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GOVERNOR OF HAWAII



**STATE OF HAWAII**  
**DEPARTMENT OF LAND AND NATURAL RESOURCES**

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**OCT 02 2014**

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KAHOOLAWE ISLAND RESERVE COMMISSION  
LAND  
STATE PARKS

Ms. Jessica Wooley, Director  
Office of Environmental Quality Control  
Department of Health  
235 South Beretania Street, Suite 702  
Honolulu, Hawaii 96813

Dear Ms. Wooley:

**Subject: Final Environmental Assessment and Finding of No Significant Impact  
for Keahua Stream Bridge, TMK (4) 4-2-001:002, Wailua, Island of Kauai**

With this letter, the Hawaii State Department of Land and Natural Resources (DLNR) hereby transmits the final environmental assessment and anticipated finding of no significant impact (FEA-FONSI) for the subject project for publication in the next available edition of the Environmental Notice.

Enclosed is a completed OEQC Publication Form, one copy of the FEA-FONSI, a CD with an Adobe Acrobat PDF file of the same, and an electronic copy of the publication form in MS Word.

Please contact Mr. Carty Chang, Chief Engineer of our Engineering Division at 587-0230 if you have any questions.

Sincerely,

WILLIAM J. AILA, JR.  
Chairperson

**RECEIVED**  
**14 OCT -7 P1:58**  
**OFC. OF ENVIRONMENTAL  
QUALITY CONTROL**

Enclosures

c:Ron Terry, Ph.D., Project Environmental Consultant (w/o attachment)

**FILE COPY**

**OCT 23 2014**

**AGENCY ACTIONS  
SECTION 343-5(B), HRS  
PUBLICATION FORM (JULY 2012 REVISION)**

**Project Name:** Keāhua Stream Bridge  
**Island:** Kaua'i  
**District:** Lihu'e  
**TMK:** (4th.): 4-2-001:002 (por.)  
**Permits:** County of Kaua'i Grading Permit  
State BLNR Conservation District Use Permit  
**Proposing/Determination Agency:** State of Hawaii, Department of Land and Natural Resources  
(Address, Contact Person, Telephone) Clyde Y. Tomihara  
Hawaii State DLNR Engineering Division  
1151 Punchbowl Street, Room 221  
Honolulu HI 96809  
**Consultant:** Geometrician Associates  
(Address, Contact Person, Telephone) PO Box 386  
Hilo HI 96721  
(808) 969-7090  
rterry@hawaii.rr.com

**Status (check one only):**

- DEA-AFNSI** Submit the proposing agency notice of determination/transmittal on agency letterhead, a hard copy of DEA, a completed OEQC publication form, along with an electronic word processing summary and a PDF copy (you may send both summary and PDF to [oeqchawaii@doh.hawaii.gov](mailto:oeqchawaii@doh.hawaii.gov)); a 30-day comment period ensues upon publication in the periodic bulletin.
- FEA-FONSI** Submit the proposing agency notice of determination/transmittal on agency letterhead, a hard copy of the FEA, an OEQC publication form, along with an electronic word processing summary and a PDF copy (send both summary and PDF to [oeqchawaii@doh.hawaii.gov](mailto:oeqchawaii@doh.hawaii.gov)); no comment period ensues upon publication in the periodic bulletin.
- FEA-EISPN** Submit the proposing agency notice of determination/transmittal on agency letterhead, a hard copy of the FEA, an OEQC publication form, along with an electronic word processing summary and PDF copy (you may send both summary and PDF to [oeqchawaii@doh.hawaii.gov](mailto:oeqchawaii@doh.hawaii.gov)); a 30-day consultation period ensues upon publication in the periodic bulletin.
- Act 172-12 EISPN** Submit the proposing agency notice of determination on agency letterhead, an OEQC publication form, and an electronic word processing summary (you may send the summary to [oeqchawaii@doh.hawaii.gov](mailto:oeqchawaii@doh.hawaii.gov)). NO environmental assessment is required and a 30-day consultation period upon publication in the periodic bulletin.
- DEIS** The proposing agency simultaneously transmits to both the OEQC and the accepting authority, a hard copy of the DEIS, a completed OEQC publication form, a distribution list, along with an electronic word processing summary and PDF copy of the DEIS (you may send both the summary and PDF to [oeqchawaii@doh.hawaii.gov](mailto:oeqchawaii@doh.hawaii.gov)); a 45-day comment period ensues upon publication in the periodic bulletin.
- FEIS** The proposing agency simultaneously transmits to both the OEQC and the accepting authority, a hard copy of the FEIS, a completed OEQC publication form, a distribution list, along with an electronic word processing summary and PDF copy of the FEIS (you may send both the summary and PDF to [oeqchawaii@doh.hawaii.gov](mailto:oeqchawaii@doh.hawaii.gov)); no comment period ensues upon publication in the periodic bulletin.
- Section 11-200-23 Determination** The accepting authority simultaneously transmits its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS to both OEQC and the proposing agency. No comment period ensues upon publication in the periodic bulletin.
- Section 11-200-27 Determination** The accepting authority simultaneously transmits its notice to both the proposing agency and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously

accepted FEIS and determines that a supplemental EIS is not required. No EA is required and no comment period ensues upon publication in the periodic bulletin.

\_\_\_Withdrawal (explain)

**Summary** (Provide proposed action and purpose/need in less than 200 words. Please keep the summary brief and on this one page):

The Department of Land and Natural Resources proposes to build a vehicular and pedestrian bridge and improve parking on State land in the Conservation District next to the existing concrete ford crossing of Kuamo'o Road at Keāhua Stream, within the Keāhua Forestry Arboretum. The bridge would allow safer and more consistently available access to recreational resources, preventing vehicles from being swept over the ford and addressing the safety problems of mixing motor vehicles and recreational water users. The single-span steel truss bridge would be 115 feet long with one 13-foot lane travel lane and a protected sidewalk cantilevered off one side of the bridge. The concrete abutments would be placed outside of the stream channel. The existing roadway approaches would be rerouted into the parking lots, which would be slightly expanded and paved to provide parking, including two ADA compliant stalls. The access to the existing ford would be eliminated for vehicles using bollards. Temporary erosion control structures would prevent silt from entering the stream directly or indirectly through the adjacent ditches. No threatened or endangered plant species would be affected, and timing of project activities would avoid or minimize impacts to Hawaiian hoary bats. No historic or cultural properties will be affected, and visual impacts will be minor.

**FINAL ENVIRONMENTAL ASSESSMENT  
AND FINDING OF NO SIGNIFICANT IMPACT**

**Keāhua Stream Bridge**

TMK (4) 4-2-001:002 (por.)  
Līhu‘e District, Island of Kaua‘i, State of Hawai‘i

August 2014

State of Hawai‘i  
Department of Land and Natural Resources  
Engineering Division



**FINAL ENVIRONMENTAL ASSESSMENT  
AND FINDING OF NO SIGNIFICANT IMPACT**

**Keāhua Stream Bridge**

TMK (4) 4-2-001:002 (por.)  
Līhu‘e District, Island of Kaua‘i, State of Hawai‘i

PROPOSING/  
APPROVING AGENCY:

State of Hawai‘i  
Department of Land and Natural Resources  
Engineering Division  
PO Box 621  
Honolulu, HI 96809

CONSULTANT:

Geometrician Associates LLC  
PO Box 396  
Hilo, HI 96721

CLASS OF ACTION:

Use of State Land  
Use of State Funds  
Use of Land in the Conservation District

This document is prepared pursuant to:

The Hawai‘i Environmental Protection Act,  
Chapter 343, Hawai‘i Revised Statutes (HRS), and  
Title 11, Chapter 200, Hawai‘i Department of Health Administrative Rules (HAR).

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APPENDIX 7	Faunal Survey (Terrestrial Vertebrate Fauna)

## **SUMMARY OF THE PROPOSED ACTION, ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES**

The Department of Land and Natural Resources (DLNR) proposes to build a vehicular and pedestrian bridge and improve parking on State land in the Conservation District next to the existing concrete ford crossing of Kuamo‘o Road at Keāhua Stream, within the Keāhua Forestry Arboretum on Kaua‘i.

The purpose is to allow safer and more consistently available vehicular and pedestrian access across Keāhua Stream and to the recreational resources beyond access by Kuamo‘o Road, a non-through street. On most days, water over the existing crossing varies in depth between a few inches and about a foot. At least three times a year stream flow is much greater and vehicles cannot cross. If vehicles are already on the far side of the crossing, drivers must wait for the stream to subside before crossing, which can take up to a day. On several occasions vehicles have actually been swept over the edge of the existing ford attempting to cross in high water. The daily mixture of motor vehicles and pedestrians crossing the narrow ford and recreational water users also presents ongoing safety issues.

The single-span steel truss bridge would be 115 feet long with one 13-foot lane travel lane and a protected sidewalk that is cantilevered off one side of the bridge. Because of poor soil conditions, the reinforced concrete abutments would be supported on micro-piles and placed outside of the stream channel. The existing roadway approaches on Kuamo‘o Road on both sides of the stream would be rerouted into the parking lots, which would be slightly expanded and paved to provide parking, including two ADA compliant stalls. The access to the existing ford would be eliminated for vehicles using bollards. Temporary erosion control structures including silt fences and sandbag berms would prevent silt from entering the stream directly or indirectly through the adjacent ditches. All excavation will occur above the Ordinary High Water Mark of the stream.

No threatened or endangered plant species would be affected, and timing of project activities would avoid or minimize impacts to Hawaiian hoary bats. No historic or cultural properties will be affected, and visual impacts will be minor.

## **PART 1: PROJECT DESCRIPTION, PURPOSE AND NEED AND ENVIRONMENTAL ASSESSMENT PROCESS**

### **1.1 Project Location and Description**

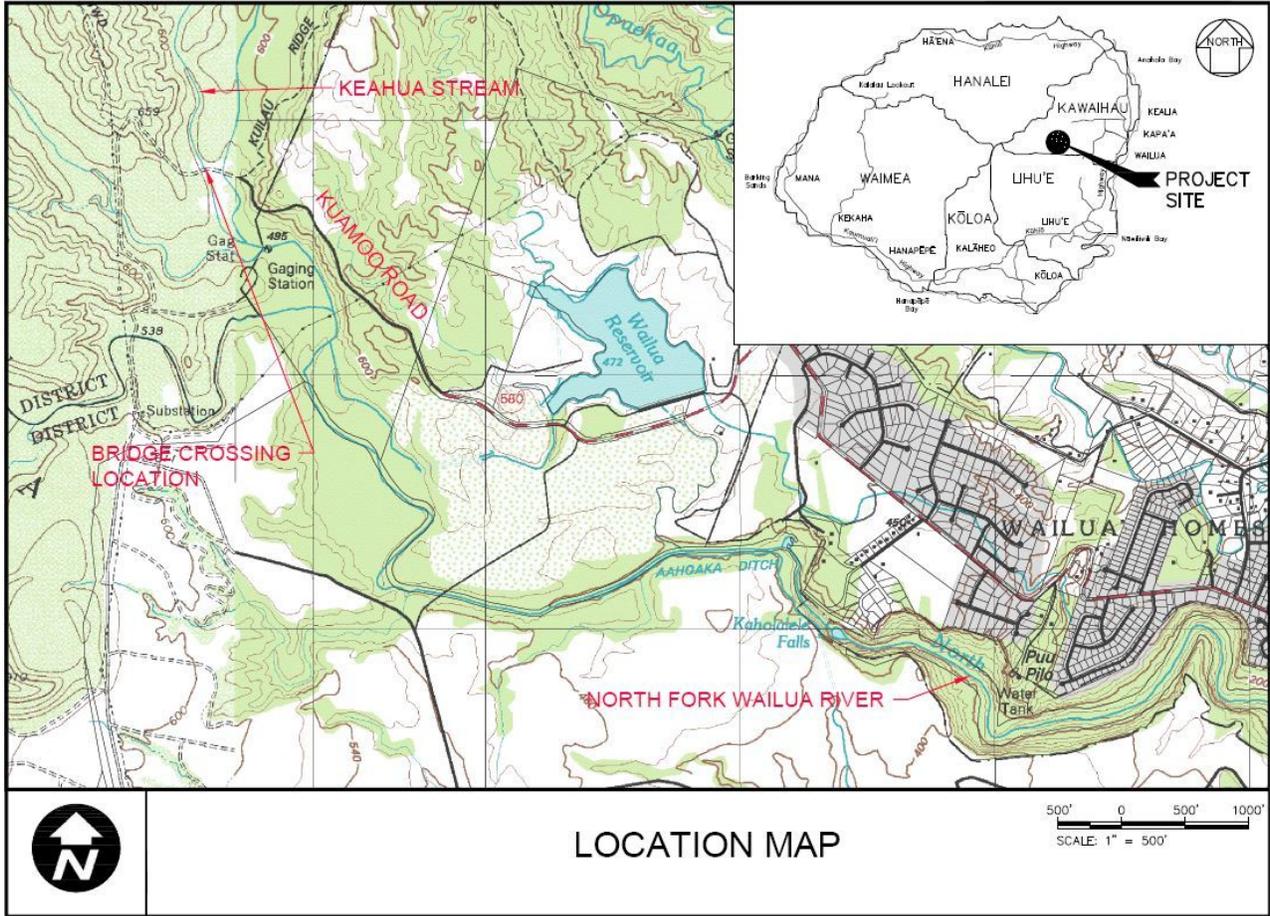
The Department of Land and Natural Resources (DLNR), Engineering Division, proposes to construct a vehicular and pedestrian bridge and improve parking at the crossing of Kuamo‘o Road and Keāhua Stream within the Keāhua Forestry Arboretum of the Līhu‘e-Koloa Forest Reserve, on the island of Kaua‘i. The area is within TMK (4) 4-2-001:002, on State Land Use Conservation District land owned by the State of Hawai‘i (Figures 1-2). The project site currently has a concrete ford crossing for vehicles and pedestrian’s . Vehicles and some hikers cross here on their way to Powerline Trail, other hiking and hunting trails, and swimming areas on several streams within the forest reserve.

As shown in the Site Plans in Appendix 2, the single-span steel truss bridge would be 115 feet long, with one 13-foot lane travel lane and a protected sidewalk cantilevered off one side of the bridge. It would be located parallel to the existing ford at a point about 20 feet downstream. The prefabricated, hot-dip galvanized structural steel bridge would be painted green. The reinforced concrete abutments would be supported on micro-piles and placed outside of the stream channel, above the Ordinary High Water Mark of the stream. The existing roadway approaches on Kuamo‘o Road on both sides of the stream would be rerouted into the parking lots, which would be slightly expanded and paved to provide 25 standard parking stalls and two stalls compliant with the Americans with Disabilities Act (ADA). At the east parking lot, a concrete slab would extend over a grass-banked drainage ditch to provide more parking space, but the ditch itself would not be affected or disturbed in any way. An accessible ramp would lead from the east parking lot to the bridge, which will have a 3.5-foot wide sidewalk with railings and would also be ADA-compliant. The west parking lot includes a sidewalk that is accessible. Signs would be relocated and new drainage inlets and culverts would be installed. At the “bypassed” roadway approaches to the stream, pavement would be removed and the area would be grassed, serving as additional recreational area and a vegetated stream buffer. Temporary erosion control structures including silt fences and sandbag berms would prevent silt from entering the stream directly or indirectly through the adjacent ditches. Stabilized construction entrances using coarse aggregate and a filter fabric between the aggregate and the soil would minimize tracking soil offsite.

The ford structure itself would be left in place but the pavement approaching it would be removed and vehicular traffic would be blocked from using it. Leaving it in place would avoid any temporary impact on the existing stream or its banks or bed associated with the demolition process. Eliminating vehicular traffic over the submerged ford would end the ongoing impact to the water quality and the biota of the stream from the petrochemicals associated with vehicles that can leak into the stream during crossings, particularly on those occasions in which vehicles get stuck.

The project would cost approximately \$2.7 million and would take about six months to complete once construction began.

**Figure 1. Location Map**



**Figure 2. Photos of Project Site**

▼ 2a Approach to Existing Ford © Google Earth



**Figure 2. Photos of Project Site (continued)**



2b Proposed Crossing Area (see line highlights) ▲ ▼ 2c Mixed Uses



**Figure 2. Photos of Project Site (continued)**



2d Spalling and undermining of ford ▲ ▼ 2e Drainage ditch



## **1.2 Purpose and Need**

The basic project purpose is to allow safer and more consistently available vehicular and pedestrian access across Keāhūa Stream. On most days, the crossing varies in depth between a few inches and about a foot. When stream flow is greater than this, which occurs at least three times per year, vehicles cannot cross. If vehicles are already on the far side of the crossing, drivers must wait for the stream to subside before crossing, which can take up to a day. The alternate route out of this area extends over private agricultural land and is not accessible to the public. In any case, it also involves an even larger stream crossing and does not present a feasible route to escape from the area during heavy stream flow. On several occasions vehicles have actually been swept over the edge of the ford attempting to cross in high water.

Many visitors and residents wade in the ford and swim in the pond directly downstream for recreation. There is slippery footing and sometimes a strong current. The mixture of these users and trucks and cars crossing the stream, some doing so at higher than safe speeds either to minimize their time in the water or for the thrill of splashing through the stream, is less than ideal from a safety standpoint (see photo in Figure 2c). While DLNR does not have any record of an injury related to this, it is a risk that can be avoided by relocating vehicular traffic to a bridge.

As evident in the photo in Figure 2d, the ford structure is crumbling, and at some point in the future it could collapse, either during high stream flow or while a vehicle was crossing. This could strand and/or damage vehicles. The ford would then either need to be repaired and brought up to current safety standards, or replaced with a bridge, as proposed in the current project. Access to the recreational resources on the far side would be lost for an indeterminate length of time, as there is no public access through the alternate route that extends through several miles of private agricultural land. It is prudent to avoid this possibility by planning for permanent, safe access before the damage, rather than after major damage.

Providing a bridge structure would improve recreational access for hunters, hikers and gatherers in the forest reserve and improve safety.

## **1.3 Environmental Assessment Process**

This Environmental Assessment (EA) process is being conducted in accordance with Chapter 343 of the Hawai‘i Revised Statutes (HRS). This law, along with its implementing regulations, Title 11, Chapter 200, of the Hawai‘i Administrative Rules (HAR), is the basis for the environmental impact process in the State of Hawai‘i. According to Chapter 343, an EA is prepared to determine impacts associated with an action, to develop mitigation measures for adverse impacts, and to determine whether any of the impacts are significant according to thirteen specific criteria. Part 4 of this document states the finding (anticipated finding, in the Draft EA) that no significant impacts are expected to occur; Part 5 lists each criterion and presents the findings (preliminary, for the Draft EA) for each made by the Hawai‘i State Department of Land and Natural Resources (DLNR), the proposing and approving agency for the EA. In the EA process, if after considering comments to the Draft EA, the approving agency concludes that no significant impacts would be expected to occur, then the

agency issues a Finding of No Significant Impact (FONSI), and the action will be permitted to occur. If the approving agency concludes that significant impacts are expected to occur as a result of the proposed action, then an Environmental Impact Statement (EIS) must be prepared.

#### **1.4 Public Involvement and Agency Coordination**

The following agencies and organizations were consulted in development of the environmental assessment:

Federal:

U.S. Army Corps of Engineers

State:

Department of Health  
Office of Hawaiian Affairs  
Department of Land and Natural Resources

County:

Civil Defense Agency  
County Council  
Fire Department  
Planning Department

Private:

Aloha Kauai Tours  
Historic Hawai'i Foundation  
Kaua'i Historic Preservation Review Committee  
Wailua-Kapa'a Neighborhood Association

Copies of communications received during early consultation are contained in Appendix 1a. No comments in response to the Draft EA were received. Additional or modified non-procedural text (primarily the outcome of lack of response) is denoted by double underlines, as in this sentence.

## **PART 2: ALTERNATIVES**

### **2.1 No Action**

Under the No Action Alternative, the bridge would not be constructed and no other action would be taken. The ongoing safety and reliability of access for vehicles would continue, and the safety issue of mixing recreational stream users and vehicles would remain. Eventually, the ford would collapse and access across Keāhua Stream would be blocked except for wading across the stream. Alternative access to the road on the other side is technically feasible but involves a very roundabout route of several miles through private agricultural lands with no public right of entry, and another, even longer ford crossing. For all practical purposes, vehicular access to recreational resources on the far side of

Keāhua Stream would be lost. DLNR would then need to reinitiate the planning of and funding for a ford repair or bridge construction project. It is prudent to avoid this possibility by planning for permanent, safe access before, rather than after, major damage.

## **2.2 Alternative Strategies or Locations**

An alternative strategy would be to repair the existing ford. This would have the advantage of limiting built structures near the stream to the current location. However, it would also involve disruption to the stream environment, both temporarily during construction and permanently as vehicles continue to utilize the ford. It would not address the issue of the reliability and safety of vehicular crossing, and would not separate the recreational stream users from vehicles, perpetuating the safety issues of this mixture of uses. Finally, it would involve an extensive permitting process with the U.S. Army Corps of Engineer and the State Department of Health to satisfy the Section 404 and Section 401 of the Clean Water Act. A Stream Channel Alteration Permit (SCAP) from the State Commission on Water Resources Management may also be required. Aside from the expense and time involved in preparing and processing these permits, the analysis of alternatives to avoid effects to streams, wetlands and other waters of the U.S. might conclude that a bridge would be required.

There are very limited areas available for crossing Keāhua Stream in this area. The alternative of placing a bridge over the ford was examined, but this would prevent access during the six month construction period. Use of or access from Kuamo'o Road to any area upstream of the bridge would have involved extensive wetlands, which the project proponents did not wish to disturb. Areas further downstream would be feasible but would have involved considerably more extensive land disturbance and would have no known cost or environmental advantage.

As such, no alternative sites or strategies have been advanced in this Environmental Assessment, which systematically considers the Proposed Project and the No Action Alternative only.

## **PART 3: ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION MEASURES**

The area proposed for the new bridge and the associated parking lot and road improvements is referred to throughout this EA as the *project site*. The term *project area* is used to describe general area of this part of Kauaʻi.

### **3.1 Physical Environment**

#### **3.1.1 Climate, Geology, Soils and Geologic Hazards**

##### *Environmental Setting*

The average maximum daily temperature is approximately 80 degrees F., with an average minimum of 67 degrees, and annual rainfall averages approximately 100 inches (Giambelluca et al 2014). Rainfall is highly variable and storms can produce significant rainfall in short periods of times, which can cause Keāhua Stream to rise rapidly.

Kauaʻi, the oldest and fourth largest of the eight main Hawaiian Islands, was formed from one great shield volcano (Macdonald and Abbott 1970:458-461). At one time, this vast volcano supported the largest caldera in the islands, horizontally extending 10 to 14 miles across. Mount Waiʻaleʻale, which forms the central hub of the island, rises to 5,148 feet above sea level. Topographically, Kauaʻi is a product of heavy erosion with broad, deep valleys, and large alluvial plains.

The project site is about 525 feet above sea level. Geologically, the surface of the project site is composed of late Pliocene and Pleistocene-era lava flows from the Kōloa Volcanic Series (Sherrod et al 2007). The project site soil is classified as part of the Pooku Series, which are well-drained soils occurring on the uplands of Kauai (Foote et al. 1972: Sheet 20; 114). The soil is derived from basic igneous rock, mostly in situ. The primary soil unit is composed Pooku silty clay loam, occurring on 3%-8% slopes. The surface layer is composed of silty clay loam with ironstone sheets. Lower strata, as reported by Foote et al. (1972:114), consist of a weaker structured silty clay loam. Runoff is slow and the erosion hazard is only slight for these soils. Large roots reach depths of over 5 feet below surface. The silty clay loams are often associated in this area with wildlife habitat, water supply, and woodlands.

The entire Island of Kauaʻi is rated Zone 1 Seismic Hazard, with a low chance of experiencing severe shaking in any given 50-year period (<http://hvo.wr.usgs.gov/earthquakes/hazards/>). The Island of Kauaʻi is rated within the lowest seismic hazard zone by the Uniform Building Code (Uniform Building Code, 1997 Edition, Figure 16-2). The project site does not appear to be at major risk of subsidence, landslides or other forms of mass wasting, although stream banks are inherently unstable and require geotechnical investigations for all footings and other foundation work.

Contractor Hirata and Associates conducted fieldwork at the project site on February 14, 2014 by drilling five test borings ranging in depths from about 5.5 to 48 feet. A boring drilled at the proposed location on the east side bridge abutments encountered brown, clayey silt surface soil that was soft and highly compressible. Underlying this at a depth of about 7 feet was alluvial soil consisting of brown silty/clayey gravel with sand, with the upper 3 feet loose, and lower levels transitioning to dense, with numerous cobbles and boulders. Completely weathered rock was encountered at a depth of 23 feet. The weathered material was in a dense to medium hard condition. Underlying the weathered rock at a depth of about 32 feet was gray, hard basalt extending down to the maximum depth drilled. The west side abutment boring encountered dense silty/clayey gravel with sand, cobbles, and boulders from near surface down to a depth of about 15 feet. Underlying the silty/clayey gravel was a thin layer of dense to medium hard, completely weathered rock, followed by hard basalt down to the maximum depth drilled. Groundwater was encountered in the borings at depths of about 5.4 and 5.6 feet, a level that can be expected to vary with water level in the nearby stream. Shallower borings drilled at the existing parking lots encountered brown clayey silt in soft to medium stiff condition.

### *Impacts and Mitigation Measures*

In general, geologic conditions impose no constraints on the proposed project, which is not imprudent to construct. The design of the bridge and ancillary facilities will take into account the physical and chemical characteristics of the local rock and soil. The facilities will also be designed and built in accordance with regulations related to the seismic setting.

Geotechnical investigations indicate that the project site is suitable for construction of a bridge and parking, with proper design to accommodate bearing loads and erosion potential. Conventional shallow foundations may be used to support the bridge at its proposed location. However, due to the soft and highly compressible surface soil, additional site preparation work will be required. The geotechnical investigation recommended that the surface clayey silt and the loose silty/clayey gravel at the east abutment location be completely removed down to the dense silty/clayey gravel that was encountered in the borings at a depth of about 10 feet. The excavation is expected to extend below groundwater level; therefore, initial backfill for the excavation should consist of clean gravel enveloped in geotextile filter fabric. The clean gravel should extend to about 12 inches above the groundwater level and be tamped to an unyielding surface. Backfilling above the clean gravel section should consist of well-graded granular structural fill compacted to a minimum 95 percent compaction. At the west abutment, where soft and compressible clayey silt are not expected based on test borings, the footing should be founded on 12 inches of well-graded granular structural fill provide more uniform support. Footings founded on compacted granular structural fill may be designed for an allowable bearing value of 3,000 pounds per square foot. The footings should be embedded such that a minimum horizontal distance of six feet is maintained between the bottom edge of footing and the stream bank. As determined in final soil testing, the pavement section is expected to consist of 2 inches of asphalt concrete and 6 inches of base course over 18 to 24 inches of sub-base course material.

### 3.1.2 Drainage, Water Features and Water Quality

#### *Existing Environment*

Keāhua is one of several tributaries to the North Fork of Wailua River that originate on the slopes of Makaleha Mountain, west of Kuilau Ridge, in the Līhu‘e-Koloa Forest Reserve. The upper reaches of Keāhua Stream are above Kapakanui and Kapakaiki falls. The 52.6-square mile Wailua Watershed is one of the largest in the state and includes one of the longest stream channels at over 175 miles, which forms a wide estuary that discharges into Wailua Bay on windward Kaua‘i.

Kuamo‘o Road fords the middle reach of Keāhua Stream at approximately 525 feet above sea level. About 1,380 feet downstream of the ford is the confluence of Keāhua, Uhau‘iole, and Kāwī streams. Another 1,312 feet beyond is where stream flow enters the North Fork Wailua River. Near Kuamo‘o Road ford, Keāhua Stream is a series of riffles, runs, and pools. The streambed here has boulders and cobbles. Just downstream from Kuamo‘o Road, flow slows within a broad pool, and then the channel becomes braided with a network of small channels around bars in the stream bed. Just upstream of the ford is a wide pool within an overhanging hau (*Hibiscus tiliaceus*) forest. Roadside ditches direct water into the stream.

According to the latest EPA guidance ([http://www.epa.gov/indian/pdf/wous\\_guidance\\_4-2011.pdf](http://www.epa.gov/indian/pdf/wous_guidance_4-2011.pdf)), based on the EPA’s interpretation of the Clean Water Act (CWA), implementing regulations and relevant case law, the following waters are considered waters of the U.S. protected by the CWA:

- Traditional navigable waters;
- Interstate waters;
- Wetlands adjacent to either traditional navigable waters or interstate waters;
- Non-navigable tributaries to traditional navigable waters that are relatively permanent, meaning they contain water at least seasonally; and
- Wetlands that directly abut relatively permanent waters.

In addition, the following waters are protected by the Clean Water Act if a fact-specific analysis determines they have a “significant nexus” to a traditional navigable water or interstate water:

- Tributaries to traditional navigable waters or interstate waters;
- Wetlands adjacent to jurisdictional tributaries to traditional navigable waters or interstate waters; and
- Waters that fall under the “other waters” category of the regulations.

The U.S. Army Corps of Engineers (USACE) is the agency with jurisdiction over waters subject to the Clean Water Act, and the agency consulted to determine if it had information on waters of the U.S. It is a relatively permanent water that flows to Wailua River—a traditional navigable water. Keāhua Stream is thus considered to be “Waters of the U.S.,” jurisdictional under Section 404 of the Clean Water Act (CWA). The CWA assigns regulatory authority to the U.S. Army Corps of Engineers (USACE) over certain activities in waters of the U.S. The bounding limit of federal jurisdiction in streams (in the

absence of wetlands) is the Ordinary High Water Mark (OHWM). If any construction of the Keāhua Bridge will occur within the stream channel, i.e., between the OHWMs that flank the stream, the project would require a Department of the Army permit.

According to information provided by the DLNR Engineering Division (see Appendix 1a), the project site is in Zone X, outside the designated 500-year floodplain on the Federal Emergency Management Agency's Flood Insurance Rate Maps (FIRM). No base flood elevations are present on the FIRM Map and no flow data are provided in the FEMA Flood Insurance Study.

Keāhua Stream has recreational, scenic and wildlife values, and maintenance of water quality is critical. The Wailua Stream watershed of which the stream is a part has a very high watershed value rating in the *Atlas of Hawaiian Watersheds and their Aquatic Resources* (Parham et al 2018).

#### *Impacts and Mitigation Measure*

A determination of the OHWM was conducted in the field by AECOS Inc., as part of the biological survey. The reader is referred to Appendix 4 for details. A change in plant community, shelving, and sediment sorting were found to be the strongest indicators of the OHWM, which was clearly visible on both stream banks. Maps and photographs in Appendix 4 illustrate the position of the OHWM. The bridge design took into consideration the position of the OHWM and kept all disturbance outside this area, meaning that no dredge or fill in waters of the U.S. will occur.

Hydrologists analyzed Keāhua Stream to determine if the construction of a new bridge would have any effects on its flow. The study also sought to determine the height of the bridge necessary to ensure that the bottom of the bridge was an appropriate distance above the stream level calculated for the 100-year design storm. Appendix 3 contains the full study, but in summary, the analysis consisted of a series of steps conducted in accordance with County of Kaua'i standards. First, the tributary area was determined; next, an analysis of peak flow rate in cubic feet per second (cfs) was conducted for all the tributaries combined, which calculated a flow of 6,700 cfs in a 100-year storm at the proposed bridge; then, a computer simulation was conducted to model stream behavior under existing conditions; finally, the simulation was run with the proposed bridge improvements in place.

The water surface elevations generated from the simulation provided a basis for the 100-year flood limits on the ground surface around Keāhua Stream. The proposed bridge abutments and all site improvements will be constructed above the Ordinary High Water Mark of Keahua Stream. The location and configuration of the proposed bridge will have minimal effect, if any, on the existing (pre-development) flow conditions of the stream. To meet this requirement, the proposed bridge was designed to have one clear span, 115 feet in length, and be situated above the theoretical 100-year flood elevation. The 100-year flood elevation was modeled at 524.6 feet above mean sea level where the proposed bridge is to cross. A 1-foot freeboard (the distance between the 100-year flood elevation and the bottom of the bridge) was used for the design. With this design, the hydrologic study concluded that the proposed bridge and site improvements at the Keāhua Stream Bridge crossing would have no impact to the existing stream conditions.

The project will involve excavation, grading, and paving in areas away from Keāhua Stream. One of the goals of project design has been to avoid the discharge of dredged or fill materials into waters of the U.S., as discussed above. However, if not properly mitigated, construction in any project can produce uncontrolled excess sediment from soil erosion during and after excavation and construction, which may impact natural watercourses, water quality and flooding. This is especially true in projects adjacent to streams. Contaminants associated with heavy equipment and other sources during construction may impact surface water and groundwater if not mitigated effectively.

Design for the project has taken into account the potential discharge of sediment-laden storm water runoff into the stream. In order to minimize the potential for sedimentation and erosion, the contractor shall perform all earthwork and grading in conformance with the Kaua‘i County Code. The project is expected to disturb less than an acre of surface, and dewatering and hydrotesting are not anticipated. Therefore, a National Pollutant Discharge Elimination System (NPDES) permit from the State Department of Health is not expected to be required.

The project includes a number of best management practices (BMPs) for the project in conformance with the requirements of the County Sediment and Erosion Control Permit, as specified in the Site Plans in Appendix 2. These will include the following:

- *Erosion and sediment controls.* Any disturbed areas shall be stabilized with erosion control measures. Specifically, temporary erosion control structures including silt fences and sandbag berms will prevent silt from entering the stream directly or indirectly through the adjacent ditches. Stabilized construction entrances using coarse aggregate and a filter fabric between the aggregate and the soil will minimize tracking soil offsite.
- *Drainage.* On-site drainage shall be handled in such a way as to control erosion, prevent damage to downstream properties and to return water to the natural drainage course in a manner that minimizes sedimentation or other pollution to the maximum extent practicable.
- *Dust control.* All areas disturbed by construction activities shall control dust emissions to the maximum extent practicable through the application of BMPs that may include watering with trucks, erection of dust fences, limiting the area of disturbance, and timely grassing of finished areas.
- *Vegetation.* Whenever feasible, natural vegetation, especially grass, will be retained. At the “bypassed” roadway approaches to the stream, pavement will be removed and the area will be grassed, serving as additional recreational area and a vegetated stream buffer. After being uprooted, displaced, or dislodged from the ground by excavation, clearing or grubbing, any trees, timber, plants, shrubbery and other woody vegetation that must be removed will not be stored in or deposited along the banks of the stream. This material will be removed within a reasonable time, no longer than three months from when it was uprooted, displaced, or dislodged.
- *Material and waste management.* Measures to insure the proper storage of toxic material and prevent the discharge of pollutants associated with construction materials and waste shall implement.
- *Timing of control measure implementation.* Timing of control measure implementation shall be in accordance with the approved erosion control plan. At a minimum, disturbed areas of

construction sites that will be redisturbed for 21 days or more will be stabilized (grassed or graveled) by no later than the 14th day after the last disturbance.

The No Action Alternative would avoid any potential for impacts to water quality during construction, but the eventual deterioration of the ford would require dismantling activities, along with replacement of the ford or construction of a bridge, as proposed here. Thus the No Action Alternative would probably only delay construction and would eventually lead to impacts and mitigation measures similar to that of the proposed project.

### 3.1.3 Flora, Fauna and Ecosystems

AECOS Inc., conducted a biological survey of the project site in January 2014, and Rana Biological Consulting conducted a bird and mammal survey in May 2014. The surveys are contained in whole as Appendix 4 and Appendix 7 and summarized below. Some scholarly references have been removed for readability; interested readers may refer to the appendices.

#### *Environmental Setting, Impacts and Mitigation Measures: Flora*

The botanical survey included the project site itself as well as the roadside vegetation and the riparian zone upstream and downstream of the ford. The project site is a widely used recreational area. Eighty species were identified, with 10 native species, two of them planted as ornamentals in the botanical garden (see Table 1 of Appendix 4). Twenty-eight species are associated with the riparian zone along Keāhua Stream. The roadside vegetation along Kuamo‘o Road in the vicinity of the ford is typical ruderal vegetation found in mesic forests on Kaua‘i. The area, including the roadside ditch at the southern end of the project area, appears to be maintained with herbicide application. North of the road is a *hau* (*Hibiscus tiliaceus*) forest. The parking lots consist of regularly mowed grasses.

No plant species listed under federal or state statutes, nor any other rare Hawaiian plants, were encountered in the survey, nor are any expected to occur at the project site.

An arborist conducted a study of the trees that would require removal for the improvements. The report is contained in Appendix 6 and summarized here. Four *Senna siamea* trees are in fair to poor health and structural condition, with lower trunks have cavities with decay, and they are poor candidates for relocation. Two African tulip (*Spathodea campanulata*) trees on the west side of the stream are within the footprint of the new bridge alignment. The 35-foot tall, mature specimens have 32 and 28-inch diameter trunks. There are decayed sections in the lower trunk. As these trees are marginal for relocation and also are now a widely naturalized common species, they will be removed. Two Queensland maples (*Flindersia brayleyana*) trees are just outside the project limits. Project construction will include a ten-foot protection zone around the trees to reduce any negative impact to the major structural roots, and roots outside the protection zone will be pruned by an arborist. The arborist also noted several hazardous albizia trees (*Falcataria moluccana*) that lie beyond that project limits but require attention. This information was provided to DLNR for their consideration.

In summary, the project would not lead to any adverse effects on the flora or vegetation at or near the project site.

*Environmental Setting, Impacts and Mitigation Measures: Fauna:*

One avian point count station was sited on the southeast corner of the project site. A single eight-minute point count was made at the count stations. The station was counted once. Field observations were made with the aid of Leica 8 X 42 binoculars and by listening for vocalizations. Survey activities were concentrated during the early morning hours, the peak of daily bird activity. Additionally two 30-minute time-dependent waterbird counts were conducted, one on each side of the stream in locations that afforded the most complete view of the stream in both directions of flow. Time not spent counting was used to search the remainder of the project site for species and habitats that were not detected during count sessions.

A total of 42 individual birds of 14 species, representing 13 separate families, were recorded during the point count (see Table 1 of Appendix 7). All avian species detected while on site are alien to the Hawaiian Islands. Avian diversity and densities was in keeping with the location of the property and the habitats presently on and adjacent to the project site. Two species; Red Junglefowl (*Gallus gallus*), and Japanese White-eye (*Zosterops japonicus*) accounted for 40 percent of all birds recorded during the station count. The most commonly recorded species was Red Junglefowl, which accounted for 21 percent of the total number of individual birds recorded. No avian species currently listed or proposed for listing under either federal or State of Hawai‘i endangered species statutes was recorded during the course of this survey.

Although not detected during this survey, the endangered Hawaiian Petrel (*Pterodroma sandwichensis*), and the threatened endemic sub-species of the Newell’s Shearwater (*Puffinus auricularis newelli*) have been recorded over-flying the general project area between April and the end of November each year. Additionally, the Save Our Shearwaters Program has recovered both species from the Wailua District on an annual basis over the past three decades. The petrel is listed as endangered, and the shearwater as threatened under both Federal and State of Hawai‘i endangered species statutes. The primary cause of mortality in both Hawaiian Petrels and Newell’s Shearwaters is thought to be predation by alien mammalian species at the nesting colonies. Collision with man-made structures is considered to be the second most significant cause of mortality of these seabird species in Hawai‘i. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. When disoriented, seabirds can collide with manmade structures, and if they are not killed outright, the dazed or injured birds are easy targets of opportunity for feral mammals. There are no nesting colonies nor appropriate nesting habitat for either of these listed seabird species within the current study site (see Appendix 7 for references). No permanent lighting or temporary nighttime construction or equipment maintenance lighting is required, and no impacts should occur.

While no waterbirds were detected in the survey, it is possible that some utilize the site, as at least one endangered waterbird has been observed in Keāhua Stream previously (*Gallinula chloropus*

*sandvicensis*, the Hawaiian Gallinule or '*alae 'ula*). To avoid impact to threatened or endangered waterbirds, the following contract conditions will be imposed:

- All on-site project personnel will be apprised that they are working in an environmentally sensitive area and that threatened or endangered (T&E) Hawaiian waterbirds may be in the vicinity of the project.
- If any unknown or potentially T&E bird species appears in the project area, it will be reported to DLNR-DOFAW, which will identify the species. If it is a threatened or endangered species, work activity will be temporarily suspended until the bird leaves the area of its own accord.
- Any potential nests or broods of T&E birds within the project vicinity will be reported to the DLNR-DOFAW within 48 hours and appropriate additional mitigation will be determined.
- The project will conserve the maximum amount of stream and riparian habitat for native stream species by avoiding placement of fill or structures in the stream for temporary diversion or construction purposes, and minimizing any stream hardening (including concrete channelization) associated with the bridge construction.

With the exception of the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*; '*ōpe 'ape 'a*), all terrestrial mammals currently found on the Island of Kaua'i are alien species. Most are ubiquitous. A mammalian survey in May 2014 detected several pet dogs (*Canis familiaris*), along with tracks of cats (*Felis catus*) and scat and sign of pigs (*Sus scrofa*). All of the mammalian species recorded are alien to the Hawaiian Islands. It is well known that the area supports feral pigs and surrounding areas are used for hunting. The Hawaiian hoary bat almost certainly uses resources within the general project area on a seasonal basis, as the species is all but ubiquitous in the lowlands of Kaua'i. The impact that a construction project potentially poses to bats is during the clearing and grubbing phases of construction as vegetation is removed. The removal of vegetation within the project site may temporarily displace bats using the vegetation for roosting. As bats use multiple roosts within their home territories, this disturbance from the removal of vegetation is likely to be minimal. However, during the pupping season, female bats carrying pups may be less able to rapidly vacate a roost site when the vegetation is cleared. Additionally, adult female bats sometimes leave their pups in the roost tree while they forage, and very small pups may be unable to flee a tree that is being felled. Potential adverse impacts from such disturbance can be avoided or minimized by not clearing woody vegetation taller than 15 feet between June 1 and September 15 of the year, the period when female bats are likely to be tending pups. In the case of the proposed project, there are several trees that need to be removed. The project will be timed to avoid removal of these trees in the pupping season.

The biologists made observations of aquatic organisms as they waded through an approximate 100-meter length of stream channel upstream and downstream of the ford. The survey also included the roadside ditches to the east of the stream. The biologists used dip nets to capture and observe organisms and they also snorkeled the deeper pools to observe organisms that evaded capture. As the survey progressed, notes were made on relative abundances of each species (e.g., rare, common, abundant).

Few species of fish are present in Keāhua Stream near the project site. Small non-native guppies, swordtails and mosquito fish called poeciliids (*Poecilia reticulata* and indeterminate juveniles) are most common in the sluggish waters of the ditch and along the sides of the channels. Smallmouth bass (*Micropterus dolomieu*) inhabit the deeper, shaded pools in the *hau* forest. Bass (*Micropterus* spp.), sunfish (*Lepomis* spp.), and Chinese catfish (*Clarius fuscus*), all non-native predators, are found throughout the Wailua River (Parham et al., 2008). The Watershed Atlas also reports native amphidromous animals (i.e., *Atyoida bisulcata*, *Macrobrachium grandimanus*, *Eleotris sandwicensis*, *Awaous guamensis*, and *Sicyopterus stimpsoni*) and other typical native estuarine fishes (i.e., *Elops hawaiiensis*, *Kuhlia* spp., and *Mugil cephalus*) from the estuary and lower reach of the river. Two amphidromous species (i.e., *Macrobrachium lar* and *Awaous guamensis*) have been found in the middle and upper reaches, and *M. lar* is the only species reported from the headwaters of the Wailua River (i.e., above about 2,400 feet elevation). The red swamp crayfish (*Procambarus clarkii*) is common, burrowing in the silt bottom of the ditch and the red-rimmed melania snail (*Melanoides tuberculata*) occurs in the ditch and on the bed of Keāhua Stream. Various naturalized damselflies (e.g., *Ischnura posita* and *I. ramburii*) alight on riparian vegetation. At least 5 species of native damselflies (*Megalagrion* spp.) have been reported from the estuary to the upper reach of Wailua River (Parham et al., 2008), though none was observed at the project site during the biological survey.

No aquatic species protected under state or federal laws were observed in Keāhua Stream at the project site. The large population of smallmouth bass in Keāhua Stream is likely responsible for the small (or absent) population of native ‘o‘opu in the stream. Native stream macrofauna are diadromous: eggs are laid in the stream and the larvae that hatch from these eggs move down stream and out into the ocean where they develop for a time before migrating back into fresh water to grow to maturity. It is possible for amphidromous organisms to migrate through the project site on their way upstream or downstream. An important consideration in project design was avoidance of the stream area and development of BMPs to prevent degradation of the water of Keāhua Stream are essential to protect the aquatic biota, including waterbirds, as discussed above.

#### *Impacts of No Action Alternative*

The No Action Alternative would avoid any change to existing conditions, at least until the ford needed to be replaced or a bridge built because of deterioration. As discussed previously, this would mean continuing use of the stream bed by vehicles, involving minor contamination of the stream by vehicle fluids, as well as occasionally larger releases if vehicles become stuck on the ford or swept into the stream.

### **3.1.4 Air Quality, Noise and Scenic Resources**

#### *Environmental Setting*

Air pollution in the project area, which is far from sources of manmade pollution, is generally excellent, with no violations of criteria pollutants. During dry periods, the bare parking lots and ditches can generate minor quantities of dust. Winter visibility on Kauaʻi is occasionally affected by particulates derived from sulfur dioxide (SO<sub>2</sub>) emissions drifting up on southerly winds from Kilauea Volcano on the Island of Hawaiʻi. The SO<sub>2</sub> component of these emissions is converted into vog (i.e., volcanic smog) when it interacts chemically with sunlight, atmospheric oxygen, moisture, and dust. At the concentrations and frequencies found in Kauaʻi, vog is generally not considered a health hazard.

Noise on the project site is generally quite low, and is derived principally from motor vehicles crossing the ford and recreational activities.

Views on the project site, which is part of Keāhūa Arboretum, are scenic and typical of rural streamside areas of Kauaʻi (see photos in Figure 2).

#### *Impacts and Mitigation Measures*

The proposed action will not measurably affect air quality or noise levels except minimally during construction activities. This will not affect sensitive receptors except temporarily for users of the recreation area, which the project is meant to benefit. In order to avoid impacts from dust, DLNR will minimize the amount of disturbed area at any given time and will avoid ground disturbance during high winds.

Construction will cause temporary visual impacts over the course of about six months of construction. No important viewplanes or scenic sites would be permanently affected by the project. The bridge will alter the visual landscape of the area through another built element in addition to the existing road, ford and parking lot, but the bridge has been designed to have a positive visual impact to the area (see Appendix 2).

### **3.1.5 Hazardous Substances, Toxic Waste and Hazardous Conditions**

#### *Environmental Setting, Impacts and Mitigation Measures*

No professional evaluation such as a Phase I Environmental Site Assessment (ESA) was performed for the project site. To DLNR officials' knowledge, there have been no spills or other incidents involving hazardous or toxic substances, and no such materials are stored on the sites of the proposed construction. The construction of a bridge and ancillary facilities does not pose any unreasonable risk in terms of worker or public exposure to such materials.

## 3.2 Socioeconomic and Cultural

### 3.2.1 Socioeconomic Characteristics and Recreational Uses

#### *Existing Environment*

The project would affect and benefit recreational users of the Keāhua Forestry Arboretum and the Līhu‘e-Koloa Forest Reserve, which includes many residents of and visitors to Kaua‘i. Observations of the area and discussions with DLNR officials indicate that there is a nearly even split of users between residents and visitors. No visitor censuses have been conducted, but on an average sunny day there are often 5 to 20 vehicles in the parking lots, with the ford acting as a focus (see Figure 2c).

Hunting is a very popular recreational activity in the project area. Hunting in the State of Hawai‘i is regulated by DOFAW and requires a hunting license whether hunting on public or private land. A hunting license is valid for all game in the State of Hawai‘i, including mammals (pigs, goats, sheep, mouflon and black-tailed deer and axis deer, on some islands) and gamebirds. A 2006 survey of recreationalists in Hawai‘i found that 18,000 residents hunted in the previous year (USFWS-USCB 2006). Other key wildlife-related recreational activities include wildlife viewing and hiking. Hawai‘i has 34 endangered bird species that are among the objects of “life lists” for birders from around the world. The 2006 recreational survey estimated that 155,000 Hawai‘i residents and 107,000 visitors engaged in wildlife viewing (USFWS and USCB 2006).

#### *Impacts and Mitigation Measures*

The project would improve the recreational resources of the project area and thus improve the socioeconomic environment by providing safer and more consistently available vehicular and pedestrian access across Keāhua Stream. It would benefit most directly hunters, hikers and gatherers in the forest reserve. It would eliminate the possibility of vehicles being stuck or swept away in the stream, or stranded on the far side by high water. It would also eliminate the unsafe mixture of waders, swimmers and vehicles crossing the ford in an area of slippery footing and sometimes strong current. There is no need for right-of-way acquisition or any other action that would have an effect on any resident or business. The project would provide some short-term construction jobs which would almost certainly be filled by on-island residents, and would not induce in-migration.

The No Action Alternative would not address problems with the safety and access issues associated with the ford, which at some point in the near future could collapse, leaving the area without access for vehicles.

### 3.2.2 Cultural and Historic Resources

#### *Methods*

This section is based upon an archaeological assessment developed for the project by Scientific Consultants, Inc. (see Appendix 5), various other written sources, and early consultation for the EA.

#### *Cultural and Historical Background*

Approximately 600 years ago, the Hawaiian population had expanded throughout the Hawaiian Islands to a point where large, political districts could be formed. At that time, Kaua‘i consisted of six districts, or moku: East and West Kona, Puna, Ko‘olau, Halele‘a, and Nāpili. Land was considered to be the property of the king or *ali‘i ‘ai moku* (the leader who controls the island/ district), which he held in trust for the gods. The title of *ali‘i ‘ai moku* ensured rights and responsibilities to the land, but did not confer absolute ownership. The king kept the parcels he wanted; his higher chiefs received large parcels from him, and in turn, distributed smaller parcels to lesser chiefs. The *maka‘āinana* (commoners) worked the individual plots of land.

In general, several terms, such as moku, *ahupua‘a*, *‘ili* or *‘ili ‘āina* were used to delineate various land sections. A district (*moku*) contained smaller land divisions (*ahupua‘a*) that customarily continued inland from the ocean and upland into the mountains. Extended household groups living within the *ahupua‘a* were therefore able to harvest from both the land and the sea. Ideally, this situation allowed each *ahupua‘a* to be self-sufficient by supplying the needed resources from different environmental zones. The *‘ili* or *‘ili ‘āina* were smaller land divisions next in importance to the *ahupua‘a* and were administered by the chief who controlled the *ahupua‘a* in which it was located. The *mo‘o ‘āina* were narrow strips of land within an *‘ili*. The land holding of a tenant or *hoa ‘āina* residing in an *ahupua‘a* was called a *kuleana*.

The Hawaiian economy was based on agricultural production and harvesting marine resources, as well as raising livestock and collecting wild plants and birds. Extended household groups settled in various *ahupua‘a*. During pre-Contact times, there were primarily two types of agriculture, wetland and dryland, both of which were dependent upon geography and physiography. River valleys, such as those on Kaua‘i, provided ideal conditions for wetland *kalo* (*Colocasia esculenta*)—agriculture that incorporated pond fields and irrigation canals (*auwai*). Other cultigens, such as *kō* (sugarcane, *Saccharum officinarum*), *mai‘a* (banana, *Musa sp.*), and *‘uala* (sweet potato, *Ipomoea batatas*) were also grown.

Coastal zones were utilized for marine resources, habitation, burials, and ceremonial structures often associated with fishing. Often, land sections located in back of the shoreline contained pond fields and dunes that were used for sweet potato production. Trails linked the *makai* and *mauka* sections of the *ahupua‘a*, allowing easy access to its resources. Other trails skirted the coast, which made communication between *ahupua‘a* possible.

It is said that many years ago, the fire goddess Pele and her family briefly stopped on Kaua‘i to explore the possibility of finding a permanent home. She dug a deep pit, but it was instantly filled with water, so they left Kaua‘i and traveled on, and eventually settled in Halema‘uma‘u, on the island of Hawai‘i, where she resides to this day (Beckwith 1976).

The project site is within the *ahupua‘a* of Wailua. According to Pukui et al. (1974), “Keāhua” literally means “mound”. Keāhua Stream itself plays an important role as a tributary of the North Fork of the Wailua River and provides perennial water to the area. Wailua Ahupua‘a, particularly the area around the lower portion of the river near the coast, is well known and represents one of the most important archaeological site complexes in the islands. The lower river areas were home to *ali‘i* and their retinues. Archaeologically, the focal points are the large *heiau* and other features composing the Wailua Complex, which has multiple *heiau*, a city of refuge, petroglyphs, and the Wailua Bellstone, among other features.

The interior areas of Wailua, such as the project site, were traditionally areas for wetland taro agriculture, residences and gathering. Keāhua Stream in this reach flows through a gently sloped floodplain expanse with mainly flat, alluvial deposits occurring off the stream, ideal locations for taro production. However, no terraces or other agricultural features are present at the project site. Irrigated taro was probably grown along the banks of the tributary stream.

The first recorded Western contact in the Hawaiian Islands was made in 1778 on the southern coast of Kaua‘i, but there is no description of the eastern coast until Captain George Vancouver traveled up the coast from Wailua in 1793. As there was no anchorage, he sailed towards Kapa‘a, noting that this was: “...the most fertile and pleasant district of the island...” (Joesting 1987:50).

In the 1840s, traditional land tenure shifted drastically with the introduction of private land ownership based on Western law. The Māhele of 1848 divided Hawaiian lands between the king, the chiefs, the government, and began the process of private ownership of lands. The subsequently awarded parcels were called Land Commission Awards (LCAs). Once lands were made available and private ownership was instituted, the *maka‘āinana* (commoners) were able to claim the plots on which they had been cultivating and living, if they had been made aware of the procedures. These claims did not include any previously cultivated but presently fallow land, stream fisheries, or many other resources necessary for traditional life. If occupation could be established through the testimony of two witnesses, the petitioners were awarded the claimed LCA and issued a Royal Patent after which they could take possession of the property. There are no land commissions awards (LCA) within or near the project site.

#### *Cultural Resources and Practices on the Project Site*

Modern recreational practices occurring at the Keāhua Arboretum and adjacent areas of the Līhue-Koloa Forest Reserve, such as swimming, wading, hiking and hunting, are important activities that will all benefit from the proposed project but are not traditional cultural practices. The streambanks may serve as a site of gathering for plant material, although little native vegetation remains. Consultation conducted as part of the EA process, including various agencies of DLNR, the Office of Hawaiian

Affairs, and local community groups, did not reveal any practices that might be occurring, nor did observation or interviews with various parkgoers.

However, in the areas west of the project site, the archaeologists observed areas in which *'alaea* gathering once occurred and could continue to occur. *'Alaea* is a water-soluble, colloidal ochre used for coloring salt, for making medicine, for dye, and in purification ceremonies called "*hi'uwai*." It is unknown how long the Keāhua Stream and environs have been utilized to gather *'alaea*, but it could be related to the nearby adze quarry, and may have been procured from the area for centuries. *'Alaea* pits are visible along the northeast and southwest flanks of a gravel road located to the west of the Keāhua Stream Crossing. If these areas remain in use, they will not be affected by any aspect of the project.

### *Impacts and Mitigation Measures to Cultural Resources and Practices*

The Constitution of the State of Hawai'i clearly states the duty of the State and its agencies to preserve, protect, and prevent interference with the traditional and customary rights of native Hawaiians. Article XII, Section 7 requires the State to "protect all rights, customarily and traditionally exercised for subsistence, cultural and religious purposes and possessed by *ahupua'a* tenants who are descendants of native Hawaiians who inhabited the Hawaiian Islands prior to 1778" (2000). In spite of the establishment of the foreign concept of private ownership and western-style government, Kamehameha III (Kauikeaouli) preserved the people's traditional right to subsistence. As a result, in 1850 the Hawaiian Government confirmed the traditional access rights to native Hawaiian *ahupua'a* tenants to gather specific natural resources for customary uses from undeveloped private property and waterways under the Hawai'i Revised Statutes (HRS) 7-1. In 1992, the State of Hawai'i Supreme Court reaffirmed HRS 7-1 and expanded it to include:

"native Hawaiian rights...may extend beyond the *ahupua'a* in which a native Hawaiian resides where such rights have been customarily and traditionally exercised in this manner" (Pele Defense Fund v. Paty, 73 Haw.578, 1992).

Act 50, enacted by the Legislature of the State of Hawai'i in 2000, relating to Environmental Impact Statements, stated that:

"...there is a need to clarify that the preparation of environmental assessments or environmental impact statements should identify and address effects on Hawaii's culture, and traditional and customary rights... "[H.B. NO. 2895].

The proposed bridge would not likely impact any culturally valued resources or cultural practices. SHPD, the Office of Hawaiian Affairs, and various other organizations and individuals contacted as part of early consultation have been supplied a copy of the EA for their comments. No party reviewing the Draft EA supplied any cultural information.

## *Historic Properties*

Archaeological investigations of inland areas of the Wailua River watershed have previously documented include legendary sites, house sites, petroglyphs, and burials (see Yent 1989:5). The current project site had not previously been subject to formal archaeological investigations. However, three investigations had been conducted nearby in the Keāhua Arboretum, all recording and assessing the State Inventory of Historic Properties (SIHP) Site 50-30-07-4000, an adze quarry. Dr. William Kikuchi of Kauai Community College did a field inspection in 1988 that resulted in the discovery of a workshop consisting of adze preforms and debitage. Kikuchi surveyed and surface collected cultural material in an area of approximately three acres. Later, Yent (1988) mapped, surveyed, and tested the site, expanding the site area to 20 acres. The site occurred as discontinuous flake scatters on the ground surface, with adze preforms occurring within the scatters and as isolated finds. Yent (1988) noted that the site's exposure and artifact distributions were somewhat affected by bulldozing at the site. Finally, Spear (1992) conducted data recovery testing to determine if the quarry extended into and beyond a KIUC power line corridor.

Fieldwork on the project site itself was conducted on May 15, 2013 by SCS personnel Jim Powell, B.A. and Milton Ching, under the overall direction of Michael Dega, Ph.D (Principal Investigator). The P.I. conducted a walk-through of the project area with J. Powell on April 23, 2014. The formal survey included a 100% pedestrian survey of the project area in 5 meter transects. Visibility in the project area was high. Several modern features were noted in the project area, and the 'alaea gathering areas were also noted outside the project site. Fieldwork did not lead to the identification of any historic properties. The earliest surface features identified in the project area consist of the ford crossing Keahua Stream and a drainage ditch providing roadside drainage. The latter had a concrete mark dating it to 1964, the same time as the crossing was built. No further archaeological work is recommended for the project area.

## *Impacts and Mitigation Measures for Historic Properties*

The State Historic Preservation Division (SHPD) is currently reviewing the archaeological assessment. The Final EA was to report on the results of the review. As of July 30, 2014, SHPD has not replied. As a precaution, DLNR will require that in the unlikely event that human skeletal remains, undocumented archaeological resources, or cultural or traditional remains are encountered during future development activities within the project site, work in the immediate area of the discovery shall be halted and the State Historic Preservation Division contacted as outlined in Hawai'i Administrative Rules 13§13-275-12.

### **3.3 Public Facilities and Services**

#### *Existing Facilities and Services and Impacts and Mitigation Measures*

No electrical, telephone, potable water or wastewater infrastructure is present at the site, and none is necessary for the proposed project.

### **3.4 Secondary and Cumulative Impacts**

#### **3.4.1 Secondary Impacts**

The proposed project would not lead to major secondary impacts, such as population changes or effects on public facilities. Although the project would involve limited short-term construction jobs, these minor services could be provided by local firms and labor and would not induce in-migration. Providing a bridge instead of a ford may encourage more recreational uses in the portions of the Līhu‘e-Koloa Forest Reserve that lie beyond the ford, including hiking and hunting trails and swimming spots. However, on typical days this area is already accessible to not only 4WD vehicles but normal cars whose drivers choose to make the water crossing, and any increase would likely be very minor.

#### **3.4.2 Cumulative Impacts**

##### *Planned and Reasonably Foreseeable Projects*

Cumulative impacts result when implementation of several projects that individually have limited impacts combine to produce more severe impacts or conflicts in mitigation measures. No construction or other projects involving an active land use are known to be occurring within a one-mile radius of the project site, nor on the tributary or receiving waters of Keāhua Stream. Thus, there does not appear to be any potential for adverse cumulative impacts to resources such as water quality, scenic viewplanes, native vegetation, recreation, or any other resource.

### **3.5 Required Permits and Approvals**

- County of Kaua‘i Grading Permit
- State BLNR Conservation District Use Permit

### **3.6 Consistency With Government Plans and Policies**

#### **3.6.1 Hawai‘i State Plan**

Adopted in 1978 and last revised in 1991 (Hawai‘i Revised Statutes, Chapter 226, as amended), the Plan establishes a set of themes, goals, objectives and policies that are meant to guide the State’s long-run growth and development activities. The three themes that express the basic purpose of the *Hawai‘i State Plan* are individual and family self-sufficiency, social and economic mobility and community or social well-being. The proposed project would promote these goals by improving access to recreational areas and increasing safety, thereby enhancing quality-of-life and community and social well-being.

#### **3.6.2 Hawai‘i State Land Use Law**

All land in the State of Hawai‘i is classified into one of four land use categories – Urban, Rural, Agricultural, or Conservation – by the State Land Use Commission, pursuant to Chapter 205, HRS.

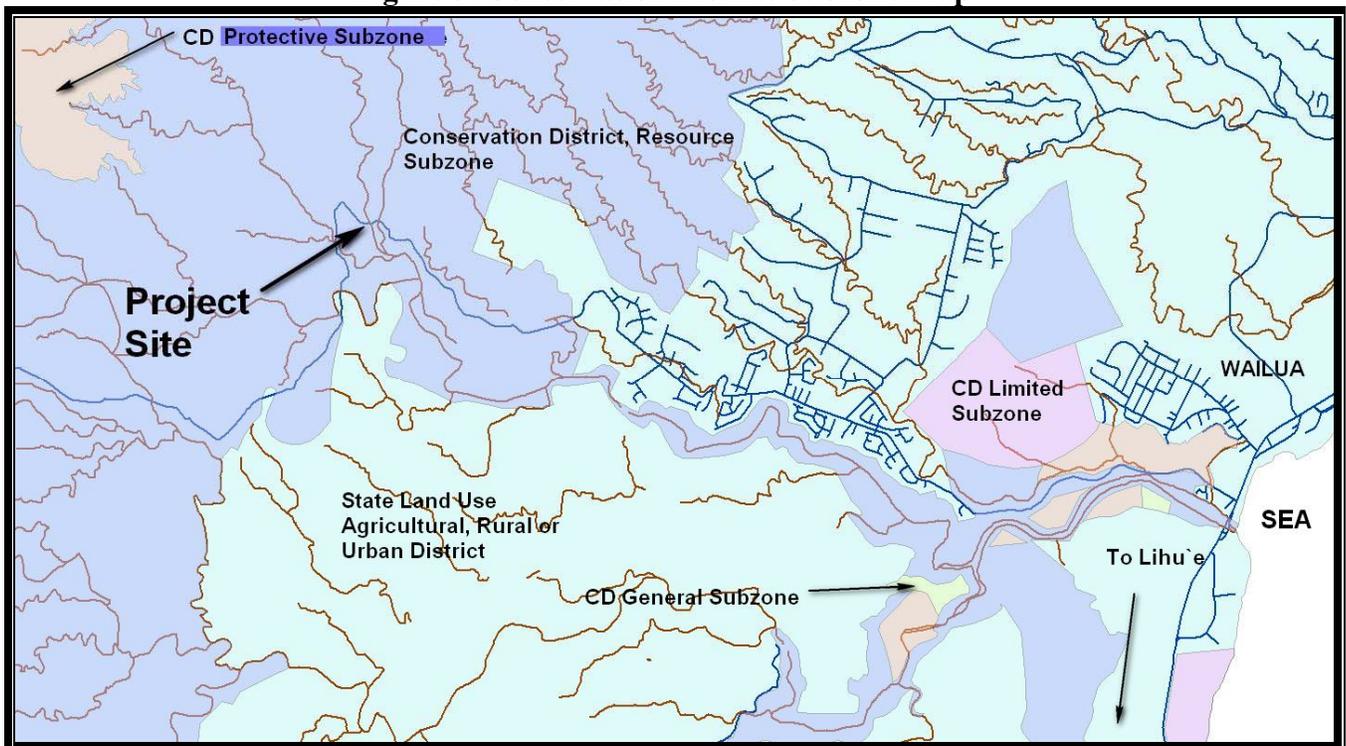
The project site is classified within the State Land Use Conservation District, Resource Subzone. According to an April 11, 2014 memo from the DLNR Office of Conservation and Coastal Lands (OCCL) in response to early consultation (see Appendix 1a):

“The Office of Conservation and Coastal Lands (OCCL) has reviewed the submitted information and is unable to pinpoint the location noted as "at the crossing of Keahua Stream over Kuamo‘o Road within the Lihu‘e-Koloa Forest Reserve," to make a determination if the subject location is within the Conservation District.

A Tax Map Key (TMK) and boundary interpretation from the Land Use Commission should be included with the environmental document. Should the proposed use(s) be located within the Conservation District, further review by the OCCL should be completed to determine what type of authorization may be required.”

This EA contains more specific information than provided to OCCL in the early consultation letter. The project site is located within a specific and very limited area of less than acre in TMK 4-2-001:002. As illustrated in maps generated from data in the Hawai‘i Statewide GIS Program of the State Office of Planning (<http://planning.hawaii.gov/gis/>) (Figure 3), the project site is clearly within the Resource subzone of the Conservation District, and a boundary interpretation from the State Land Use Commission does not appear to be necessary.

**Figure 3. Conservation District Subzone Map**



It is expected that OCCL will make a determination of the need for a Conservation District Use Permit, and the type and level of permit if needed, after review of the Draft EA.

### **3.6.3 Kaua‘i County Zoning and General Plan**

As the project site is within the State Land Use Conservation District, County zoning per se does not apply. The project site is not within the Special Management Area, which is meant to protect coastal resources.

The *Kaua‘i General Plan* was adopted in November 2000 and provides broad policy statements to guide land use regulations, new developments and facilities, and planning for County facilities and services (County of Kaua‘i 2000). The General Plan employs projections of employment and population to 2020 in forecasting land supply and infrastructure needs and, subsequently, in developing land use plans and long-range plans for public facilities and services.

In Chapter 5 of the General Plan, “Preserving Kaua‘i’s Rural Character”, an essential part of the Vision and one of the driving ideas of the General Plan is to preserve Kaua‘i’s special rural character, which includes “how the built areas relate to the natural features of the landscape...” The Līhu‘e Land Use map and the Heritage Resources Map indicate that the general project area is designated for Open Space, Parks, Agricultural and Conservation. Important landforms nearby include the lower reaches of the Wailua River and Kalepa Ridge. Section 6.3 addresses the resources and policies for the Līhu‘e District. It is noted that scenic mountain views are valued. Stream valleys crossing the Līhu‘e area are maintained as important watercourses and floodplains. The valley wetlands filter stormwater flows, capturing erosion sediments before they reach the ocean.

The project site is in an area designated as Open. Policies related to Open Lands are discussed in Section 5.3 of the Plan, and identified on maps.

#### **5.3.1 Policy**

(a) The intent of the Open designation is to preserve, maintain or improve the natural characteristics of non-urban land and water areas that:

- (1) are of significant value to the public as scenic or recreation resources;
- (2) perform essential physical and ecologic functions important to the welfare of surrounding lands, waters, and biological resources;
- (3) have the potential to create or exacerbate soil erosion or flooding on adjacent lands;
- (4) are potentially susceptible to natural hazards such as flood, hurricane, tsunami, coastal erosion, landslide or subsidence; or
- (5) form a cultural, historic or archaeological resource of significant public value.

(b) Lands designated Open shall include: important landforms such as mountains, coastal bluffs, cinder cones, and stream valleys; native plant and wildlife habitat; areas of predominantly steep slopes (20 percent or greater); beaches and coastal areas susceptible to coastal erosion or hurricane, tsunami, or storm-wave inundation; wetlands and flood plains; important scenic resources; and known natural, historic and archaeological resources. Open shall also include parks, golf courses, and other areas

committed to outdoor recreation.

(c) Lands designated Open shall remain predominantly free of development involving buildings, paving and other construction. With the exception of kuleanas and other small lots of record, any construction that is permitted shall be clearly incidental to the use and open character of the surrounding lands.

Policies related to scenic views are Section 3.2 of the Plan.

### 3.2.1 Policy

(a) In developing public facilities and in administering land use regulations, the County shall seek to preserve scenic resources and public views. Public views are those from a public place, such as a park, highway, or along the shoreline.

(b) The County shall observe the following general principles in maintaining scenic resources:

(1) Preserve public views that exhibit a high degree of intactness or vividness.

n “Intactness” refers both to the integrity of visual patterns and the extent to which the landscape is free from structures or other visually encroaching features.

n “Vividness” relates to the memorability of a view, caused by contrasting landforms which create striking and distinctive patterns. (Examples are the silhouette of Mt. Hā‘upu against the horizon, views of Nounou Mountain from the valley and the coast, and the view of Hanalei Valley from the overlook.)

(2) Preserve the scenic qualities of mountains, hills and other elevated landforms, qualities such as the silhouette against the horizon and the mass and shape of the landform.

(3) Preserve the scenic qualities of lowland/open space features, such as the shoreline, the edge of a coastal bluff, a marsh, a fishpond, or a historic or cultural property. Structures should not impede or intrude upon public views of the feature and should not alter the character of the immediate area around the land feature, historic or cultural property.

Policies related to water quality are discussed in Section 3.4 of the Plan. Among them are the following:

### Policy 3.4.2

In developing County roads and drainage facilities and in administering the grading, flood control, and drainage regulations, the County of Kaua‘i shall carry out the following policies.

(a) New Development

(1) Reduce average annual post-development sediment in runoff (total suspended solids), so that it is no greater than pre-development levels.

(2) Maintain post-development peak runoff rate and average volume at levels similar to pre-development.

(3) Work with other government agencies and community organizations to seek ways of reducing all types of nonpoint source water pollutants.

(b) Site Development. Plan, design and develop sites to:

(1) Protect areas that provide important water quality benefits – i.e., wetlands;

- (2) Protect areas that are particularly susceptible to erosion and sediment loss – i.e., stream banks;
- (3) Promote the use of permeable surfaces for driveways and parking and limit increases of impervious areas;
- (4) Limit land disturbance activities such as clearing and grading, and cut and fill to reduce erosion and sediment loss; and
- (5) Avoid disturbance of natural drainage features and vegetation.
- (c) Construction Site Erosion and Sediment Control
  - (1) Reduce erosion and, to the extent practicable, retain sediment onsite during and after construction.
  - (2) Prior to land disturbance, prepare and implement an approved erosion and sediment control plan or similar administrative document that contains erosion and sediment control provisions.
- (d) Watershed Management
  - (1) Manage land use and earth-moving activities from the standpoint of the entire watershed, considering important characteristics such as scenic landscape features, historic sites, native species of plants and animals, and other special resources.
  - (2) Specify relevant best management practices as a condition of approving land use permits that affect stream corridors.
  - (3) Collaborate with State agencies (Office of Planning, DLNR, DOH), federal agencies (U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service), and community organizations (e.g., Soil and Water Conservation Districts) in order to plan and manage watersheds.

The project is entirely consistent with the General Plan, in that it improves and improves access to recreational resources for residents and visitors while preserving and improving the natural scenic and water quality resources of the area.

#### **PART 4: DETERMINATION**

Based on the findings above, and in consideration of the lack of comments received, the Hawai‘i State Department of Land and Natural Resources has determined that the proposed project will not have any significant effect in the context of Chapter 343, Hawai‘i Revised Statutes and section 11-200-12 of the State Administrative Rules, and has issued a Finding of No Significant Impact (FONSI).

#### **PART 5: FINDINGS AND REASONS**

Chapter 11-200-12, Hawai‘i Administrative Rules, outlines those factors agencies must consider when determining whether an Action has significant effects:

1. *The proposed project will not involve an irrevocable commitment or loss or destruction of any natural or cultural resources.* No valuable natural or cultural resources would be committed or lost, and the project would remove motor vehicles from operating within a stream, better protecting water quality and aquatic resources.
2. *The proposed project will not curtail the range of beneficial uses of the environment.* The proposed project expands and in no way curtails beneficial uses of the environment.

3. *The proposed project will not conflict with the State's long-term environmental policies.* The State's long-term environmental policies are set forth in Chapter 344, HRS. The broad goals of this policy are to conserve natural resources and enhance the quality of life. The project has a minor footprint, has been designed to avoid environmental impacts and fulfills aspects of these policies calling for protecting the natural environment and improving human enjoyment of natural resources. It is thus consistent with all elements of the State's long-term environmental policies.
4. *The proposed project will not substantially affect the economic or social welfare of the community or State.* The project will benefit the economic and social welfare of the community by providing safer and more reliable access to recreational uses and a separation of motor vehicles from pedestrians and waders.
5. *The proposed project does not substantially affect public health in any detrimental way.* The proposed project will benefit public health by improving safety in a recreational area and removing motor vehicles from operating inside a stream.
6. *The proposed project will not involve substantial secondary impacts, such as population changes or effects on public facilities.* The proposed project would not lead to major secondary impacts, such as population changes or effects on public facilities. Although the project would involve limited short-term construction labor, these minor services could be provided by local firms and labor and would not induce in-migration. Providing a bridge instead of a ford may encourage more recreational uses in the portions of the Līhu'e-Koloa Forest Reserve that lie beyond the ford, including hiking and hunting trails and swimming spots. However, on typical days this area is already accessible to not only 4WD vehicles but normal cars whose drivers choose to make the water crossing, and any increase would likely be very minor.
7. *The proposed project will not involve a substantial degradation of environmental quality.* The project will not degrade the environment in any way.
8. *The proposed project will not substantially affect any rare, threatened or endangered species of flora or fauna or habitat.* No threatened or endangered species is present or would be adversely affected by the project.
9. *The proposed project is not one which is individually limited but cumulatively may have considerable effect upon the environment or involves a commitment for larger actions.* No construction or other projects involving an active land use are known to be occurring within a one-mile radius of the project site, nor on the tributary or receiving waters of Keāhua Stream. Thus, there does not appear to be any potential for adverse cumulative impacts to resources such as water quality, scenic viewplanes, native vegetation, recreation, or any other resource.
10. *The proposed project will not detrimentally affect air or water quality or ambient noise levels.* No adverse effects on these resources would occur. All air quality and noise impacts will be temporary.
11. *The project does not affect nor would it likely be damaged as a result of being located in environmentally sensitive area such as a flood plain, tsunami zone, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal area.* Although the bridge is located in an area with flooding risk, this is inevitable in a low-lying stream. As it removes vehicles from an occasionally hazardous crossing, it reduces the potential hazard to life and property. The project would not be imprudent to construct and would employ design and construction standards appropriate to the geologic, hydrologic and seismic context.

12. *The project will not substantially affect scenic vistas and viewplanes identified in county or state plans or studies.* No scenic vistas or viewplanes identified in Kaua‘i County General Plan will be adversely affected by the project, and visual impacts will be negligible. Construction will cause temporary visual impacts over the course of about six months of construction. No important viewplanes or scenic sites would be permanently affected by the project. The bridge will alter the visual landscape of the area through another built element in addition to the existing road, ford and parking lot, but the bridge has been designed to have visual interest in itself.
13. *The project will not require substantial energy consumption.* The project involves only minor energy use and no adverse effects are expected.

For the reasons above, the proposed action is not expected to have any significant effect in the context of Chapter 343, Hawai‘i Revised Statutes and section 11-200-12 of the State Administrative Rules.

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# **ENVIRONMENTAL ASSESSMENT**

## **Keāhua Stream Bridge**

### **APPENDIX 1a Comments in Response to Early Consultation**

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NEIL ABERCROMBIE  
GOVERNOR OF HAWAII



WILLIAM J. ALA, JR.  
CHAIRPERSON  
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JONATHAN STARR  
TED YAMAMURA  
WILLIAM M. TAM  
DEPUTY DIRECTOR

STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
**COMMISSION ON WATER RESOURCE MANAGEMENT**  
P.O. BOX 621  
HONOLULU, HAWAII 96809

April 15, 2014

Ref.: RFD.3952.2

Ron Terry, Ph.D.  
Project Environmental Consultant  
Geometrician Associates  
PO Box 396  
Hilo, HI 96721

Dear Mr. Terry:

Request for Determination  
Construction of Keahua Bridge, Keahua Stream, Lihue-Koloa Forest Reserve, Kauai

We are responding to your April 3, 2014, request for determination concerning early consultation for the construction of Keahua Bridge over the Keahua Stream in the Lihue-Koloa Forest Reserve, Kauai. The proposed project would build a one-lane, single-span steel truss bridge about 20 feet downstream from the existing ford crossing. The existing crossing would be left in place. Pursuant to §174C-71(3)(A), Hawaii Revised Statutes, the Commission on Water Resource Management "shall require persons to obtain a permit from the Commission prior to undertaking a stream channel alteration; provided that routine streambed and drainageway maintenance activities are exempt from obtaining a permit<sup>1</sup>."

Based on the materials you submitted and information contained therein, the Commission may require a Stream Channel Alteration Permit. The Commission would like to receive notice of the availability of the draft environmental assessment when completed. If you have any questions, contact Rebecca Alakai at 587-0266, or [rebecca.r.alakai@hawaii.gov](mailto:rebecca.r.alakai@hawaii.gov).

Very truly yours,

A handwritten signature in black ink, appearing to read "William M. Tam".

WILLIAM M. TAM  
Deputy Director

<sup>1</sup> The Commission's Stream Protection and Management Branch, has the responsibility to protect stream channels from alteration whenever practicable to provide for fishery, wildlife, recreational, aesthetic, scenic, and other beneficial instream uses in the State of Hawaii under the authorization of the State Water Code, HRS Chapter 174C, and Hawaii Administrative Rules Chapter 13-169 (Protection of Instream Uses of Water). Chapter 174C-3, HRS provides definitions for the terms "stream channel", and "channel alteration." "Stream channel" means "a natural or artificial watercourse with a definite bed and banks which periodically or continuously contains flowing water." "Channel alteration" means: 1) to obstruct, diminish, destroy, modify, or relocate a stream channel; 2) to change the direction of flow of water in a stream channel; 3) to place any material or structures in a stream channel; and 4) to remove any material or structures from a stream channel."

Please be advised that the project may require other agency approvals regarding wetlands, water quality, grading, stockpiling, and floodways. This letter should not be used for other regulatory jurisdictions or used to imply compliance with other federal, state, or county rules. Work performed without appropriate permits or authorizations may be subject to fines and/or remedial actions.



April 25, 2014

Ron Terry  
Project Environmental Consultant  
Geometrician Associates LLC  
PO Box 396  
Hilo, Hawai'i 96721

**RE: HRS CH 343 Environmental Assessment Early Consultation  
Keahua Bridge Construction and Improvements  
Līhu'e-Kōloa Forest Reserve  
Department of Land and Natural Resources**

Dear Mr. Terry,

Thank you for referring the Keahua Stream Bridge and Related Improvements Project to Historic Hawai'i Foundation (HHF) for early consultation prior to the draft Environmental Assessment under the Hawai'i Revised Statutes Chapter 343. Since 1974, HHF has been a statewide leader for historic preservation with a mission to preserve and encourage the preservation of historic properties significant to the history of Hawai'i.

Located within Līhu'e-Kōloa Forest Reserve, managed by the Department of Land and Natural Resources, the proposed project consists of the construction of a new bridge over the Keahua Stream which currently features a ford crossing cement "Texas Bridge" as it is described the correspondence from Geometrician Associates LLC dated April 3, 2014. Scope of work also includes parking area and existing roadway improvements.

Based on DLNR's Līhu'e-Kōloa Forest Reserve Management Plan dated September 2010, there are archaeological and historical resources present in the area. Historic Hawai'i Foundation suggests that the Environmental Assessment address the methods that will be used to identify archaeological and historic resources, and what process will be followed once historic properties are identified. Additionally the existing bridge and roadways should be assessed for historic significance during the aforementioned identification process. Due to the presence of both archaeological and historic resources, Historic Hawai'i Foundation suggests consultation with the Archaeological Branch and Architecture Branch at the State Historic Preservation Division. Historic Hawai'i Foundation feels that the Environmental Assessment should address how the proposed project meets Management Objects and Goals set forth in the 2010 Management Plan.

Historic Hawai'i Foundation would like to be included in further consultation regarding this project Megan Borthwick, Preservation Program Manager, will be HHF's point of contact. She can be reached at 808-523-2900 or [Megan@historichawaii.org](mailto:Megan@historichawaii.org)

Very truly yours,

Kiersten Faulkner, AICP  
Executive Director

CC: Clyde Tomihara  
Susan Lebo & Michael Gushard, SHPD

NEIL ABERCROMBIE  
GOVERNOR OF HAWAII



WILLIAM J. AILA, JR.  
CHAIRPERSON  
BOARD OF LAND AND NATURAL RESOURCES  
COMMISSION ON WATER RESOURCE MANAGEMENT



STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
LAND DIVISION

POST OFFICE BOX 621  
HONOLULU, HAWAII 96809

May 1, 2014

Geometrician Associates, LLC  
Attention: Mr. Ron Terry  
P.O. Box 396  
Hilo, Hawaii 96721

via email: [rterry@hawaii.rr.com](mailto:rterry@hawaii.rr.com)

Dear Mr. Terry,

SUBJECT: Early Consultation for Construction of Keahua Bridge and Related Improvements, Lihue-Koloa Forest Reserve, Island of Kaua'i

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR) Land Division distributed or made available a copy of your report pertaining to the subject matter to DLNR Divisions for their review and comments.

At this time, enclosed are comments from (1) Land Division – Kauai District; (2) Engineering Division; (3) Office of Conservation and Coastal Lands; and (4) Division of State Parks. No other comments were received as of our suspense date. Should you have any questions, please feel free to call Supervising Land Agent Steve Molmen at 587-0439. Thank you.

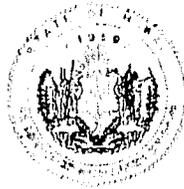
Sincerely,

A handwritten signature in black ink, appearing to read "Russell Y. Tsuji".

Russell Y. Tsuji  
Land Administrator

Enclosure(s)

c: [Clyde.Y.Tomihara@hawaii.gov](mailto:Clyde.Y.Tomihara@hawaii.gov)



STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
LAND DIVISION

POST OFFICE BOX 621  
HONOLULU, HAWAII 96809

April 4, 2014

MEMORANDUM

TO: **DLNR Agencies:**  
X Div. of Aquatic Resources  
   Div. of Boating & Ocean Recreation  
X Engineering Division  
X Div. of Forestry & Wildlife  
X Div. of State Parks  
X Commission on Water Resource Management  
X Office of Conservation & Coastal Lands  
X Land Division - Kauai District  
X Historic Preservation

FROM: *Russell Y. Tsuji, Land Administrator*  
SUBJECT: Early Consultation for Construction of Keahua Bridge and Related Improvements, Lihue-Koloa Forest Reserve, Island of Kaua'i  
LOCATION: At the crossing of Keahua Stream over Kuamoo Road within the Lihue-Koloa Forest Reserve, Island of Kaua'i  
APPLICANT: Department of Land and Natural Resources, Engineering Division by its consultant, Geometrician Associates, LLC

Transmitted for your review and comment on the above-referenced document. We would appreciate your comments on this document.

Please submit any comments by May 1, 2014. If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Supervising Land Agent Steve Molmen at (808) 587-0439. Thank you.

*TO* → Attachments

- ( X ) We have no objections.
- ( ) We have no comments.
- ( ) Comments are attached.

*FROM:*

Signed: *Marvin Muleka*  
Print Name: MARVIN MULEKA, KAUAI DISTRICT LAND AGENT  
Date: APRIL 10, 2014



14 APR 8 PM 3:46 ENGINEERING

WILLIAM J. AHA, JR.  
CHAIRPERSON  
BOARD OF LAND AND NATURAL RESOURCES  
COMMISSION ON WATER RESOURCE MANAGEMENT



**STATE OF HAWAII**  
**DEPARTMENT OF LAND AND NATURAL RESOURCES**  
**LAND DIVISION**

POST OFFICE BOX 621  
HONOLULU, HAWAII 96809

April 4, 2014

**MEMORANDUM**

TO: FR

**DLNR Agencies:**

- Div. of Aquatic Resources
- Div. of Boating & Ocean Recreation
- Engineering Division
- Div. of Forestry & Wildlife
- Div. of State Parks
- Commission on Water Resource Management
- Office of Conservation & Coastal Lands
- Land Division – Kauai District
- Historic Preservation

FROM: TO

*Russell Y. Tsuji*  
Russell Y. Tsuji, Land Administrator

SUBJECT:

Early Consultation for Construction of Keahua Bridge and Related Improvements, Lihue-Koloa Forest Reserve, Island of Kaua'i

LOCATION:

At the crossing of Keahua Stream over Kuamoo Road within the Lihue-Koloa Forest Reserve, Island of Kaua'i

APPLICANT:

Department of Land and Natural Resources, Engineering Division by its consultant, Geometrician Associates, LLC

Transmitted for your review and comment on the above-referenced document. We would appreciate your comments on this document.

Please submit any comments by May 1, 2014. If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Supervising Land Agent Steve Molmen at (808) 587-0439. Thank you.

**Attachments**

- We have no objections.
- We have no comments.
- Comments are attached.

Signed: \_\_\_\_\_

Print Name: Cory S. Chung, Chief Engineer

Date: 4/22/14

DEPARTMENT OF LAND AND NATURAL RESOURCES  
ENGINEERING DIVISION

LD/ Russell Y. Tsuji

REF: Early Consultation for Construction of Keahua Bridge and Related Improvements, Lihue-  
Koloa Forest Reserve  
Kauai.003

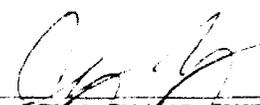
COMMENTS

- ( ) We confirm that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Flood Zone \_\_\_\_.
- (X) **Please take note that the project site according to the Flood Insurance Rate Map (FIRM), is located in Zone X. The National Flood Insurance Program (NFIP) does not regulate developments within Zone X.**
- ( ) Please note that the correct Flood Zone Designation for the project site according to the Flood Insurance Rate Map (FIRM) is \_\_\_\_.
- ( ) Please note that the project must comply with the rules and regulations of the National Flood Insurance Program (NFIP) presented in Title 44 of the Code of Federal Regulations (44CFR), whenever development within a Special Flood Hazard Area is undertaken. If there are any questions, please contact the State NFIP Coordinator, Ms. Carol Tyau-Beam, of the Department of Land and Natural Resources, Engineering Division at (808) 587-0267.

Please be advised that 44CFR indicates the minimum standards set forth by the NFIP. Your Community's local flood ordinance may prove to be more restrictive and thus take precedence over the minimum NFIP standards. If there are questions regarding the local flood ordinances, please contact the applicable County NFIP Coordinators below:

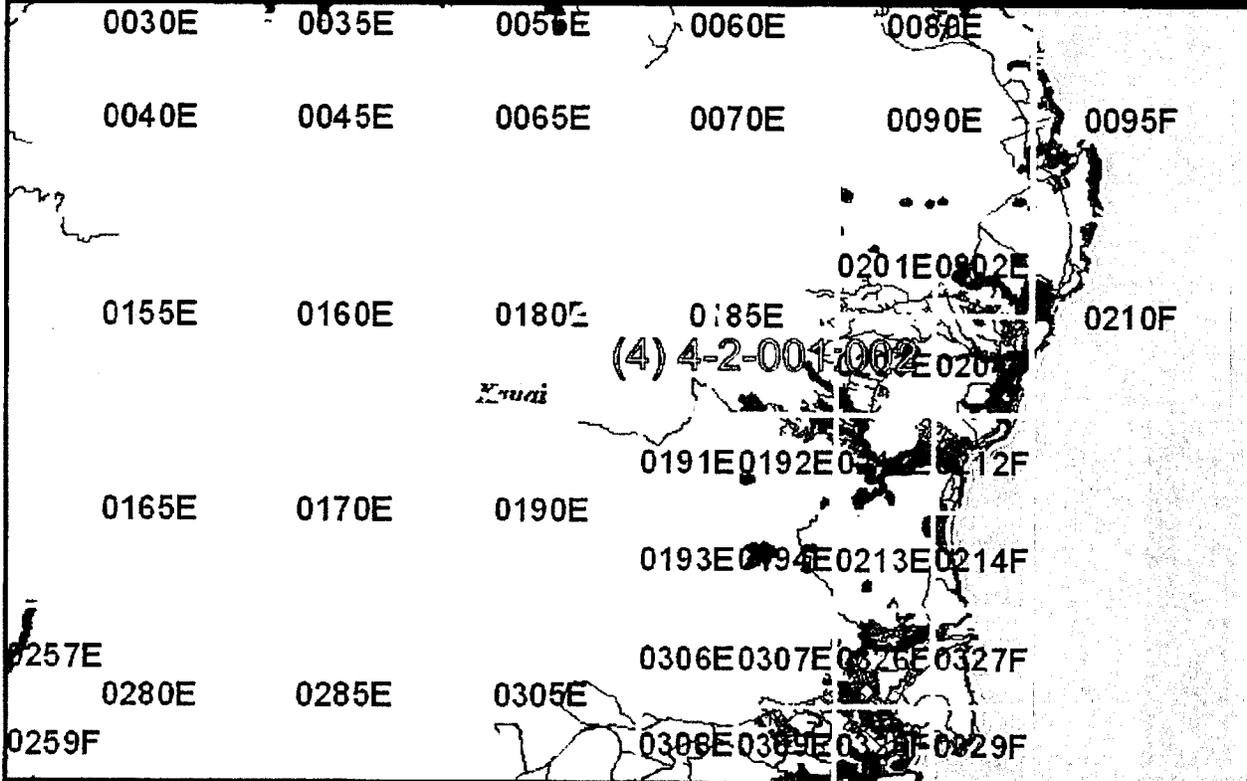
- ( ) Mr. Mario Siu Li at (808) 768-8098 of the City and County of Honolulu, Department of Planning and Permitting.
- ( ) Mr. Frank DeMarco at (808) 961-8042 of the County of Hawaii, Department of Public Works.
- ( ) Mr. Carolyn Cortez at (808) 270-7253 of the County of Maui, Department of Planning.
- ( ) Mr. Stanford Iwamoto at (808) 241-4896 of the County of Kauai, Department of Public Works.
  
- ( ) The applicant should include project water demands and infrastructure required to meet water demands. Please note that the implementation of any State-sponsored projects requiring water service from the Honolulu Board of Water Supply system must first obtain water allocation credits from the Engineering Division before it can receive a building permit and/or water meter.
  
- ( ) The applicant should provide the water demands and calculations to the Engineering Division so it can be included in the State Water Projects Plan Update.
  
- ( ) Additional Comments: \_\_\_\_\_  
\_\_\_\_\_
  
- ( ) Other: \_\_\_\_\_  
\_\_\_\_\_

Should you have any questions, please call Mr. Dennis Imada of the Planning Branch at 587-0257.

Signed:   
CARLY S. CHANG, CHIEF ENGINEER  
Date: 4/22/14



# FLOOD HAZARD ASSESSMENT REPORT



STATE OF HAWAII DEPARTMENT OF LAND AND NATURAL RESOURCES

**FLOOD ZONE DEFINITIONS**

**SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD** – The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water-surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

- **Zone A:** No BFE determined.
- **Zone AE:** BFE determined.
- **Zone AH:** Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
- **Zone AO:** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
- **Zone V:** Coastal flood zone with velocity hazard (wave action); no BFE determined.
- **Zone VE:** Coastal flood zone with velocity hazard (wave action); BFE determined.
- **Zone AEF:** Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

**NON-SPECIAL FLOOD HAZARD AREA** – An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

- **Zone XS (X shaded):** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
- **Zone X:** Areas determined to be outside the 0.2% annual chance floodplain.

**OTHER FLOOD AREAS**

- **Zone D:** Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

**PROPERTY INFORMATION**

COUNTY: KAUAI  
 TMK NO: (4) 4-2-001-002  
 PARCEL ADDRESS:  
 FIRM INDEX DATE: NOVEMBER 26, 2010  
 LETTER OF MAP CHANGE(S): NONE  
 FEMA FIRM PANEL(S):  
 1500020190E - PANEL NOT PRINTED  
 1500020185E-SEPTEMBER 16, 2005  
 1500020180E - PANEL NOT PRINTED

PARCEL DATA FROM: JANUARY 2012  
 IMAGERY DATA FROM: MAY 2005

**IMPORTANT PHONE NUMBERS**

County NFIP Coordinator  
 County of Kauai  
 Stanford Iwamoto, P.E. (808) 241-4896  
State NFIP Coordinator  
 Carol Tyau-Beam, P.E., CFM (808) 587-0267

*Disclaimer: The Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use of the information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR from any liability which may arise from its use.*

*If this map has been identified as 'PRELIMINARY' or 'UNOFFICIAL', please note that it is being provided for informational purposes and is not to be used for official/legal decisions, regulatory compliance, or flood insurance rating. Contact your county NFIP coordinator for flood zone determinations to be used for compliance with local floodplain management regulations.*



*K74-176*

STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
LAND DIVISION

2014 APR -8 P 3: 44

POST OFFICE BOX 621  
HONOLULU, HAWAII 96809

April 4, 2014

MEMORANDUM

TO:

**DLNR Agencies:**

- Div. of Aquatic Resources
- Div. of Boating & Ocean Recreation
- Engineering Division
- Div. of Forestry & Wildlife
- Div. of State Parks
- Commission on Water Resource Management
- Office of Conservation & Coastal Lands
- Land Division – Kauai District
- Historic Preservation

FROM:

*Russell Y. Tsuji, Land Administrator*

SUBJECT:

Early Consultation for Construction of Keāhua Bridge and Related Improvements, Lihue-Kōloa Forest Reserve, Island of Kaua'i

LOCATION:

At the crossing of Keāhua Stream over Kuamo'o Road within the Lihue-Kōloa Forest Reserve, Island of Kaua'i

APPLICANT:

Department of Land and Natural Resources, Engineering Division by its consultant, Geometrician Associates, LLC

Transmitted for your review and comment on the above-referenced document. We would appreciate your comments on this document.

Please submit any comments by May 1, 2014. If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Supervising Land Agent Steve Molmen at (808) 587-0439. Thank you.

Attachments

- We have no objections.
- We have no comments.
- Comments are attached.

Signed:

*K. Tiger Mills*

Print Name:

*K. Tiger Mills*

Date:

*April 10 2014*

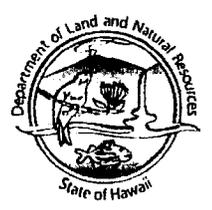
RECEIVED  
LAND DIVISION  
APR 11 PM 3:00



NEIL ABERGE JOMBIE  
GOVERNOR OF HAWAII



WILLIAM J. AIL A, JR.  
CHAIRPERSON  
BOARD OF LAND AND NATURAL RESOURCES  
COMMISSION ON WATER RESOURCE MANAGEMENT



STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
LAND DIVISION

POST OFFICE BOX 621  
HONOLULU, HAWAII 96809

April 4, 2014

MEMORANDUM

- TO: **DLNR Agencies:**
- Div. of Aquatic Resources
  - Div. of Boating & Ocean Recreation
  - Engineering Division
  - Div. of Forestry & Wildlife
  - Div. of State Parks
  - Commission on Water Resource Management
  - Office of Conservation & Coastal Lands
  - Land Division – Kauai District
  - Historic Preservation

APR 15 PM 12:09  
LAND DIVISION

FROM: Russell Y. Tsuji, Land Administrator

SUBJECT: Early Consultation for Construction of Keahua Bridge and Related Improvements, Lihue-Koloa Forest Reserve, Island of Kaua'i

LOCATION: At the crossing of Keahua Stream over Kuamoo Road within the Lihue-Koloa Forest Reserve, Island of Kaua'i

APPLICANT: Department of Land and Natural Resources, Engineering Division by its consultant, Geometrician Associates, LLC

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Please submit any comments by May 1, 2014. If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Supervising Land Agent Steve Molmen at (808) 587-0439. Thank you.

Attachments

- We have no objections.
- We have no comments.
- Comments are attached.

Signed: *[Signature]*

Print Name: Daniel S. Quinn

Date: 4/15/14

NEIL ABERCROMBIE  
GOVERNOR OF HAWAII



WILLIAM J. AILA, JR.  
CHAIRPERSON  
BOARD OF LAND AND NATURAL RESOURCES  
COMMISSION ON WATER RESOURCE MANAGEMENT



STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
LAND DIVISION

POST OFFICE BOX 621  
HONOLULU, HAWAII 96809

May 6, 2014

Geometrician Associates, LLC  
Attention: Mr. Ron Terry  
P.O. Box 396  
Hilo, Hawaii 96721

via email: [rterry@hawaii.rr.com](mailto:rterry@hawaii.rr.com)

Dear Mr. Terry,

SUBJECT: Early Consultation for Construction of Keahua Bridge and Related Improvements, Lihue-Koloa Forest Reserve, Island of Kaua'i

Thank you for the opportunity to review and comment on the subject matter. In addition to the comments sent to you on May 1, 2014, enclosed are additional comments from the (1) Commission on Water Resource Management; and (2) Division of Forestry and Wildlife on the subject matter. Should you have any questions, please feel free to call Supervising Land Agent Steve Molmen at (808) 587-0439. Thank you

Sincerely,

A handwritten signature in black ink, appearing to read "Russell Y. Tsuji".

Russell Y. Tsuji  
Land Administrator

Enclosure(s)

c: [Clyde.Y.Tomihara@hawaii.gov](mailto:Clyde.Y.Tomihara@hawaii.gov)

NEIL ABERCROMBIE  
GOVERNOR OF HAWAII



WILLIAM J. TAM, JR.  
CHAIRPERSON  
BOARD OF LAND AND NATURAL RESOURCES  
COMMISSIONER ON WATER RESOURCE MANAGEMENT



STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
LAND DIVISION

POST OFFICE BOX 621  
HONOLULU, HAWAII 96809

April 4, 2014

MEMORANDUM

TO:

**DLNR Agencies:**

- Div. of Aquatic Resources
- Div. of Boating & Ocean Recreation
- Engineering Division
- Div. of Forestry & Wildlife
- Div. of State Parks
- Commission on Water Resource Management
- Office of Conservation & Coastal Lands
- Land Division - Kauai District
- Historic Preservation

FROM:

*Russell Y. Tsuji*  
Russell Y. Tsuji, Land Administrator

SUBJECT:

Early Consultation for Construction of Keahua Bridge and Related Improvements, Lihue-Koloa Forest Reserve, Island of Kaua'i

LOCATION:

At the crossing of Keahua Stream over Kuamoo Road within the Lihue-Koloa Forest Reserve, Island of Kaua'i

APPLICANT:

Department of Land and Natural Resources, Engineering Division by its consultant, Geometrician Associates, LLC

Transmitted for your review and comment on the above-referenced document. We would appreciate your comments on this document.

Please submit any comments by May 1, 2014. If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Supervising Land Agent Steve Molmen at (808) 587-0439. Thank you.

Attachments

- We have no objections.
- We have no comments.
- Comments are attached.

Signed:

*William M. Tam*

Print Name: William M. Tam, Deputy Director

Date: May 1, 2014

FILE ID:	RFO.395A.2
OFF ID:	11550

NEIL ABERCROMBIE  
GOVERNOR OF HAWAII



WILLIAM J. AILA, JR.  
CHAIRPERSON

WILLIAM D. BALFOUR, JR.  
KAMANA BEAMER  
MILTON D. PAVAO  
LINDA ROSEN, M.D., M.P.H.  
JONATHAN STARR  
TED YAMAMURA

WILLIAM M. TAM  
DEPUTY DIRECTOR

STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
**COMMISSION ON WATER RESOURCE MANAGEMENT**  
P.O. BOX 621  
HONOLULU HAWAII 96809

May 1, 2014

REF: RFD.3954.2

TO: Russell Tsuji, Administrator  
Land Division

FROM: William M. Tam, Deputy Director   
Commission on Water Resource Management

SUBJECT: Construction for Keahua Bridge and Related Improvements, Lihue-Koloa Forest Reserve, Kauai

FILE NO.:

TMK NO.: (4) 4-2-001:002

Thank you for the opportunity to review the subject document. The Commission on Water Resource Management (CWRM) is the agency responsible for administering the State Water Code (Code). Under the Code, all waters of the State are held in trust for the benefit of the citizens of the State, therefore, all water use is subject to legally protected water rights. CWRM strongly promotes the efficient use of Hawaii's water resources through conservation measures and appropriate resource management. For more information, please refer to the State Water Code, Chapter 174C, Hawaii Revised Statutes, and Hawaii Administrative Rules, Chapters 13-167 to 13-171. These documents are available via the Internet at <http://www.hawaii.gov/dlnr/cwrm>.

Our comments related to water resources are checked off below.

- 1. We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information.
- 2. We recommend coordination with the Engineering Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.
- 3. We recommend coordination with the Hawaii Department of Agriculture (HDOA) to incorporate the reclassification of agricultural zoned land and the redistribution of agricultural resources into the State's Agricultural Water Use and Development Plan (AWUDP). Please contact the HDOA for more information.
- 4. We recommend that water efficient fixtures be installed and water efficient practices implemented throughout the development to reduce the increased demand on the area's freshwater resources. Reducing the water usage of a home or building may earn credit towards Leadership in Energy and Environmental Design (LEED) certification. More information on LEED certification is available at <http://www.usgbc.org/leed>. A listing of fixtures certified by the EPA as having high water efficiency can be found at <http://www.epa.gov/watersense/>.
- 5. We recommend the use of best management practices (BMP) for stormwater management to minimize the impact of the project to the existing area's hydrology while maintaining on-site infiltration and preventing polluted runoff from storm events. Stormwater management BMPs may earn credit toward LEED certification. More information on stormwater BMPs can be found at <http://hawaii.gov/dbedt/czm/initiative/lid.php>.
- 6. We recommend the use of alternative water sources, wherever practicable.
- 7. We recommend participating in the Hawaii Green Business Program, that assists and recognizes businesses that strive to operate in an environmentally and socially responsible manner. The program description can be found online at <http://energy.hawaii.gov/green-business-program>

DRF-IA 03/20/2013

- 8. We recommend adopting landscape irrigation conservation best management practices endorsed by the Landscape Industry Council of Hawaii. These practices can be found online at [http://www.hawaiiscape.com/wp-content/uploads/2013/04/LICH\\_Irrigation\\_Conservation\\_BMPs.pdf](http://www.hawaiiscape.com/wp-content/uploads/2013/04/LICH_Irrigation_Conservation_BMPs.pdf)
- 9. There may be the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

Permits required by CWRM:

Additional information and forms are available at [http://hawaii.gov/dlnr/cwrm/info\\_permits.htm](http://hawaii.gov/dlnr/cwrm/info_permits.htm).

- 10. The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit is required prior to use of water. The Water Use Permit may be conditioned on the requirement to use dual line water supply systems for new industrial and commercial developments.
- 11. A Well Construction Permit(s) is (are) required before any well construction work begins.
- 12. A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.
- 13. There is (are) well(s) located on or adjacent to this project. If wells are not planned to be used and will be affected by any new construction, they must be properly abandoned and sealed. A permit for well abandonment must be obtained.
- 14. Ground water withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.
- 15. A Stream Channel Alteration Permit(s) is (are) required before any alteration(s) can be made to the bed and/or banks of a stream channel.
- 16. A Stream Diversion Works Permit(s) is (are) required before any stream diversion works is (are) constructed or altered.
- 17. A Petition to Amend the Interim Instream Flow Standard is required for any new or expanded diversion(s) of surface water.
- 18. The planned source of water for this project has not been identified in this report. Therefore, we cannot determine what permits or petitions are required from our office, or whether there are potential impacts to water resources.
- OTHER:  
May require a SCAP, more information needed (Separate response already sent per RFD).

If there are any questions, please contact Dean Uyeno at 587-0234.



**STATE OF HAWAII**  
**DEPARTMENT OF LAND AND NATURAL RESOURCES**  
**LAND DIVISION**

POST OFFICE BOX 621  
HONOLULU, HAWAII 96809

April 4, 2014

**MEMORANDUM**

**TO:** **DLNR Agencies:**  
X Div. of Aquatic Resources  
   Div. of Boating & Ocean Recreation  
X Engineering Division  
X Div. of Forestry & Wildlife  
X Div. of State Parks  
X Commission on Water Resource Management  
X Office of Conservation & Coastal Lands  
X Land Division – Kauai District  
X Historic Preservation

**FROM:**  Russell Y. Tsuji, Land Administrator  
**SUBJECT:** Early Consultation for Construction of Keahua Bridge and Related Improvements, Lihue-Koloa Forest Reserve, Island of Kaua'i  
**LOCATION:** At the crossing of Keahua Stream over Kuamoo Road within the Lihue-Koloa Forest Reserve, Island of Kaua'i  
**APPLICANT:** Department of Land and Natural Resources, Engineering Division by its consultant, Geometrician Associates, LLC

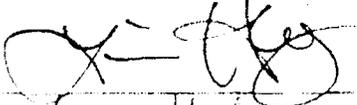
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Please submit any comments by May 1, 2014. If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Supervising Land Agent Steve Molmen at (808) 587-0439. Thank you.

Attachments:

RECEIVED  
14 APR -9 11 2014

- We have no objections.
- We have no comments.
- Comments are attached.

Signed:   
Print Name: Lisa Hadway, DOLNR Administrator  
Date: 4/14/2014  
NLA

**From:** Darryl Perry [mailto:dperry@kauai.gov]  
**Sent:** Tuesday, May 06, 2014 8:16 AM  
**To:** rterry@hawaii.rr.com  
**Subject:** Construction of Keahua Bridge, Lihue, Kauai

Aloha Dr. Terry,

I received your letter dated April 3, 2014, relating to the construction of Keahua Bridge. I have no comments or concerns relating to this project, and need not receive notice of the EA Draft.

Mahalo. Chief Perry

*Darryl D. Perry*

*Chief of Police*

*Kauai Police Department*

*3990 Kaana Street, Suite 200*

*Lihue, Hawaii 96766*

*Ph. 808-241-1600*

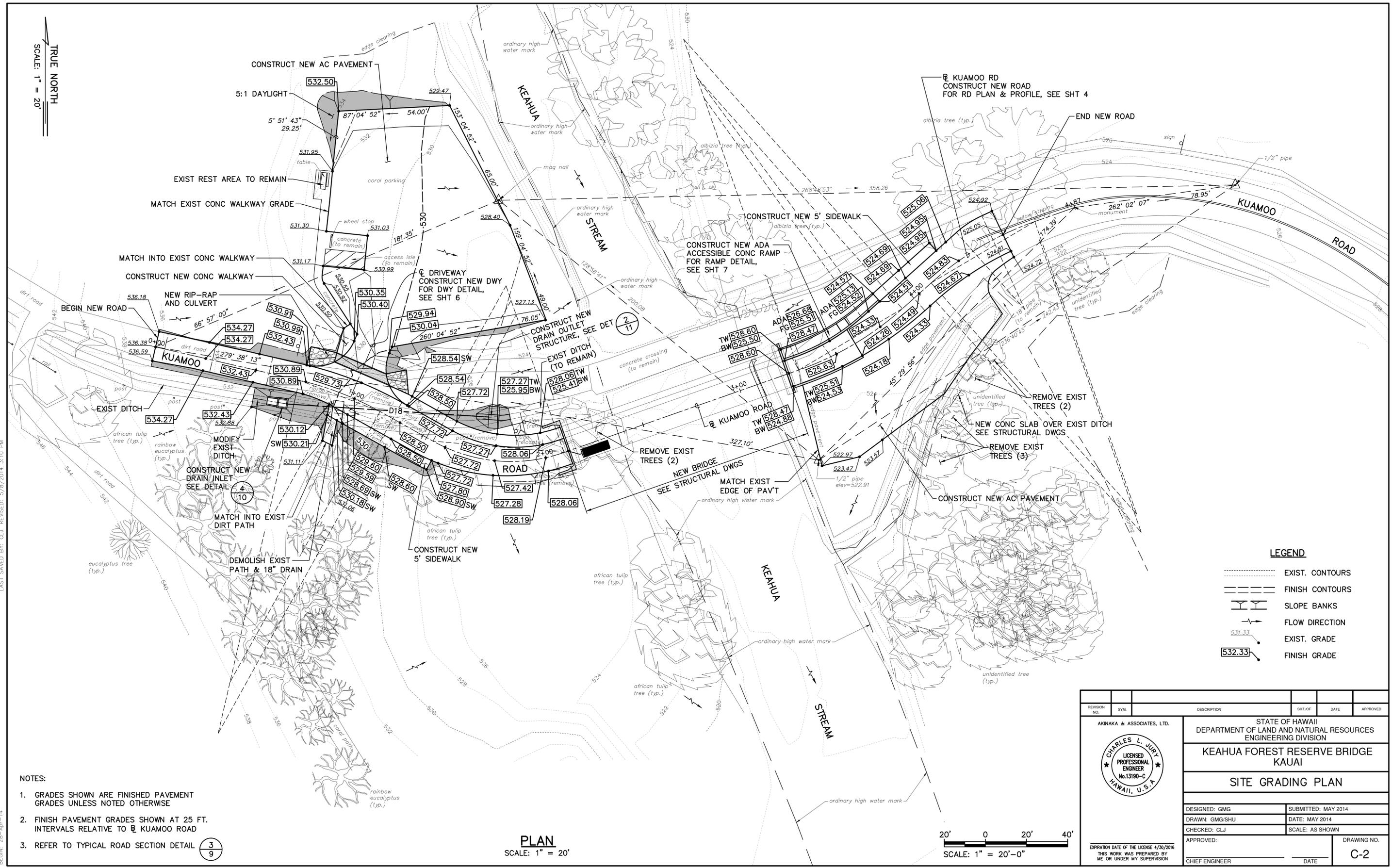
# **ENVIRONMENTAL ASSESSMENT**

## **Keāhua Stream Bridge**

### **APPENDIX 2 Site Plans**

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TRUE NORTH  
SCALE: 1" = 20'

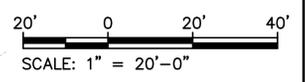


**LEGEND**

- EXIST. CONTOURS
- FINISH CONTOURS
- SLOPE BANKS
- FLOW DIRECTION
- EXIST. GRADE
- FINISH GRADE

- NOTES:**
- GRADES SHOWN ARE FINISHED PAVEMENT GRADES UNLESS NOTED OTHERWISE
  - FINISH PAVEMENT GRADES SHOWN AT 25 FT. INTERVALS RELATIVE TO KUAMOO ROAD
  - REFER TO TYPICAL ROAD SECTION DETAIL

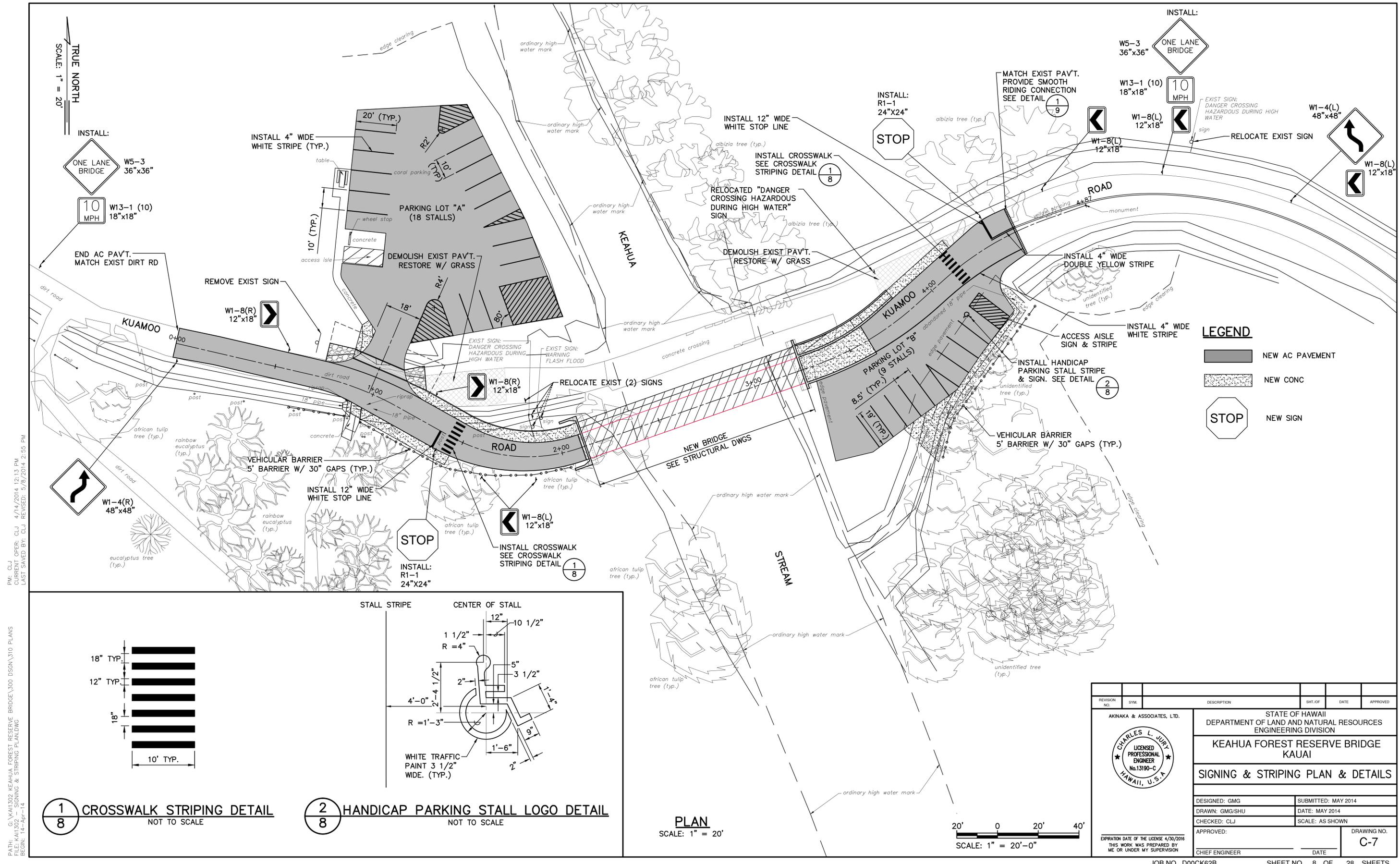
**PLAN**  
SCALE: 1" = 20'



PM: CLJ  
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 FILE: KAI1302 - SITE GRADING PLAN.DWG  
 BEGIN: 28-Apr-14

REVISION NO.	SYM.	DESCRIPTION	SHT. OF	DATE	APPROVED
AKINAKA & ASSOCIATES, LTD.  STATE OF HAWAII DEPARTMENT OF LAND AND NATURAL RESOURCES ENGINEERING DIVISION <b>KEAHUA FOREST RESERVE BRIDGE            KAUAI</b> <b>SITE GRADING PLAN</b>					
DESIGNED: GMG		SUBMITTED: MAY 2014			
DRAWN: GMG/SHU		DATE: MAY 2014			
CHECKED: CLJ		SCALE: AS SHOWN			
APPROVED:					DRAWING NO.
CHIEF ENGINEER					C-2
EXPIRATION DATE OF THE LICENSE 4/30/2016 THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION					DATE





PM: CLJ  
 CURRENT OPER: CLJ 4/14/2014 12:13 PM  
 LAST SAVED BY: CLJ REVISED: 5/8/2014 2:55 PM  
 PATH: G:\KAI1302\_KEAHUA FOREST RESERVE BRIDGE\300 DSCN\310 PLANS  
 FILE: KAI1302\_KEAHUA FOREST RESERVE BRIDGE\_SIGNING & STRIPING\_PLANDWG  
 BEGIN: 14-Apr-14

REVISION NO.	SYM.	DESCRIPTION	SHT. OF	DATE	APPROVED

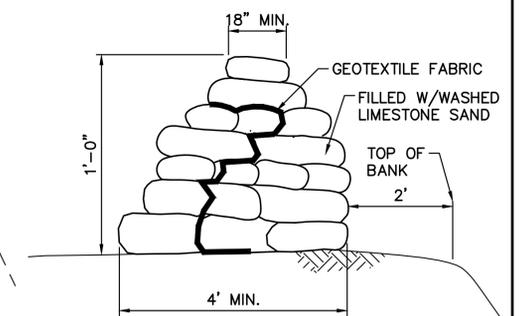
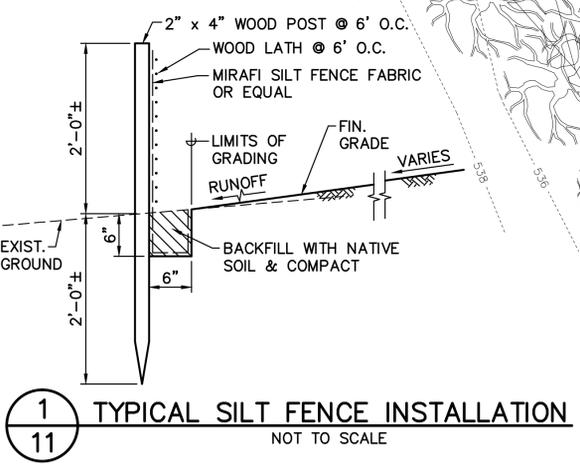
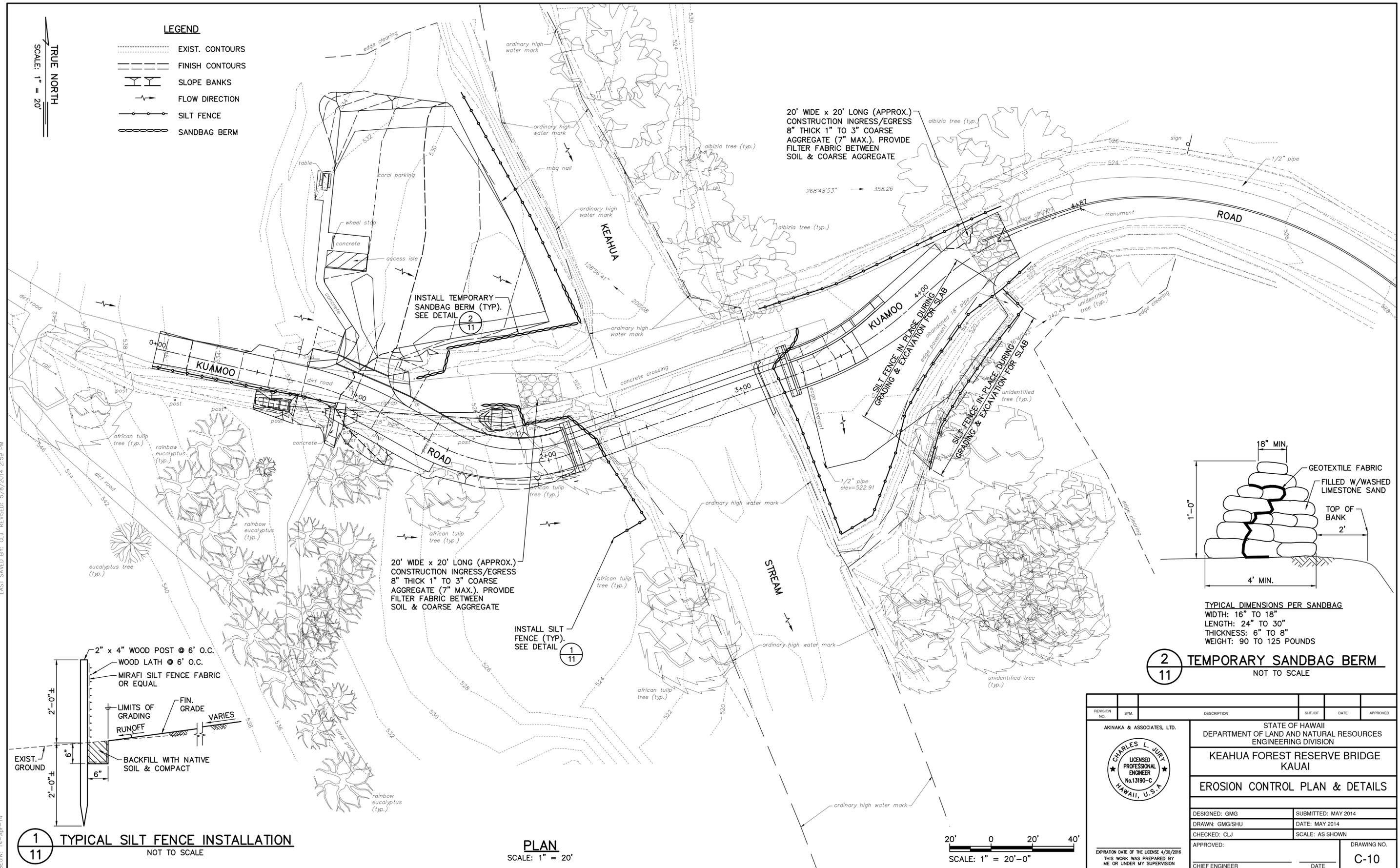
AKINAKA & ASSOCIATES, LTD.  LICENSED PROFESSIONAL ENGINEER No. 13190-C HAWAII, U.S.A.		STATE OF HAWAII DEPARTMENT OF LAND AND NATURAL RESOURCES ENGINEERING DIVISION <b>KEAHUA FOREST RESERVE BRIDGE          KAUAI</b> <b>SIGNING &amp; STRIPING PLAN &amp; DETAILS</b>	
DESIGNED: GMG	SUBMITTED: MAY 2014	DRAWING NO. C-7	
DRAWN: GMG/SHU	DATE: MAY 2014		
CHECKED: CLJ	SCALE: AS SHOWN		
APPROVED: _____	DATE: _____		
CHIEF ENGINEER			

JOB NO. D00CK62B SHEET NO. 8 OF 28 SHEETS

TRUE NORTH  
SCALE: 1" = 20'

**LEGEND**

- EXIST. CONTOURS
- FINISH CONTOURS
- ▬ SLOPE BANKS
- FLOW DIRECTION
- SILT FENCE
- SANDBAG BERM

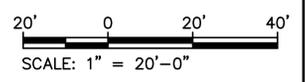


**2/11 TEMPORARY SANDBAG BERM**  
NOT TO SCALE

TYPICAL DIMENSIONS PER SANDBAG  
WIDTH: 16" TO 18"  
LENGTH: 24" TO 30"  
THICKNESS: 6" TO 8"  
WEIGHT: 90 TO 125 POUNDS

PATH: G:\KAI1302\_KEAHUA FOREST RESERVE BRIDGE\300 DSCN\310 PLANS  
 FILE: KAI1302 - EROSION CONTROL PLAN & DETAILS.DWG  
 BEGIN: 14-Apr-14  
 PM: CLJ  
 CURRENT OPER: CLJ 4/14/2014 12:13 PM  
 LAST SAVED BY: CLJ REVISED: 5/8/2014 2:59 PM

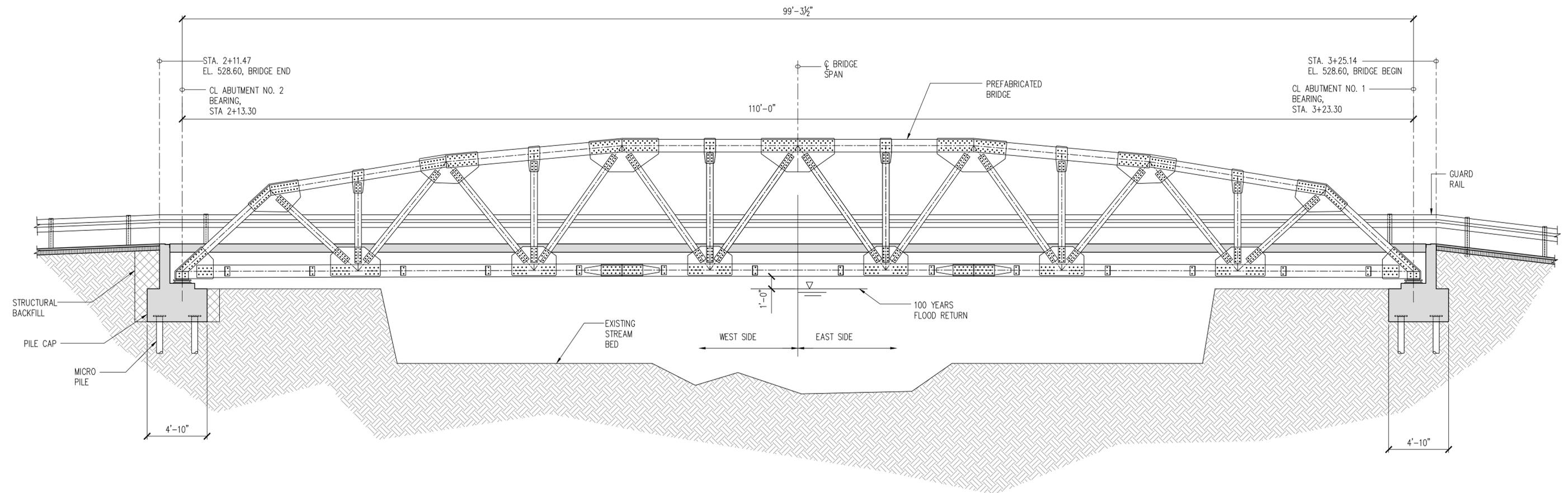
**PLAN**  
SCALE: 1" = 20'



REVISION NO.	SYM.	DESCRIPTION	SHT. OF	DATE	APPROVED

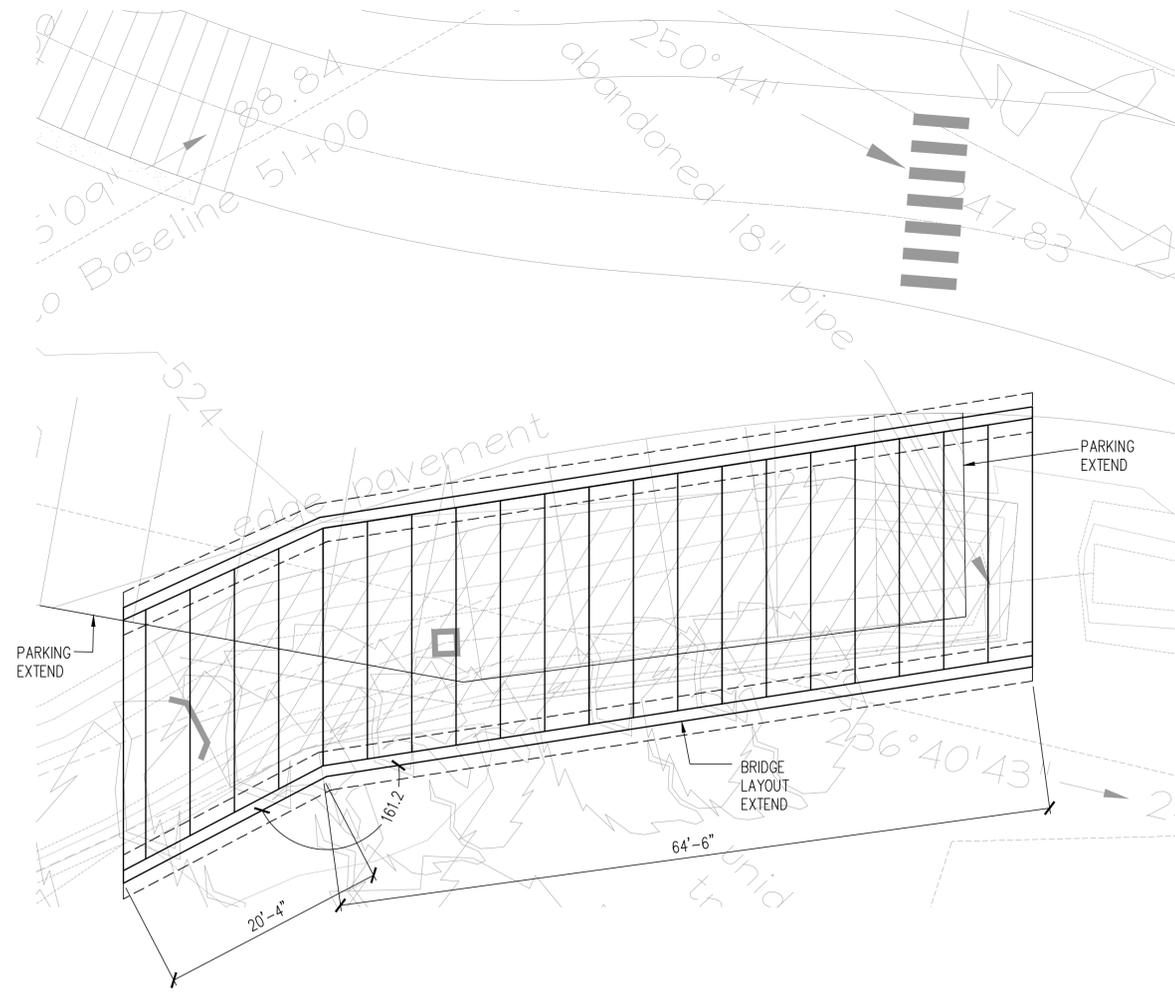
AKINAKA & ASSOCIATES, LTD.		STATE OF HAWAII DEPARTMENT OF LAND AND NATURAL RESOURCES ENGINEERING DIVISION	
		KEAHUA FOREST RESERVE BRIDGE KAUAI	
		EROSION CONTROL PLAN & DETAILS	
DESIGNED: GMG	SUBMITTED: MAY 2014		
DRAWN: GMG/SHU	DATE: MAY 2014		
CHECKED: CLJ	SCALE: AS SHOWN		
APPROVED: _____	DATE: _____	DRAWING NO. <b>C-10</b>	
<small>EXPIRATION DATE OF THE LICENSE 4/30/2016 THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION</small>			



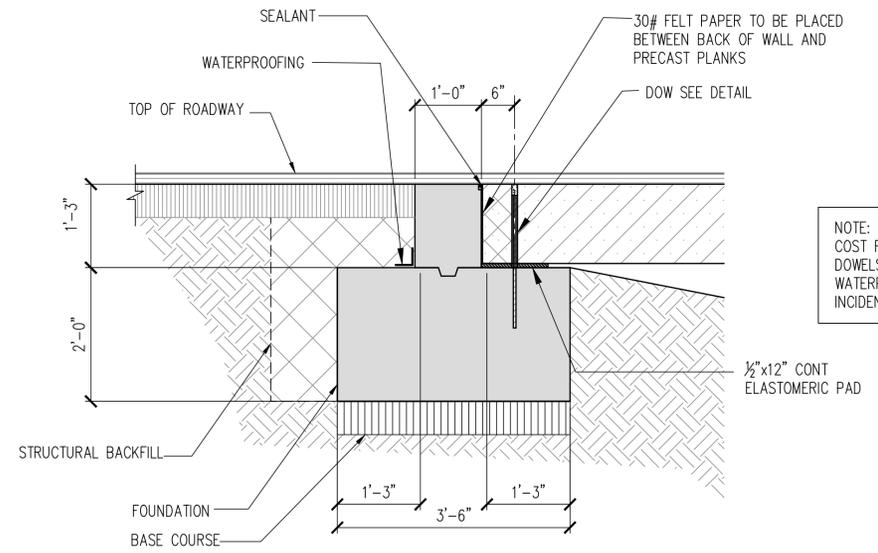
1 BRIDGE LONG. SECTION  
 S1-2 SCALE: 1/4" = 1'-0"

REVISION NO.	SYM.	DESCRIPTION	SHT. OF	DATE	APPROVED
STATE OF HAWAII DEPARTMENT OF LAND AND NATURAL RESOURCES ENGINEERING DIVISION					
KEAHUA FOREST RESERVE BRIDGE KAUAI					
BRIDGE LONG SECTION					
DESIGNED:			SUBMITTED:		
DRAWN:			DATE:		
CHECKED:			SCALE:		
APPROVED:			DRAWING NO.		
CHIEF ENGINEER			S1-2		
EXPIRATION DATE OF THE LICENSE 4/30/2014 THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION			DATE		

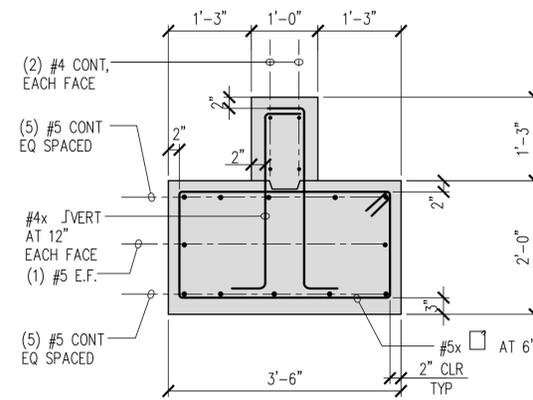
05-02\_32363236-51-2.dwg, 5/9/2014 9:36:30 AM, tamahana



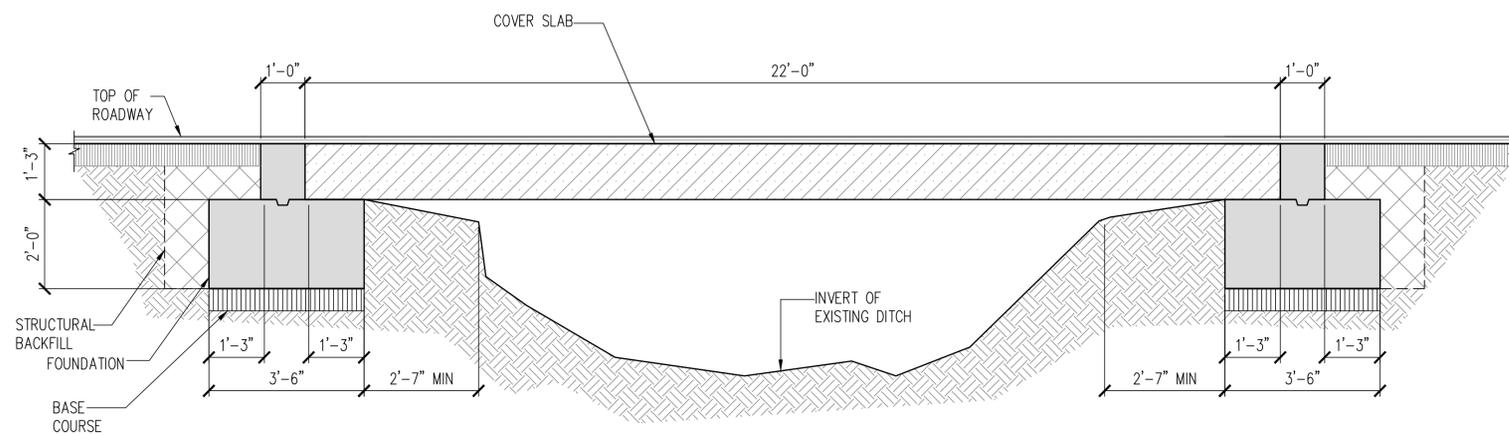
1 SLAB OVER DITCH PLAN  
S5-1 SCALE: 1/8" = 1'-0"



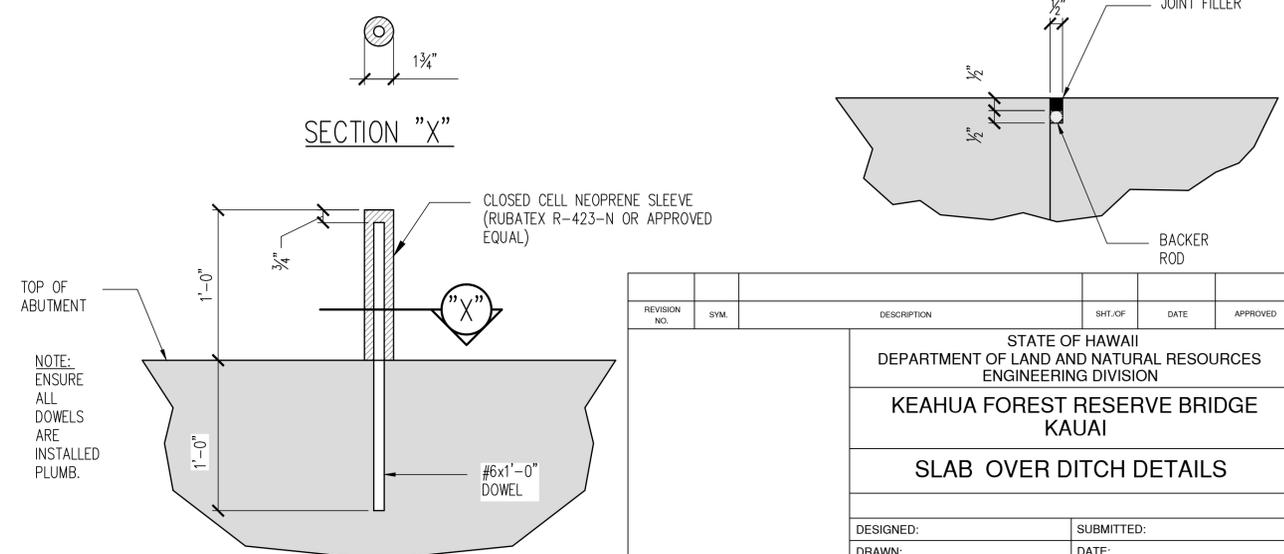
3 FOUNDATION SECTION  
S5-1 SCALE: 3/4" = 1'-0"



4 FOUNDATION REINFORCEMENT  
S5-1 SCALE: 3/4" = 1'-0"



2 COVER SECTION  
S5-1 SCALE: 1/2" = 1'-0"



5 DETAILS  
S5-1 SCALE: 3/4" = 1'-0"

REVISION NO.	SYMBOL	DESCRIPTION	SHT. OF	DATE	APPROVED
STATE OF HAWAII DEPARTMENT OF LAND AND NATURAL RESOURCES ENGINEERING DIVISION					
KEAHUA FOREST RESERVE BRIDGE KAUAI					
SLAB OVER DITCH DETAILS					
DESIGNED:			SUBMITTED:		
DRAWN:			DATE:		
CHECKED:			SCALE:		
APPROVED:			DRAWING NO.		
CHIEF ENGINEER			DATE		
EXPIRATION DATE OF THE LICENSE 4/30/2014 THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION					

## PROPOSED BRIDGE APPEARANCE (TYPICAL)



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# **ENVIRONMENTAL ASSESSMENT**

## **Keāhua Stream Bridge**

### **APPENDIX 3 Stream Hydrologic Analysis**

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# REHABILITATION/REPLACEMENT OF KEAHUA STREAM CROSSING



## STREAM ANALYSIS

FEDERAL AID PROJECT NO. BR-050-1(30)  
Koloa, Kauai, Hawai'i  
T.M.K. (4) 2-5-01

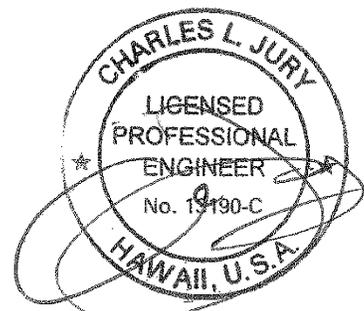
Prepared for:

**KAI Hawaii, Inc.**  
50 South Beretania Street, #C-119C  
Honolulu, Hawai'i 96813

Prepared by:

**Akinaka & Associates, Ltd.**  
3375 Koapaka Street, Suite B-206  
Honolulu, Hawai'i 96819

**APRIL 2014**



EXPIRATION DATE OF THE LICENSE

04/30/16

THIS WORK WAS PREPARED BY  
ME OR UNDER MY SUPERVISION

**KEAHUA STREAM  
FOREST RESERVE BRIDGE  
STREAM ANALYSIS**

For

**REHABILITATION/REPLACEMENT OF  
KEAHUA STREAM CROSSING  
(FEDERAL AID PROJECT NO. BR-050-1(30))**

Koloa, Kauai, Hawaii  
T.M.K. (4) 2-5-01

Prepared For:

KAI Hawaii, Inc.  
50 South Beretania Street, #C-119C  
Honolulu, Hawaii 96813

Prepared By:

Akinaka & Associates, Ltd.  
3375 Koapaka Street, Suite B-206  
Honolulu, Hawaii 96819

## **Introduction**

This study involves the analysis of the existing Keahua Stream and what effects the rehabilitation/replacement of the existing Keahua Stream Forest Reserve Bridge along Kuamoo Road has on the stream conditions. Keahua Stream flows from north to south crossing Kuamoo Road and discharges into the Uhaiuole Stream which connects to North Fork Wailua River (**Exhibit 1–Location Map**).

The stream analysis was performed through a series of steps to determine the impact such bridge improvements shall have on flow behavior in the stream:

1. Define the tributary area to determine what areas contribute to Keahua Stream.
2. Conduct an Autodesk Storm and Sanitary Analysis 2013 (SSA) analysis to generate peak flow rate data from the tributary area.
3. Conduct a steady flow HEC-RAS simulation to model stream behavior with existing conditions under peak flow during a 100-year event.
4. Conduct a steady flow HEC-RAS simulation to model stream behavior with proposed rehabilitation/replacement measures under peak flow during a 100-year event.

## **Hydrologic Analysis**

A hydrologic analysis was required to determine a flow value based on a specific storm event discharging runoff from a defined tributary area into Keahua Stream. The location of the Keahua Bridge crossing falls in Zone “X” on the Firm Map (**Exhibit B-FIRM Map**). Zone “X” is defined as areas of moderate or minimal hazard from the principal source of flood in the area. No base flood elevations are present on the FIRM Map and no flow data was provided in the FEMA Flood Insurance Study.

A tributary area was generated for Keahua Stream using a USGS Contour Map (**Exhibit 2-USGS Contour Map**). USGS 20-foot elevation contours were used to determine the tributary area that feeds Keahua Stream. Department of Public Works (DPW) County of Kauai Standards require use of the NRCS Hydrograph Analysis TR-20 method to determine storm runoff quantities for drainage areas between 100 acres and 2000 acres in size. Per County standards, a 100-year storm was used in the analysis to obtain a flow (cfs) value. Autodesk Storm and Sanitary Analysis 2013 software program was used to facilitate the peak flow analysis utilizing the TR-20 method.

The SSA analysis determined a 100-year storm event to discharge approximately 6,700 cfs into Keahua Stream near the Kuamoo Road Forest Reserve Bridge crossing.

**Appendix A–Hydrologic Analysis** provides data compiled during the hydrologic analysis assisted by SSA.

### **Hydraulic Analysis**

A hydraulic analysis was required to model storm runoff given the desired improvements to the Keahua Stream Bridge do not cause any adverse conditions in the existing behavior of Keahua Stream. HEC-RAS 4.1.0 was used to model the existing stream conditions using existing surface data provided by the surveyor and flow data generated from SSA. **Exhibit 3-General Layout Plan** illustrates the Keahua Stream with the existing topography of the region. Cross sections of Keahua Stream were cut along the stream approximately 200 feet upstream and 200 feet downstream of the current forest reserve crossing along Kuamoo Road. The HEC-RAS runs were analyzed using a steady flow simulation under a supercritical flow regime. Supercritical flow was used under the assumption that the stream, during a 100-year storm, will be turbulent, sustain higher velocities and exhibit properties closer to a supercritical state.

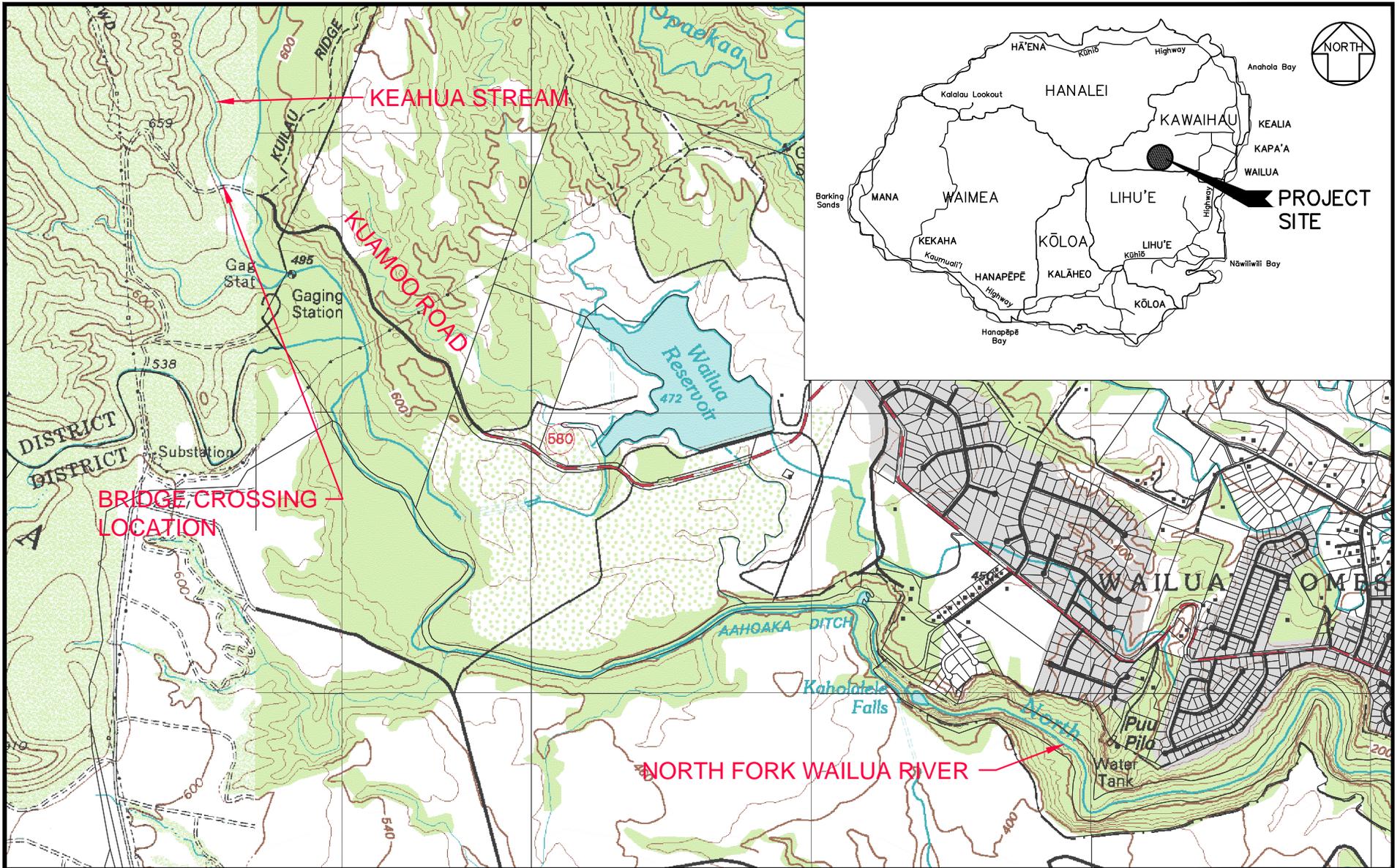
The water surface elevations generated from the steady flow simulation provided a basis for the 100-year flood limits within the project area along Keahua Stream. The proposed bridge abutments and site improvements shall be constructed out of the 100-year flood limits to minimize any impact the proposed crossing will have on existing (pre-development) flow conditions. The proposed bridge is clear span and will be 115 feet in length and sit approximately 30 feet (on center) downstream of the existing ford crossing. The hydraulic model computes the 100-year flood elevation at 524.6 feet where the proposed bridge is to cross. Based on DPW County standards, freeboard allowance is 3 feet above 100-year flood elevation. Per discussions with various State and County agencies, a 1 foot freeboard will be used for the design. See **Appendix B–Hydraulic Analysis** for data compiled from the hydraulic analysis performed in HEC-RAS.

### **Conclusion**

The analysis shows the proposed bridge and site improvements at the Keahua Stream Bridge crossing will have no impact to the existing stream conditions.

## References

- A. *Storm Water Runoff System Manual*, County of Kauai, Department of Public Works, July 2001
- B. Topographic Survey – Esaki Surveying and Mapping, Inc., 2014
- C. *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii*, USDA Soil Conservation Service, August 1972



# LOCATION MAP

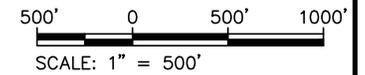
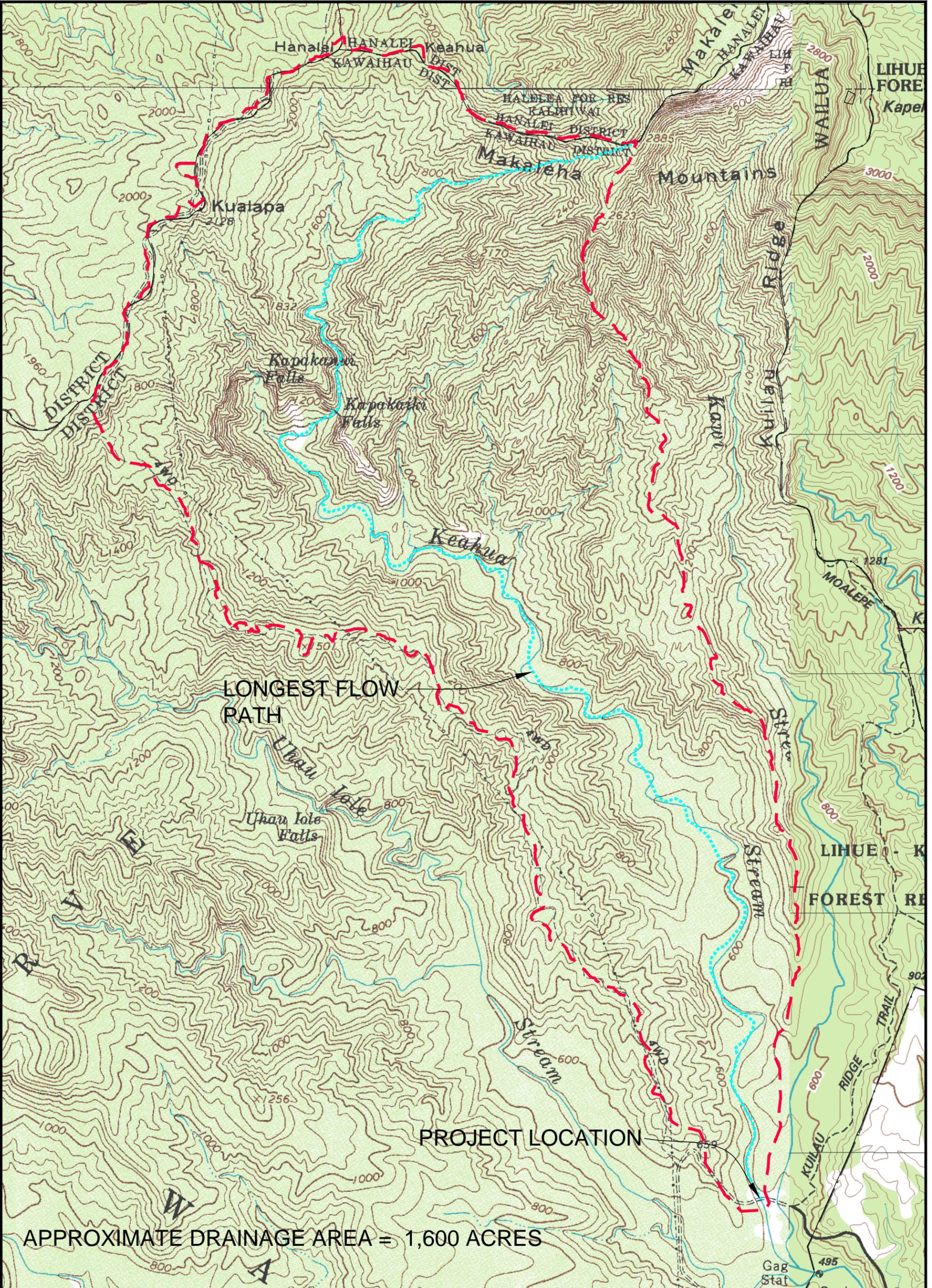


EXHIBIT 1



APPROXIMATE DRAINAGE AREA = 1,600 ACRES



KEAHUA STREAM BRIDGE

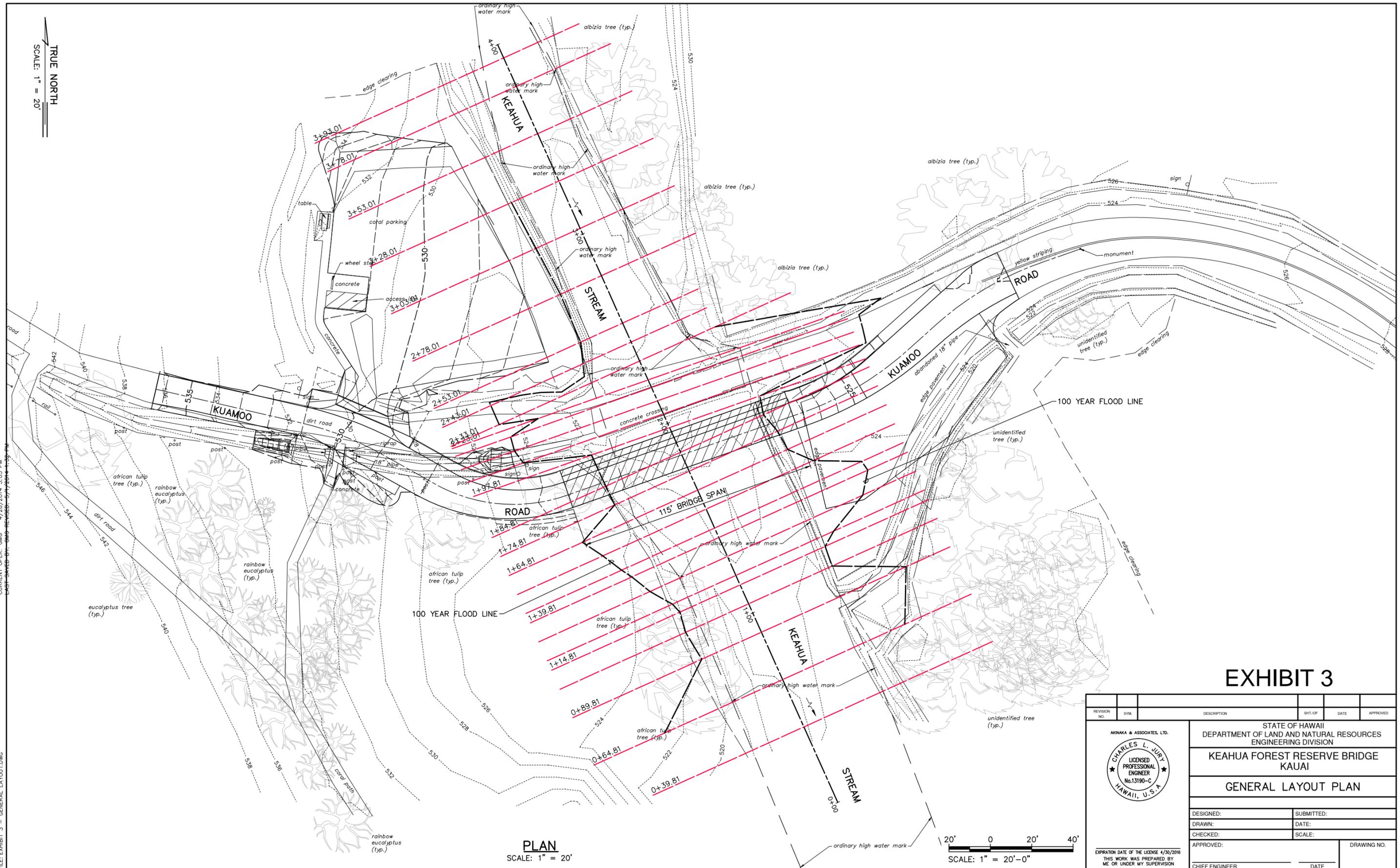
# TRIBUTARY BOUNDARY MAP - KEAHUA STREAM

NOT TO SCALE

EXHIBIT

# 2

TRUE NORTH  
SCALE: 1" = 20'



PLAN  
SCALE: 1" = 20'

20' 0 20' 40'  
SCALE: 1" = 20'-0"

### EXHIBIT 3

REVISION NO.	SYMBOL	DESCRIPTION	SHEET OF	DATE	APPROVED
STATE OF HAWAII DEPARTMENT OF LAND AND NATURAL RESOURCES ENGINEERING DIVISION <b>KEAHUA FOREST RESERVE BRIDGE            KAUI</b> <b>GENERAL LAYOUT PLAN</b>					
DESIGNED:			SUBMITTED:		
DRAWN:			DATE:		
CHECKED:			SCALE:		
APPROVED:			DRAWING NO.		
CHIEF ENGINEER _____ DATE _____ <small>EXPIRATION DATE OF THE LICENSE 4/30/2016            THIS WORK WAS PREPARED BY            ME OR UNDER MY SUPERVISION</small>					

PATH: C:\KAI1302 KEAHUA FOREST RESERVE BRIDGE\700 REPORTS\703 DRAINAGE  
 REPORT\03 EXHIBITS  
 FILE: EXHIBIT 3 - GENERAL LAYOUT.DWG  
 BEGIN: 28-Apr-14  
 PM: C.L.J.  
 CURRENT OPER: GNG 4/28/2014 3:05 PM  
 LAST SAVED BY: GNS REVISION: 2/1/2014 1:32 PM

**APPENDIX A**  
**HYDROLOGIC ANALYSIS**



Flood Hazard Report

The purpose of this report is to provide information on general requirements and procedures involved in obtaining approval of building permit applications in flood zones. This report provides a general description of relevant flood requirements. Reference should be made to Chapter 15 Article 1 of the Kaua`i County Code relating to floodplain management for more detailed information.

<b>AOI Lat. Coordinates</b>	-17746543.034179892 , -17746005.586324807
<b>AOI Long. Coordinates</b>	2519780.7345364443 , 2520319.376720096
<b>SPECIAL FLOOD HAZARD AREA (SFHA)</b>	No
<b>FLOODWAY</b>	No
<b>FLOOD ZONE INTERSECTIONS (BFE or BFE RANGE)</b>	X(No BFE)
<b>INTERSECTS SPECIAL MANAGEMENT AREA</b>	No
<b>INTERSECTS TSUNAMI EVACUATION ZONE</b>	No
<b>CONSERVATION DISTRICT</b>	Resource Subzone
<b>FEMA PANEL (FIRM Revision Date: September 16, 2005)</b>	1500020185E



**Map Legend**

- Area Of Interest (AOI)
- Streets
- County Parcels

**Hazard Data Layer Descriptions**

FEMA Digital Flood Insurance Rate Map for the County of Kaua`i published in 2005. Special Management Areas from Kaua`i County Planning Department blue-line maps digitalized by the State of Hawai'i Office of Planning in 1996. Tsunami Evacuation Zones were digitalized by the Pacific Disaster Center from maps provided by the State of Hawai'i Civil Defense, and published in County Telephone directories by GTE in 1991. These maps were produced by the Joint Institute for Marine and Atmospheric Research, at the University of Hawai'i in cooperation with the State of Hawai'i Civil Defense System.

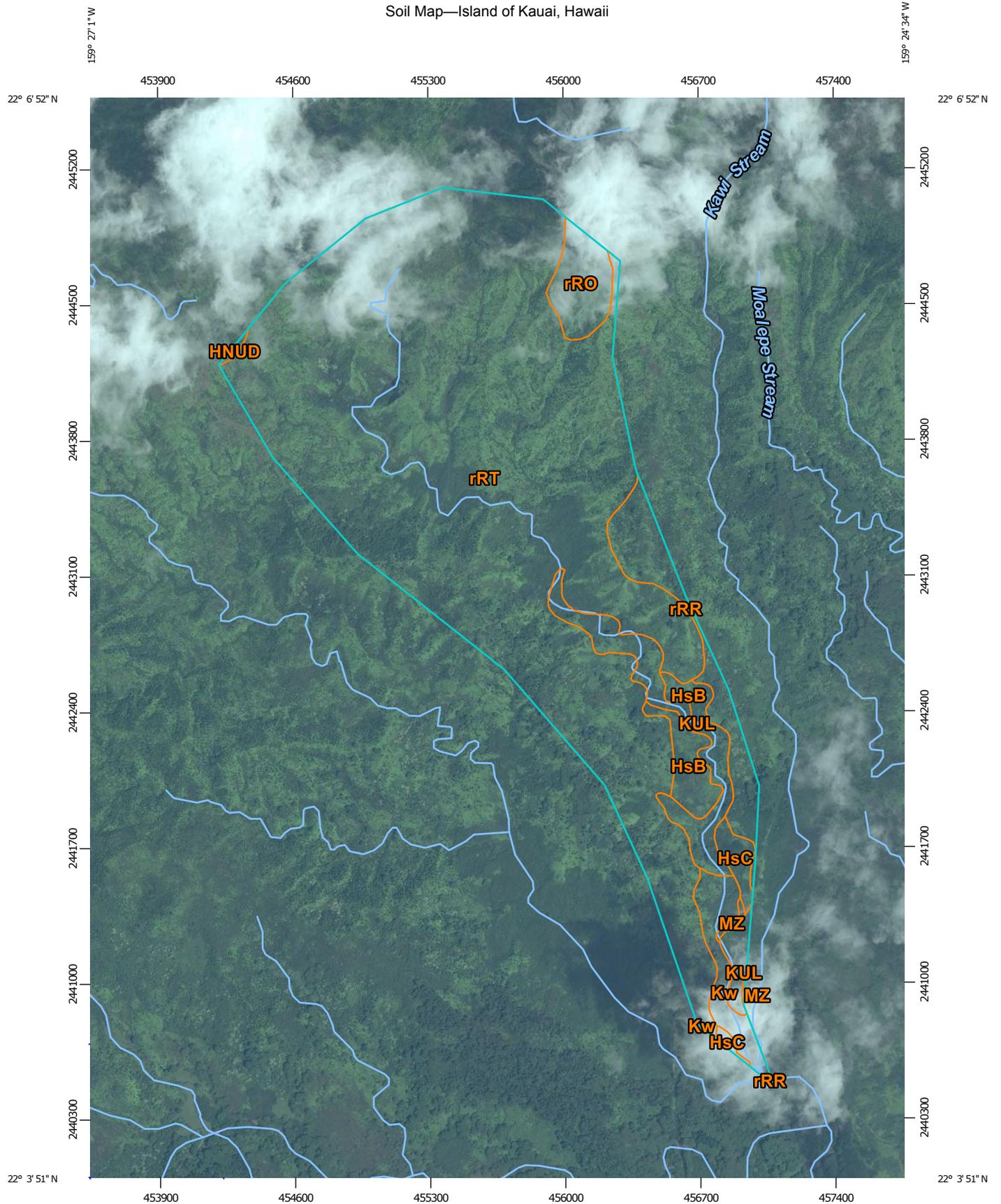
**THESE MAPS ARE NOT A SUBSTITUTE FOR LAND SURVEYS OR LEGAL DOCUMENTS. Users of this map are hereby notified that the aforementioned public primary information sources should be consulted for verification of the information contained on this map. Kaua`i County and NOAA assume no legal responsibility for the information contained on this map.**

**County of Kaua`i  
Department of Public Works  
Engineering Division  
Design and Permitting**

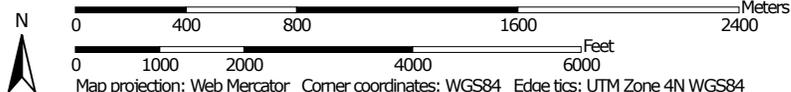
**4444 Rice Street, Suite 175  
Lihue, Hawai`i 96766-1340**



Soil Map—Island of Kauai, Hawaii



Map Scale: 1:27,200 if printed on A portrait (8.5" x 11") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 4N WGS84

### MAP LEGEND

**Area of Interest (AOI)**

 Area of Interest (AOI)

**Soils**

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

**Special Point Features**

-  Blowout
-  Borrow Pit
-  Clay Spot
-  Closed Depression
-  Gravel Pit
-  Gravelly Spot
-  Landfill
-  Lava Flow
-  Marsh or swamp
-  Mine or Quarry
-  Miscellaneous Water
-  Perennial Water
-  Rock Outcrop
-  Saline Spot
-  Sandy Spot
-  Severely Eroded Spot
-  Sinkhole
-  Slide or Slip
-  Sodic Spot

-  Spoil Area
-  Stony Spot
-  Very Stony Spot
-  Wet Spot
-  Other
-  Special Line Features

**Water Features**

 Streams and Canals

**Transportation**

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

**Background**

 Aerial Photography

### MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service  
 Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>  
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Island of Kauai, Hawaii  
 Survey Area Data: Version 8, Dec 7, 2013

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 26, 2011—Oct 3, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Map Unit Legend

Island of Kauai, Hawaii (HI960)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
HNUD	Hulua gravelly silty clay loam, 3 to 25 percent slopes	1.4	0.1%
HsB	Hanamaulu silty clay, 3 to 8 percent slopes	43.5	3.4%
HsC	Hanamaulu silty clay, 8 to 15 percent slopes	14.3	1.1%
KUL	Kolokolo extremely stony clay loam	57.4	4.4%
Kw	Kolokolo clay loam	33.0	2.5%
MZ	Marsh	2.4	0.2%
rRO	Rock outcrop	35.0	2.7%
rRR	Rough broken land	60.8	4.7%
rRT	Rough mountainous land	1,049.3	80.9%
<b>Totals for Area of Interest</b>		<b>1,297.1</b>	<b>100.0%</b>

## Island of Kauai, Hawaii

### rRT—Rough mountainous land

#### Map Unit Setting

*Elevation:* 0 to 6,000 feet

*Mean annual air temperature:* 57 to 72 degrees F

*Frost-free period:* 365 days

#### Map Unit Composition

*Rough mountainous land and similar soils:* 100 percent

#### Description of Rough Mountainous Land

##### Setting

*Landform:* Gulches

*Landform position (two-dimensional):* Backslope

*Landform position (three-dimensional):* Mountainflank, side slope, rise

*Down-slope shape:* Linear

*Across-slope shape:* Convex

*Parent material:* Alluvium and colluvium

##### Properties and qualities

*Slope:* 50 to 99 percent

*Depth to restrictive feature:* 20 to 40 inches to paralithic bedrock

*Drainage class:* Well drained

*Capacity of the most limiting layer to transmit water (Ksat):* Low to moderately low (0.00 to 0.06 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Low (about 3.2 inches)

##### Interpretive groups

*Farmland classification:* Not prime farmland

*Land capability (nonirrigated):* 8e

*Hydrologic Soil Group:* D

##### Typical profile

*0 to 5 inches:* Silty clay loam

*5 to 25 inches:* Very cobbly clay loam

*25 to 29 inches:* Bedrock

## Data Source Information

Soil Survey Area: Island of Kauai, Hawaii

Survey Area Data: Version 8, Dec 7, 2013

## Project Description

File Name ..... WKSHT-Keahua Stream 100yr Peak Flow.SPF

## Project Options

Flow Units ..... CFS  
 Elevation Type ..... Elevation  
 Hydrology Method ..... SCS TR-20  
 Time of Concentration (TOC) Method ..... User-Defined  
 Link Routing Method ..... Kinematic Wave  
 Enable Overflow Ponding at Nodes ..... NO  
 Skip Steady State Analysis Time Periods ... NO

## Analysis Options

Start Analysis On ..... Jan 29, 2014 00:00:00  
 End Analysis On ..... Jan 30, 2014 00:00:00  
 Start Reporting On ..... Jan 29, 2014 00:00:00  
 Antecedent Dry Days ..... 0 days  
 Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss  
 Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss  
 Reporting Time Step ..... 0 00:05:00 days hh:mm:ss  
 Routing Time Step ..... 30 seconds

## Number of Elements

	Qty
Rain Gages .....	1
Subbasins.....	1
Nodes.....	1
<i>Junctions</i> .....	0
<i>Outfalls</i> .....	1
<i>Flow Diversions</i> .....	0
<i>Inlets</i> .....	0
<i>Storage Nodes</i> .....	0
Links.....	0
<i>Channels</i> .....	0
<i>Pipes</i> .....	0
<i>Pumps</i> .....	0
<i>Orifices</i> .....	0
<i>Weirs</i> .....	0
<i>Outlets</i> .....	0
Pollutants .....	0
Land Uses .....	0

## Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Type124hr	Time Series	TS-01	Cumulative	inches	Hawaii	Kauai (Kaneohe)	100	21.00	SCS Type I 24-hr

## Subbasin Summary

SN Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1 TributaryArea	1600.00	75.00	21.00	17.47	27950.40	6712.70	0 01:38:00

## Node Summary

SN ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft <sup>2</sup> )	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	POC	0.00					0.00	0.00					

# Subbasin Hydrology

## Subbasin : TributaryArea

### Input Data

Area (ac) ..... 1600.00  
Weighted Curve Number ..... 75.00  
Rain Gage ID ..... Type124hr

### Composite Curve Number

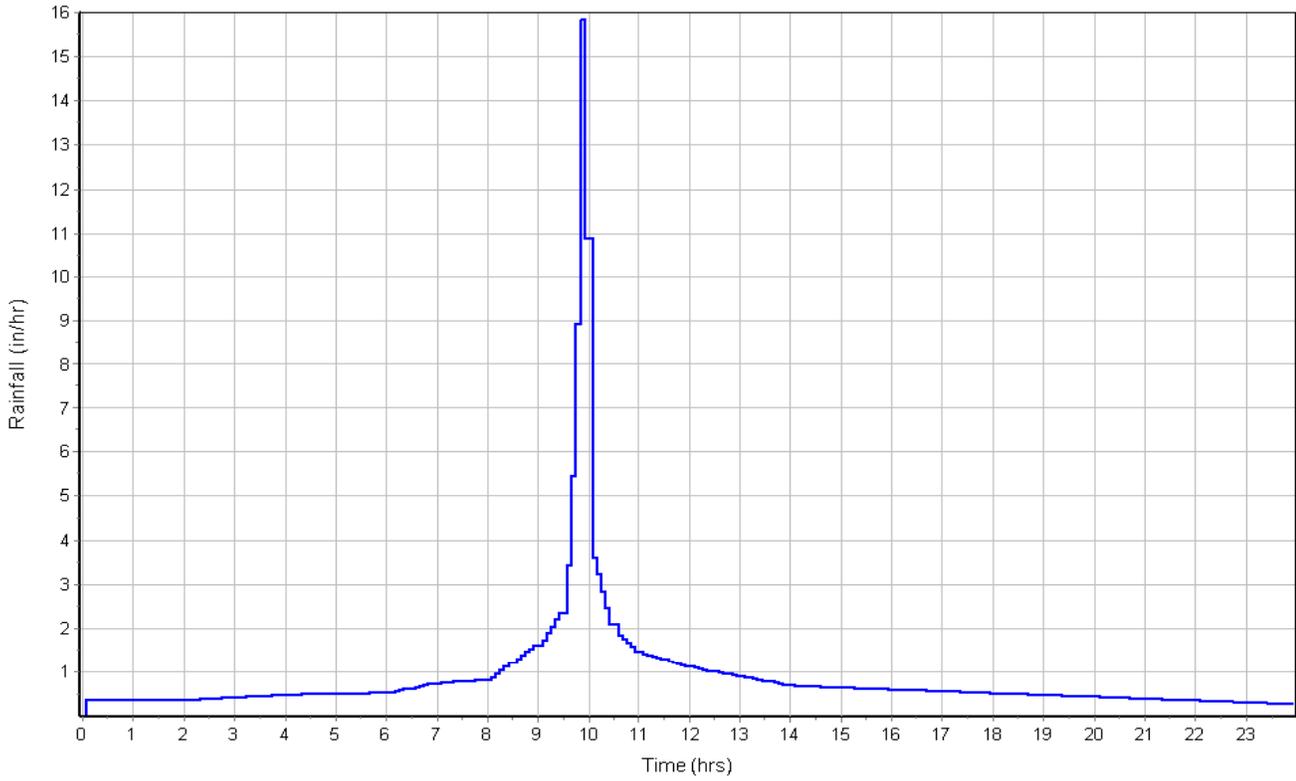
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Fair	1600.00	D	75.00
Composite Area & Weighted CN	1600.00		75.00

### Subbasin Runoff Results

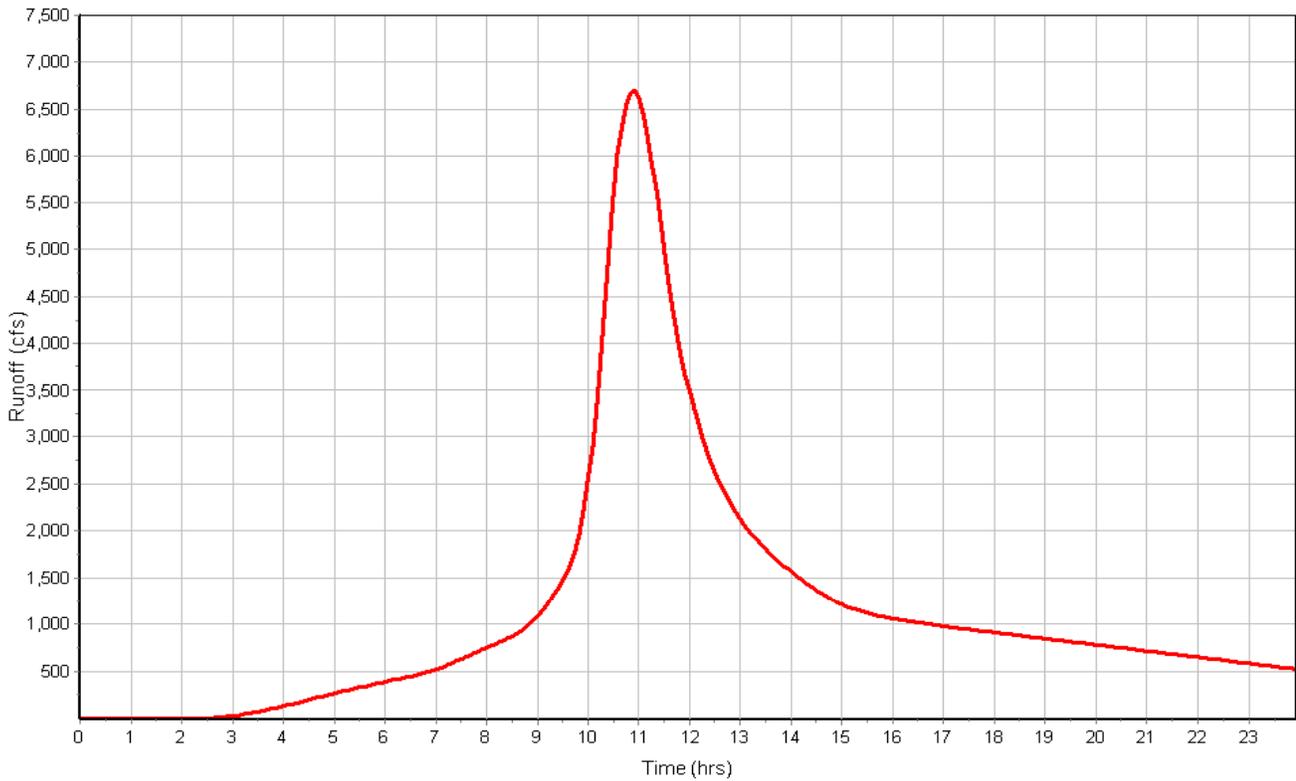
Total Rainfall (in) ..... 21.00  
Total Runoff (in) ..... 17.47  
Peak Runoff (cfs) ..... 6712.70  
Weighted Curve Number ..... 75.00  
Time of Concentration (days hh:mm:ss) ..... 0 01:38:00

Subbasin : TributaryArea

Rainfall Intensity Graph



Runoff Hydrograph



**APPENDIX B**  
**HYDRAULIC ANALYSIS**

HEC-RAS Plan: 140216 River: Keahua Reach: BL-Keahua Stream Profile: PF 1

Reach	River Sta	Profile	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
BL-Keahua Stream	393.01	PF 1	518.90	527.42	528.15	531.71	0.010010	16.90	419.76	69.77	1.15
BL-Keahua Stream	378.01	PF 1	518.93	527.06	528.13	531.53	0.011609	17.68	424.56	78.66	1.21
BL-Keahua Stream	353.01	PF 1	518.26	526.51	527.64	531.23	0.011267	18.01	415.21	76.41	1.20
BL-Keahua Stream	328.01	PF 1	517.59	525.92	527.18	530.91	0.012366	18.62	405.43	75.12	1.25
BL-Keahua Stream	303.01	PF 1	517.28	525.46	526.79	530.58	0.012782	18.96	401.59	73.39	1.27
BL-Keahua Stream	278.01	PF 1	516.88	525.10	526.48	530.26	0.012888	19.02	394.86	70.00	1.27
BL-Keahua Stream	253.01	PF 1	517.13	526.46	526.46	530.14	0.007274	15.83	456.42	62.98	0.97
BL-Keahua Stream	243.01	PF 1	517.51	525.92	527.38	530.02	0.009131	16.69	444.76	95.65	1.08
BL-Keahua Stream	233.01	PF 1	518.20	524.90	526.49	529.82	0.015363	18.49	411.72	114.57	1.36
BL-Keahua Stream	223.01	PF 1	518.97	523.26	524.99	529.44	0.049077	20.77	355.32	156.68	2.02
BL-Keahua Stream	218.99	PF 1	520.30	524.57	525.85	528.81	0.005017	17.88	489.15	172.52	1.56
BL-Keahua Stream	211.97	PF 1	520.27	524.54	525.82	528.77	0.005069	17.96	508.57	200.76	1.57
BL-Keahua Stream	205.09	PF 1	520.19	524.35	525.65	528.71	0.005626	18.41	483.05	172.04	1.64
BL-Keahua Stream	197.81	PF 1	515.68	520.53	522.84	528.29	0.039590	22.35	299.81	86.14	2.11
BL-Keahua Stream	184.81	PF 1	516.12	521.96	523.46	527.17	0.020672	18.33	365.61	84.04	1.55
BL-Keahua Stream	174.81	PF 1	517.50	524.18	524.18	527.06	0.008152	13.62	491.80	86.33	1.01
BL-Keahua Stream	164.81	PF 1	517.35	524.89	524.89	527.23	0.005909	12.36	570.70	161.07	0.87
BL-Keahua Stream	154.81	PF 1	517.09	524.45	524.83	527.14	0.007078	13.22	530.29	154.77	0.95
BL-Keahua Stream	144.81	PF 1	516.63	524.13	524.76	527.04	0.007887	13.75	509.75	149.28	1.00
BL-Keahua Stream	139.81	PF 1	516.54	523.95	524.68	526.98	0.011415	14.04	496.43	146.14	1.03
BL-Keahua Stream	129.81	PF 1	516.29	523.50	524.45	526.82	0.013508	14.77	472.04	119.22	1.11
BL-Keahua Stream	119.81	PF 1	516.04	522.46	524.05	526.58	0.020867	16.60	415.14	99.02	1.35
BL-Keahua Stream	114.81	PF 1	515.91	522.11	523.10	526.44	0.022345	17.04	404.29	94.40	1.40
BL-Keahua Stream	104.81	PF 1	515.66	521.84	523.42	526.21	0.022367	17.13	404.34	96.09	1.40
BL-Keahua Stream	89.81	PF 1	515.21	520.54	522.10	525.73	0.031513	18.70	372.67	108.36	1.66
BL-Keahua Stream	64.81	PF 1	514.61	522.52	522.52	524.97	0.008540	12.85	555.50	127.27	0.92
BL-Keahua Stream	39.81	PF 1	514.65	521.60	522.28	524.66	0.012296	14.32	505.25	130.66	1.08

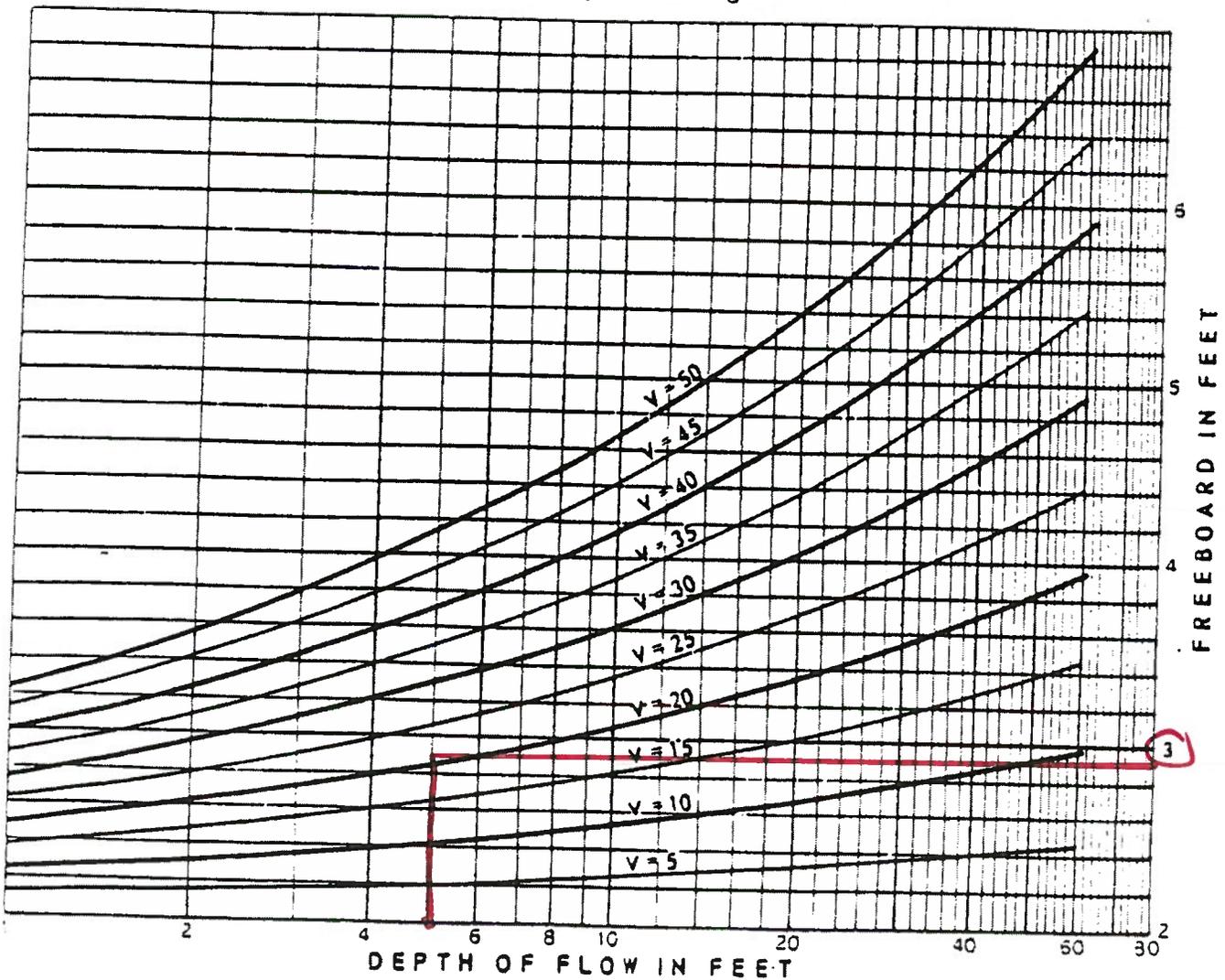
# FREEBOARD ALLOWANCES

FREEBOARD IN FEET:

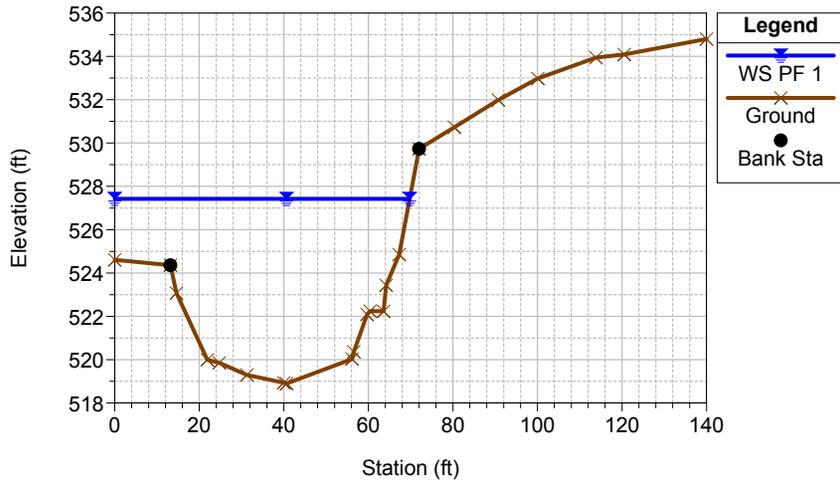
1.  $2.0 + 0.025 V \sqrt[3]{d}$
2.  $d \geq 5'$ ;  $5' > d > d_c$ ;  $V < 20$   
 $1.0 + 0.20d + 0.025 V \sqrt[3]{d}$

Where  $V$  = Velocity, in feet per second  
 $d$  = Depth of flow, in feet

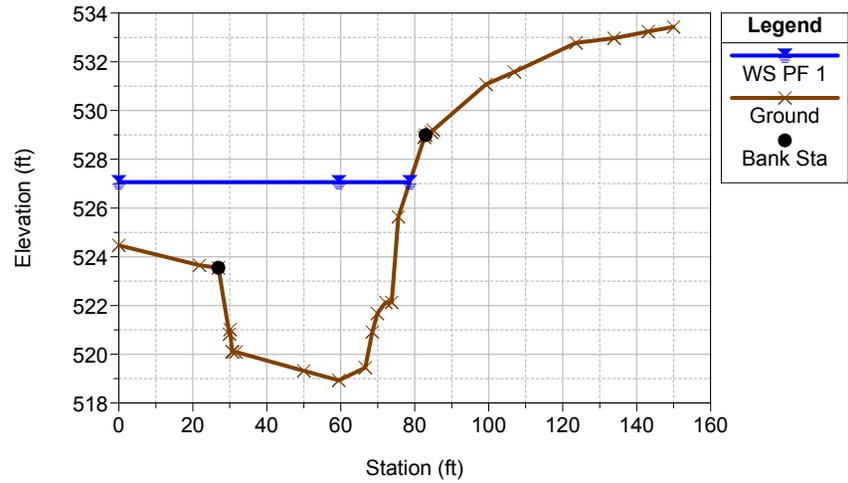
NOTE: For discharges less than 30 cfs, channel shall be designed for 100% greater capacity than the design discharge.



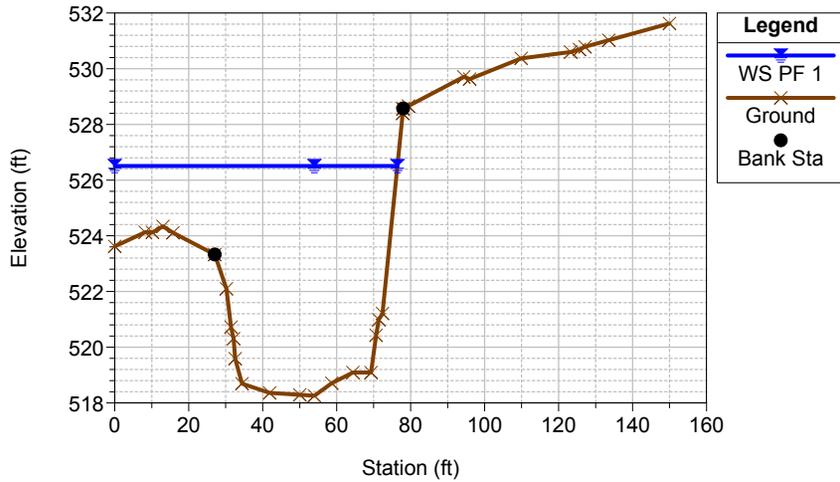
Keahua Stream Plan: Sections Only  
 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 393.01 19



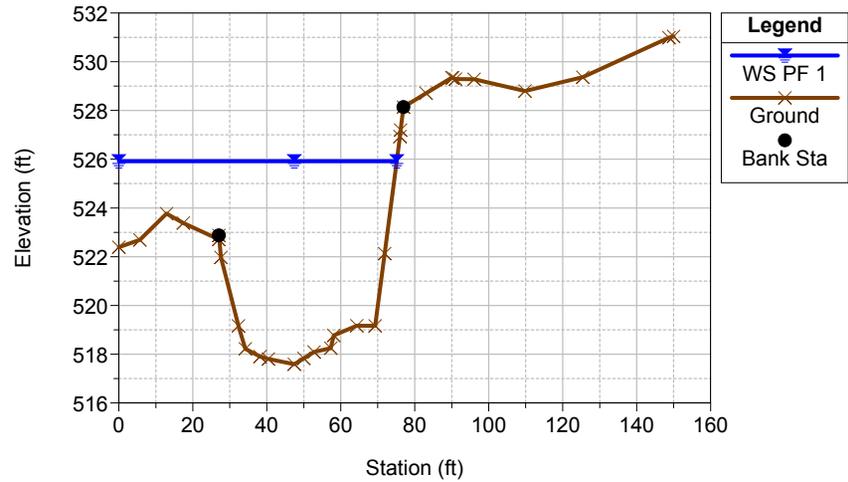
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 RS = 378.01 18



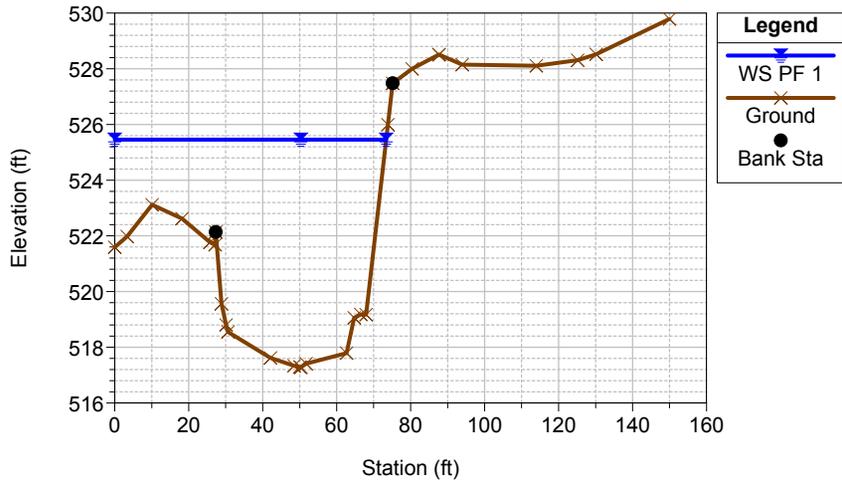
Keahua Stream Plan: Sections Only  
 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 353.01 17



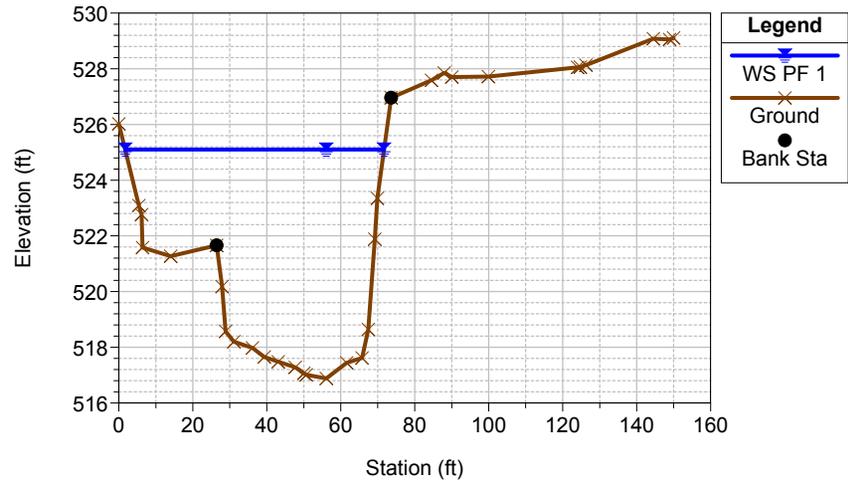
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 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 328.01 16



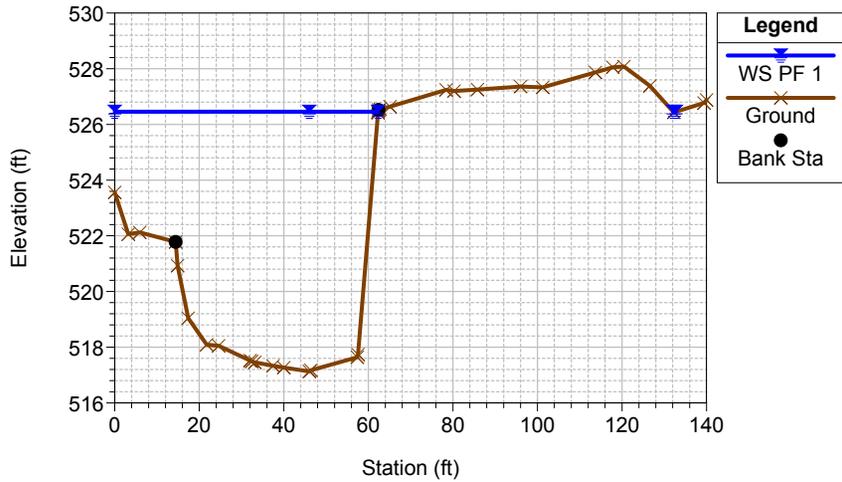
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 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 303.01 15



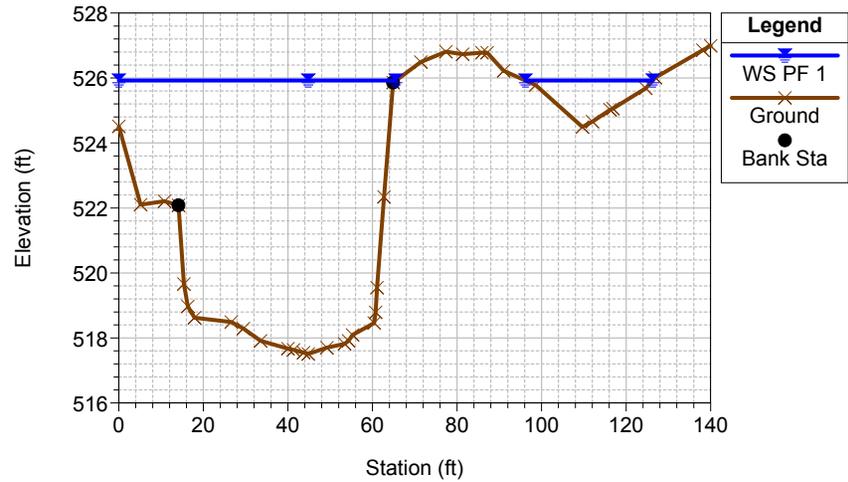
Keahua Stream Plan: Sections Only  
 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 278.01 14



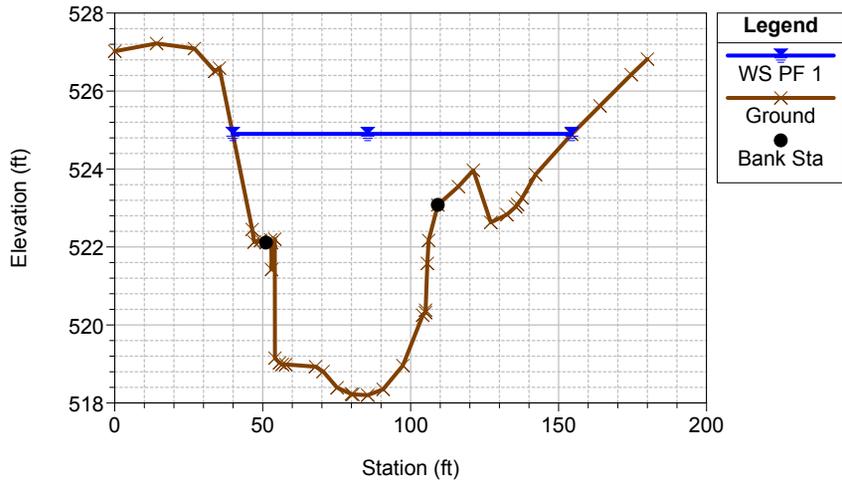
Keahua Stream Plan: Sections Only  
 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 253.01 13



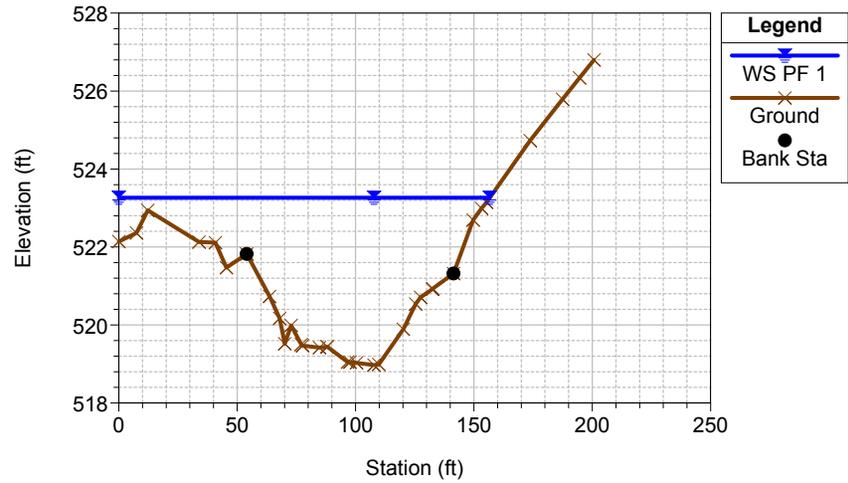
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 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 243.01 12



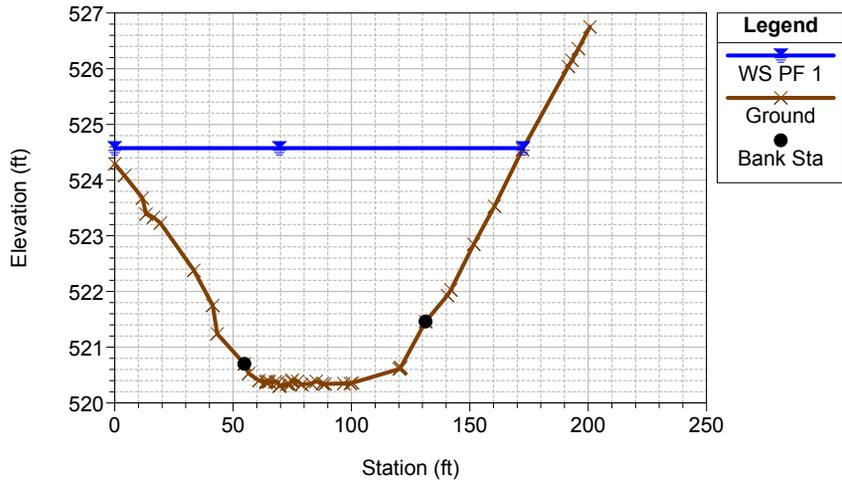
Keahua Stream Plan: Sections Only  
 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 233.01 11



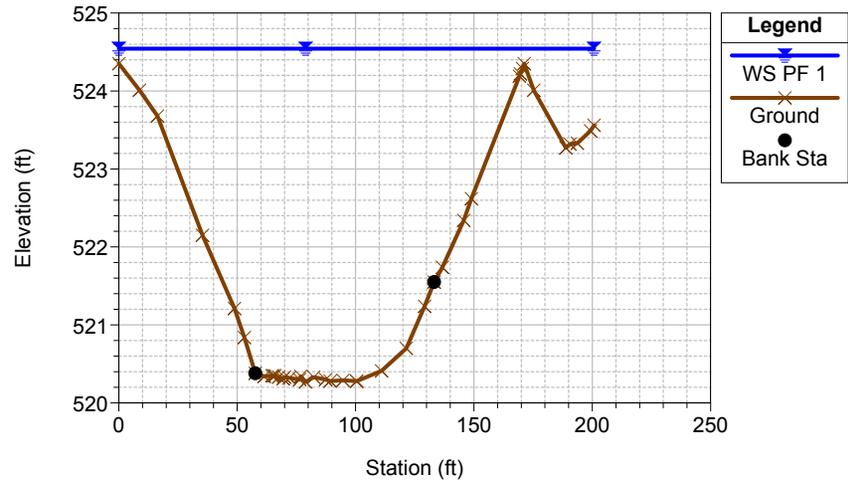
Keahua Stream Plan: Sections Only  
 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 223.01 10



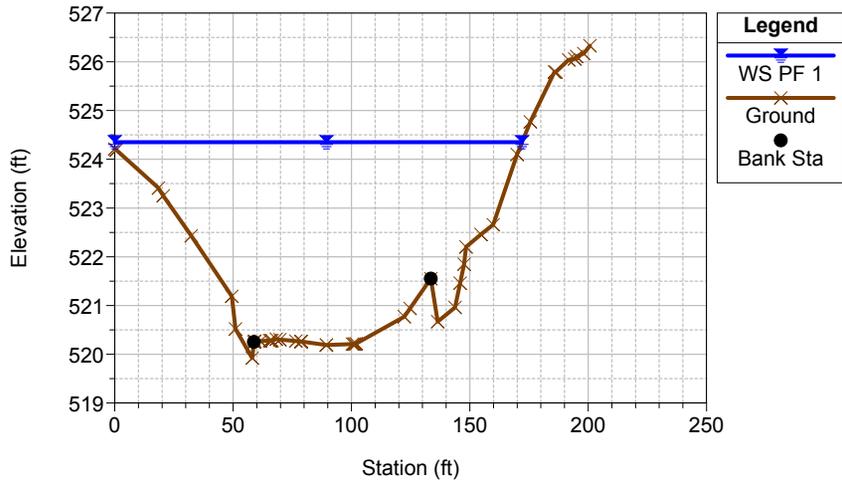
Keahua Stream Plan: Sections Only  
 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 218.99 9.5



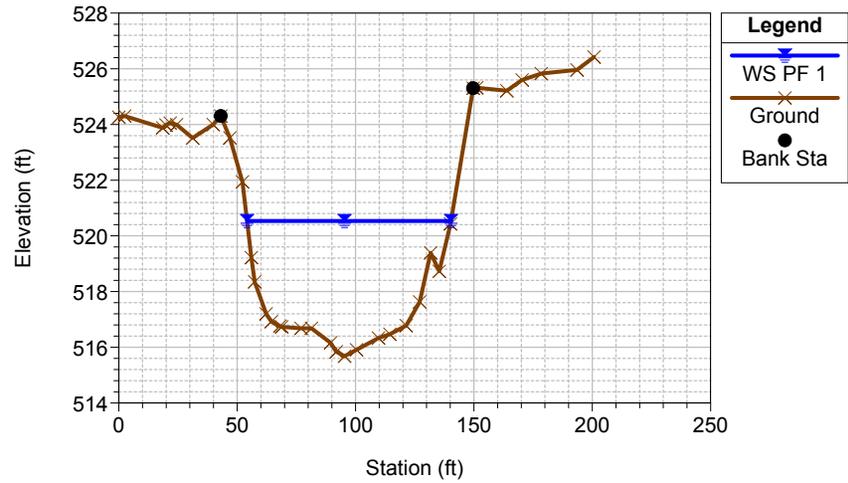
Keahua Stream Plan: Sections Only  
 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 211.97 9.3



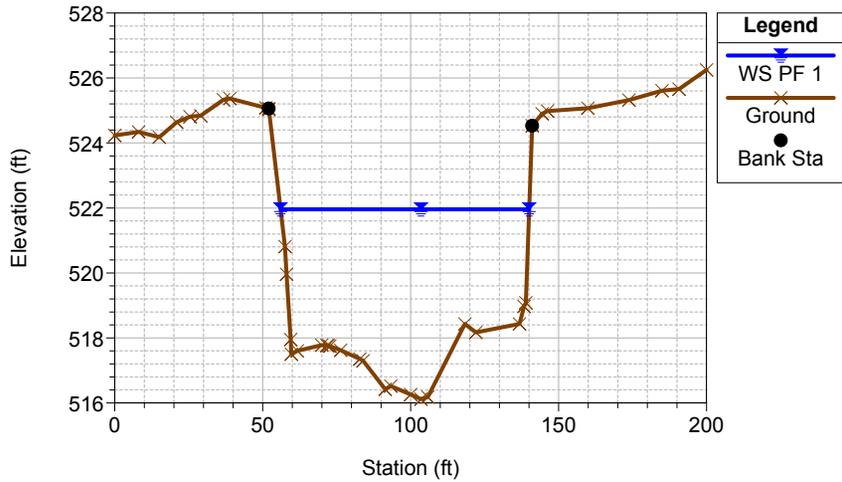
Keahua Stream Plan: Sections Only  
 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 205.09 9.1



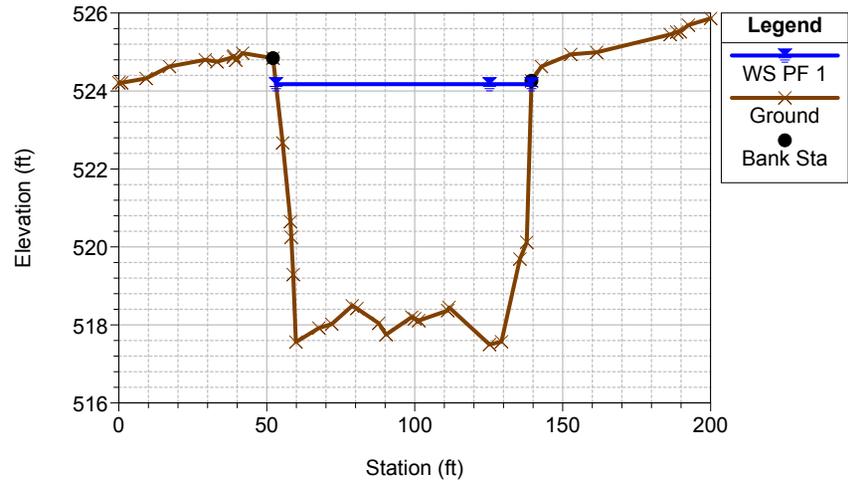
Keahua Stream Plan: Sections Only  
 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 197.81 9



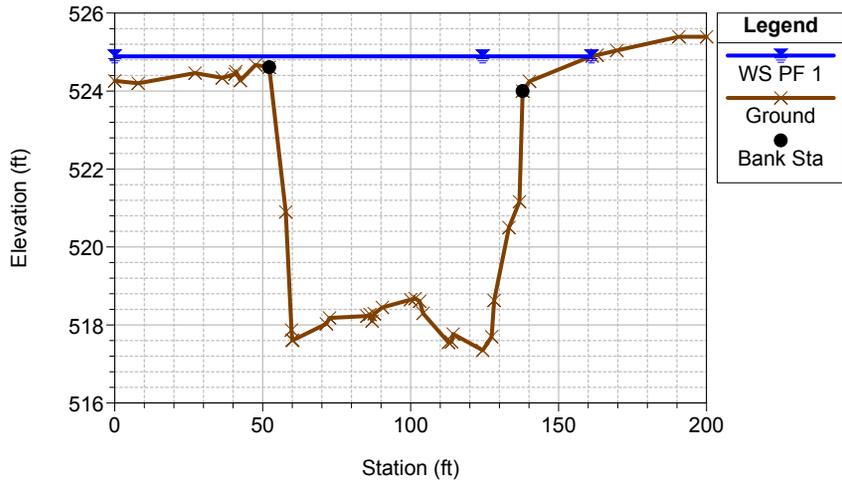
Keahua Stream Plan: Sections Only  
 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 184.81 8



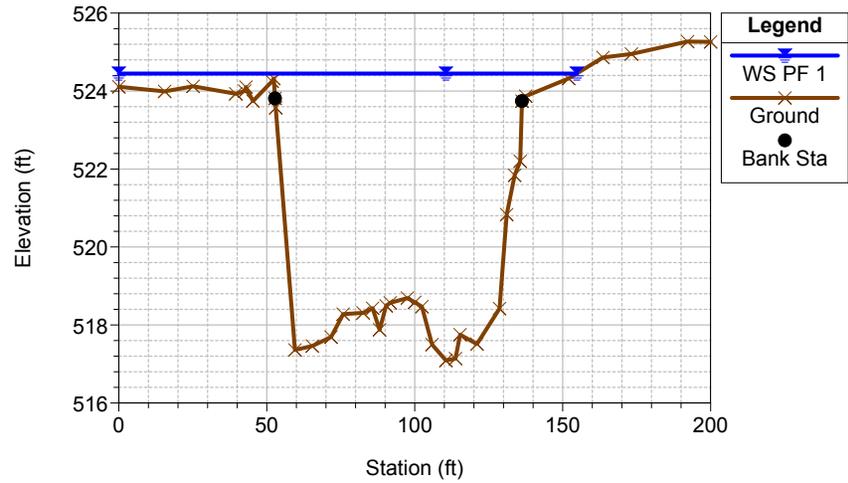
Keahua Stream Plan: Sections Only  
 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 174.81 7



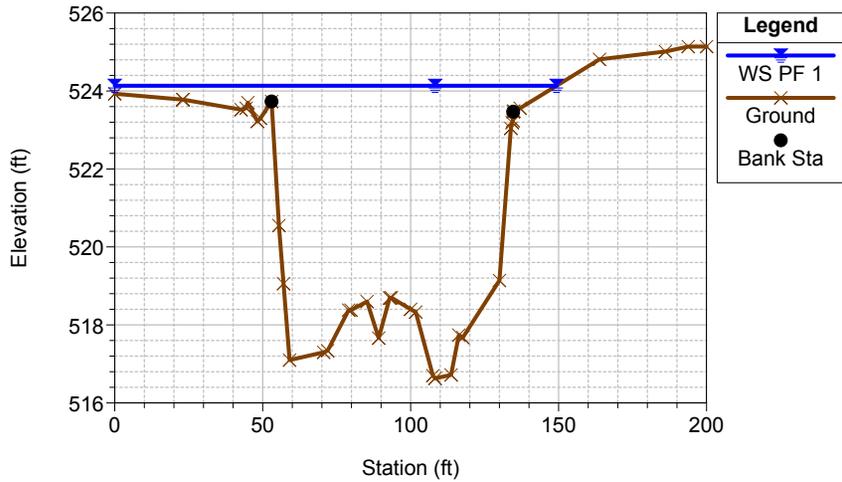
Keahua Stream Plan: Sections Only  
 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 164.81 6



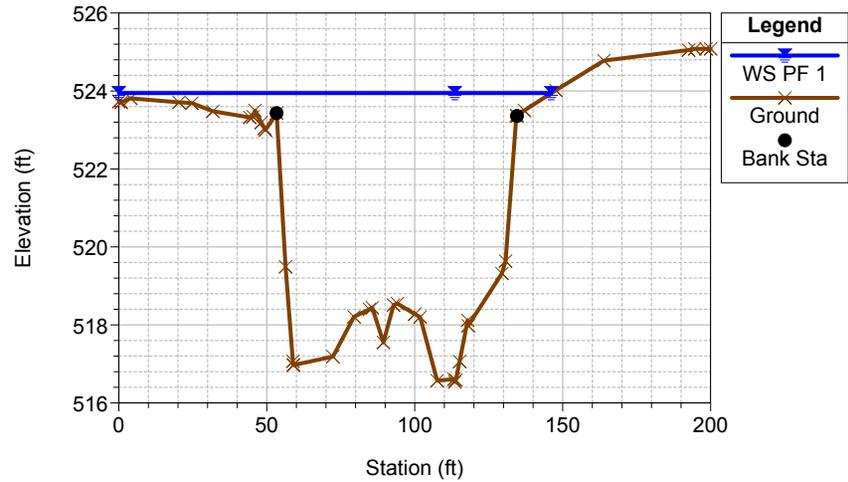
Keahua Stream Plan: Sections Only  
 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 154.81



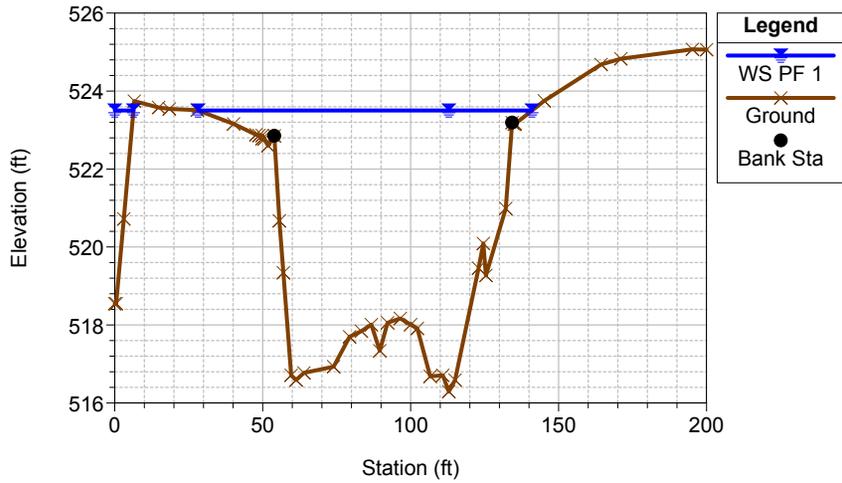
Keahua Stream Plan: Sections Only  
 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 144.81



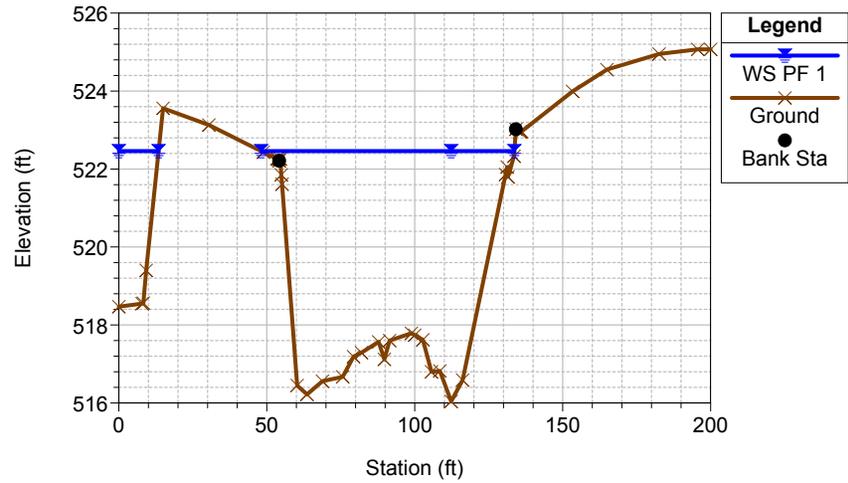
Keahua Stream Plan: Sections Only  
 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 139.81 5



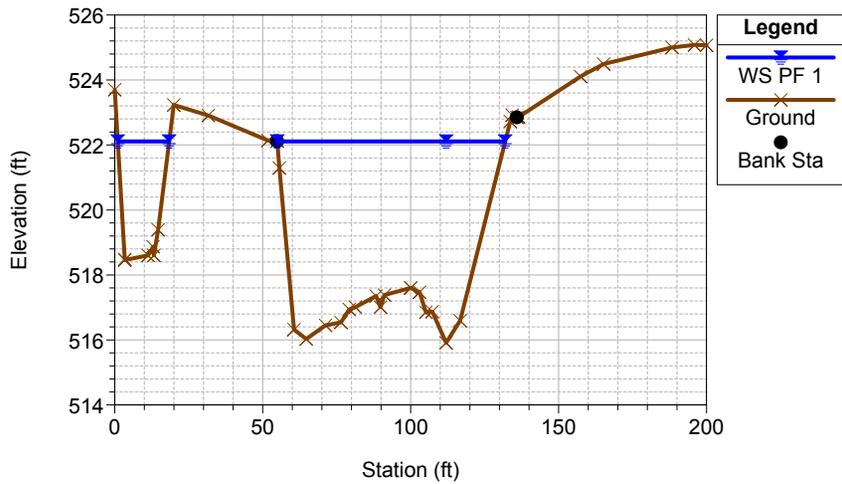
Keahua Stream Plan: Sections Only  
 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 129.81



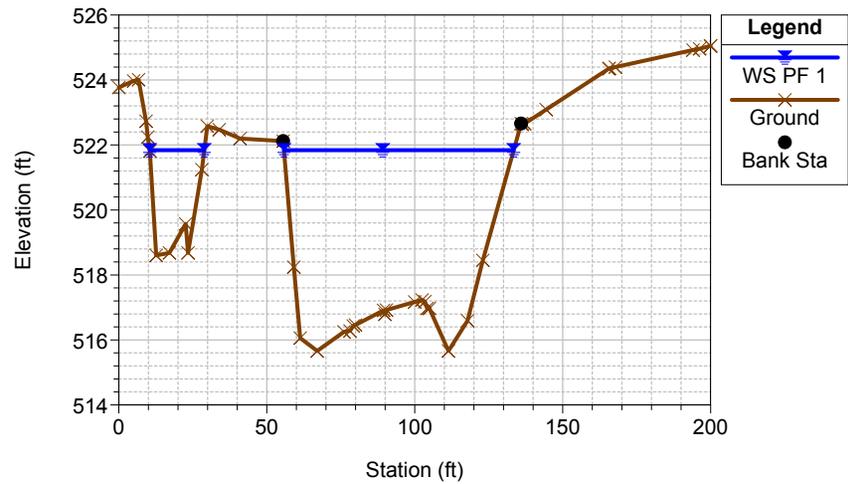
Keahua Stream Plan: Sections Only  
 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 119.81



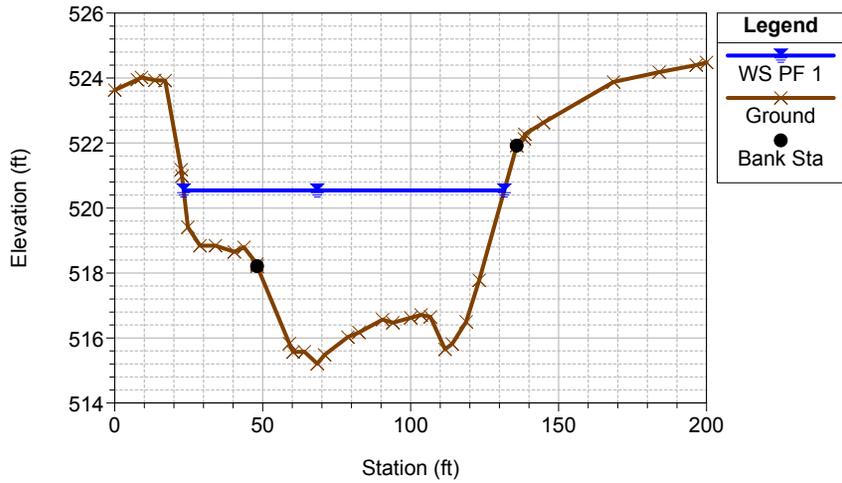
Keahua Stream Plan: Sections Only  
 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 114.81 4



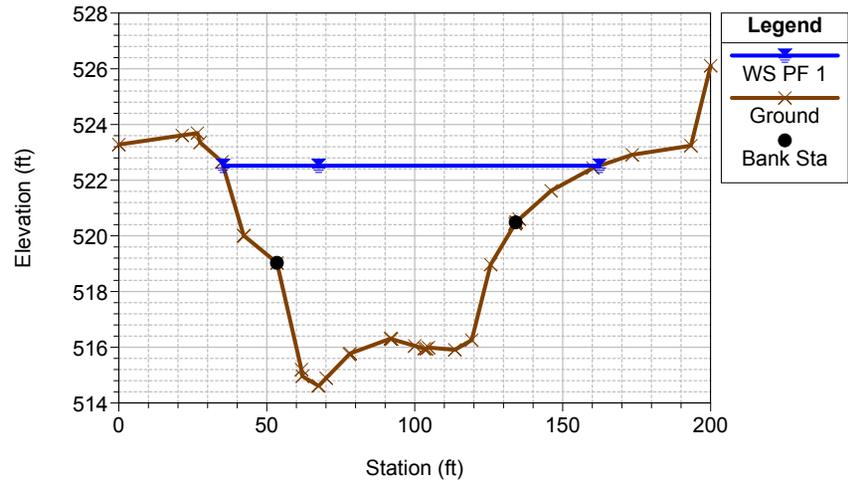
Keahua Stream Plan: Sections Only  
 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 104.81



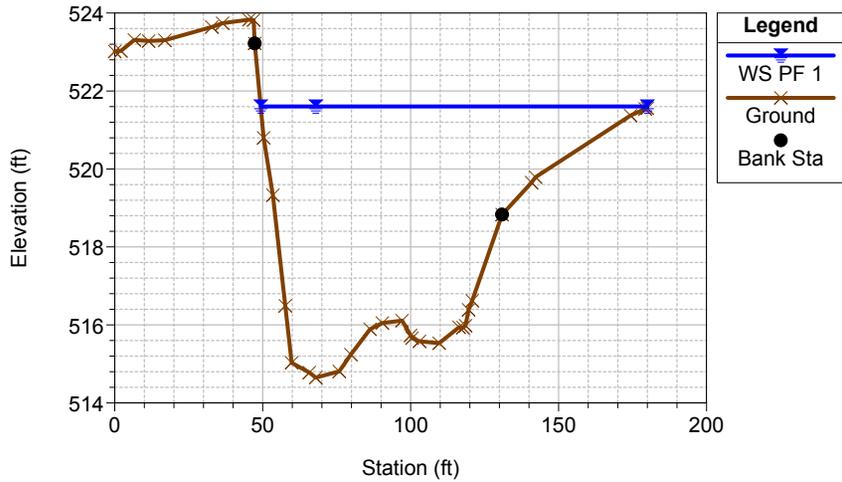
Keahua Stream Plan: Sections Only  
 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 89.81 3



Keahua Stream Plan: Sections Only  
 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 64.81 2



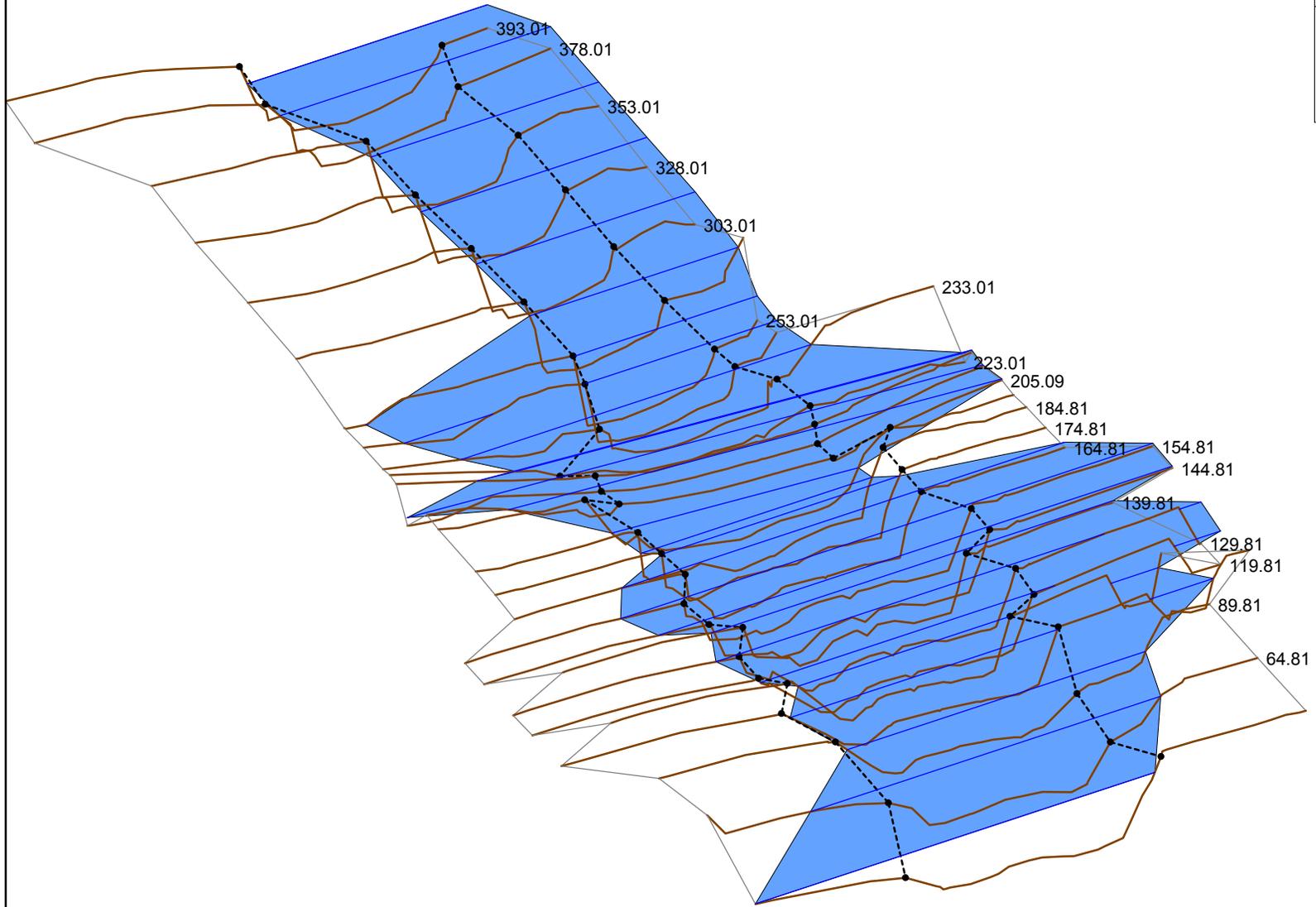
Keahua Stream Plan: Sections Only  
 Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak  
 RS = 39.81 1



Keahua Stream Plan: Sections Only  
Geom: Keahua Stream-Sections Only ADD Flow: Keahua Stream 100yr Peak

**Legend**

- WS PF 1
- Ground
- Bank Sta



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# **ENVIRONMENTAL ASSESSMENT**

## **Keāhua Stream Bridge**

### **APPENDIX 4**

#### **Biological Survey (Botanical and Stream Fauna)**

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## Biological surveys for the Keāhua Bridge Project Wailua, Kauaʻi

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Prepared by:

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

April 28, 2014

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# Biological surveys for the Keāhua Bridge Project Wailua, Kaua‘i

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April 28, 2014

*Draft*

AECOS No. 1380

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## Introduction

The Department of Land and Natural Resources (DLNR) proposes to construct a single-lane, one-span bridge in the vicinity of the existing Kuamo‘o Road ford at Keāhua Stream (“Project”), located on the Island of Kaua‘i (Fig 1). Current project plans call for all abutments and other bridge structures to be placed outside of the stream channel. A temporary detour bridge may be built, if necessary. Parking lots on both sides of the stream will be re-designed. AECOS, Inc. was contracted to conduct environmental surveys to support the preparation of an Environmental Assessment for the project<sup>1</sup>. Our survey was undertaken on January 29, 2014 and included delineation of the ordinary high water mark (OHWM), a botanical survey in the project area, and a survey of aquatic fauna. This report details findings of those surveys.

## Stream Description

Keāhua, Kāwī, Uhaui‘ole, and Waikoko streams—all tributaries to the North Fork of Wailua River—originate on the slopes of Makaleha Mountain, west of Kuilau Ridge, in the Lihue-Koloa Forest Reserve. The upper reaches of Keāhua Stream are above Kapakanui and Kapakaiki falls. The 136.2 km<sup>2</sup> (52.6 mi<sup>2</sup>) Wailua Watershed is one of the largest in the state and includes one of the longest stream channels at 285.4 km or (177.3 mi; Parham et al., 2008). The

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<sup>1</sup> Report prepared for Kai Hawaii for environmental entitlements. This report will become part of the public record for the Project.

confluence of the North Fork and South Fork of Wailua River is approximately 3.2 km (2.0 mi) from the mouth with a wide estuary that discharges into Wailua Bay on windward Kaua'i.

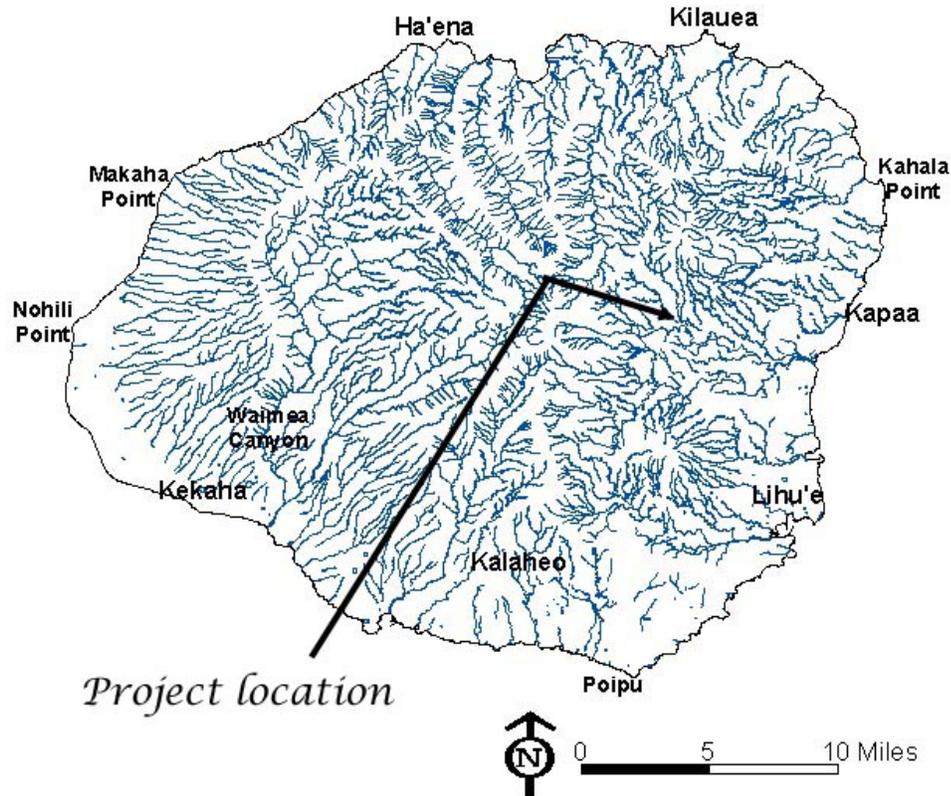


Figure 1. General location of project area on the island of Kaua'i.

Kuamo'o Road fords the middle reach of Keāhua Stream at approximately 155 m (510 ft) above sea level (ASL; see cover photo). Some 420 m (1380 ft) downstream of the ford, at 151 m (495 ft) ASL, is the confluence of Keāhua, Uhaui'ole, and Kāwī streams. Another 400 m (1312 ft) beyond is where stream flow enters the North Fork Wailua River. At Kaholalele Falls, the North Fork Wailua River enters Wailua River State Park. The confluence of the North Fork and South Fork of Wailua River is estuarine, approximately 3.2 km (2.0 mi) upstream from the mouth.

Within the vicinity of Kuamo’o Road ford, Keāhua Stream is a series of riffles, runs, and pools. The stream bed comprises boulders and cobbles. Just downstream from Kuamo’o Road, flow slows within a broad pool, and then the channel becomes braided with a network of small channels around bars in the stream bed. Just upstream of the ford is a wide pool within an overhanging *hau* (*Hibiscus tiliaceus*) forest. Two roadside ditches direct water into the stream along the left bank (viewed in the downstream direction).

## Methods

### OHWM

The OHWM is defined in federal regulations [33 CFR 328.3(e)] as:

“... the line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of the soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.”

AECOS biologists established the OHWM in the Project area upstream and downstream of Kuamo’o Road ford. Within this survey area, the following physical characteristics—as provided in a regulatory guidance letter (USACE, 2005)—were considered when establishing an OHWM for the stream:

Natural line impressed on the bank	Leaf litter disturbed or washed away
Shelving	Scour
Changes in the character of the soil	Deposition
Destruction of terrestrial vegetation	Multiple observed flow events
Presence of litter and debris	Bed and banks
Wracking	Water staining
Vegetation matted down, bent, or absent	Change in the plant community
Sediment sorting	

The biologists marked the OHWM in the field with 11 pairs of wire stake flags placed on both sides of the stream approximately every 10 m (33 ft). A set of photographs (left and right bank and upstream and downstream) were taken from the center of the stream at nearly every pair of flags to document the marking and to characterize the environment. Subsequent to flagging of the

OHWM, land surveyors surveyed the flags and added that information to Project survey maps.

### Botanical Survey Methods

A botanist conducted a survey of the flora in the project area. The survey was of the ruderal vegetation of Kuamo'o Road and extended approximately 220 m (722 ft) to the west of Moalepe Road. The survey included the parking areas to the east and west of the ford and approximately 100 m (328 ft) of the riparian zone upstream and downstream of the ford. Species names follow the nomenclature in *Manual for the Flowering Plants of Hawai'i: Volumes I and II* (Wagner et al., 1990, 1999) and *Hawai'i's Ferns and Fern Allies* (Palmer, 2003), and as updated by various more recently published papers summarized by Imada (2012).

### Aquatic Biota

The biologists made observations of aquatic organisms as they waded through an approximate 100 m (328 ft) length of stream channel up- and downstream of the ford. The survey also included the road-side ditches to the east of the stream. The biologists used dip nets to capture and observe organisms and they also snorkeled the deeper pools to observe organisms that evaded capture. As the survey progressed, notes were made on relative abundances of each species (e.g., rare, common, abundant).

## Survey Results

### Ordinary High Water Mark (OHWM)

The U.S. Geological Survey (USGS) has operated a gage at the confluence of Keāhua, Uhaui'ole, and Kāwī streams at ~150 m (500 ft) elevation above sea level (ASL) for over 100 years (USGS, 2014). Over the past year and a half, median daily discharge has been approximately 0.85 m<sup>3</sup>/s (30 ft<sup>3</sup>/s) and the highest daily discharge during this time period was 39.6 m<sup>3</sup>/s (1,400 ft<sup>3</sup>/s) on March 27, 2013. Discharge was typical at this station during our survey: 0.76 m<sup>3</sup>/s (27 ft<sup>3</sup>/s). Peak streamflow at this station was 509 m<sup>3</sup>/s (18,000 ft<sup>3</sup>/s) with a gage height of 4.5 m (14.70 ft) on November 12, 1955.

A change in plant community, shelving, and sediment sorting are the strongest indicators of the OHWM in Keāhua Stream. Upstream from Kuamo'o Road, the stream is a slow run and pool through a *hau* forest. The left bank is gradual and

the OHWM is largely defined by the line above which *hau* trees establish roots (Fig. 2). The right bank is low and nearly vertical; the OHWM is weakly indicated by sediment deposits below the OHWM, water staining above the OHWM, and a change in the plant community (*Christella dentata* rooted above the OHWM).



Figure 2. Roots of *hau* trees are found primarily above OHWM.

The stream channel widens substantially just downstream from Kuamo'o Road, with boulder and sand bars populated with wetland plants (e.g., *Coix lacrymajobi*, *Commelina diffusa*, and *Ludwigia octovalvis*). Trees, such as albizia (*Falcateria moluccana*), African tulip (*Spathodea campanulata*), kukui (*Aleurites moluccana*), eucalyptus (*Eucalyptus deglupta*), and tropical ash (*Fraxinus uhdei*) are rooted mostly above the top of the bank, though saplings occur on the bank above the OHWM (Fig. 3). The right bank is less steep than the left bank, with shelving evident above and below the OHWM.

A small area with wetland characteristics (not confirmed as likely jurisdictional by the biologists) is present on the right bank between the OHWM and top of bank near flags 9 and 10. Attachment A presents the OHWM elevation as delineated in the field by AECOS and surveyed by Esaki Surveying & Mapping. Photographs taken to document the process are included in Attachment B.

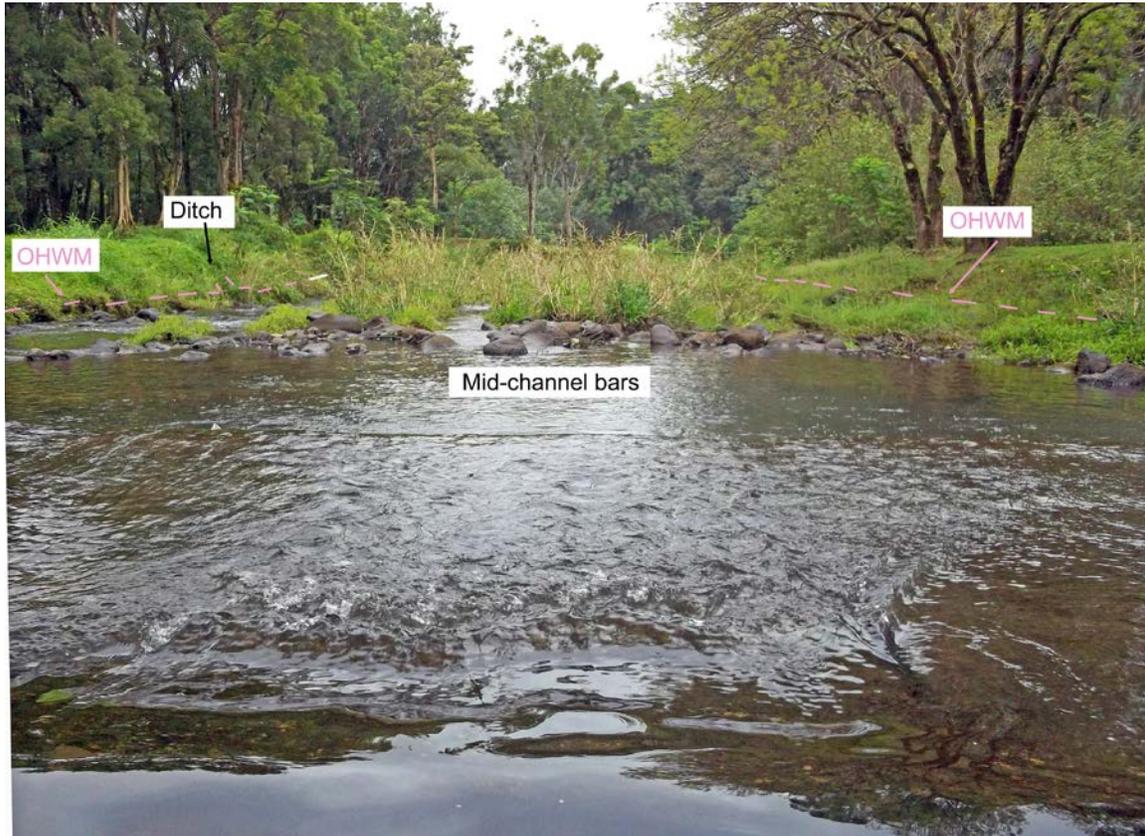


Figure 3. Looking downstream from Kuamo‘o Road ford into an area of boulder bars.

## Vegetation

The roadside vegetation along Kuamo‘o Road in the vicinity of the ford is typical ruderal vegetation found in mesic forests on Kaua‘i. The area, including the roadside ditch at the southern end of the project area, appears to be maintained with herbicide application. North of the road is a *hau* (*Hibiscus tiliaceus*) forest. The parking lots consist of regularly mowed grasses. Some of the trees and other plants may be cultivated in association with the Kaua‘i Arboretum.

## Flora

Our flora listing (Table 1) covers plants observed in the Project area on January 29, 2013. The table includes the scientific name, common name, status, and relative abundance for each species. Notes provide additional information on occurrences and other observations made during the botanical survey. The total number of species identified from the survey is 80. Of these 80 species, native species (plants of status indigenous or endemic) number 10 (13%) and two of these are planted as ornamentals in the botanical garden. Twenty-eight species are associated with the riparian zone along Keāhua Stream (Note <1>). No plant of any particular concern in terms of rarity in the Hawaiian Islands was found.

Table 1. Checklist of plants recorded in the survey area of Kuamo‘o Road near Keāhua Stream.

Family	<i>Genus species</i>	Common name	STATUS	ABUNDANCE	NOTES
<b>PTERIDOPHYTES – FERNS &amp; FERN ALLIES</b>					
BLECHNACEAE	<i>Blechnum appendiculatum</i> Willd.	---	Nat	O	
GLEICHENIACEAE	<i>Dicranopteris linearis</i> (Burm. f) Underw.	<i>uluhe</i>	<b>Ind</b>	O	
NEPHROLEPIDACEAE	<i>Nephrolepis multiflora</i> (Roxb.) F.M. Jarrett ex C.V. Morton	swordfern	Nat	C	<1>
POLYPODIACEAE	<i>Lepisorus thunbergianus</i> (Kaulf.) Ching	<i>akolea</i>	<b>Ind</b>	C	
	<i>Phymatosorus grossus</i> (Langsd. & Fisch.) Brownlie	<i>laua‘e, maile</i> scented fern	Nat	R	
PTERIDACEAE	<i>Pityrogramma calomelanos</i> (L.) Link	silverback fern	Nat	O	
THELYPTERIDACEAE	<i>Christella dentata</i> (Forssk.) Brownsey & Jermy	<i>pai‘i‘iha</i>	Nat	O	<1>
	<i>Christella parasitica</i> (L.) H. Lev.		Nat	O	
	<i>Cyclosorus interruptus</i> (Willd.) H. Ito	<i>neke</i>	<b>Ind</b>	C	
PSILOTACEAE	<i>Psilotum nudum</i> (L.) P. Beauv.	<i>moa</i>	<b>Ind</b>	R	

Table 1 (continued)

Family	<i>Genus species</i>	Common name	STATUS	ABUNDANCE	NOTES
<b>CONIFERS – GYMNOSPERMS</b>					
ARAUCARIACEAE					
	<i>Araucaria araucana</i> (Molina) K. Koch	monkeypuzzle tree	Orn	O	<2>
<b>FLOWERING PLANTS – DICOTS</b>					
APIACEAE					
	<i>Centella asiatica</i> (L.) Urb.	Asiatic pennywort	Nat	A	<1>
	<i>Ciclospermum leptophyllum</i> (Pers.) Sprague	fir-leafed celery	Nat	R	
ASTERACEAE					
	<i>Ageratina riparia</i> (Regel) R. King & H. Robinson	<i>Hamakua pamakani</i>	Nat	R	<1>
	<i>Ageratum conyzoides</i> L.	<i>maile hohono</i>	Nat	C	<1>
	<i>Crassocephalum crepidioides</i> (Benth.) S. Moore	--	Nat	O	<1>
	<i>Erechtites valerianifolia</i> (Wolf) DC.	fireweed	Nat	O	<1>
	<i>Elephantopus mollis</i> Kunth	soft elephant's foot	Nat	O	
	<i>Pluchea carolinensis</i> (Mill.) Gillis	sourbush	Nat	R	
	<i>Sphagneticola trilobata</i> L.	wedelia	Nat	C	<1>
	<i>Youngia japonica</i> (L.) DC.	oriental hawksbeard	Nat	O	
BIGONACEAE					
	<i>Spathodea campanulata</i> P. Beauv.	African tulip tree	Nat	R	
CARYOPHYLLACEAE					
	<i>Drymaria cordata</i> (L.) Willd. Ex Roem. & Schult.	<i>pilipili</i>	Nat	C	
CONVOLVULACEAE					
	<i>Ipomoea alba</i> L.	moon flower	Nat	C	
	<i>Ipomoea triloba</i> L.	little bell	Nat	R	
EUPHORBIACEAE					
	<i>Aleurites moluccana</i> (L.) Willd.	<i>kukui</i>	<b>Pol</b>	R	
	<i>Phylanthus debilis</i> Klein ex Willd.	<i>niuri</i>	Nat	O	
FABACEAE					
	<i>Acacia koa</i> A. Gray	<i>koa</i>	<b>End</b>	R	<2>
	<i>Cassia</i> sp.	shower tree	Orn		<3>
	<i>Desmodium incanum</i> DC.	Spanish clover	Nat	O	<1>
	<i>Falcataria moluccana</i> (Miq.) Barneby & Grimes	albizia	Nat	A	
	<i>Mimosa pudica</i> var. <i>unijuga</i> (Duchass. & Walp.) Griseb.	sensitive plant	Nat	O	<1>
LAURACEAE					
	<i>Persea americana</i> Mill.	avocado	Nat	R	

Table 1 (continued)

Family	<i>Genus species</i>	Common name	STATUS	ABUNDANCE	NOTES
<b>LYTHRACEAE</b>					
	<i>Cuphea carthagenesis</i> (Jacq.) Macbr.	tarweed	Nat	R	<1>
<b>MALVACEAE</b>					
	<i>Hibiscus rosa-sinensis</i> L.	Chinese hibiscus	Orn	C	<2>
	<i>Hibiscus tiliaceus</i> L.	<i>hau</i>	<b>Ind?</b>	A	<1>
	<i>Hibiscus waimeae</i> A. Heller	<i>koki'o ke'oke'o</i>	<b>End</b>	O	<2>
<b>MELASTOMATACEAE</b>					
	<i>Clidemia hirta</i> (L.) D. Don	Koster's curse	Nat	C	<1>
<b>MORACEAE</b>					
	<i>Ficus microcarpa</i> L. fil.	Chinese banyan	Nat	R	
<b>MYRTACEAE</b>					
	<i>Eucalyptus deglupta</i> Blume	Mindano gum	Orn	???	<2>
	<i>Psidium cattleianum</i> Sabine	strawberry guava	Nat	C	
	<i>Psidium guajava</i> L.	common guava	Nat	C	<1>
<b>OLEACEAE</b>					
	<i>Fraxinus uhdei</i> (Wenzig) Lingelsh.	tropical ash	Nat	C	<2>
<b>ONAGRACEAE</b>					
	<i>Ludwigia octovalvus</i> (Jacq.) Raven	primrose willow	Nat	C	<1>
<b>PLANTAGINACEAE</b>					
	<i>Plantago major</i> L.	brdlvd. plantain	Nat	A	<1>
<b>POLYGALACEAE</b>					
	<i>Polygala paniculata</i> L.	bubblegum plant	Nat	C	<1>
<b>ROSACEAE</b>					
	<i>Rubus rosifolius</i> Sm.	thimbleberry	Nat	O	<1>
<b>URTICACEAE</b>					
	<i>Pilea microphylla</i> (L.) Liebm.	artillery plant	Nat	A	
<b>VERBENACEAE</b>					
	<i>Lantana camara</i> L.	lantana	Nat	R	
	<i>Stachytarpheta urticifolia</i> (Salisb.) Sims	<i>oī</i>	Nat	O	
<b>FLOWERING PLANTS - MONOCOTS</b>					
<b>AGAVACEAE</b>					
	<i>Cordyline fruticosa</i> (L.) A. Chev.	<i>ki, ti</i>	<b>Pol</b>	R	<1>
<b>ARACEAE</b>					
	<i>Epipremnum pinnatum</i> (L.) Engl.	golden pothos	Nat	C	
<b>COMMELINACEAE</b>					
	<i>Commelina diffusa</i> N.L. Burm.	day flower; <i>honohono</i>	Nat	A	<1>
	<i>Dichorisandra thyrifloa</i> J. C. Mikan	blue ginger	Nat	O	

Table 1 (continued)

Family	<i>Genus species</i>	Common name	STATUS	ABUNDANCE	NOTES
<b>COSTACEAE</b>					
	<i>Costus speciosus</i> (J. Konig) Sm.	crepe ginger	Orn	O	<2>
<b>CYPERACEAE</b>					
	<i>Cyperus gracilis</i> R. Br.	McCoy grass	Nat	C	<1>
	<i>Cyperus laevigatus</i> L.	<i>makaloa</i>	<b>Ind</b>	O	<1>
	<i>Cyperus papyrus</i> L.	papyrus	Nat	C	<1>
	<i>Kyllinga brevifolia</i> Rottb.	green Kyllinga	Nat	O	<1>
	<i>Mariscus javanicus</i> (Houtt.) Merr. & Metcalfe	' <i>ahu'awa</i>	<b>Ind</b>	O	<1>
<b>DIOSCOREACEAE</b>					
	<i>Dioscorea bulbifera</i> L.	<i>ho'i</i> , bitter yam	<b>Pol</b>	C	
	<i>Dioscorea pentaphylla</i> L.	<i>pi'a</i> , <i>pi'ia</i>	<b>Pol</b>	R	
<b>HELICONIACEAE</b>					
	<i>Heliconia</i> sp.		--	O	<3>
<b>MUSACEAE</b>					
	<i>Musa</i> hybrid	banana	Orn	O	<2>
<b>ORCHIDACEAE</b>					
	<i>Spathoglottis plicata</i> Blume	Philippine ground orchid	Nat	R	
<b>PANDANACEAE</b>					
	<i>Pandanus tectorius</i> S. Parkinson ex Z	<i>hala</i>	<b>Ind</b>	R	
<b>POACEAE (GRAMINEAE)</b>					
	<i>Coix lacryma-jobi</i> L.	Job's tears	Nat	C	<1>
	<i>Digitaria ciliaris</i> (Retz.) Koeler	Henry's crabgrass	Nat	O	
	<i>Oplismenus hirtellus</i> (L.) P. Beauv.	basketgrass	Nat	C	
	<i>Paspalum conjugatum</i> Bergius	Hilo grass	Nat	A	
	<i>Phyllostachys nigra</i> (Lodd. ex Lindl.) Munro	Henon bamboo	Nat	C	
	<i>Sacciolepis indica</i> (L.) Chase	Glenwood grass	Nat	R	
	<i>Sporobolus indicus</i> (L.) R.Br.	West Indian dropseed	Nat	O	
	<i>Urochloa maxima</i> (Jacq.) R. Webster	Guinea grass	Nat	A	
	<i>Urochloa mutica</i> (Forssk.) T.Q. Nguyen	California grass	Nat	C	<1>
<b>ZINGIBERACEAE</b>					
	<i>Alpinia purpurea</i> (Vieill.) K. Schum.	red ginger	Orn		<2>
	<i>Hedychium coronarium</i> J. Konig	white ginger	Nat	C	
	<i>Hedychium flavescens</i> Carey ex Roscoe	yellow ginger	Nat	C	

Table 1 (continued)

Family	<i>Genus species</i>	Common name	STATUS	ABUNDANCE	NOTES
ZINGIBERACEAE (continued)					
	<i>Zingiber zerumbet</i> (L.) Sm.	shampoo ginger	<b>Pol</b>	<b>0</b>	

## Key to Table 1

Status = distributional status

- End** = endemic; native to Hawaii and found naturally nowhere else  
**Ind** = indigenous; native to Hawaii, but not unique to the Hawaiian Islands  
**Nat** = naturalized, exotic, plant introduced to the Hawaiian Islands since 1778 and well-established  
**Orn.** = exotic, ornamental or cultivated; plant not naturalized (not well-established outside of cultivation)  
**Pol** = Polynesian introduction before 1778

Abundance = occurrence ratings for plants in survey area.

- R** – Rare – only one, two, or three plants seen.  
**U** – Uncommon – several to a dozen plants observed.  
**O** – Occasional – found regularly around the site.  
**C** – Common - considered an important part of the vegetation and observed numerous times.  
**A** – Abundant – found in large numbers; may be locally dominant.

Notes:

- <1> Plant found in riparian area of Keāhua Stream.  
 <2> Plant in cultivation, associated with botanical garden.  
 <3> Plant without flower or fruit; identification uncertain.

## Aquatic Biota

Table 2 is a listing of aquatic animals identified by *AECOS* biologists on January 29, 2014 in Keāhua Stream in the project area. Results of biota surveys conducted in Kuamo‘o Road Culvert and Wailua River estuary (*AECOS*, 2007) and survey data reported in the watershed atlas (Parham, et al., 2008) are included in our table to assess the potential for migration of native amphidromous<sup>2</sup> animals and the distribution of naturalized organisms throughout the system. The observational records are identified in the table under “notes” as deriving from the estuary (est), lower (low), middle (mid), upper (up), and headwater (head) reaches of the Wailua River system.

Few fishes are present in Keāhua Stream within the project vicinity. Small poeciliids (*Poecilia reticulata* and indeterminate juveniles) are most common in the sluggish waters of the ditch and along the sides of the channels. Smallmouth bass (*Micropterus dolomieu*) inhabit the deeper, shaded pools in the *hau* forest. Bass (*Micropterus* spp.), sunfish (*Lepomis* spp.), and Chinese catfish (*Clarius fuscus*), all non-native predators, are found throughout the Wailua River (Parham et al., 2008). The Watershed Atlas reports native amphidromous

<sup>2</sup> Meaning they move between fresh and salt water as part of their life cycle.

Table 2. List of aquatic species observed in Keāhua Stream and reported elsewhere in the Wailua River (W).

<b>PHYLUM, CLASS, ORDER, FAMILY</b>	<b>Common name</b>	<b>Abundance</b>	<b>Status</b>	<b>ID Code (reach)</b>
<b>ALGAE</b>				
<b>CYANOPHYCOTA, CYANOPHYCEAE, NOSTOCALES OSCILLATORIACEAE</b>	blue-green algae			
<i>Oscillatoria</i> sp.		P	--	3 (W est)
<i>Schizothrix</i> sp.		P	--	3 (W est)
<b>CHLOROPHYTA, ULVOPHYCEAE, CLADOPHORALES CLADOPHORACEAE</b>	green algae			
<i>Cladophora</i> sp.		P	--	3 (W est)
<i>Rhizoclonium</i> sp.		P	--	3 (W est)
<b>INVERTEBRATES</b>				
<b>PLATYHELMINTHES TURBELLARIA, TRICLADIDA PLANARIIDAE</b>	flatworms			
<i>Dugesia</i> sp.		O	Nat	2 (W up)
<b>ANNELIDA POLYCHAETA, PHYLLODOCIDA NEREIDIDAE</b>	clamworms			
<i>Namalycastis</i> sp.		P	<b>Ind</b>	2 (W mid)
<b>MOLLUSCA, BIVALVIA VENEROIDA CYRENIDAE</b>				
<i>Corbicula fluminea</i> (O.F. Müller, 1774)	Asiatic flume clam	P	Nat	2 (W mid, up)
<b>MOLLUSCA, GASTROPODA BASOMMATOPHORA LYMNAEIDAE</b>				
indet. Lymnaeidae	lymnaeid snail	P U	Nat	2 (W low, up) 3 (W est)
<b>PLANORBIDAE</b>				
<i>Helisoma anceps</i> (Menke, 1833)	rams-horn snail	P	Nat	2 (W up)
<b>PHYSIDAE</b>				
indet. Physidae	physid snail	C	Nat	3 (W est)

Table 2 (continued).

**PHYLUM, CLASS, ORDER,  
FAMILY**

<i>Genus species</i>	Common name	Abundance	Status	ID Code (reach)
<b>THIARIDAE</b>				
indet. Thiaridae		P	Nat	2 (W up)
<i>Melanoides tuberculata</i> Muller	red-rimmed melania	C	Nat	1 (Keāhua) 3 (W est)
<i>Tarebia granifera</i> (Lamarck, 1822)	quilted melania	P C	Nat	2 (W up) 3 (W est)
<b>ARTHROPODA,INSECTA</b>				
<b>DIPTERA</b>				
<b>CHIRONOMIDAE</b>				
indet. Chironomidae	non-biting midge larva	P	Nat	2 (W mid, up)
<i>Telmatogeton</i> sp.		P	<b>Ind</b>	2 (W low, mid, up)
<b>CULICIDAE</b>				
indet. Culicidae	mosquitoes	P	Nat	2 (W up)
<b>DOLICHOPODIDAE</b>				
<i>Campsicnemus bicoloripes</i> Parent	longlegged flies	P	<b>End</b>	2 (W mid)
<b>EPHYDRIDAE</b>				
indet. Ephydriidae		P	--	2 (W up)
<i>Neoscatella cilipes</i> (Wirth)	shore fly	P	<b>End</b>	2 (W mid)
<b>TIPULIDAE</b>				
indet. Tipulidae	crane-fly	P	Nat	2 (W up)
<b>ARTHROPODA,INSECTA</b>				
<b>ODONATA</b>				
<b>AESHNIDAE</b>				
<i>Anax</i> sp.	darner	P	<b>Ind</b>	2 (W up)
<i>Anax junius</i> Drury	green darner	P	<b>Ind</b>	2 (W up)
<b>COENAGRIONIDAE</b>				
<i>Enallagma civile</i> (Hagen, 1861)	familiar bluet	P	Nat	2 (W up)
<i>Ischnura posita</i> Hagen	fragile florktail	R P	Nat	1 (Keāhua) 2 (W low, up)
<i>Ischnura ramburii</i> (Selys, 1850)	Rambur's florktail	R	Nat	1 (Keāhua) 2 (up)
<i>Megalagrion</i> sp.	Hawaiian damselfly	P	<b>End</b>	2 (W est, low, mid, up)
<i>Megalagrion eudytum</i> (Perkins, 1899)	frosty Hawaiian damselfly	P	<b>End</b>	2 (W up)
<i>Megalagrion heterogamias</i> (Perkins, 1899)	Kauai mountain damselfly	P	<b>End</b>	2 (W up)

Table 2 (continued).

<b>PHYLUM, CLASS, ORDER, FAMILY</b>	<i>Genus species</i>	Common name	Abundance	Status	ID Code (reach)
	<i>Megalagrion oresitrophum</i> (Perkins, 1899)	slender Kauai damselfly	P	<b>End</b>	2 (W up)
	<i>Megalagrion orobates</i> (Perkins, 1899)	yellowface Kauai damselfly	P	<b>End</b>	2 (W up)
	<i>Megalagrion vagabundum</i> (Perkins, 1899)	scarlet Kauai damselfly	O	<b>End</b>	2 (W low, up)
<b>ARTHROPODA,INSECTA</b>					
<b>TRICHOPTERA</b>					
<b>HYDROPSYCHIDAE</b>		net-spinning caddisflies			
	<i>Cheumatopsyche analis</i> (Banks, 1903)	---	P	Nat	2 (W mid, up)
<b>ARTHROPODA, CRUSTACEA</b>					
	unidentified Copepoda	copepod	P	--	2 (W mid)
	unidentified Ostracoda	ostracod	P	--	2 (W mid)
<b>ARTHROPODA, MALACOSTRACA, AMPHIPODA</b>					
	indet. Amphipoda	amphipod	P	<b>Ind</b>	2 (W up)
<b>ARTHROPODA, MALACOSTRACA, DECAPODA</b>					
<b>ATYIDAE</b>					
	<i>Atyoida bisulcata</i> J.W. Randall	<i>ōpae kala'ole</i>	P	<b>End</b>	2 (W low, mid, up)
<b>CAMBARIDAE</b>					
	<i>Procambarus clarkii</i> Girard	American crayfish	C P	Nat	1 (Keāhua) 2 (W est, low, mid, up)
<b>GRAPSIDAE</b>					
	<i>Pachygrapsus plicatus</i> (H. Milne Edwards, 1837)	<i>'a'ama</i> , pleated rock crab	C	<b>Ind</b>	3 (W est)
<b>PALAEEMONIDAE</b>					
	<i>Macrobrachium grandimanus</i> J.W.Randall	<i>'opae oeha'a</i>	P	<b>End</b>	2 (W est, low)
	<i>Macrobrachium lar</i> J.C. Fabricius	Pacific prawn	P	Nat	2 (W mid, up, head)
	<i>Palaemon debilis</i> Dana, 1852	<i>'opae huna</i> , grass shrimp	P	<b>Ind</b>	3 (W est)
<b>PORTUNIDAE</b>					
	<i>Scylla errate</i> (Forskål, 1775)	Samoan crab	P	Nat	3 (W est)

Table 2 (continued).

**PHYLUM, CLASS, ORDER,  
FAMILY**

<i>Genus species</i>	Common name	Abundance	Status	ID Code (reach)
<b>FISHES</b>				
<b>CHORDATA, ACTINOPTERYGII</b>				
<b>CENTRARCHIDAE</b>				
	sunfish			
<i>Lepomis</i> sp.		P	Nat	2 (W est, mid, up)
<i>Lepomis macrochirus</i> (Rafinesque, 1819)	bluegill	P	Nat	2 (W est, low, mid, up)
<i>Micropterus</i> sp.	bass	P	Nat	2 (W mid, up)
<i>Micropterus dolomieu</i> Lacèpede	smallmouth bass	O P	Nat	1 (Keāhua) 2 (W est, low, mid, up)
<i>Micropterus salmoides</i> (Lacèpede, 1802)	largemouth bass	P	Nat	2 (W low, mid, up)
<b>CHANIDAE</b>				
<i>Chanos chanos</i> (Forsskål, 1775)	<i>awa</i> , milkfish	P	<b>Ind</b>	3 (W low)
<b>CICHLIDAE</b>				
<i>Oreochromis mossambicus</i> (Peters, 1852)	Mozambique tilapia	P A	Nat	2 (W est) 3 (W est)
<i>Tilapia</i> sp.	tilapia	P	Nat	2 (W est, mid, up)
<i>Tilapia zilli</i> (Gervais, 1848)	redbelly tilapia	C	Nat	3 (W est)
<b>CLARIIDAE</b>				
<i>Clarias fuscus</i> (Lacèpède, 1803)	puntat, Chinese catfish	P	Nat	2 (W low, mid, up)
<b>CYPRINIDAE</b>				
indet. Cyprinidae	carp	P	Nat	2 (W mid, up)
<i>Cyprinus carpio</i> (Linnaeus, 1758)	common carp	P	Nat	2 (W low, up)
<b>ELOPIDAE</b>				
<i>Elops hawaiiensis</i> Regan, 1909	'awa'awa, ladyfish	P	<b>End</b>	2 (W est)
<b>ELEOTRIDAE</b>				
<i>Eleotris sandwicensis</i> Vaillant and Sauvage	'o'opu 'akupa	P	<b>End</b>	2 (W est, low)
<b>GOBIIDAE</b>				
indet. Gobiidae	gobies	P	<b>Ind</b>	2 (W est, low, mid, up)
<i>Awaous guamensis</i> Valenciennes in Cuvier and Valenciennes	'o'opu nākea	P	<b>Ind</b>	2 (W est, low, mid, up)
<i>Sicyopterus stimpsoni</i> Gill	'o'opu nōpili	P	<b>End</b>	3 (W est) 2 (W low)

Table 2 (continued).

**PHYLUM, CLASS, ORDER,  
FAMILY**

<i>Genus species</i>	Common name	Abundance	Status	ID Code (reach)
<b>KUHLIIDAE</b>				
<i>Kuhlia</i> sp.	'āholehole, flagtail	P	--	2 (W est)
<i>Kuhlia sandvicensis</i> (Steindachner, 1876)	'āholehole, zebra- head flagtail	P	<b>Ind</b>	2 (W est, low)
<i>Kuhlia xenura</i> (Jordan and Gilbert, 1882)	'āholehole, Hawaiian flagtail	P	<b>End</b>	3 (W est)
<b>MUGILIDAE</b>				
<i>Mugil cephalus</i> Linnaeus, 1758	'ama'ama, striped mullet	P	<b>Ind</b>	2 (W est, low) 3 (W est)
<b>POECILIIDAE</b>				
indet. Poeciliidae		U	Nat	1 (Keāhua)
<i>Gambusia affinis</i> Baird and Girard	mosquitofish	P	Nat	2 (W up) 3 (W est)
<i>Limia vittata</i> (Guichenot, 1853)	Cuban limia	R	Nat	3 (W est)
<i>Poecilia reticulata</i> Peters	guppy	C	Nat	1 (Keāhua) 2 (W low, up) 3 (W est)
<i>Xiphophorus helleri</i> Heckel	swordtail	P	Nat	2 (W low, mid, up)
<b>AMPHIBIANS</b>				
<b>CHORDATA, AMPHIBIA ANURA</b>				
<b>RANIDAE</b>				
<i>Glandirana rugosa</i> (Temminck and Schlegel, 1838)	Japanese wrinkled frog	O	Nat	1 (Keāhua)
<b>BIRDS</b>				
<b>VERTEBRATA, AVES</b>				
<b>RALLIDAE</b>				
<i>Gallinula chloropus</i> <i>sandvicensis</i> Streets, 1877	'alae 'ula; Hawaiian Gallinule	P	<b>End</b>	3 (W est)

## Key to Table 2

## Abundance categories:

R - Rare - only one or two 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.

## Status categories:

**End** - Endemic - species found only in Hawai'i.**Ind** - Indigenous - species found in Hawai'i and elsewhere.

Nat - Naturalized - species introduced to Hawai'i intentionally, or accidentally.

Table 2 (continued).

## ID codes:

- 1 – observed in or near Keāhua Stream on January 29, 2014.
- 2 – reported in Wailua Watershed (Parham et al., 2008).
- 3 – observed in Kuamo‘o Culvert of Wailua estuary (AECOS, 2007).

## Reach codes:

- Est – estuary; between coast line and 1-m elevation ASL.
- Low – lower reach; between 1- and 20-m elevation ASL.
- Mid – middle reach; between 20- and 200-m elevation ASL.
- Up – upper reach; between 200- and 750-m elevation ASL.
- Head – headwaters; greater than 750-m elevation ASL

animals (i.e., *Atyoida bisulcata*, *Macrobrachium grandimanus*, *Eleotris sandwicensis*, *Awaous guamensis*, and *Sicyopterus stimpsoni*) and other typical native estuarine fishes (i.e., *Elops hawaiiensis*, *Kuhlia* spp., and *Mugil cephalus*) from the estuary and lower reach of the river. Two amphidromous species (i.e., *Macrobrachium lar* and *Awaous guamensis*) have been found in the middle and upper reaches and *M. lar* is the only species reported from the headwaters of the Wailua River (i.e., above 750-m elevation ASL).

The red swamp crayfish (*Procambarus clarkii*) is common, burrowing in the silt bottom of the the ditch and the red-rimmed melania snail (*Melanoides tuberculata*) occurs in the ditch and on the bed of Keāhua Stream. Various naturalized damselflies (e.g., *Ischnura posita* and *I. ramburii*) alight on riparian vegetation. At least 5 species of native damselflies (*Megalagrion* spp.) have been reported from the estuary to the upper reach of Wailua River (Parham et al., 2008), though none was observed in the Project area during our survey.

## Assessment

### OHWM

Keāhua Stream is considered to be “Waters of the U.S.” and therefore jurisdictional under Section 404 of the Clean Water Act (CWA). It is a relatively permanent water that flows to Wailua River—a traditional navigable water. The CWA assigns regulatory authority to the U.S. Army Corps of Engineers (USACE) over certain activities in waters of the U.S. The bounding limit of federal jurisdiction in streams (in the absence of wetlands) is the Ordinary High Water Mark (OHWM). If any construction of the Keāhua Bridge will occur within the stream channel (between the OHWM as depicted in Attachment A), the Project will require a Department of the Army permit.

## Terrestrial plants

No plants of particular conservation value occur in the Project area. Large trees do have significant ornamental value in the park setting. The only two endemic species observed are associated with the botanical garden, and all indigenous species recorded are common species. No plant species listed under federal or state statutes were encountered in the survey, nor are any expected to occur in the Project area.

## Aquatic Resources

No aquatic species protected by State of Hawai'i Administrative Rules (DLNR, 1998, 2007), nor federally endangered or threatened species (USFWS, 2008, 2011) were observed in Keāhua Stream within the Project area. The large population of smallmouth bass in Keāhua Stream is likely responsible for the small (or absent) population of native 'o'opu in the stream (Yamamoto and Tagawa, 2000). However, it is possible for amphidromous organisms to migrate through the Project area. Native stream macrofauna are diadromous: eggs are laid in the stream and the larvae that hatch from these eggs move down stream and out into the ocean where they develop for a time before migrating back into fresh water to grow to maturity (Ford and Kinzie, 1982; Kinzie, 1988). If construction is to occur below the OWHM, it must be phased such that at no time is the entire stream bed blocked or altered in a manner that would prevent upstream migration of native amphidromous species. Construction BMPs developed to prevent degradation of the water of Keāhua Stream are essential to protect the aquatic biota.

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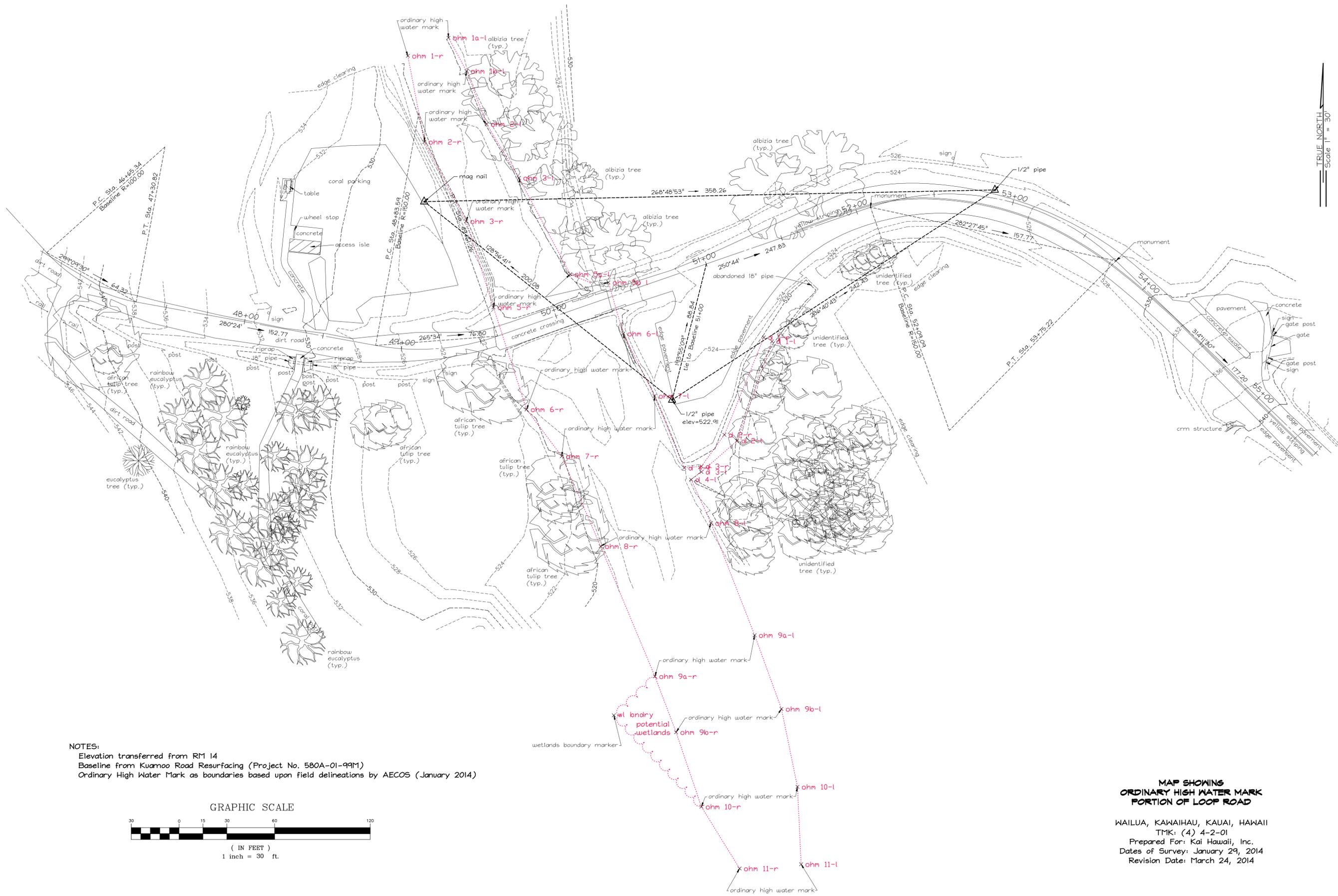
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## Attachment A

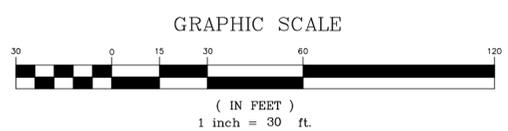
### Ordinary High Water Mark Map

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NOTES:  
 Elevation transferred from RM 14  
 Baseline from Kuamoo Road Resurfacing (Project No. 580A-01-99M)  
 Ordinary High Water Mark as boundaries based upon field delineations by AECOS (January 2014)



**MAP SHOWING  
 ORDINARY HIGH WATER MARK  
 PORTION OF LOOP ROAD**  
 WAILUA, KAWAIHAU, KAUAI, HAWAII  
 TMK: (4) 4-2-01  
 Prepared For: Kai Hawaii, Inc.  
 Dates of Survey: January 29, 2014  
 Revision Date: March 24, 2014

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## Attachment B

### Ordinary High Water Mark Figures

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Flag 1 Upstream



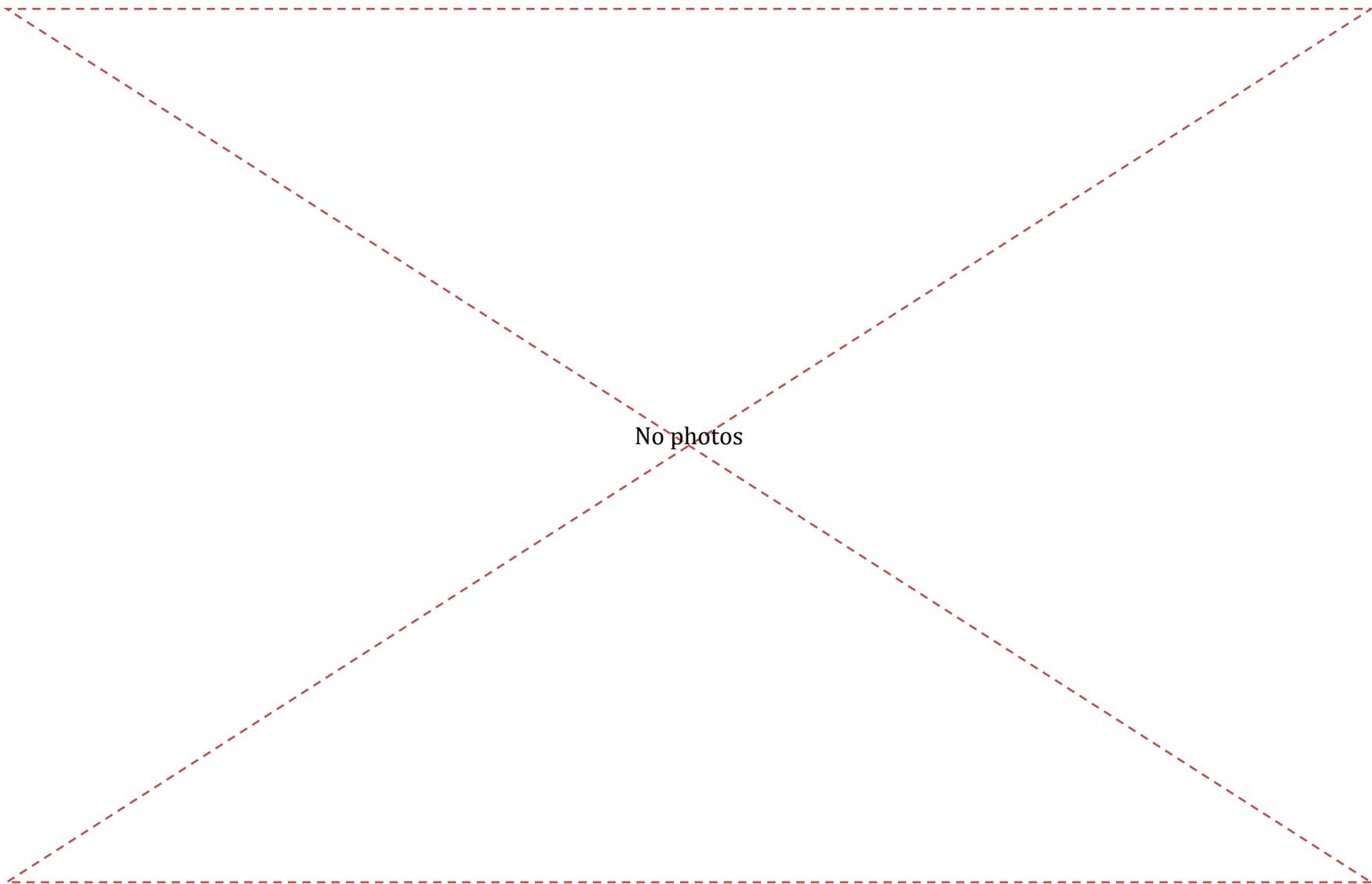
Flag 1 Left bank



Flag 1 Right bank

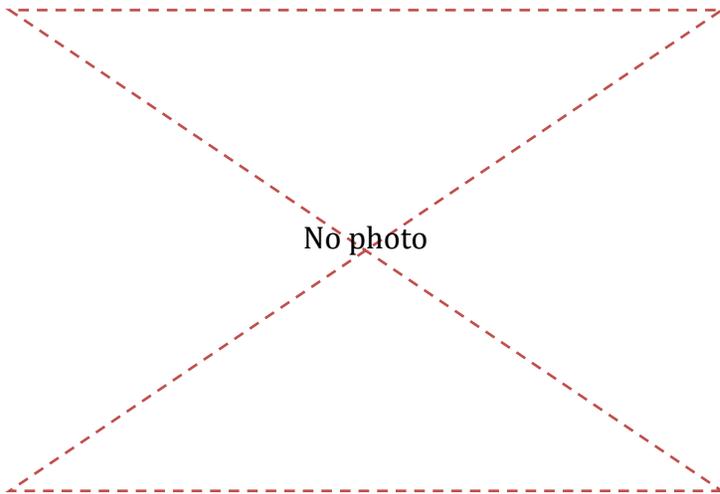


Flag 1 Downstream



No photos

Flag 2

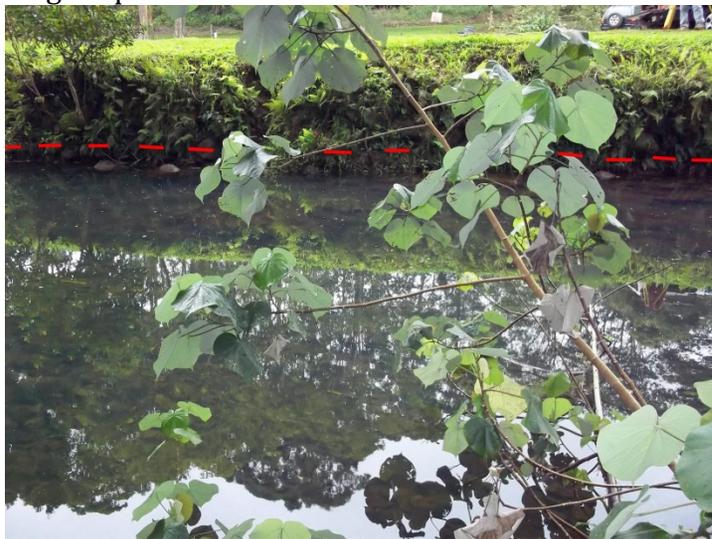


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Flag 3 Upstream



Flag 3 Left bank (photo from left bank)



Flag 3 Right bank (photo from left bank)



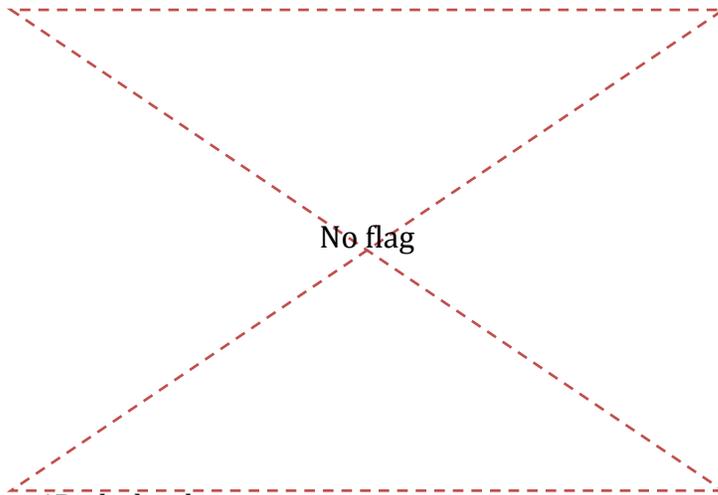
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Flag 4 Upstream (from left bank)



Flag 4 Left bank (mis-numbered flag in photo)



Flag 4 Right bank



Flag 4 Downstream



Flag 5 Upstream



Flag 5 Left bank



Flag 5 Right bank



Flag 5 Downstream



Flag 6 Upstream



Flag 6 Left bank



Flag 6 Right bank



Flag 6 Downstream



Flag 7 Upstream



Flag 7 Left bank

No photo

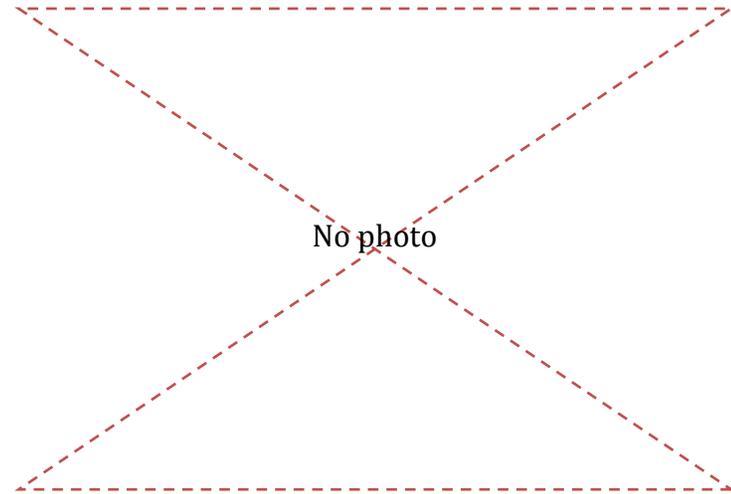
Flag 7 Right bank

No photo

Flag 7 Downstream

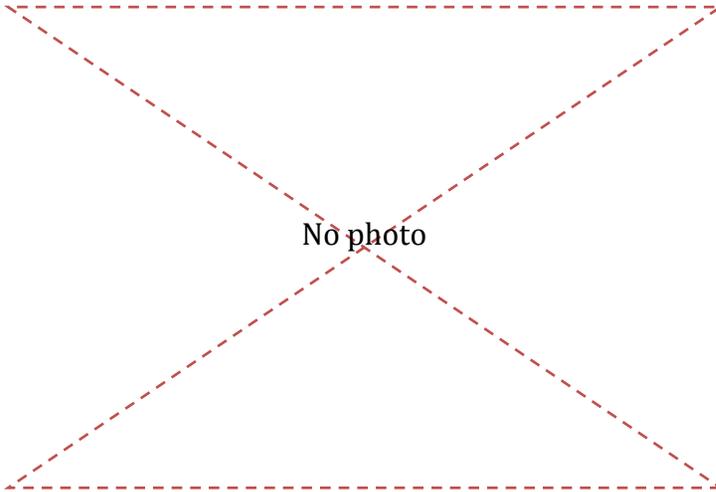


Flag 8 Upstream



No photo

Flag 8 Left bank



No photo

Flag 8 Right bank



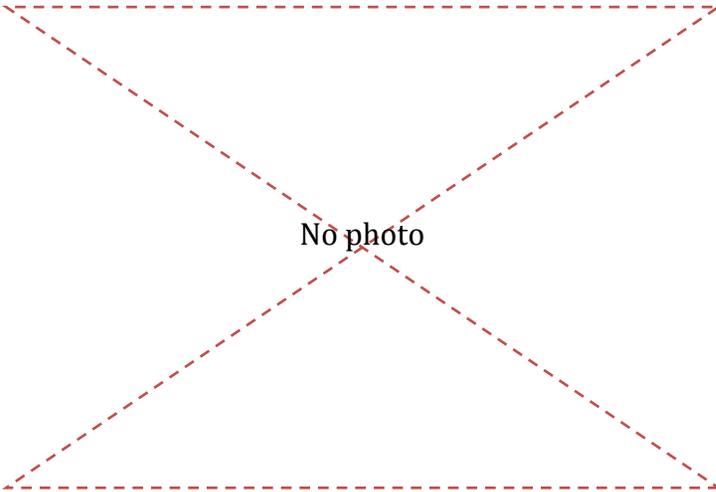
Flag 8 Downstream



Flag 9 Upstream



Flag 9 Left bank



Flag 9 Right bank



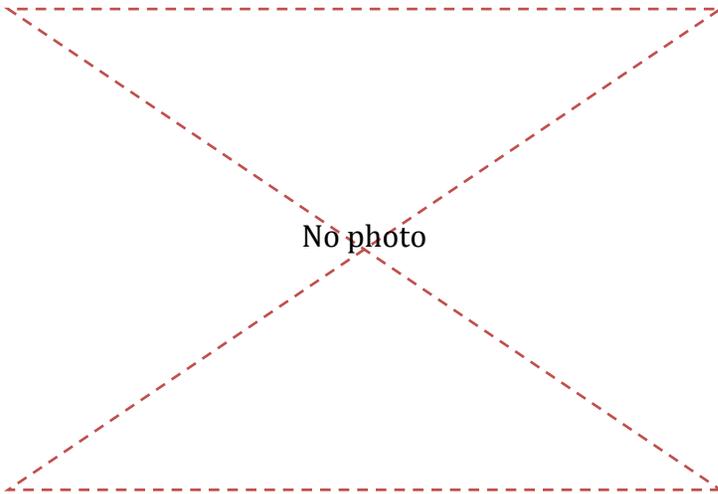
Flag 9 Downstream



Flag 10 Upstream



Flag 10 Left bank



Flag 10 Right bank



Flag 10 Downstream



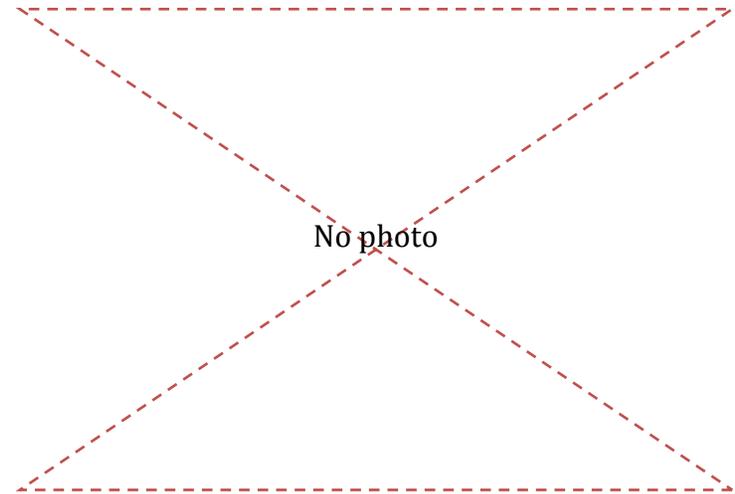
Flag 11 Upstream



Flag 11 Left bank



Flag 11 Right bank



Flag 11 Downstream

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# **ENVIRONMENTAL ASSESSMENT**

## **Keāhua Stream Bridge**

### **APPENDIX 5 Archaeological Survey**

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**AN ARCHAEOLOGICAL ASSESSMENT  
FOR THE KEAHU STREAM BRIDGE PROJECT IN KEAHUA,  
WAILUA AHUPUA‘A, KAWAIHAU DISTRICT, KAUA‘I, HAWAII  
[TMK: (4) 4-2-001:002]  
DIVISION OF FORESTRY AND WILDLIFE JOB NO. D00CK62B**

Prepared by:  
**Jim Powell, B.A.,  
Milton Ching,  
and  
Michael Dega, Ph.D.  
May, 2014**

Prepared for:  
**KAI Hawaii, Inc.  
31 South Pauahi Street #2  
Honolulu, HI 96817**

## **ABSTRACT**

Scientific Consultant Services, Inc. (SCS) conducted Archaeological Inventory Survey on a c. 1-acre project area in Wailua Ahupua'a, Kawaihau District, Kaua'i [TMK: (4) 4-2-001:002]. The study included archival and background research, full pedestrian survey within the area of potential effect, and subsurface testing in three locations. Fieldwork did not lead to the identification of any historic properties. The earliest surface features identified in the project area consist of the ford crossing Keahua Stream and a drainage ditch providing roadside drainage. The latter had a concrete mark dating it to 1964, the same time as the crossing was built. No further archaeological work is recommended for the project area.

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## **INTRODUCTION**

Scientific Consultant Services, Inc. (SCS) conducted Archaeological Inventory Survey-level work on a c. 1-acre project area in Wailua Ahupua'a, Kawaihau District, Kaua'i [TMK: (4) 4-2-001:002] (Figures 1 through 3). The study was done in advance of the proposed Keahua Stream Bridge project for the Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (landowner; Job No. D00CK62B). No federal funds are involved in this project.

The overall project involves the DLNR proposing to construct a single-lane, on-span bridge in the vicinity of the existing Kuamo'o Road ford at Keahua Stream. Current project plans call for all abutments and other bridge structures to be placed outside the stream channel. A temporary detour bridge may be built, if necessary. Existing parking lots on both sides of the stream will be redesigned.

The archaeological work consisted of historical background and archival research, full pedestrian survey and inspection of the parcel, representative excavation, and reporting. Fieldwork was conducted on May 15, 2014 by Jim Powell, B.A. and Milton Ching, B.S., under the overall direction of Michael Dega, Ph.D., Principle Investigator. The overall purpose of this project was to determine the presence or absence of architecture, midden deposits, and/or artifact deposits on the surface of the project area, as well as assess the presence/absence of subsurface cultural deposits. In addition, the report provides recommendations to the State Historic Preservation Division (SHPD) for the project. This Archaeological Assessment Report was written in lieu of an Archaeological Inventory Survey report due to the determination of "no findings" during fieldwork within the project area, per the State of Hawai'i Historic Preservation Division Guidelines for an Archaeological Assessment (13-276-5 (a) and (c)).

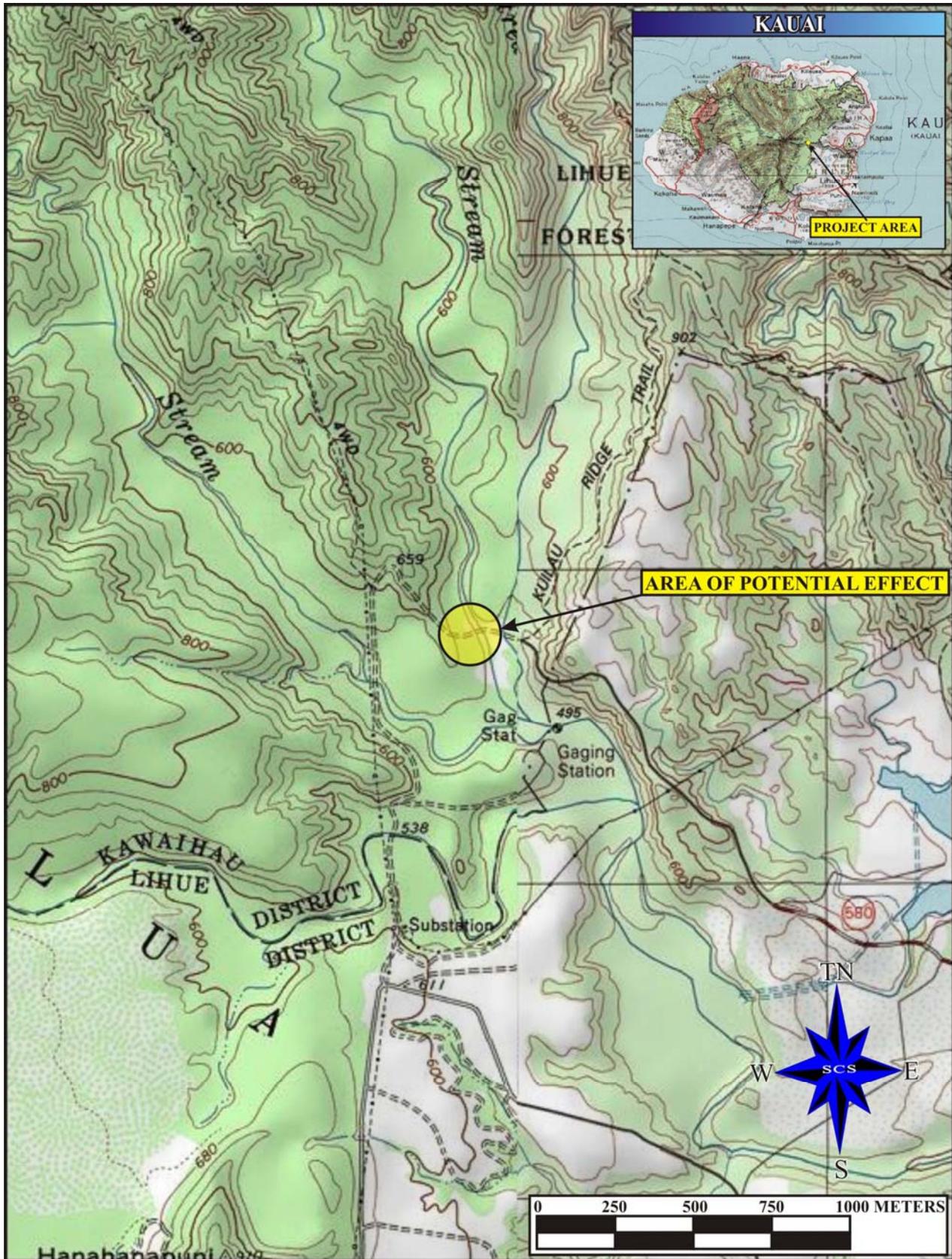


Figure 1: Portion of USGS Map Showing Location of Project Area.

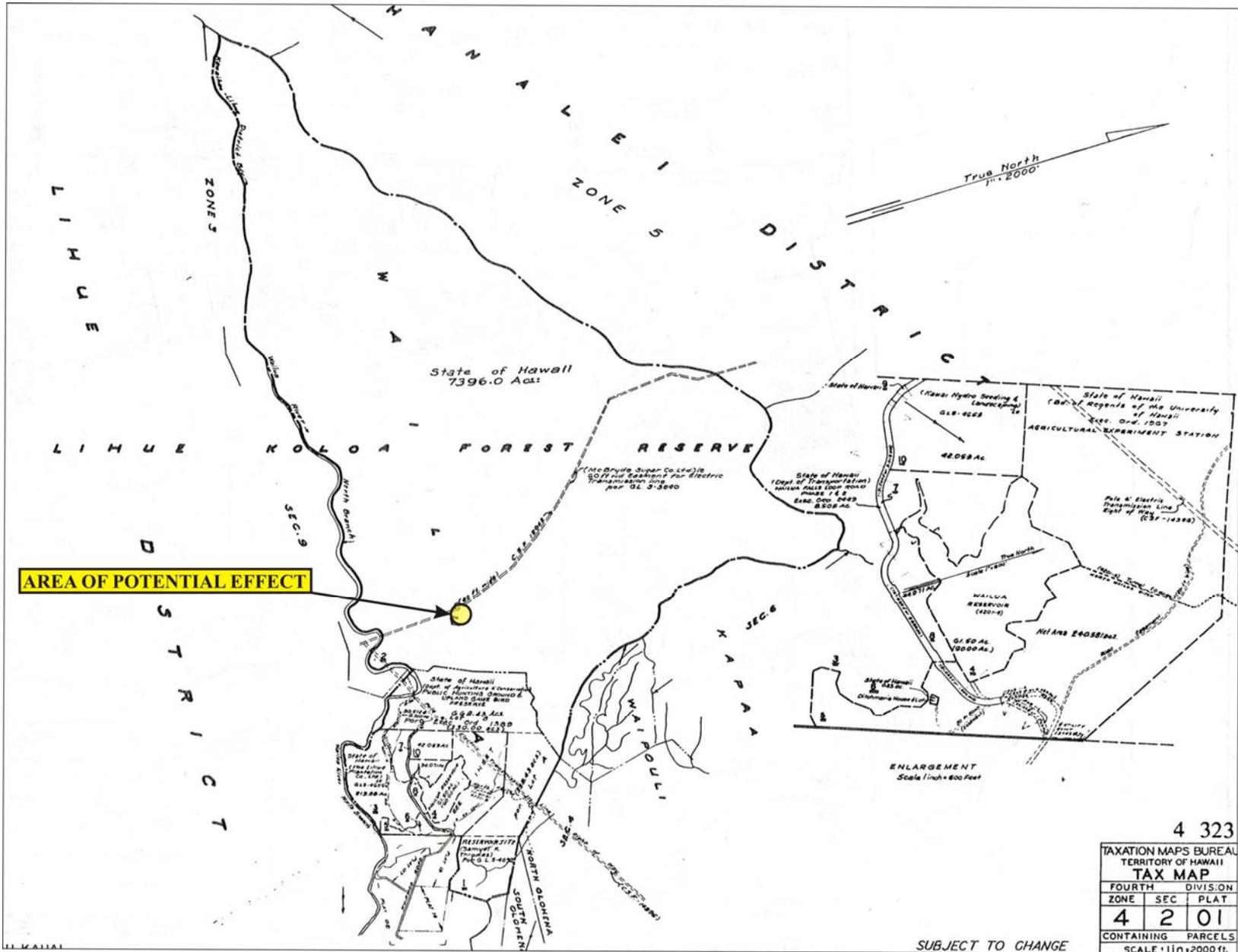
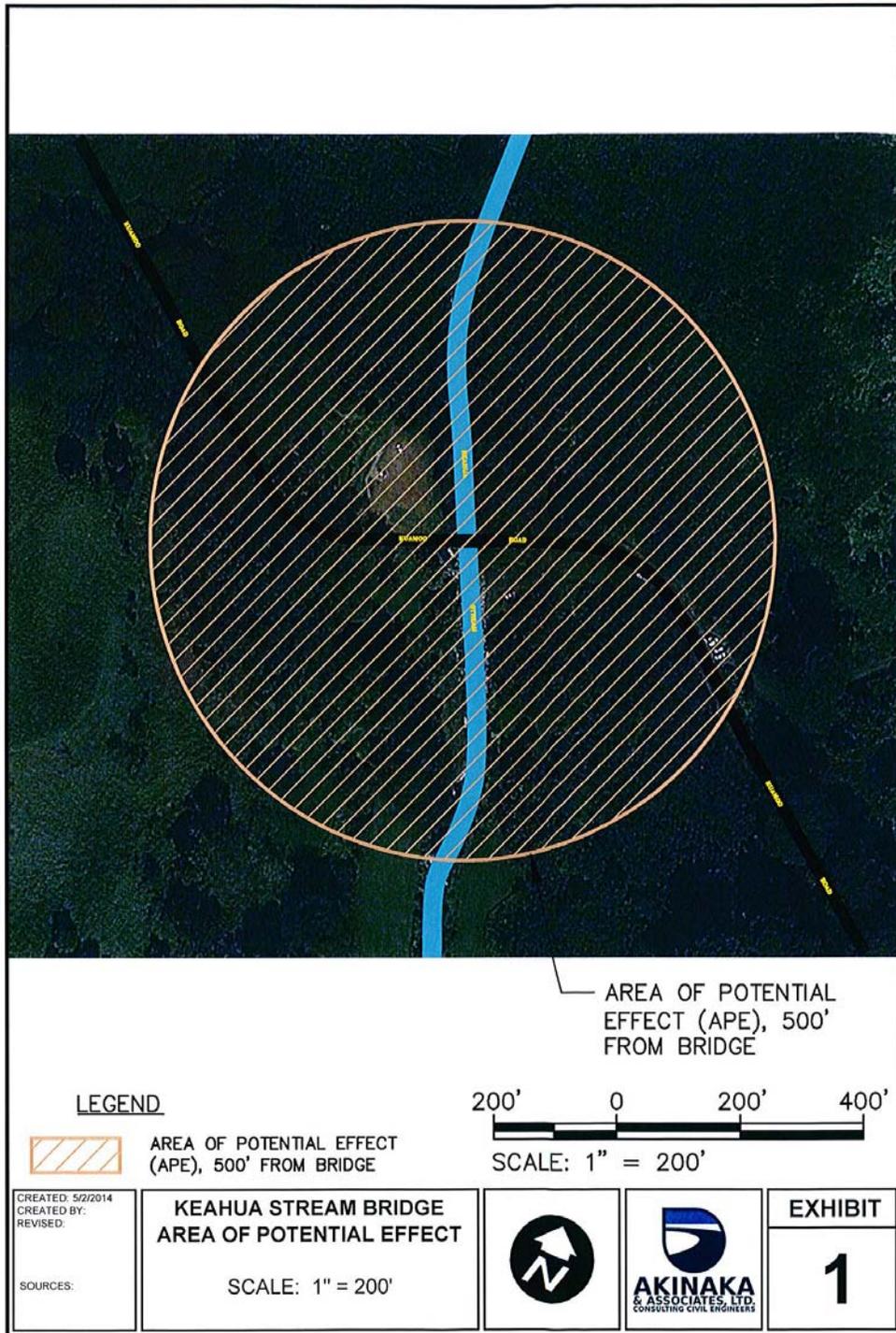


Figure 2: TMK (4) 4-2-001:002 2-1-08 Showing Location of Project Area.



**Figure 3: Keahua Stream Bridge Area of Potential Effect**

## ENVIRONMENTAL SETTING

### **PROJECT AREA LOCATION**

The current project area is located within Wailua Ahupua`a, Kawaihau District, on the eastern flank of Mt. Waialeale, above the eastern coastline of the island. The project area is located c. 9 kilometers (just over 5.5 miles) from the Wailua coastline (see Figure 1) and just to the east of Keahua Arboretum and within the Lihue-Koloa Forest Reserve. Elevation in the project area is c. 510 feet above mean sea level (amsl). The project area contains Kuamo`o Road segments to the stream ford and over the stream, and Forest Reserve land on all flanks (see Figure 2). Keahua Stream is a tributary to the North Fork of Wailua River and originates on the slopes of Makaleha Mountain, west of Kuilau Ridge. The upper reaches of the stream lie above Kapakanui and Kapakaiki Falls (Burr and Miranda 2014).

### **RAINFALL AND SOILS**

Annual rainfall in the project area is approximately 2000 mm per year (Giambelluca *et al.* 2013; Armstrong 1983), with drainages from the uplands also swelling streams in the area. Winter months account for the majority of the rainfall.

Project area soils are classified as of the Pooku Series, which are well-drained soils occurring on the uplands of Kauai (Foote *et al.* 1972: Sheet 20; 114). The soil is derived from basic igneous rock, mostly *in situ*. The primary soil unit is composed Pooku silty clay loam, occurring on 3%-8% slopes. The surface layer is composed of silty clay loam with ironstone sheets. Lower strata, as reported by Foote *et al.* (1972:114) consist of a weaker structured silty clay loam. Run-off is slow and the erosion hazard is only slight for these soils. Large roots reach depths of over 5 feet below surface. The silty clay loams are often associated in this area with wildlife habitat, water supply, and woodlands. The fairly dense silty clay/silty clay loams were confirmed during project area testing by SCS, with profiles only consisting of a single stratum.

### **VEGETATION**

While a majority of the project area consists of the Keahua Stream area and its banks, which have been laid with common lawn grass (see below), vegetation occurring in the general area includes a *hau* (*Hibiscus tiliaceus*) forest to the north of the road and scattering of eucalyptus, monkey pod, Palapalai Fern, *ie ie* vine, mountain apple, *ti*, banana, soap ginger, red hibiscus, pandanus, and *lantana*. Burr and Miranda (2014:7-11) conducted a botanical survey of the project area and environs and recorded 80 species, of which 10 were native. There were no rare plants in the project area of potential effect (*Ibid.*).

## **BACKGROUND**

According to Pukui *et al.* (1974), “Keahua” literally means “mound”. Keahua Stream itself plays an important role as a tributary of the North Fork of the Wailua River and provides perennial water to the area. Wailua Ahupua`a, particularly the area around the lower portion of the river near the coast, is well known and represents one of the most important archaeological site complexes in the islands. The lower river areas were home to *ali`i* and their retinues. Archaeologically, the focal points are the large *heiau* and other features composing the Wailua Complex (State Site Number 50-30-08-502). The complex consists of multiple *heiau*, a city of refuge, petroglyphs, and the Wailua Bellstone, among other features.

The interior areas of Wailua, near the current project area, were used for multiple functions, including wetland *kalo* agricultural and gathering areas. Interior sites previously documented include legendary sites, house sites, petroglyphs, and burials (see Yent 1989:5). Site 50-30-07-4000, the adze quarry, is also present. These site types, particularly wetland taro producing areas, characterize the current project area: Keahua Stream flows through a gentle expanse with mainly flat, alluvial deposits occurring off the stream, ideal locations for taro production. However, no terraces or other agricultural features are present in the area. It is more than likely irrigated taro was done along the banks of the tributary stream, there is just no surface empirical evidence for such as present. There are no land commissions awards (LCA) within or near the project area.

The current project area has not previously been subject to formal archaeological investigations. However, three projects have been conducted nearby in the Keahua Arboretum, all recording and assessing the Site -4000 adze quarry. First, initial archaeological work on Site -4000 was conducted by Dr. William Kikuchi of Kauai Community College in February, 1988. Kikuchi's field inspection resulted in the discovery of an adze workshop consisting of adze preforms and debitage. Kikuchi surveyed and surface collected cultural material in an area of approximately three acres. Later, Yent (1988) mapped, surveyed, and tested Site -4000 as a follow-up to Kikuchi's work. The site area worked by Yent (1988) measured 250 m north/south by 350 m east/west, or approximately 20 acres. The site occurred as discontinuous flake scatters on the ground surface, with adze preforms occurring within the scatters and as isolated finds. Yent (1988) noted that the site's exposure and artifact distributions were somewhat affected by bulldozing at the site. Test excavations revealed that the cultural deposits were shallow and extended to 0.25 m below the surface. Finally, Spear (1992) conducted testing (Data Recovery-

level work) to determine if Site -4000 extended into and beyond a Kaua`i Electrical Division power line corridor.

Spear (1992:15-20) notes that a total of fifteen (15) 0.50 m x 0.50 m test units were manually excavated in and beyond the corridor. Cultural materials were recovered from four units and included 15 pieces of basalt debitage and one split hammerstone. Very sparse charcoal flecking was observed in several units. Inclusive of the earlier studies by Kikuchi and Yent, Site -4000 was interpreted as an adze workshop based on the numerous adze blanks and preforms present, as well as large amounts of debitage. While a workshop site can be considered a task specific site, there is evidence of secondary or support activities. Between Yent (1988:6-7) and Spear and Williams N.D., "other, non-adze related tools have been identified." These include cobble cores, hammerstones, edge altered flakes, and an awl. Such tools indicate processing or manufacturing activities not directly related to the production of adze blanks or preforms. The wide distribution of cultural material suggests that the site area was repeatedly visited over an extended period of time. One possibility is that the site was utilized by small groups of people for short intervals of time. This would account for the clusters of debitage and adze forms since each visit would return to the same general location but not necessarily the exact same spot. In a broader view of the *ahupua'a*, Site -4000 played the role of a workshop for the production of adze blanks and preforms. These tools were then probably transported to the coastal Wailua area where the adzes were finished. The lack of grinding or abrading stones and polished adzes or flakes supports the interpretation that the preforms were finished in another location.

## METHODS

Fieldwork was conducted on May 15, 2013 by SCS personnel Jim Powell, B.A. and Milton Ching, under the overall direction of Michael Dega, Ph.D (Principle Investigator). The P.I. conducted a walk-through of the project area with J. Powell on April 23, 2014. The formal survey included a 100% pedestrian survey of the project area in 5 m transects. Visibility in the project area was high. Numerous photographs were taken of the project area in addition to written notes and descriptions of the topography and natural environment. Several modern features were noted in the project area (see below) and `Ala`ea gathering areas were also noted along the road. No formal documentation was done of these modern features/practices.

To assess the subsurface stratigraphic sequence and potentially identify any subterranean cultural deposits or sites, three (3) mechanically excavated trenches were excavated within the project area. The trenches were placed in three locations proposed for project ground altering activity. Stratigraphic Trench 1 (ST-1) was placed on the eastern flank of the stream, along the western edge of the existing parking lot. The trench location was the probable location of proposed bridge abutments and to avoid damaging existing asphalt in the parking lot. ST-2 was placed on the west side of the stream, within the proposed location of bridge abutments. ST-3 was excavated on the western side of the stream, also within a proposed bridge abutment locale.

Stratigraphic sequences were profiled using a Munsell Color Chart. Additional soil characteristics were also noted. All trenches were measured for length, width, and depth and photographs were taken after excavation was completed. Table 1 illustrates descriptive data for the trenches.

**Table 1: Stratigraphic Trench Descriptive Data**

<b>Trench</b>	<b>Location</b>	<b>GPS</b>	<b>Dimensions Metric</b>	<b>Comments / Results</b>
1	East side of stream, west edge of parking lot.	0456907 2440811	L – 4.2 m D – 1.5	Negative. Red dirt fill, absence of rocks.
2	West side of stream.	0456888 2440791	L - 5.4 D – 1.0	Negative. Natural alluvial soils with natural water worn rocks.
3	West side of stream.	0456876 2440802	L – 4.8 D – 1.0	Negative. Natural alluvial soils with natural water worn rocks..

Laboratory work was conducted in the Kapaa and Honolulu offices of SCS and primarily included drafting, cataloguing photographs and notes, and reporting. All documentary materials are currently being curated at the SCS office in Honolulu.

### **RESULTS OF FIELDWORK**

The project area consisted of a c. 1.0-acre area of potential effect that is mostly undeveloped. Current modern features include the Keahua ford crossing, Kuamo`o Road, a retaining wall and ditch along the east flank of the stream, and adjacent parking lots on both sides of the stream. No extant historic properties were documented during the study. Table 2 lists the existing structures and areas of interest nearby the project area.

**Table 2: Existing Structures and Activity Areas**

<b>Sites</b>	<b>Feature</b>	<b>GPS</b>	<b>Descriptive</b>	<b>Comments</b>
1	Crossing / Ford	0456884 2440811	See plans for dimensions	Shallow ford across Keahua Stream; concrete has been poured to create a smooth surface for cars to cross.
2	Retaining wall	0456907 2440811	L – 7.3 m H – 1.2 m	June 26, 1964 Inscribed as “built date” on the rock wall
3	Road side `Alaea gathering site	0456698 2440942	75 m long, both sides of gravel road (off Kuamo`o Road)	`Alaea gathering
4	Adze Quarry, Site 50-30-07-4000	Approximate 0456645 2440978	Outside of APE	Previously identified adze quarry. GPS taken from gravel road overlooking the quarry location.

Both the ford crossing and the retaining wall are less than 50 years old, as based on a “built” date inscribed on the retaining wall and ford (1964; Figures 4 through 7). Both have been reinforced with metal and concrete during recent times. The Site -4000 adze quarry, previously noted above, occurs outside the APE. Below discusses the `Alaea gathering areas used at present.



**Figure 4: Ford Crossing over Keahua Stream. View to West.**



**Figure 5: Ford Crossing over Keahua Stream. View to the North.**



**Figure 6: Ford Crossing over Keahua Stream and Retaining Wall (frame right). View to Northeast**



**Figure 7: Ford Crossing over Keahua Stream and Retaining Wall.**

**Note: Retaining wall built to prevent erosion of the eastern stream bank/parking area.**

To assess the presence/absence of any subsurface deposits or features, three (3) trenches were excavated on the parcel. No cultural deposits or isolated artifacts were identified. The trenches revealed the uniform presence of silty clay and silty clay loams, two the trenches also containing large waterworn cobbles and boulders, a function of their location near the stream. The following presents the trench data and a short discussion on the `Alaea gathering.

### Stratigraphic Trench 1

This trench was excavated on the eastern side of the stream, along the western edge of the existing parking lot (Figures 8, 9, and 10). The trench location was selected due to the probable location of bridge abutment work and to avoid damaging existing asphalt parking lot. The trench was oriented on a north-south axis and measured 4.2 m long, 0.60 m wide, and was excavated to 1.5 meters below the surface (mbs).



**Figure 8: Pre-Excavation Location of ST-1. View to North.**



**Figure 9: Pre-Excavation Location of ST-1. View to East. Red line represents trench location.  
Note: Retaining wall along stream (dated to 1964).**



**Figure 10: Profile and Overview of ST-1. View to Northwest.  
Note: Red soil fill (silty clay) with an absence of rocks.**

## Stratigraphic Trench 2

This trench was excavated on the western side of the stream (Figures 11 and 12). The trench location was selected due to the probable location of bridge abutment work. The trench was oriented on a north-south axis and measured 5.4 m long, 0.60 m wide, and was excavated to 1.0 meters below the surface (mbs).



**Figure 11: Location of ST-2 during Excavation, West bank of Keahua Stream.  
View to Northwest.**



**Figure 12: Location and Overview of ST-2. View to East.**

**Note: Single layer profile of alluvial soil with small to large waterwork basalt rocks.**

### **Stratigraphic Trench 3**

This trench was excavated on the western side of the stream (Figures 13 and 14) and the trench location was selected due to the probable location of bridge abutment work. The trench was oriented on a north-south axis and measured 4.8 m long, 0.60 m wide, and was excavated to 1.0 meters below the surface (mbs).



**Figure 13: Location and Overview of ST-3. View to North.**

**Note: Presence of much water worn basalt.**



**Figure 14: Overview of Post-Excavation ST-3. View to East.**

**Note: Smaller water worn cobbles from trench.**

#### ‘Alaea Gathering Pits (Modern)

‘Alaea is an water soluble, colloidal, ochre used for coloring salt, for medicine, for dye, and formerly used in purification ceremonies called “*hi`uwai*” (Milton Ching-pers. comm.). It is unknown how long the Keahua Stream and environs have been utilized to gather `alaea. The Site -4000 adze quarry is very nearby, so both lithic and `alaea may have been procured from the area for centuries. `Alaea pits were visible along the northeast and southwest flanks of a gravel road which occurs to the west of the Keahua Stream Crossing (Figures 15, 16, and 17). `Alaea also occurs on the surface on the northeast flank, in a drainage ditch.



**Figure 15: Photo showing pit dug to remove `Alaea.**



**Figure 16: Close-Up Photograph showing pit dug to remove `Alaea.**



**Figure 17: Road with `Alaea Deposits.**

**Note: Deposits can be seen on both sides of the road. Only the south side appears as an active gathering site, with pits dug into the embankment. These deposits may have been exposed when this road was constructed.**

### **SUMMARY AND RECOMMENDATIONS**

The current Archaeological Assessment included survey and testing of the project area, with photographic and written documentation of the proposed development areas. No new sites, surface features, or midden scatters were identified during the pedestrian survey. Mechanical subsurface testing was conducted in three locations of the project area. No subsurface sites or deposits were identified.

It is our estimation, based on this study, that the proposed undertaking would not have an adverse impact on any historic properties. No further work is recommended for this project.

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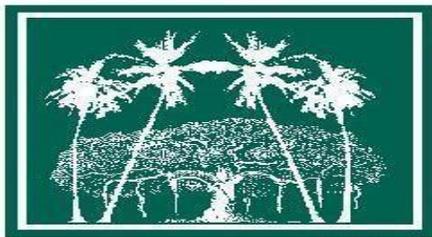
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# **ENVIRONMENTAL ASSESSMENT**

## **Keāhua Stream Bridge**

### **APPENDIX 6 Arborist Report**

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# Steve Nimz and Associates Inc.

Consulting Arborist Services

PO BOX 10026 Honolulu, Hawaii 96816  
Office # (808) 734-5963 Fax # (808) 732-4433  
Email: [Steve@stevenimz.com](mailto:Steve@stevenimz.com)

May 22, 2014

Saied Pourjalali  
Kai Hawaii  
50 S. Beretania Street # C-119C  
Honolulu, Hawaii 96813

Re: Keahuea Forest Reserve Bridge Project Tree Survey

Dear Mr. Pourjalali:

The following tree assessment report was requested by KAI Hawaii regarding trees impacted by Keahuea Forest Preserve Bridge Project which incorporates road, parking lot and bridge realignment on Kauai. The Keahuea Forest Reserve Park was planted with a large variety of different tree species.

The tree numbered site map corresponds to the spreadsheet that provides:

- Tree number
- Species
- Tree attributes (trunk, diameter, height, crown spread)
- Condition rating (health and structure)
- Mitigation (prune, root prune, remove, transplant)
- Comments

A site inspection was conducted on April 1, 2014 to inventory the trees within the project limits and just outside the boundaries.

Along the south side of the roadway is a drainage canal with nine (9) *Senna siamea* trees # 4 – # 13 growing on the bank adjacent to the park. The *Senna siamea* trees are in fair to poor health and structural condition. The lower trunks have cavities with decay. The trees could be preserved in place but are poor candidates for relocation. Trees # 8, # 9 and # 10 and possibly # 11 will be significantly impacted by the parking lot expansion. These specific four (4) trees should be removed to accommodate the expansion.



The two (2) African Tulip (*Spathodea campanulata*) trees # 23 and # 24 on the west side of the stream are within the new bridge alignment. The trees are large mature specimens with thirty-two and twenty-eight inch diameter trunks, approximately thirty-five foot height. The trunk flare and surface roots extend out into the stream and slope. There are decayed sections in the lower trunk. The trees are marginal for relocation and also are now a widely naturalized common species. I recommend the trees be removed.



The two (2) Queensland Maple (*Flindersia brayleyana*) trees # 25 and # 26 are just outside the project limits. I recommend providing a ten-foot protection zone around the trees to reduce any negative impact to the major structural roots. Roots outside the protection zone shall be carefully exposed and properly pruned by the Project arborist.



Albizia trees # 1, # 16, # 17, # 18, # 19, # 20 and # 21 are outside the project boundaries. The trees are invasive species and have a history of both major branch failures and total tree failures. The trees are covered in Pothos vines increasing failure potential. I recommend the removal of the trees to reduce future road blockage and possible damage to cars and pedestrians. The same should be considered for eight Albizia trees # 29 - # 36 on the north east side of the stream.



If you have any questions, please contact my office at 808-734-5963.

Respectfully yours,

A handwritten signature in black ink, appearing to read "Steve Nimz", with a stylized, cursive flourish at the end.

Steve Nimz,  
ASCA Consulting Arborist

ISA Certified Arborist # WE- 0314AM  
ISA Certified Tree Risk Assessor # 419

Note: Tree identification provided by Patrick T. Porter (Kauai District Forest Manager) and Adam Williams (Kauai District Botanist)



## Keahuea Bridge and State Park

Tree #	Species	Diameter (inches)	Height (feet)	Crown Spread	Health Condition	Structural Condition	Prune, Remove, Transplant	Comments
1	Albizia	14	60	20	Fair	Fair	Remove	Codominant trunks
2	Hau	2-6	35		Fair	Fair	Prune	
3	Hau	2-6	35		Fair	Fair	Prune	
4	Senna Siamea	24	30	30	Fair	Fair	Prune	Three trunks makai of trench
5	Senna Siamea	10	25	20	Fair	Fair-Poor	Prune	Broken upper crown
6	Senna Siamea	6	20	15	Fair	Poor	Prune	Decay trunk base, leaning
7	Senna Siamea	12	30	20	Fair	Fair	Prune	Leaning toward trench, lower trunk decay
8	Senna Siamea	12	20	25	Fair	Fair	Remove	Double codominant, trunk decay
9	Senna Siamea	6	25	20	Fair	Fair	Remove	Base decay
10	Senna Siamea	6	20	15	Fair	Poor	Remove	Decay lower trunk, leaning
11	Senna Siamea	8	25	20	Fair	Fair	Remove	Decay lower trunk, crown die back
12	Senna Siamea	10	35	25	Fair	Fair	Prune	Lower trunk decay
13	Senna Siamea	14	25	20	Fair	Fair	Prune	Leaning over trench
14	Strawberry Guava	2	8	8	Fair	Fair	Remove	Growing on side of bank
15	Strawberry Guava	6	12	15	Fair	Fair	Remove	Growing on side of bank
16	Albizia	32	120	50	Fair	Fair	Remove	Covered in pothos vines
17	Albizia	30	100	40	Fair	Fair	Remove	Covered in pothos vines
18	Albizia	36	150	60	Fair	Fair	Remove	Covered in pothos vines
19	Albizia	28	120	50	Fair	Fair	Remove	Covered in pothos vines
20	Albizia	28	120	40	Fair	Fair	Remove	
21	Albizia	24	120	40	Fair	Fair	Remove	
22	Hau	4-6	25		Fair	Fair	Prune	
23	African Tulip	32	35	30	Fair	Fair	Remove	Too large to relocate, decay at base
24	African Tulip	28	30	25	Fair	Fair	Remove	Too large to relocate, decay at base
25	Flindersia brayleyana	30	100	30	Good	Good	Root prune	

### Keahuea Bridge and State Park

Tree #	Species	Diameter (inches)	Height (feet)	Crown Spread	Health Condition	Structural Condition	Prune or Remove	Comments
26	Flindersia brayleyana	26	100	30	Good	Good	Root prune	
27	Mindanao Gum	18	90	20	Fair	Fair	Root prune	
28	Mindanao Gum	16	80	20	Fair	Fair	Root prune	
29	Albizia	24	120	40	Good	Good		
30	Albizia	16	80	30	Good	Good		
31	Albizia	18	100	50	Good	Good		
32	Albizia	20	100	50	Good	Good		
33	Albizia	24	130	60	Good	Good		
34	Albizia	30	170	60	Good	Good		
35	Albizia	36	150	60	Good	Good		
36	Albizia	28	130	50	Good	Good		
37	Mindanao Gum	24	100	40	Good	Good		
38	African Tulip	12	30	20	Good	Fair		
39	African Tulip	36	50	30	Good	Fair		
40	African Tulip	48	50	40	Good	Fair		

# **ENVIRONMENTAL ASSESSMENT**

## **Keāhua Stream Bridge**

### **APPENDIX 7**

#### **Faunal Survey (Terrestrial Vertebrate Fauna)**

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# **Faunal Surveys Conducted for the Keāhua Bridge Project, Wailua District, Island of Kauaʻi, Hawaiʻi**

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Prepared by:

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May 30, 2014

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## Introduction and Background

The State of Hawai'i Department of Land and Natural Resources (DLNR) proposes to construct a single-lane, one-span bridge in the vicinity of the existing Kuamo'o Road ford at Keāhua Stream, located in the Wailua District on the Island of Kaua'i (Figure 1). Current project plans call for all abutments and other bridge structures to be placed outside of the stream channel. A temporary detour bridge may be built, if necessary. Parking lots on both sides of the stream will be re-designed.

This report describes the methods used and the results of the avian and terrestrial mammalian surveys conducted on the project site as part of the environmental disclosure process associated with the proposed project. The primary purpose of the surveys was to determine if there are any avian, or terrestrial mammalian species currently listed, or proposed for listing under either federal or State of Hawai'i endangered species statutes within or adjacent to the project site.

The federal and State of Hawai'i listed species status follows species identified in the following referenced documents, DLNR 1998, U. S. Fish & Wildlife Service (USFWS) 2005a, 2005b, 2014). Fieldwork was conducted on May 28, 2014.

Hawaiian and scientific names are italicized in the text. A glossary of technical terms and acronyms used in the document, which may be unfamiliar to the reader, are included at the end of the narrative text.

### ***General Site Description***

Kuamo'o Road fords the middle reach of Keāhua Stream at approximately 155 meters above sea level (Figure 1). On either side of the ford are paved parking lots (Figures 2 and 3). Vegetation on the *mauka* side of the stream is very dense, predominately comprised of *hau* (*Hibiscus tiliaceus*). Vegetation on the *makai* side of the ford is generally open with mowed lawns and an open parkland tree stands (Figure 3).

### ***Methods***

Avian phylogenetic nomenclature used in this report follows the *AOU Check-List of North American Birds* (American Ornithologists' Union, 1998), and the 42nd through the 53rd supplements to the Check-List (American Ornithologists' Union, 2000; Banks et al., 2002, 2003, 2004, 2005, 2006, 2007, 2008; Chesser et al., 2009, 2010, 2011, 2012, 2013). Mammalian species scientific names follow (Wilson and Reeder, 2005). Place names follow (Pukui et al., 1974).





**Figure 2 – Keāhua Ford looking northwest from the southeast**



**Figure 3 – Keāhua stream crossing the road looking west from the east side of the Ford**

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### ***Avian Survey Methods***

One avian point count station was sited on the southeast corner of the project site. A single eight-minute point count was made at the count stations. The station was counted once. Field observations were made with the aid of Leica 8 X 42 binoculars and by listening for vocalizations. Survey activities were concentrated during the early morning hours, the peak of daily bird activity. Additionally two 30-minute time-dependent waterbird counts were conducted, one on each side of the stream in locations that afforded the most complete view of the stream in both directions of flow. Time not spent counting was used to search the remainder of the project site for species and habitats that were not detected during count sessions.

### ***Mammalian Survey Methods***

With the exception of the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), or 'ōpe'ape'a as it is known locally, all terrestrial mammals currently found on the Island of Kaua'i are alien species, and most are ubiquitous. The survey for terrestrial mammalian species was limited to visual and auditory detection, coupled with visual observation of scat, tracks, and other animal sign. A running tally was kept of all terrestrial vertebrate mammalian species detected within the project area during time spent within the project site.

## ***Results***

### ***Avian Survey Results***

A total of 42 individual birds of 14 species, representing 13 separate families, were recorded during the point count (Table 1). All avian species detected while on site are alien to the Hawaiian Islands.

Avian diversity and densities was in keeping with the location of the property and the habitats presently on and adjacent to the project site. Two species; Red Junglefowl (*Gallus gallus*), and Japanese White-eye (*Zosterops japonicus*) accounted for 40 percent of all birds recorded during the station count. The most commonly recorded species was Red Junglefowl, which accounted for 21 percent of the total number of individual birds recorded.

No avian species currently listed or proposed for listing under either federal or State of Hawai'i endangered species statutes was recorded during the course of this survey.

**Table 1 – Avian Species Detected Keāhua Ford Project**

<i>Common Name</i>	<i>Scientific Name</i>	<i>ST</i>	<i>#</i>
PHASIANIDAE - Pheasants & Partridges			
Phasianinae - Pheasants & Allies			
Red Junglefowl	<i>Gallus gallus</i>	A	9
PELECANIFORMES			
ARDEIDAE - Herons, Bitterns & Allies			
Cattle Egret	<i>Bubulcus ibis</i>	A	1
COLUMBIFORMES			
COLUMBIDAE - Pigeons & Doves			
Zebra Dove	<i>Geopelia striata</i>	A	2
PSITTACIFORMES			
PSITTACIDAE - Lories Parakeets, Macaws & Parrots			
Psittacinae - Typical Parrots			
Rose-ringed Parakeet	<i>Psittacula krameri</i>	A	2
PASSERIFORMES			
CETTIIDAE - Cettia Warblers & Allies			
Japanese Bush-Warbler	<i>Cettia diphone</i>	A	1
ZOSTEROPIDAE - White-eyes			
Japanese White-eye	<i>Zosterops japonicus</i>	A	8
TIMALIIDAE - Babblers			
Chinese Hwamei	<i>Garrulax canorus</i>	A	1
TURDIDAE - Thrushes			
White-rumped Shama	<i>Copsychus malabaricus</i>	A	2
STURNIDAE - Starlings			
Common Myna	<i>Acridotheres tristis</i>	A	2
THRAUPIDAE - Tanagers			
Red-crested Cardinal	<i>Paroaria coronata</i>	A	4
CARDINALIDAE - Cardinals Saltators & Allies			
Northern Cardinal	<i>Cardinalis cardinalis</i>	A	3
FRINGILLIDAE - Fringilline and Carduline Finches & Allies			
Carduelinae - Carduline Finches and Hawaiian Honeycreepers			
House Finch	<i>Haemorhous mexicanus</i>	A	4
ESTRILDIDAE - Estrildid Finches			
Nutmeg Mannikin	<i>Lonchura punctulata</i>	A	3

Legend To Table 1

ST = Status      A = Alien Species      # = Number of birds detected during Point Count

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### ***Time Dependent Waterbird Counts***

Two, 30-minute, time-dependent waterbird counts were conducted on either side of Keāhua Stream. No waterbirds were detected during either waterbird count.

### ***Mammalian Survey Results***

Three terrestrial mammalian species were recorded during the course of this survey. Several dogs (*Canis familiaris*) were being walked by their owners while I was at the site, additionally; tracks and scat of this species was encountered at several locations within the project area. Tracks of cats (*Felis catus*) were also seen within the site, as were tracks, scat and sign of pigs (*Sus scrofa*). All of the mammalian species recorded are alien to the Hawaiian Islands.

No mammalian species proposed for listing, or listed as endangered or threatened under either federal or state of Hawai'i endangered species statutes, was recorded during the course of this survey (DLNR 1998; USFWS 2014).

## ***Discussion***

### ***Avian Resources***

The findings of the avian survey are consistent with the location of the project site, and the habitat present on the site, which is dominated almost to exclusion by alien vegetation. A total of 14 avian species were recorded during the point count, no additional species were encountered while investigated the remainder of the site. As previously mentioned all of the avian species recorded are alien to the Hawaiian Islands (Table 1).

Although not detected during this survey, the endangered Hawaiian Petrel (*Pterodroma sandwichensis*), and the threatened endemic sub-species of the Newell's Shearwater (*Puffinus auricularis newelli*) have been recorded over-flying the general project area between April and the end of November each year (David, 1995, 2013; Morgan *et al.*, 2003, 2004; David and Planning Solutions 2008). Additionally, the Save Our Shearwaters Program has recovered both species from the Wailua District on an annual basis over the past three decades (Morgan *et al.*, 2003, 2004; David and Planning Solutions, 2008; Save our Shearwater Program, 2013).

The petrel is listed as endangered, and the shearwater as threatened under both Federal and State of Hawai'i endangered species statutes. The primary cause of mortality in both Hawaiian Petrels and Newell's Shearwaters is thought to be predation by alien mammalian species at the nesting colonies (USFWS 1983, Simons and Hodges 1998, Ainley *et al.*, 2001). Collision with man-made structures is considered to be the second most significant cause of mortality of these seabird species in Hawai'i. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. When disoriented, seabirds can collide with manmade structures, and if they are

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not killed outright, the dazed or injured birds are easy targets of opportunity for feral mammals (Hadley 1961; Telfer 1979; Sincok 1981; Reed *et al.*, 1985; Telfer *et al.*, 1987; Cooper and Day, 1998; Podolsky *et al.* 1998; Ainley *et al.*, 2001; Hue *et al.*, 2001; Day *et al.* 2003). There are no nesting colonies nor appropriate nesting habitat for either of these listed seabird species within the current study site.

### ***Mammalian Resources***

The findings of the mammalian survey are consistent with the location of the project site and the habitats currently present on the site. We did not record Hawaiian hoary bats overflying the site. Hawaiian hoary bats are widely distributed in the low to mid-elevation areas on the Island of Kaua'i, and have been documented in and around almost all areas that still have some dense vegetation (Tomich, 1986; USFWS 1998, David, 2014).

Although no rodents were detected during the course of this survey, it is probable that one or more of the four established alien muridae found on Kaua'i, roof rat (*Rattus rattus*), Brown rat (*Rattus norvegicus*), European house mouse (*Mus musculus domesticus*) and possibly black rats (*Rattus exulans hawaiiensis*) use various resources found within the general project area. All of these introduced rodents are deleterious to native ecosystems and the native faunal species dependant on them.

### ***Potential Impacts to Protected Species***

#### ***Seabirds***

The principal potential impact that construction of the project poses to protected seabirds is the increased threat that birds will be downed after becoming disoriented by lights associated with the project during the nesting season. The two main ways that outdoor lighting could pose a threat to these nocturnally flying seabirds is if, 1) during construction it is deemed expedient, or necessary to conduct nighttime construction activities, and 2) following build-out, the potential operation of streetlights. As neither night-time construction activity nor any streetlights are currently planned for this project, it is not expected that the project will result in deleterious impacts to these trust resources.

#### ***Hawaiian hoary bats***

It is likely that Hawaiian hoary bats utilize resources within the general project area on a seasonal basis. The principal potential impact that construction of the project poses to bats is during the clearing and grubbing phases of construction as vegetation is removed. The removal of vegetation within the project site may temporarily displace individual bats, which may use the vegetation as a roosting location. As bats use multiple roosts within their home territories, the potential disturbance resulting from the removal of the vegetation is likely to be minimal. During the pupping season, females carrying their pups may be less able to rapidly vacate a roost site as the vegetation is cleared. Additionally, adult female bats sometimes leave their pups in the roost tree while they forage. Very small pups may be unable to flee a tree that is being felled. Potential adverse effects from such disturbance can be avoided or minimized by not clearing woody vegetation taller than 4.6 meters (15-feet),

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between June 1 and September 15, the period in which bats are potentially at risk from vegetation clearing. Another possible minimization measure to consider is that if woody vegetation that might potential be used by bats to roost in during the pupping season needs to be cleared during that time frame that the project investigate the possibility that searches using thermal imaging devices be considered. That methodology is currently being used on the Island for seasonal vegetation clearing.

### ***Critical Habitat***

There is no federally delineated Critical Habitat for any species present on or adjacent to the project area. Thus the proposed project will not result in impacts to federally designated Critical Habitat. There is no equivalent statute under State law.

### ***Recommendations***

- It is recommended that woody vegetation taller than 4.6 meters (15-feet), not be cleared between June 1 and September 15, the period in which roosting bats are potentially at risk from vegetation clearing.

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## ***Glossary***

Alien – Introduced to Hawai‘i by humans

Crepuscular – Twilight hours

Endangered – Listed and protected under the Endangered Species Act of 1973, as amended (ESA) as an endangered species

*Mauka* – Upslope, towards the mountains

Muridae – Rodents, including rats, mice and voles, one of the most diverse family of mammals

Nocturnal – Night-time, after dark

‘*Ōpe‘ape‘a* – Endemic endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*)

Pelagic – An animal that spends its life at sea – in this case seabirds that only return to land to nest and rear their young

Phylogenetic – The evolutionary order that organisms are arranged by

Sign – Biological term referring to tracks, scat, rubbing, odor, marks, nests, and other signs created by animals by which their presence may be detected

Threatened – Listed and protected under the ESA as a threatened species.

DLNR – Hawai‘i State Department of Land & Natural Resources

ESA – Endangered Species Act of 1973, as amended

USFWS – United State Fish & Wildlife Service

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