.28	101	7.11	59
Bridge	1235	25.2	8.41	102	7.65	59
Upstream	1250	25.3	8.55	104	7.78	52

	TSS (mg/l)	Turbidity (ntu)	Ammonia (μg N/l)	Nitrate+ Nitrite (μg N/l)	Total N (μg N/l)	Total P (μg P/l)
Downstream	1.2	0.81	1	29	95	11
Bridge	2.0	0.70	<1	28	99	10
Upstream	1.2	0.58	1	42	104	10

Aquatic Biota

Upstream from the project site native gobies are quite common in large pools. *ʻOʻopu nākea* (*Awaous guamensis*) and *ʻoʻopu ʻalamoʻo* (*Lentipes concolor*) comprise most of the gobies sighted but a few *ʻoʻopu nōpili* (*Sicyopterus stimpsoni*) are present as well (Fig. 3). Native goby densities as high as 14/m^2 were noted in a large pool 800 ft (m) upstream of the bridge slated for rehabilitation. Native crustaceans are also present upstream of the project. Mountain *ʻōpae* or *ʻōpae kalaʻole* (*Atyoida bisulcata*; Fig. 3), are occasional while Hawaiian prawn or *ʻōpae ʻoehaʻa* (*Macrobrachium grandimanus*) are rare in large pools.

Near the project site, the Hanapueo Stream enters from the south side (left bank) of the stream as a waterfall into a small pool (Fig. 3). Swordtails (*Xiphophorus helleri*) are occasional in the brief segment of Hanapueo between the waterfall and the confluence with Umauma. A few small, shallow pools in the segment are overgrown with chlorophytes, from the genera *Rhizoclonium* and *Spyrogyra*, and diatoms, including *Synedra ulna*.

Umauma Stream bed near the project site is narrower than upstream. Water flow is brisk through a series of small pools and falls. *ʻOʻopu nākea* and *ʻoʻopu ʻalamoʻo* are sighted rarely. Feathery tufts of bright green algae (*Stigeolconium* sp.) are conspicuous on boulders and bedrock with fast water flow. Two species of dragonflies, the scarlet skimmer (*Crocothemis servilla*) and roseate skimmer (*Orthemis ferruginea*) are sighted occasionally resting on riparian vegetation along stream margins or flying above stream waters.

Similar fish and crustaceans are present in the stream downstream of the highway bridge crossing. Several isolated pools are located along stream margins just upslope from the terminal waterfall. Dragonfly and damselfly naiads (Order Odonata) are occasional in the shallow pools and red-rimmed melania (*Melanoides tuberculata*) are also present. Close inspection reveals tiny pouch snails (Family Physidae) abundant in these pools, feeding on algae and other organic matter on the pool bottom. *ʻAʻama* or thin shelled rock crabs (*Graspsus tenuicrustatus*), which are abundant along rocky marine shorelines throughout the islands are common near the stream's coastal outlet into the Pacific Ocean. Remarkably however, the crabs were present, albeit in lesser numbers, throughout the survey area including the upstream edge of the survey area approximately 1,200 ft (365 m) from the shoreline at 300-ft (90-m) elevation. All aquatic biota identified from Umauma Stream during the July 2010 survey are listed in Table 3 alongside historical data on species reported from previous surveys (DAR, 2009).

Figure 3. (Clockwise from top left) Hanapueo confluence with Umauma Stream just upslope from highway bridge; Stream flow and chlorophyte growth downstream from project site; Endemic *ʻōpae kālāʻole* from Umauma stream; Numerous *ʻoʻopu nakea* and *ʻoʻopu ʻalamoʻo* in a large pool upstream from the project site.

Assessment

Umauma Stream is listed as a perennial stream by the State of Hawaiʻi, Division of Aquatic Resources (DAR, 2009) and assigned stream code 8-2-030. The stream is classified as Class-2 inland, flowing waters. The protected uses of Class 2 waters include recreational use, support and propagation of fish and

Table 3. Checklist of aquatic biota observed during the July 21, 2010 survey or reported previously as present in Umauma Stream.

PHYLUM, CLASS, ORDER, FAMILY *Genus species*	Common name	Abundance	Status	ID Code
	ALGAE			
BACILLARIOPHYTA				
FRAGILARIACEAE				
Synedra ulna (Nitzsch) Ehrenb.	diatom	O	**Ind.**	3
CHLOROPHYTA				
CHAETOPHORACEAE				
Stigeoclonium sp. Kuetzing		C	**Ind.**	3
CLADOPHORACEAE				
Rhizoclonium sp. Kuetzing		R	**Ind.**	3
ZYGNEMATACEAE				
Spirogyra sp. Link in C.G. Nees		O	**Ind.**	3
	INVERTEBRATES			
PORIFER, DEMOSPONGIAE				
HAPLOSCLERIDA				
SPONGILLIDAE				
Heteromeyenia baileyi Bowerbank	freshwater sponge	--	**Ind.**	1
MOLLUSCA,GASTROPODA				
BASOMMATOPHORA				
LYMNAEIDAE				
unid.	pond snail	--	Nat.	1
PHYSIDAE				
unid.	pouch snail	C	Nat.	1,2
MOLLUSCA,GASTROPODA				
NEOTAENIOGLOSSA				
THIARIDAE				
Melanoides tuberculata Muller	red rimmed melania	R	Nat.	1,2
MOLLUSCA,GASTROPODA				
NERITOPSINA				
NERITIDAE				
Neritina granosa Sowerby	*hīhīwai*	--	**End.**	1
ARTHROPODA,INSECTA				
ODONATA, ANISOPTERA				
unid.	dragonfly naiad	O	--	2
LIBELLULIDAE				
Crocothemis servilla Drury	scarlet skimmer	O	Nat.	1,2
Orthemis ferruginea Fabricius	roseate skimmer	O	Nat.	1,2

Table 3 (continued).

PHYLUM, CLASS, ORDER, FAMILY *Genus species*	Common name	Abundance	Status	ID Code
ARTHROPODA, INSECTA ODONATA, ZYGOPTERA				
unid.	damselfly naiad	O	--	2
ARTHROPODA, MALACOSTRACA, DECOPODA				
ATYIDAE				
Atyoida bisulcata JW Randall	Hawaiian shrimp *ʻōpae kālā ʻole*	O	**End.**	2
PALAEMONIDAE				
Macrobrachium grandimanus JW Randall	Hawaiian prawn; *ʻōpaeʻoheaʻa*	R	**End.**	2
Macrobrachium lar J.C. Fabricius	Tahitian river prawn	--	Nat.	1
GRAPSIDAE				
Grapsus tenuicrustatus	thin shelled rock crab *ʻaʻama*	C	**Ind.**	2
	FISHES			
CHORDATA, ACTINOPTERYGII				
GOBIIDAE				
Awaous guamensis Valenciennes	*ʻoʻopu nākea*	A	**Ind.**	1,2
Lentipes concolor Gill	*ʻoʻopu ʻalamoʻo*	C	**End.**	1,2
Sicyopterus stimpsoni Gill	*ʻoʻopu nōpili*	O	**End.**	1,2
POECIILIDAE				
Poecilia reticulata Peters	guppy	C	Nat.	1,2
Xiphophorus hellerii Heckel	swordtail	O	Nat.	2
unid.	poeciliid fish	--	Nat.	1
	AMPHIBIANS			
CHORDATA, AMPHIBIA, ANURA				
BUFONIDAE				
Bufo marinus L.	giant toad	R	Nat.	1,2
RANIDAE				
Rana catesbeiana Shaw	American bullfrog	R	Nat.	1,2

KEY TO SYMBOLS USED:

Abundance categories:

R – Rare – only one or two individuals observed.
U – Uncommon – several to a dozen individuals observed.
O – Occasional – seen irregularly in small numbers
C – Common -observed everywhere, although generally not in large numbers.

A – Abundant – observed in large numbers and widely distributed.

Table 3 (continued).

Status categories:
End – Endemic – species found only in Hawaii
Ind. – Indigenous – species found in Hawaii and elsewhere
Nat. – Naturalized – species were introduced to Hawaii intentionally, or accidentally.
Identification codes:
1 –reported present within the Umauma watershed (DAR, 2009).
2 – field identification during July, 21, 2010
3 - identified by laboratory microscopic examination from collection made on July 21, 2010.

other aquatic life, and agricultural and industrial water supply. Umauma Stream does not appear on the Hawaiʻi Department of Health (HDOH) 2006 list of impaired waters in Hawaiʻi, prepared under Clean Water Act §303(d) (HDOH, 2008).

The flowing water of Umauma Stream—sampled at three locations in the project vicinity on July 21, 2010—has excellent water quality: low suspended particulates (turbidity and suspended solids) and only slightly elevated nitrate-nitrite nitrogen concentrations relative to State of Hawaiʻi water quality criteria for streams (Table 4). Upstream from the project, the nutrient concentrations are low, and fall below state water quality criteria. A single sampling event does not imply impairment or compliance with these parameters; a geometric mean of at least three sampling events would be required to determine compliance.

Umauma Stream provides habitats for an impressive assemblage of native aquatic species. Three species of *ʻoʻopu*, two of which (*L. concolor* and *S. stimpsoni*) are endemic to the Hawaiian Islands and two species of endemic crustaceans (*A. bisulcata* and *M. grandimanus*) were observed during the July 2010 field survey. A native limpet (*Neritina granosa*) and sponge (*Heteromeyenia baileyi*) have also reported (DAR, 2009) from the stream reach. All of these native fishes and invertebrates, except the sponge require passage up and down the stream to complete their diadromous life cycle.

None of the aquatic species observed during these surveys is listed as threatened or endangered by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973, as amended, or by the State of Hawaiʻi under its endangered species program (DLNR 1998; USFWS, 2009).

The proposed project plans to enlarge bridge footings slightly. The footings are planned to be placed within the existing footprint in the stream resulting in long term loss of a few square feet of natural habitat. The project is not anticipated to have adverse long term effect to stream biota or water quality. A Best Management Practices (BMP) plan should be designed and implemented to

minimize any environmental impacts to water quality and aquatic biota in the vicinity of the project site during construction. Footings placed within the ordinary high water mark (OHWM) of the stream will require a permit from the U. S. Army Corps of Engineers as this is a waterway subject to federal jurisdiction.

Table 4. State of Hawaiʻi water quality criteria for streams (geometric mean values) for wet (Nov. 1-Apr. 30) and dry (May 1-Oct. 31) seasons from HAR §11-54-05.2(b).

	Total Nitrogen (µg N/l)	Nitrate + Nitrite (µg N/l)	Total Phosphorus (µg P/l)	Turbidity (NTU)	Total Suspended Solids (mg/l)
Not to exceed given value (dry season)	180.0	30.0	30.0	2.0	10.0
(wet season)	250.0	70.0	50.0	5.0	20.0
Not to exceed more than 10% of the time (dry season)	380.0	90.0	60.0	5.5	30.0
(wet season)	520.0	180.0	100.0	15.0	50.0
Not to exceed more than 2% of the time (dry season)	600.0	170.0	80.0	10.0	55.0
(wet season)	800.0	300.0	150.0	25.0	80.0

- pH – shall not deviate more than 0.5 units from ambient and not be lower than 5.5 nor higher than 8.0.
- Dissolved oxygen – not less than 80% saturation.
- Temperature – shall not vary more than 1 °C from ambient.
- Conductivity – not more than 300 micromhos/cm.

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