ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

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MAR 08 2016

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

Highways Division

February 19, 2016

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OFC. OF ENVIRONMENTAL
QUALITY CONTROL

Mr. Scott Glenn
Interim Director
State of Hawaii
Department of Health
Office of Environmental Quality Control
235 South Beretania Street, Room 702
Honolulu, Hawai'i 96813

Subject: WITHDRAWAL of Final Environmental Assessment
for Kūlanihāko'i Bridge Replacement
Kīhei, Maui, Hawai'i
TMK: (2) 3-9-001:015 (por.), 147 (por.), 162 (por.) and South Kīhei Road Right-of-Way (por.)

Dear Mr. Glenn:

With this letter, the County of Maui, Department of Public Works (DPW) hereby withdraws the final environmental assessment and finding of no significant impact (FEA-FONSI) for the Kūlanihāko'i Bridge Replacement project situated at TMK: (2) 3-9-001:portions of 015, 147, 162 and the South Kīhei Road right-of-way in the Wailuku District on the island of Maui. The FEA-FONSI was published in the *Environmental Notice* on December 8, 2015.

The County of Maui DPW is withdrawing the FEA-FONSI to address two agency comment letters and applicable responses which were inadvertently omitted from the December 8, 2015 publication. In addition, we will address an agency comment letter received after the filing of the final environmental assessment.

If there are questions, please contact Wendy Kobashigawa at (808) 270-7745.

Sincerely,

DAVID C. GOODE
Director of Public Works

Enclosure

DG/WYKK(ED16-124)
S:\ENG\PROJECTS\01 FAP\BR\BR-3100(015) Kulanihakoi Bridge Replacement\C Environmental\EA\Revised FINAL EA (Feb 2016)\FEA Withdrawal\2016.02.19 ED16-124 (final EA withdrawal).doc

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July 2015 Revision

# AGENCY ACTION SECTION 343-5(b), HRS PUBLICATION FORM

**Project Name** Kūlanihāko'i Bridge Replacement
**HRS §343-5 Trigger(s):** Use of County lands and funds
**Island:** Maui
**District:** Wailuku
**TMK:** South Kīhei Road right-of-way, TMK: (2) 3-9-001: 015 (por.), 147 (por.), 162 (por.)

**Proposing/Determination Agency:**

County of Maui Department of Public Works
200 South High Street, 4th Floor
Wailuku, Hawai'i 96793
Contact: Ms. Wendy Kobashigawa
Telephone No.: (808) 270-7745(*Address, Contact Person, Telephone*)

**Accepting Authority:**
*(for EIS submittals only)*

**Consultant:**

Wilson Okamoto Corporation
1907 South Beretania Street, Ste, 400
Honolulu, Hawai'i 96826
Contact: Mr. Milton Arakawa,
Telephone No.: (808) 946-2277

**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); 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); 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); 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). 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); 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); 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.

_x_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 County of Maui Department of Public Works (DPW) is withdrawing the Final Environmental Assessment – Finding of No Significant Impact (FEA-FONSI) for the Kūlanihāko'i Bridge Replacement Project published in the *Environmental Notice* on December 8, 2015.

The County of Maui DPW is withdrawing the FEA-FONSI to address two comment letters and applicable responses which were inadvertently omitted from the December 8, 2015 publication. In addition, an agency comment letter received after the filing of the final environmental assessment will be addressed. The County of Maui DPW intends to incorporate the missed correspondence, the responses and any substantive changes to the text of a revised FEA-FONSI.

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QUALITY CONTROL

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7745
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MAR 08 2016

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

Highways Division

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

February 19, 2016

RECEIVED
'16 FEB 25 A11:37
OFC. OF ENVIRONMENTAL QUALITY CONTROL

Mr. Scott Glenn
Interim Director
State of Hawai'i
Department of Health
Office of Environmental Quality Control
235 South Beretania Street, Room 702
Honolulu, Hawai'i 96813

Subject: REVISED Final Environmental Assessment
for Kūlanihāko'i Bridge Replacement
Kīhei, Maui, Hawai'i
TMK: (2) 3-9-001:015 (por.), 147 (por.), 162 (por.) and South Kīhei Road Right-of Way (por.)

Dear Mr. Glenn:

With this letter, the County of Maui Department of Public Works (DPW) hereby transmits the revised final environmental assessment and finding of no significant impact (RFEA-FONSI) for Kūlanihāko'i Bridge Replacement situated at TMK: (2) 3-9-001:portions of 015, 147, 162 and the South Kīhei Road right-of-way in the Wailuku District on the island of Maui for publication in the next available edition of the Environmental Notice.

The County of Maui DPW withdrew the FEA-FONSI for the project which was published in the Environmental Notice on December 8, 2015 in order to address two agency comment letters and applicable responses which were inadvertently omitted. In addition, an agency comment letter received after the filing of the FEA-FONSI is being addressed. The County of Maui DPW has included copies of comments and responses that it received during the public comment period on the draft environmental assessment and anticipated finding of no significant impact (DEA-AFONSI).

Enclosed is a completed OEQC Publication Form, two copies of the RFEA-FONSI, and Adobe Acrobat file of the same, and an electronic copy of the publication form on MS Word. Simultaneous with this letter, we have submitted the summary of the action in a text file by electronic mail to your office.

If there are questions, please contact Wendy Kobashigawa at (808) 270-7745.

Sincerely,

DAVID C. GOODE
Director of Public Works

Enclosures

DG/WYKK:(ED16-125)
S:\ENG\PROJECTS\01 FAP\BR\BR-3100(015) Kulanihakoi Bridge Replacement\C Environmental\EA\Revised FINAL EA (Feb 2016)\RFEA Transmittal\2016.02.19 ED16-125 (Rev Final EA).doc

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MAR 08 2016



# AGENCY ACTION SECTION 343-5(b), HRS PUBLICATION FORM

**Project Name** Kūlanihāko'i Bridge Replacement
**HRS §343-5 Trigger(s):** Use of County lands and funds
**Island:** Maui
**District:** Wailuku
**TMK:** South Kīhei Road right-of-way, TMK: (2) 3-9-001: 015 (por.), 147 (por.), 162 (por.)

**Proposing/Determination Agency:**
County of Maui Department of Public Works
200 South High Street, 4th Floor
Wailuku, Hawai'i 96793
Contact: Ms. Wendy Kobashigawa
Telephone No.: (808) 270-7745(*Address, Contact Person, Telephone*)

**Accepting Authority:**
*(for EIS submittals only)*

**Consultant:**
Wilson Okamoto Corporation
1907 South Beretania Street, Ste, 400
Honolulu, Hawai'i 96826
Contact: Mr. Milton Arakawa,
Telephone No.: (808) 946-2277

**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); a 30-day comment period ensues upon publication in the periodic bulletin.

_x_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); 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); 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). 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); 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); 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 existing Kūlanihāko'i Bridge is a four (4)-cell concrete box culvert system which spans Kūlanihāko'i Gulch, in Kīhei, Maui, Hawaii. The County of Maui Department of Public Works (DPW) is proposing to replace the existing Kūlanihāko'i Bridge as the existing culverts are structurally deficient and in advanced stages of deterioration The replacement bridge will be constructed with six (6) new culverts; each approximately six 6 feet wide, 4 feet high and 50 feet across South Kīhei Road. New inlet and outlet head walls will also be constructed. The roadway section over the new bridge will be widened from two (2), 10-foot travel lanes with paved shoulders to two (2) 12-foot travel lanes, one in each direction, a 5-foot wide bike lane, a 5-foot wide paved walkway, and a 2.5-foot wide curb and gutter separating the walkway from the roadway on both sides of the bridge. A 4-foot tall traffic rated bridge wall will be constructed on top of the culverts on each side as a traffic barrier for safety purposes. ~~Existing temporary concrete barriers will be replaced with permanent guardrails~~ Guardrails and end connections~~,~~ will be designed to comply with current standards.

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# REVISED FINAL ENVIRONMENTAL ASSESSMENT – FINDING OF NO SIGNIFICANT IMPACT

## *KŪLANIHĀKOʻI BRIDGE REPLACEMENT*
## *Project No. BR-3100 (015)*

## *District of Wailuku, Island of Maui, State of Hawaiʻi*

Prepared For:

**COUNTY OF MAUI**

**DEPARTMENT OF PUBLIC WORKS**

Prepared By:

WILSON OKAMOTO CORPORATION
INNOVATORS • PLANNERS • ENGINEERS

**March 2016**

# Revised Final Environmental Assessment - Finding of No Significant Impact

# KŪLANIHĀKOʻI BRIDGE REPLACEMENT

Project No. BR-3100 (015)

District of Wailuku, Island of Maui, State of Hawaiʻi

Prepared for:
County of Maui
Department of Public Works
200 South High Street, 4th Floor
Wailuku, Hawaiʻi 96793

Prepared by:
Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, Hawaiʻi 96826
WOC Job No. 8256-01

March 2016

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Appendix B Water Quality and Biological Surveys for a Bridge Repair on Lower Kūlanihākoʻi Gulch in Kīhei, Maui. AECOS, Inc. March 2013.

Appendix C An Archaeological Literature Review and Field Inspection for Kūlanihākoʻi Bridge Replacement Project, Kaʻonoʻulu Ahupuaʻa, Wailuku District, Maui Island, TMK: (2) 3-9-001: 999, 015, 147, 162 (pors). Cultural Surveys Hawaiʻi. October 2012.

Appendix D An Archaeological Inventory Survey for the Proposed Kūlanihākoʻi Bridge Replacement Project. Kaʻonoʻulu Ahupuaʻa, Wailuku District, Maui Island, TMK: (2) 3-9-001:999, 162, 143 (pors). Cultural Surveys Hawaiʻi, June 2013.

Letter from State Historic Preservation Division to Cultural Surveys Hawaiʻi, Inc., June 25, 2014.

Appendix E Traffic Assessment Report for the Kūlanihākoʻi Bridge Replacement. Wilson Okamoto Corporation. December 2012.

Appendix F Drainage Report for Kūlanihākoʻi Bridge Replacement South Kīhei Road, Kīhei, Maui, Hawaiʻi. Wilson Okamoto Corporation. March 2013.

Appendix G Pre-Assessment Consultation Comment and Response Letters

Appendix H Draft Environmental Assessment Comment and Response Letters

Appendix I Additional Comment and Response Letters Included in Revised Final Environmental Assessment

## PREFACE

This ~~Draft~~ Revised Final Environmental Assessment (RFEA) / ~~Anticipated~~ Finding of No Significant Impact (FONSI) has been prepared pursuant to Chapter 343, Hawai'i Revised Statutes (HRS), and Title 11, Chapter 200, Hawai'i Administrative Rules (HAR), Department of Health, State of Hawai'i. The County of Maui, Department of Public Works (DPW) is proposing to replace and upgrade the Kūlanihāko'i Bridge in the Kīhei District of the Island of Maui. The project requires the use of County funds and lands, therefore, the project is subject to the State environmental review process.

In addition to using County funds, Federal Highway Administration (FHWA) funds will also be used. Separate documentation will be prepared for the proposed project to satisfy the requirements of the National Environmental Policy Act (NEPA) of 1969, as amended.

Although the Final Environmental Assessment/Finding of No Significant Impact (FEA-FONSI) was published in the December 8, 2015 edition of the *Environmental Notice*, the County of Maui DPW withdrew the FEA-FONSI to address two comment letters and applicable responses which were inadvertently omitted from the December 8, 2015 publication. In addition, an agency comment letter received after the filing of the FEA-FONSI is included in the RFEA-FONSI.

The proposed action assessed herein is for the replacement of the Kūlanihāko'i Bridge. The replacement bridge will be longer and wider than the existing bridge and will also involve several roadway improvements including installation of guardrails, and a dedicated paved walkway and bikeway on the mauka side of the roadway. Also associated with the project is a temporary bridge and bypass road that will be constructed on the mauka side of the Kūlanihāko'i Bridge to accommodate traffic while the bridge is being replaced. ~~It is anticipated that a~~ This RFEA is proposing a Finding of No Significant Impact (FONSI) as no significant impacts are anticipated as a result of implementing the proposed project. ~~will be issued and filed with the State Office of Environmental Quality Control (OEQC) by the approving agency following public review of the Draft EA.~~

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## SUMMARY

| | |
|---|---|
| **Proposing Agency:** | County of Maui, Department of Public Works |
| **Approving Agency:** | County of Maui, Department of Public Works |
| **Location:** | Kīhei, Maui, Hawai‘i |
| **Tax Map Keys (TMKs):** | (2) 3-9-001: 015 (por.), 147 (por.), 162 (por.) and South Kīhei Road Right-of-Way (por.) |
| **Recorded Fee Owner:** | County of Maui and ~~Kenranes Ltd.~~ Valley Isle Ventures, LLC |
| **Existing Use:** | Public roadway with shoulders and a four (4) cell culvert bridge supporting the road over the Kūlanihāko‘i Gulch. |
| **State Land Use Classification:** | Urban |
| **Community Plan Designation:** | Open Space and Park |
| **County Zoning Designation:** | Drainage (DR), Park (PK), and Apartment (A-1) |
| **Proposed Action:** | The proposed action assessed herein is for the replacement of the Kūlanihāko‘i Bridge. The replacement bridge will be longer and wider than the existing bridge and will also involve several roadway improvements including installation of guardrails, and a dedicated paved walkway and bikeway on the mauka side of the roadway. Also associated with the project is a temporary bridge and bypass road that will be constructed on the mauka side of the Kūlanihāko‘i Bridge to accommodate traffic while the bridge is being replaced. |
| **Impacts:** | No significant impacts are anticipated from the construction and operation of the proposed improvements. Construction activities are anticipated to have short-term noise, traffic, and air quality impacts in the surrounding area. Construction noise and air quality impacts will be minimized by compliance with applicable State Department of Health Rules. No significant long-term environmental or community impacts in the vicinity of the project site are anticipated. |
| **~~Anticipated~~ Determination:** | Finding of No Significant Impact (FONSI) |

**Parties Consulted During Pre-Assessment:**

Federal Agencies
U.S. Army Corps of Engineers (COE)
U.S. Fish and Wildlife Service
National Oceanic and Atmospheric Administration (NOAA) – National Marine Fisheries Service

State Agencies
Department of Accounting and General Services
Department of Business, Economic Development & Tourism (DBEDT)
DBEDT, Land Use Commission
DBEDT, Office of Planning
Department of Education
Department of Health (DOH)
DOH, Clean Water Branch
DOH, Environmental Management Division
DOH, Environmental Planning Office
DOH, Office of Environmental Quality Control
Department of Land and Natural Resources (DLNR)
DLNR, Engineering Division
DLNR, Land Division
DLNR, State Historic Preservation Division
DLNR, Office of Conservation and Coastal Lands
Department of Transportation
Office of Hawaiian Affairs

County of Maui Agencies
Department of Environmental Management
Department of Fire and Public Safety
Department of Parks and Recreation
Department of Planning
Department of Public Works
Department of Transportation
Department of Water Supply
Police Department

Other Interested Parties and Individuals
Kīhei Community Association

**Draft Environmental Assessment Consultation:**

The Draft Environmental Assessment for the Kūlanihāko'i Bridge Replacement was published in the Office of Environmental Quality Control Environmental Notice of July 8, 2013. Publication initiated a 30-day public review period ending on August 7, 2013.

The Draft Environmental Assessment was distributed to the following agencies, organizations and interested parties and individuals for review.

Federal Agencies
U.S. Army Corps of Engineers (COE)
  COE, Civil Works Technical Branch
  COE, Regulatory Branch
U.S. Fish and Wildlife Service
U.S. Geological Survey
National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service

State Agencies
Department of Business, Economic Development, and Tourism (DBEDT)
  DBEDT, Office of Planning
Department of Health (DOH)
  DOH, Clean Water Branch
  DOH, Environmental Planning Office
  DOH, Office of Environmental Quality Control
Department of Land and Natural Resources (DLNR)
  DLNR, Engineering Division
  DLNR, Land Division
  DLNR, Office of Conservation and Coastal Lands
  DLNR, State Historic Preservation Division
Office of Hawaiian Affairs
University of Hawai'i Environmental Center
Department of Transportation

County of Maui
Department of Environmental Management
Department of Fire and Public Safety
Department of Parks and Recreation
Department of Planning
Department of Public Works
Department of Transportation
Department of Water Supply
Police Department

Utility Companies
Maui Electric Company
Oceanic Time Warner Cable
Hawai'i Gas
Hawaiian Telcom

Other Interested Parties and Individuals

Kīhei Community Association
Kenranes, Ltd.

# 1. INTRODUCTION

## 1.1 Project Location

The County of Maui, Department of Public Works (DPW) proposes to replace and upgrade the Kūlanihākoʻi Bridge, which spans Kūlanihākoʻi Gulch, in Kīhei, Maui, Hawaiʻi. Kūlanihākoʻi Bridge is located on South Kīhei Road approximately 200 feet south of the South Kīhei Road and Kaʻonoʻulu Street intersection (see Figure 1-1). The project area is further identified as Tax Map Key (TMK) (2) 3-9-001:015 (por.), 147 (por.) and 162 (por.), and a portion of the South Kīhei Road right-of-way (see Figure 1-2).

### 1.1.1 Existing Uses

South Kīhei Road, in the vicinity of Kūlanihākoʻi Bridge currently consists of two (2) 10-foot wide travel lanes (one lane in each direction) with shoulders ranging from 4.2 to 5.6 feet wide. Currently, there are temporary concrete barriers placed along both sides of the bridge (see Figure 1-3).

The bridge is a four-cell concrete box culvert system and each cell is six (6) feet wide and four (4) feet high by 38-feet across South Kīhei Road. South Kīhei Road extends 27-feet and nine inches over the four cell box culvert. Since the box culverts span more than 20-feet, it is considered a “bridge” (see Figure 1-4).

### 1.1.2 Surrounding Uses

The project site is bounded by Kaʻonoʻulu Street to the north, Kīhei Bay Vista and the Hawaiian Islands Humpback Whale National Marine Sanctuary to the south, the Kūlanihākoʻi Gulch to the east, and Kalepoleopo Beach Park to the west (see Figure 1-5).

In addition, there are various resorts and residential areas mauka of the project site, including the Aston Maui Lu Resort to the northeast, the Kaʻonoʻulu Estates to the east, and the Kīhei Bay Vista and Kīhei Bay Surf to the southeast.

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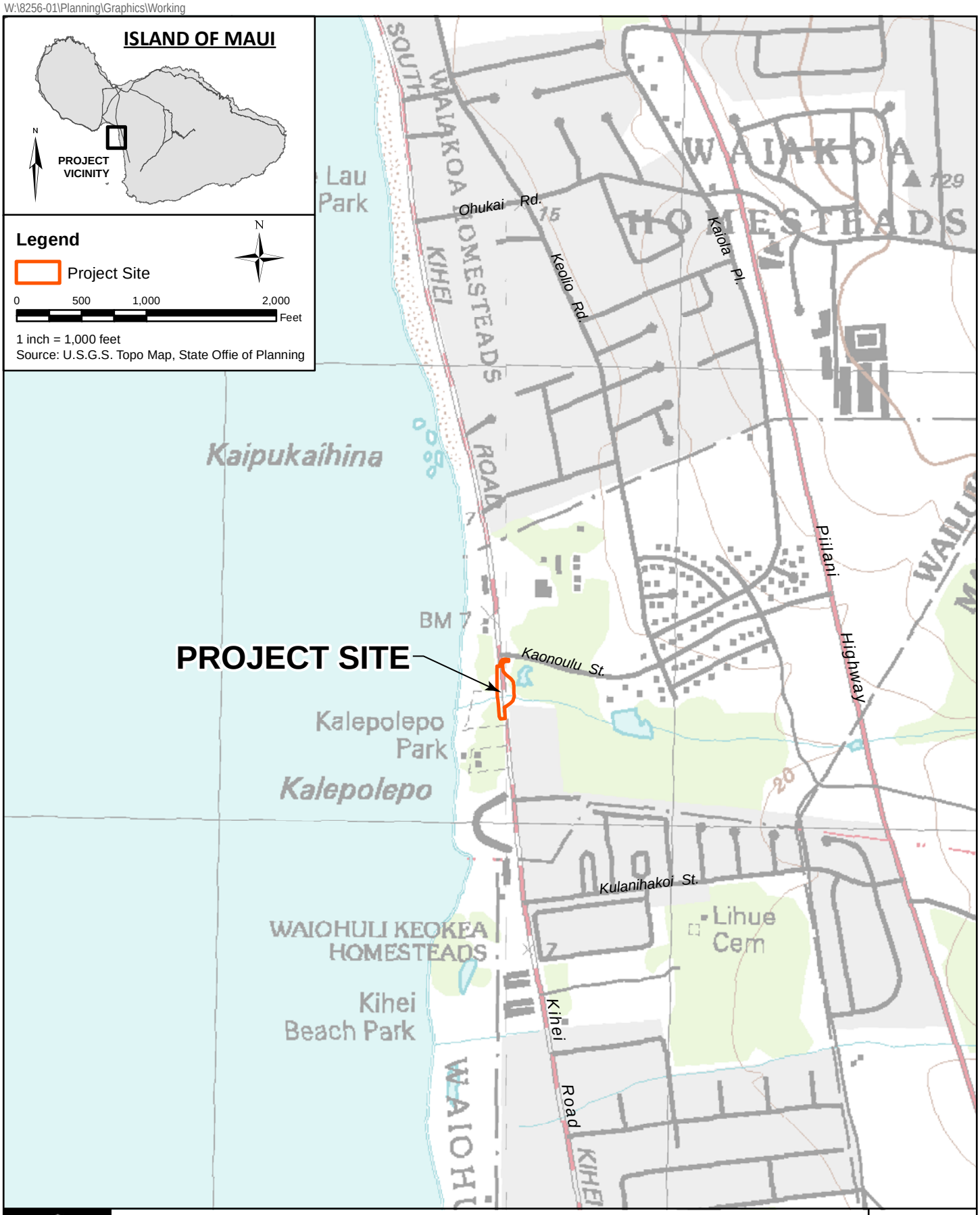


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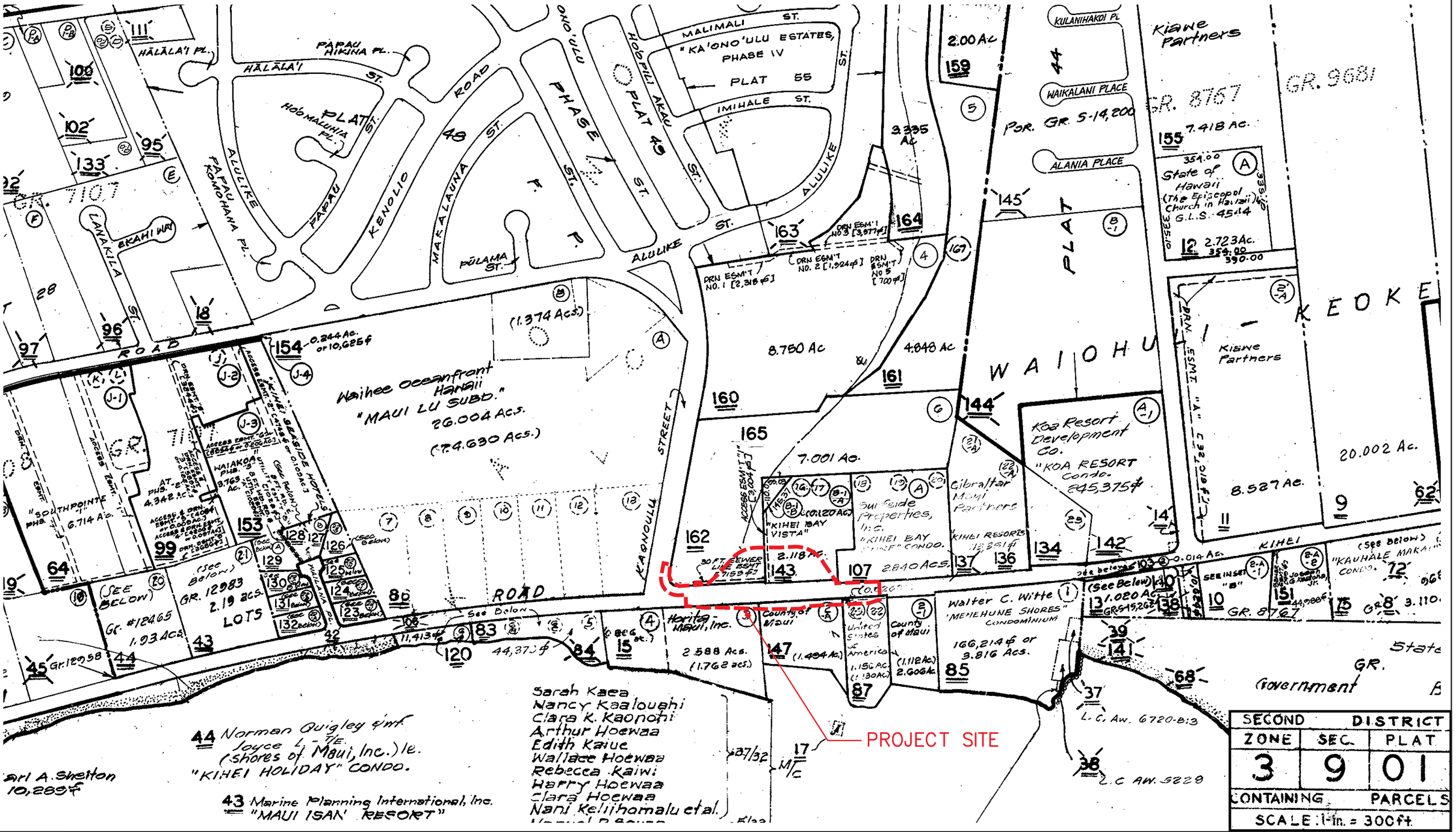
KULANIHAKOI BRIDGE REPLACEMENT

LOCATION MAP

FIGURE

1-1




KULANIHAKOI BRIDGE REPLACEMENT

TAX MAP KEY 3-9-001

FIGURE 1-2

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Photograph 1: View of South Kihei Road looking south

Photograph 2: View of South Kihei Road looking north

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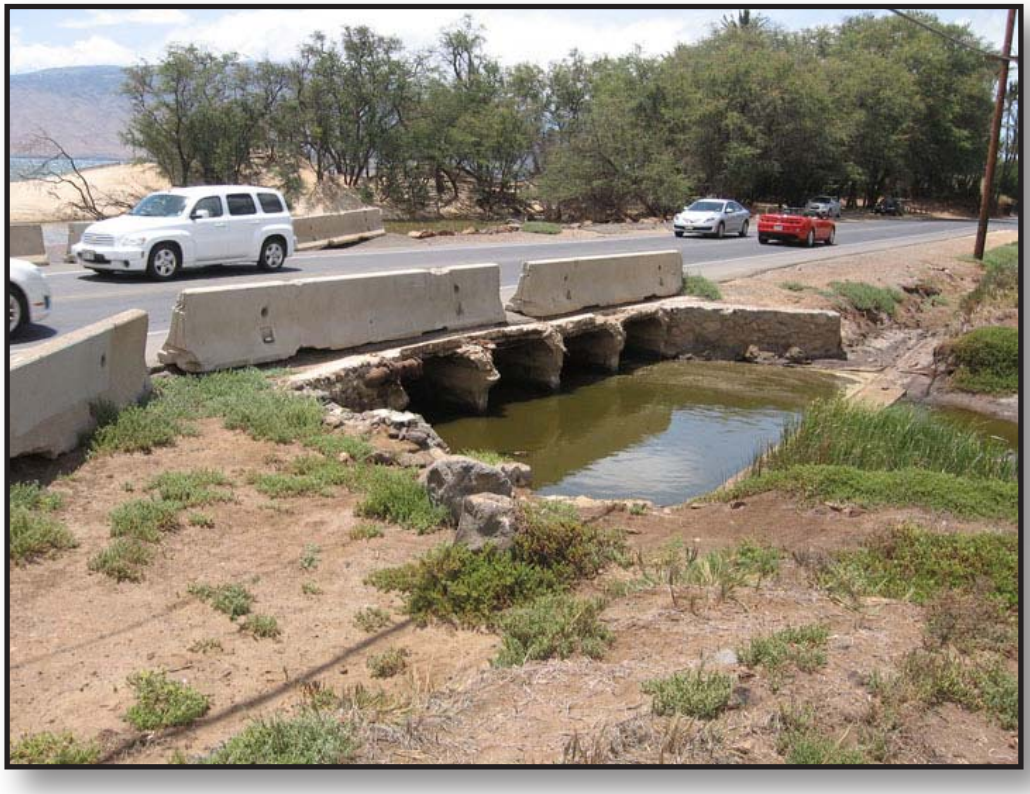
KULANIHAKOI BRIDGE REPLACEMENT

**EXISTING SOUTH KIHEI ROAD PHOTOS**

FIGURE

1-3



Photograph 3: View of Kulanihakoi Bridge inlet looking northeast

Photograph 4: View of Kulanihakoi Bridge outlet looking southeast

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KULANIHAKOI BRIDGE REPLACEMENT

**EXISTING KULANIHAKOI BRIDGE PHOTOS**

FIGURE

1-4

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KULANIHAKOI BRIDGE REPLACEMENT

## SURROUNDING LAND USE MAP

FIGURE

1-5

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# 2. PROJECT DESCRIPTION

## 2.1 Project Purpose and Need

The existing culverts are structurally deficient and in advanced stages of deterioration. The County of Maui bridge inspection report, dated January 2011, notes that the culverts and retaining walls are in critical condition. There are numerous delaminations, spalls with exposed rebar, and rebar that has been corroded away in the 4-cell reinforced concrete culvert. There are also major problems with embankment erosion and adequacy of opening.

A more recent bridge inspection report, dated March 2012, notes that Kūlanihāko'i Bridge is in a very deteriorated condition, with exposed reinforcement and crumbling concrete, severe spalling and advanced corrosion of the reinforcing of the top slab of the culvert. The report recommends that immediate repairs or shoring of the top slab be implemented. If left unrepaired there is a risk of possible collapse of the existing culverts due to vehicles traversing over it. Based on the results of the bridge inspection report, the sufficiency rating of the bridge is rated 2.0 on a scale of 0 to 100 with 100 representing a bridge fully meeting current design standards. The recommendation of the inspection report is to replace the bridge.

In addition, the ~~existing~~ traffic safety features of the bridge ~~do~~ did not meet current standards. ~~Currently, only~~ Only temporary concrete barriers ~~are~~ were located along both sides of the bridge on South Kīhei Road. There ~~are~~ were no approach guardrails or transitions at either ends of the bridge. This ~~results~~ resulted in the ends of the portable bridge parapets to be exposed to traffic.

Since the existing culverts are in very deteriorated condition, the County implemented an emergency temporary repair which involved construction of an emergency temporary steel bridge over the existing culverts to avoid the risk of possible collapse. Separate permits and approvals were obtained for the emergency repair.

~~Roadway~~ In the long-term, roadway improvements to South Kīhei Road are also necessary as there is a need for enhanced safety for vehicles, pedestrians and bicyclists. ~~Currently~~ Prior to the emergency repair, pedestrians and bicyclists ~~share~~ shared existing paved roadway shoulders on both sides of South Kīhei Road ranging in width from approximately 4.2 to 5.6 feet.

## 2.2 Project Description

The proposed project involves the replacing the existing bridge as well as various roadway improvements. The proposed improvements are described below (see Figures 2-1 to 2-4):

The existing Kūlanihāko'i Bridge, which is comprised of four culverts, will be replaced with a longer and wider bridge consisting of six (6) culverts. Prior to construction of the new culverts, the existing emergency temporary bridge and guardrails will need to be removed. Then, the existing four (4) culverts will need to be demolished and removed along with the existing inlet and outlet headwalls and temporary concrete barriers. Once the existing four (4) culverts are removed, the foundation for the new culverts will need to be installed. The

base would be excavated to accommodate an 8-inch thick gravel layer or similar structural fill.

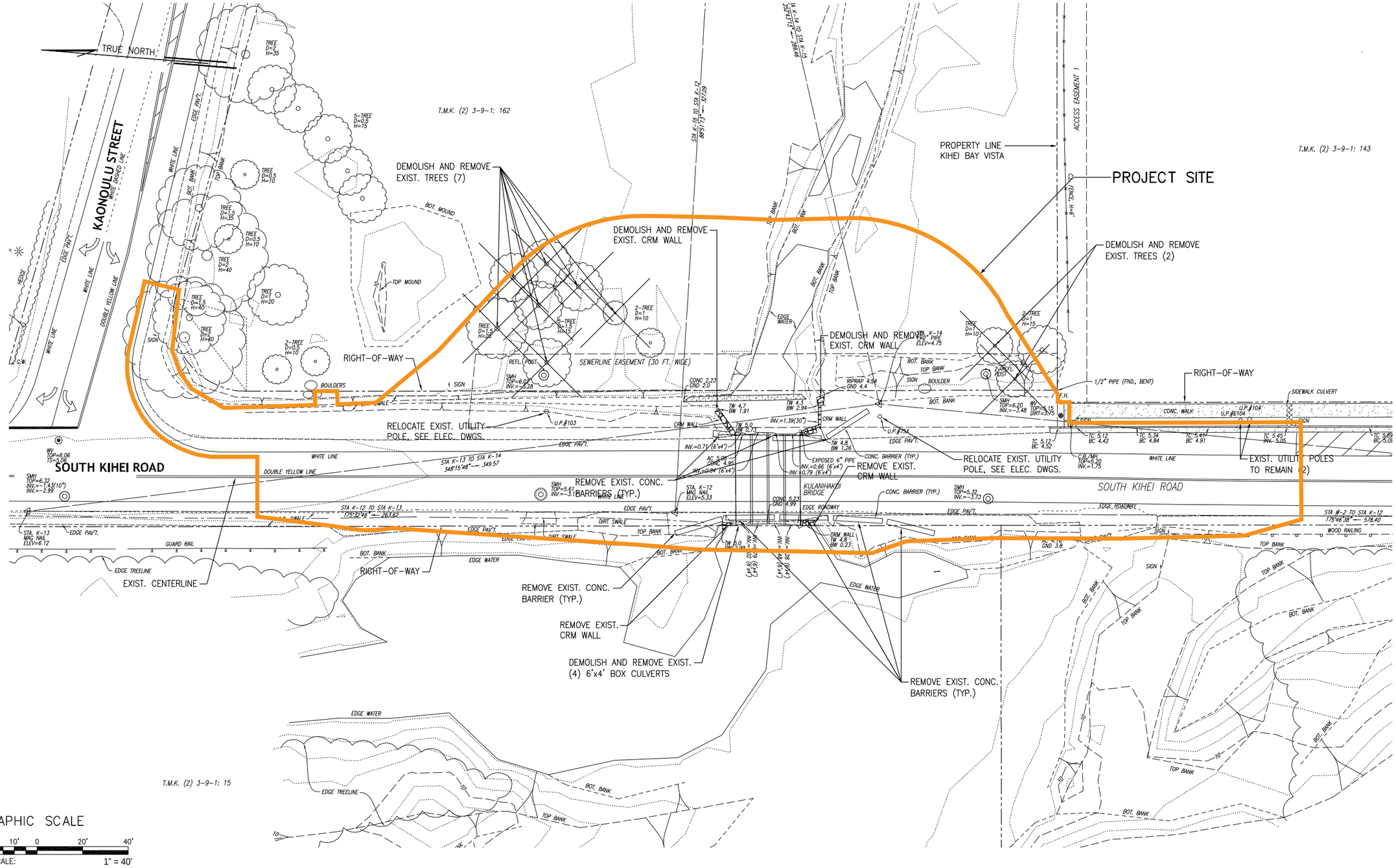
The replacement bridge will be constructed with six (6) new culverts; each approximately six (6) feet wide, four (4) feet high and 50 feet across South Kīhei Road. The pre-cast concrete culverts will be approximately one (1) foot thick. Thus, the new bridge will extend approximately 50-feet across South Kīhei Road. The six (6) culverts, placed side by side, would extend approximately 48-feet within the South Kīhei Road right-of-way. The culverts will be cast at an off-site location and then trucked to the project site where a crane will be used to lower the culverts into place. The invert of the culverts will sit at sea level. Inlet and outlet head walls will also be constructed. The inlet and outlet head walls will be one foot thick, constructed of concrete rubble masonry ~~and will be cast-in-place~~.

The roadway section over the replacement bridge will be widened from two (2), 10-foot travel lanes with paved shoulders to two (2) 12-foot travel lanes, one in each direction, a 5-foot wide bike lane, a 5-foot wide paved walkway, and a 2.5-foot wide curb and gutter separating the walkway from the roadway on both sides of the bridge. A 4-foot tall traffic rated bridge wall will be constructed on top of the culverts on each side as a traffic barrier for safety purposes. The bridge wall will be constructed of stone masonry and would be 1-foot thick. ~~The temporary concrete barriers will be replaced with permanent~~ Permanent guardrails and end connections~~,~~ will also be installed and designed to comply with current standards.

Roadway improvements to South Kīhei Road in the vicinity of the bridge include widening the roadway on the mauka side to accommodate a 5-foot wide bike lane and a 5-foot wide paved walkway with a 2.5-foot wide curb and gutter separating the walkway from the roadway. There is an existing paved walkway that terminates at the northern end of the Kīhei Bay Vista property approximately 100 feet south of the bridge. From this point, the project intends to extend the paved walkway over the new bridge until it reaches Ka‘ono‘ulu Street where it connects with an existing paved shoulder. The curb and gutter and the bike lane would follow the same route as the proposed walkway. From the bridge, the proposed improvements extend along the mauka side of the road, approximately 300 linear feet.

The proposed improvements will include a 5-foot wide bike lane and a 5-foot wide paved walkway on the makai side of the bridge. Since there are no existing sidewalk connections on the makai side of the road in close proximity of the bridge, there are limited extensions, approximately 50 feet north and 100 feet south. If and when future improvements are pursued on the makai side of South Kīhei Road, further curb, gutter, sidewalk and bike lane improvements can be implemented.

Due to the widening of the roadway, installation of a new 24-inch drain line on the mauka side of the roadway, north of the bridge, will be required to replace the existing dirt swale which currently collects runoff from the road. However, this swale would be paved over to accommodate the proposed widening. The proposed 24-inch drain line would collect the runoff from a headwall inlet that would be constructed on the mauka side of the roadway near the intersection of South Kīhei Road and Ka‘ono‘ulu Street. From there it would connect to a manhole and then traverse beneath the roadway until it reaches the bridge where it would connect with the northern most culvert. There is also an existing 30-inch drain line on the mauka and south side of the bridge which collects road runoff from an area




**KULANIHAKOI BRIDGE REPLACEMENT**

**DEMOLITION PLAN**

FIGURE 2-1

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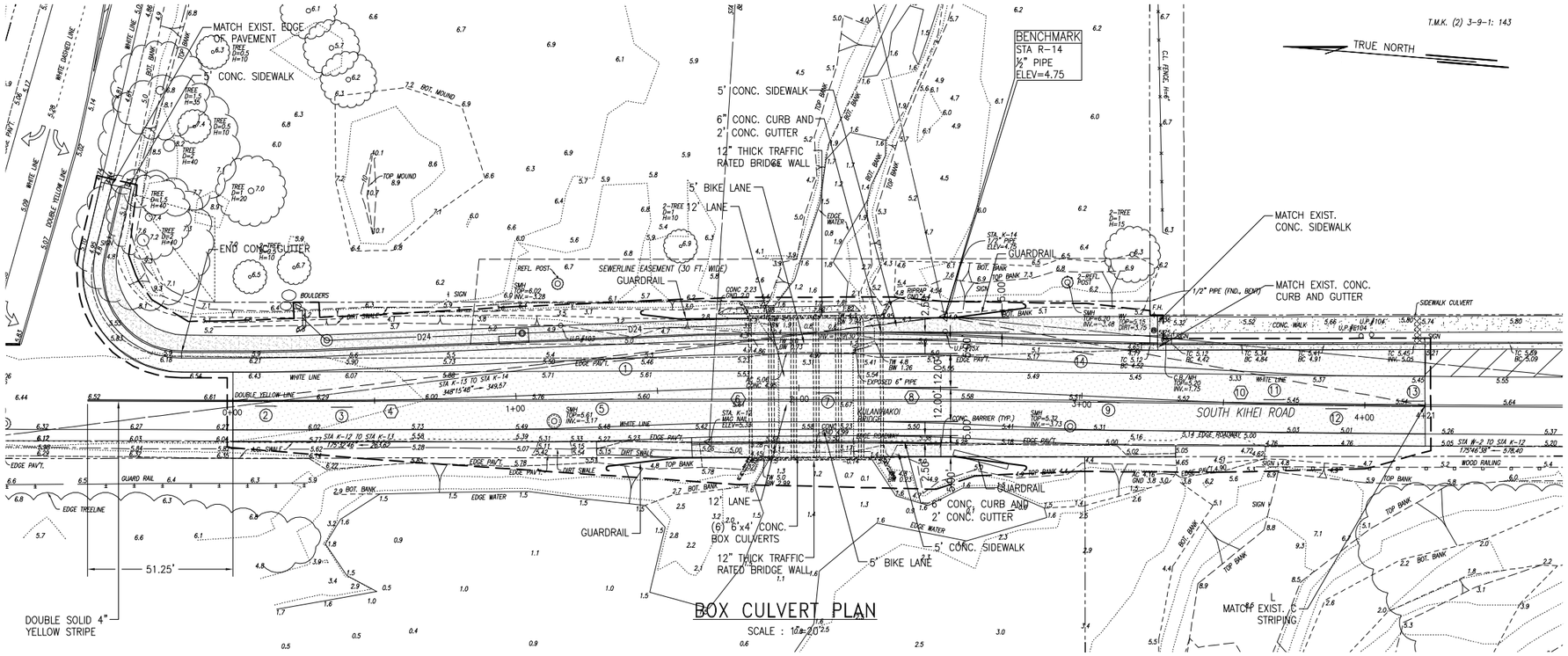
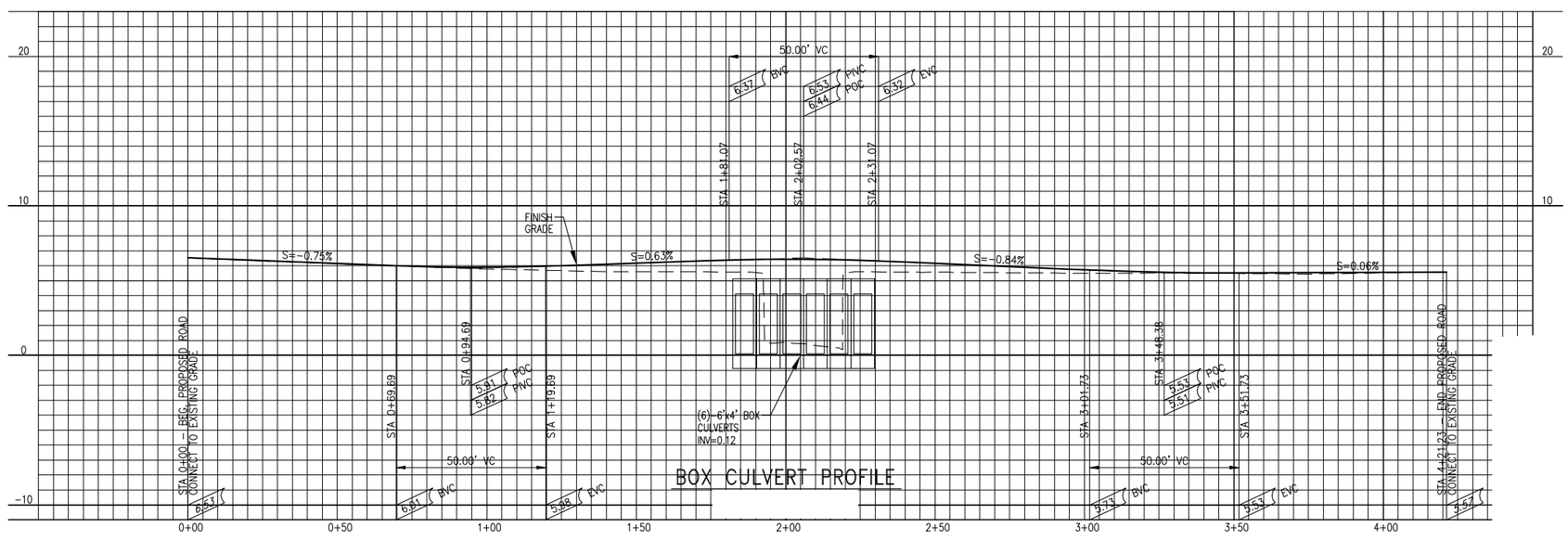



## BOX CULVERT PLAN

SCALE : 1"=20'




## BOX CULVERT PROFILE

GRAPHIC SCALE

4' 2' 0 4' 8'

20' 10' 0 20' 40'

LEGEND

NEW A.C. PAVEMENT

NEW CONCRETE PAVEMENT OR WALKWAY

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KULANIHAKOI BRIDGE REPLACEMENT

**BOX CULVERT PLAN AND PROFILE**

FIGURE 2-2

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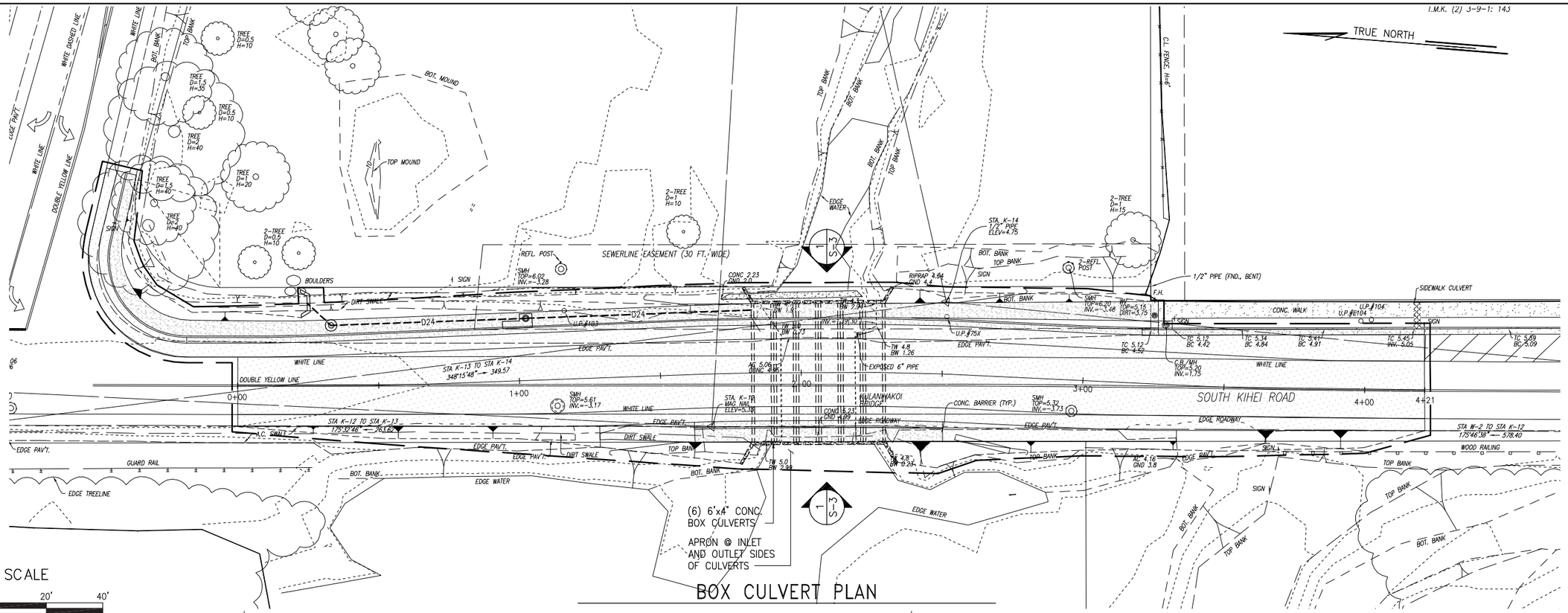
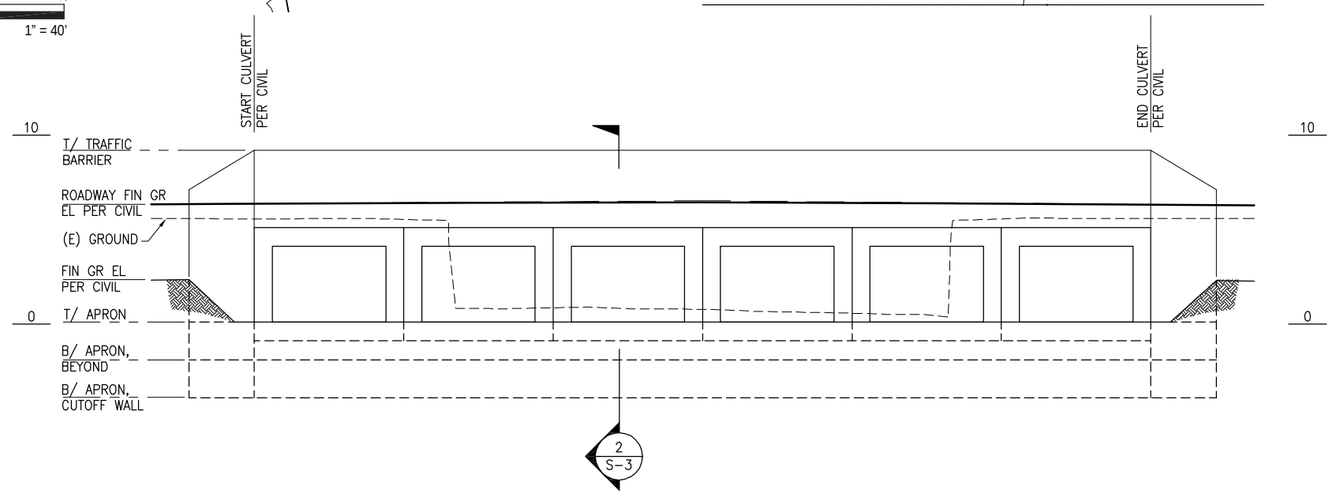



## BOX CULVERT PLAN

GRAPHIC SCALE

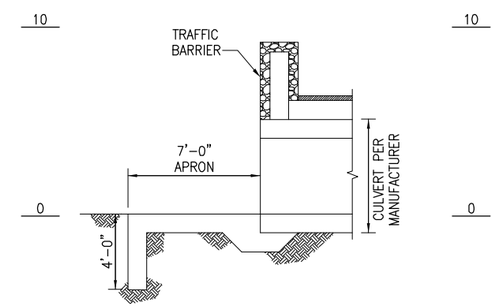
20' 10' 0 20' 40'

SCALE: 1" = 40'




1 S-3 WALL ELEVATION

SCALE: 1/4"=1'-0"




2 S-3 SECTION

SCALE: 1/4"=1'-0"

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KULANIHAKOI BRIDGE REPLACEMENT

**BOX CULVERT PLAN**

FIGURE 2-3

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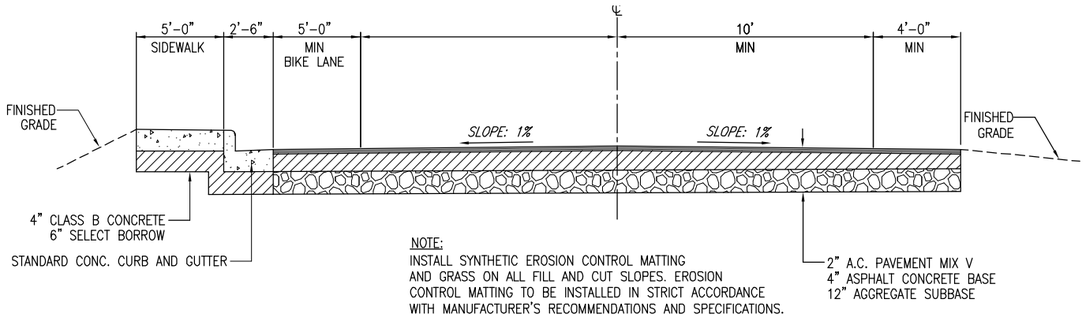
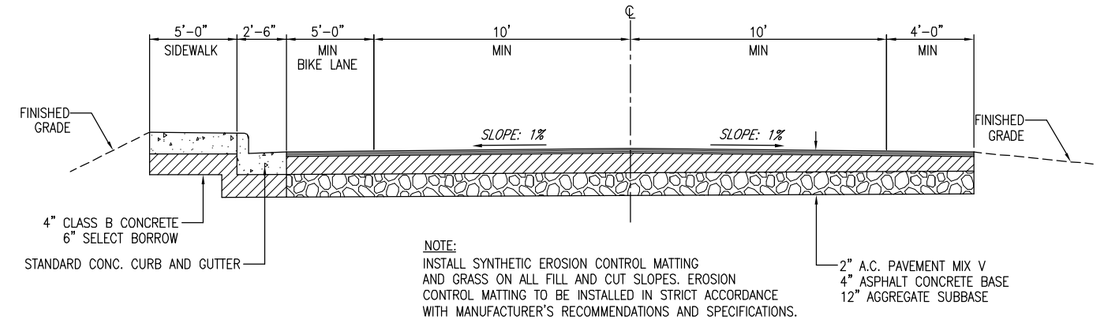


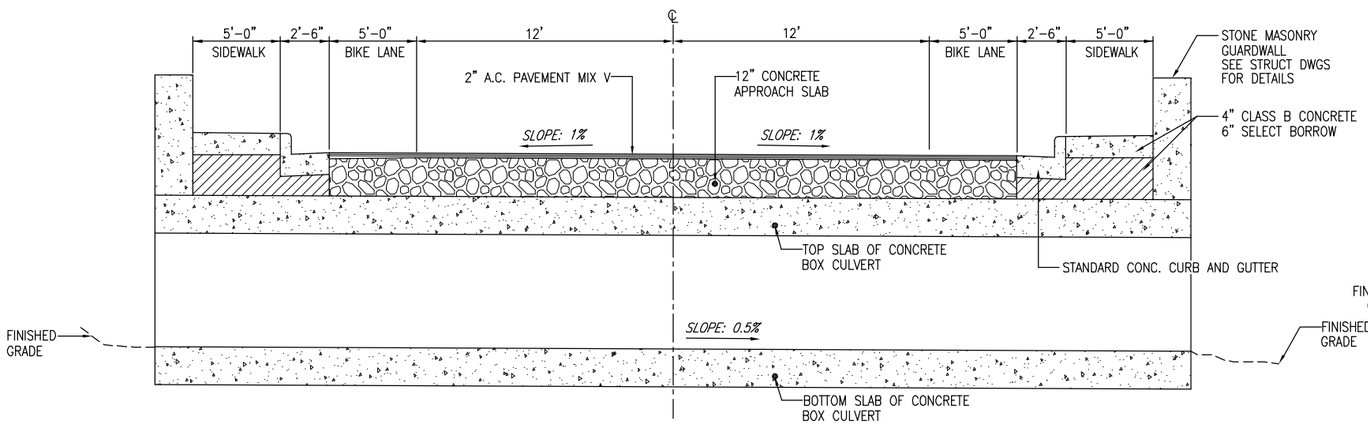

A / C-3 TYPICAL SECTION - ROAD SECTION STA. 0+00 TO 1+82.37

NOT TO SCALE



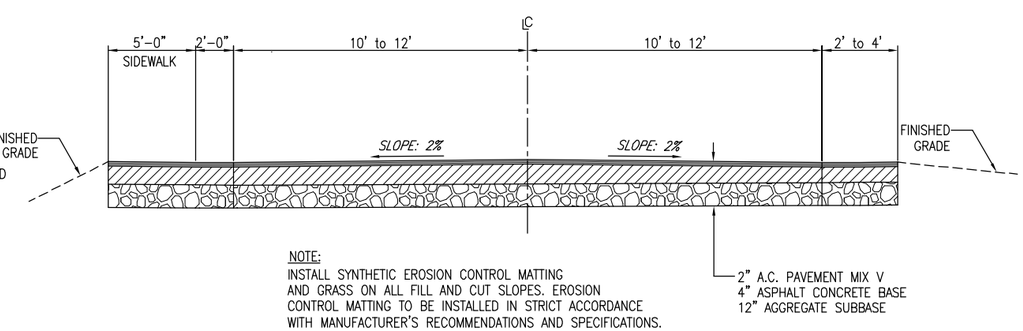

C / C-3 TYPICAL SECTION - ROAD SECTION STA. 2+29.77 TO 4+21.23

NOT TO SCALE




B / C-3 TYPICAL SECTION - ROAD SECTION STA. 1+82.37 TO 2+29.77

NOT TO SCALE




D / C-3 TYPICAL SECTION - BYPASS ROAD SECTION STA. 0+00 TO 1+98.53 AND ROAD SECTION STA. 2+68.53 TO 4+32.34

NOT TO SCALE

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KULANIHAKOI BRIDGE REPLACEMENT

**TYPICAL SECTIONS**

FIGURE 2-4

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near Kīhei Bay Vista that will be left in place. However, a new outlet into the southernmost culvert will be needed.

Widening of the roadway will also require the relocation of two (2) electrical utility poles as the poles are currently located in the area planned for the paved walkway. The poles will be relocated near their existing location, but closer to the mauka edge of the road right-of-way. The relocation of the electrical poles will be coordinated with the Maui Electric Company (MECO) prior to construction.

In addition, as the new culverts extend farther across South Kīhei Road than the existing culverts, a portion of an existing 12-inch waterline located on the mauka side of the existing bridge will need to be relocated under the new culverts. The relocated waterline is proposed to be encased in a concrete jacket.

During construction of the replacement bridge, that portion of South Kīhei Road would not be usable. Thus, prior to the removal of the existing culverts and the construction of the replacement bridge, a temporary bridge and bypass road will need to be constructed on the mauka side of the existing bridge to accommodate traffic along South Kīhei Road during construction. Construction of the temporary bridge and bypass road is described below (see Figure 2-5 and Figure 2-6).

The temporary steel panel bridge and bypass road will be constructed on the mauka side of the existing bridge. The temporary bridge will be approximately 31-feet wide and span approximately 70-feet over the drainageway. The steel panels on each side of the bridge are approximately 3.5-feet wide, leaving enough room to accommodate two, 12-foot travel lanes, one in each direction. The mauka side of the temporary bridge will include a 5-foot wide suspended walkway (see Figure 2-7). Prior to construction of the temporary steel bridge, an area on both sides of the temporary bridge will need to be cleared and excavated to construct the concrete footings that will support the temporary bridge. The area of the footings would not exceed 20-feet by 38-feet on each side of the bridge. The depth of excavation is expected to exceed 3.5-feet. The bridge will be assembled in sections off-site and trucked over to the project site for installation.

Construction of the temporary bypass road on both sides of the temporary bridge will also include two, 12-foot travel lanes, one in each direction and a temporary 5-foot wide temporary sidewalk on the mauka side of the roadway (refer back to Figure 2-4). The route of the bypass road is currently undeveloped and covered with vegetation that would need to be removed prior to roadway construction (refer back to Figure 2-1). In addition, the slope of the ground in this area varies slightly and will require cut and fill activities to create a level area for the temporary road.

After completion of the permanent culvert improvements, the temporary bridge and bypass road would be removed.

It should be noted that ~~there is another set of~~ emergency temporary bridge improvements ~~being proposed~~ were recently completed in January 2015 as an emergency temporary repair. This was prompted by the March 2012 County of Maui Bridge Inspection Report which showed accelerated deterioration of the existing culverts. The report recommends that

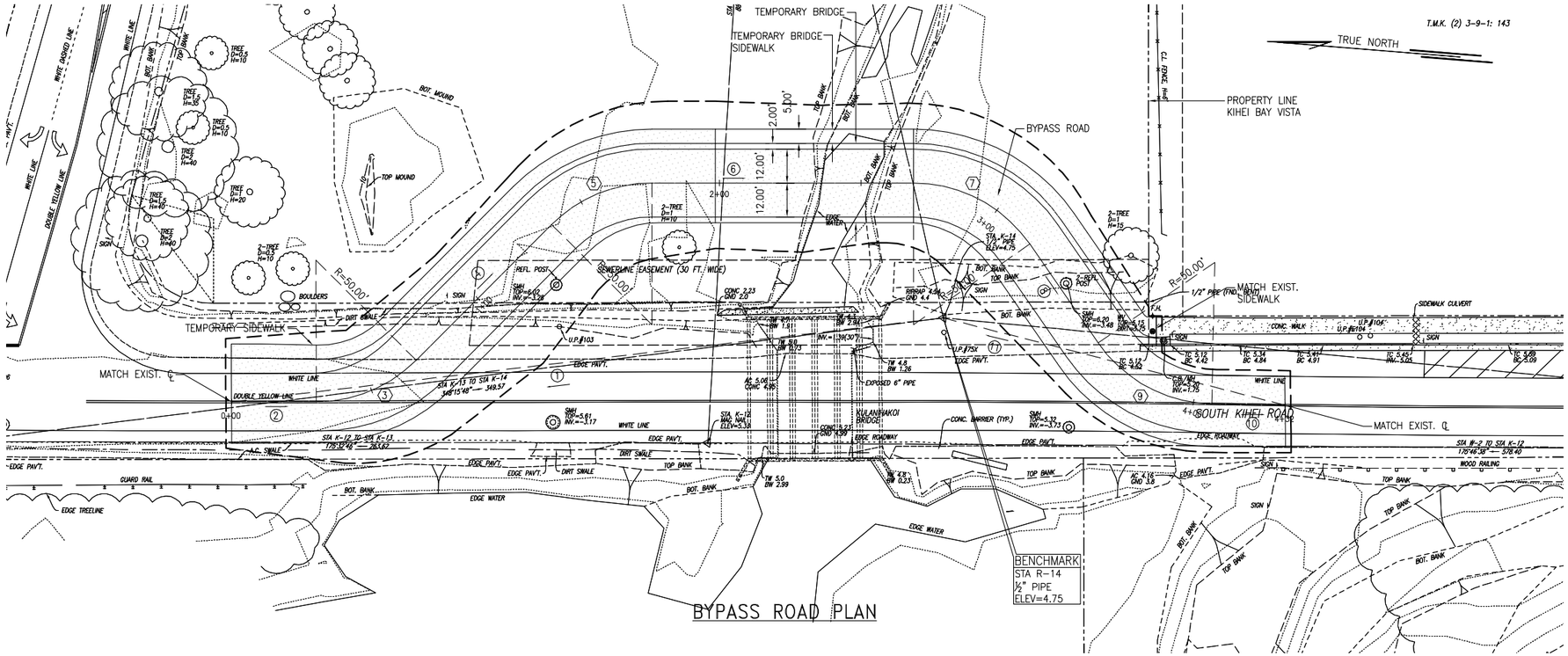
immediate repairs or shoring of the top slab of the existing bridge be implemented to eliminate the risk of possible collapse of the existing culverts due to vehicles traversing over it. Therefore, in response to this recommendation, while waiting for the new bridge to be constructed, the DPW has decided to construct an emergency temporary steel bridge over the existing culverts to avoid such risk.

This has been prompted by the accelerated deterioration of the existing bridge as well as the projection that design, permitting, and construction for the temporary bridge and bypass road mauka of the existing bridge is not expected to be completed until ~~2015~~ 2019 assuming all applicable approvals are obtained. ~~An emergency temporary bridge over the road is less complicated regarding permitting and can be constructed by 2013.~~ Because of the need to expedite construction of the emergency temporary bridge over South Kīhei Road, a Special Management Area (SMA) Assessment ~~has been~~ was granted on March 4, 2013. However, since the construction of the replacement bridge will need sufficient space for the new culverts to be installed by crane, the temporary bridge and bypass road on the mauka side of the existing bridge would still be necessary. Once the temporary bridge and bypass road mauka of the existing bridge is constructed, the emergency temporary bridge over the existing culverts would be disassembled and removed.

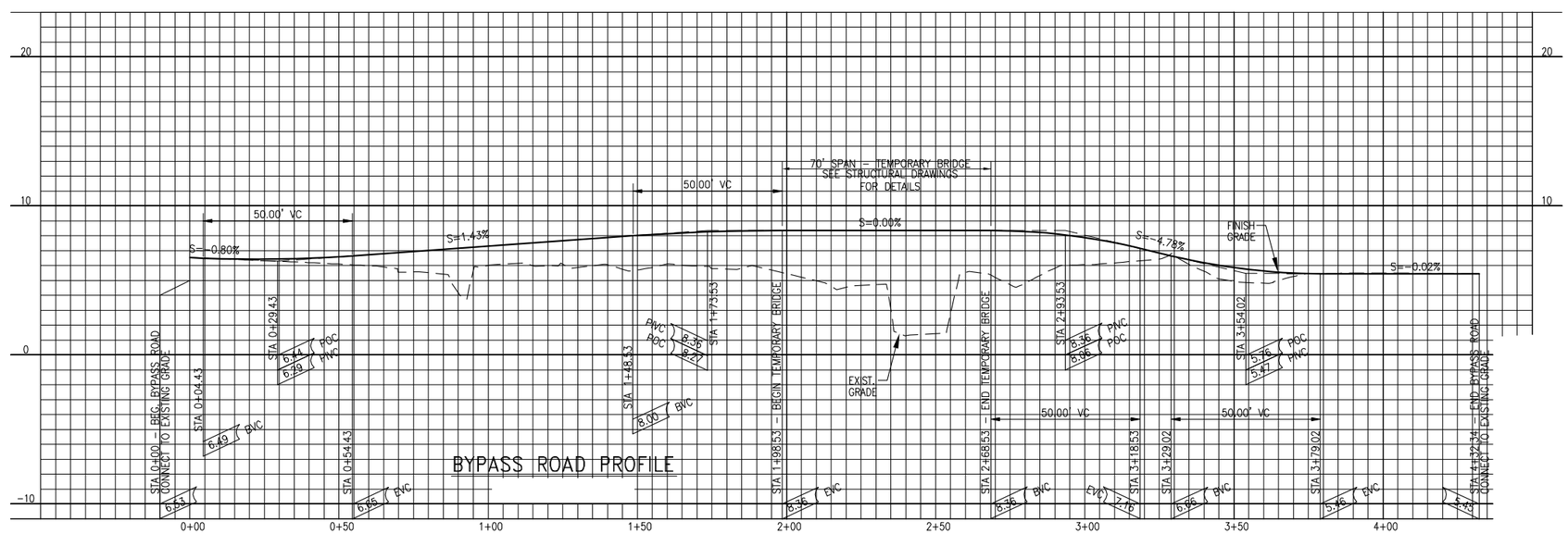
It is noted that the project involves the installation of six (6) new culverts rather than four (4) culverts as the six (6) culverts will provide an incremental increase in drainage capacity from approximately 204 cfs to 306 cfs (assuming the outlet is not blocked) while still remaining feasible. However, ocean wave action results in sand plugs of varying heights and sizes which blocks the ocean outlet. When substantial storm flows occur, this may be sufficient to open the plug. However, it is noted that the drainageway immediately mauka of the proposed project is relatively flat and undefined. Thus, substantial storm flows overtop the relatively flat drainageway and provides a limitation to provision of greater additional capacity. Moreover, the existing built environment provides limitations on increasing drainage volume horizontally and vertically under South Kīhei Road. While the proposed project does slightly increase drainage capacity and decrease flood risk, it is not intended to address flooding issues on a regional basis.

## 2.3 Project Cost and Schedule

Construction of the proposed project is anticipated to commence by the first quarter of ~~2015~~ 2019 with completion approximately nine (9) months later. The project cost is estimated at $3.6 million, which will be funded by the County and FHWA.




BYPASS ROAD PLAN




BYPASS ROAD PROFILE

GRAPHIC SCALE

SCALE: 1"=4'

SCALE: 1"=20'

LEGEND

NEW A.C. PAVEMENT

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KULANIHAKOI BRIDGE REPLACEMENT

**BYPASS ROAD PLAN AND PROFILE**

FIGURE 2-5

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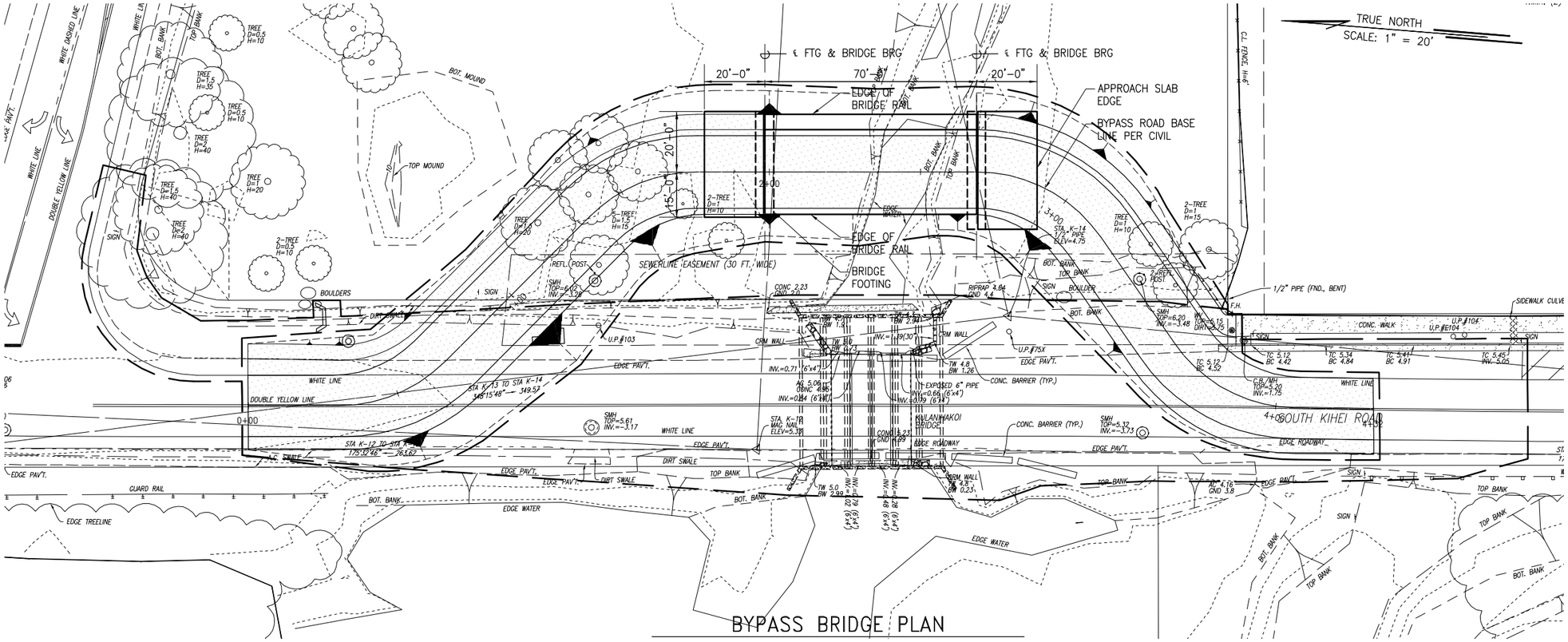
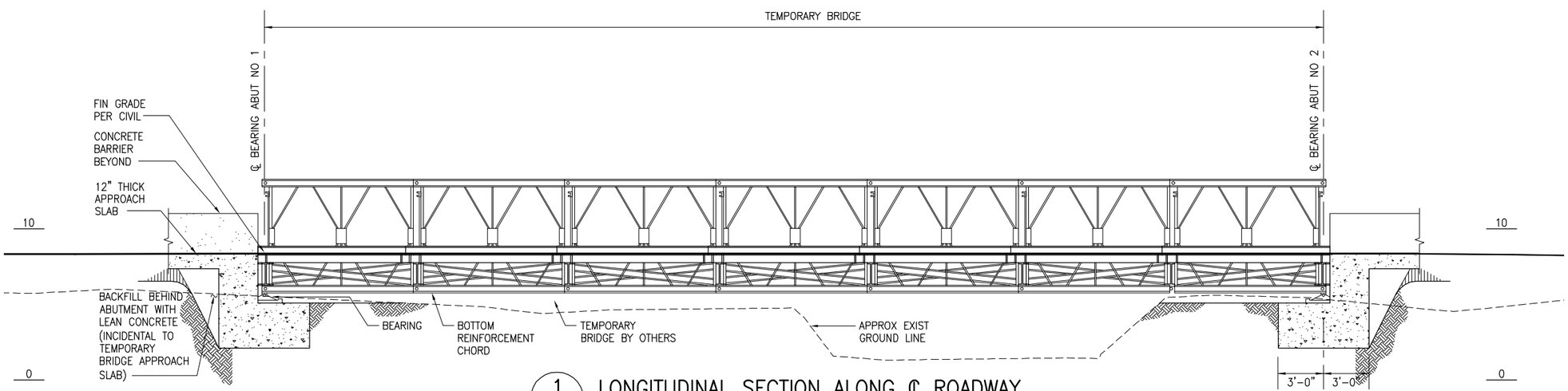



BYPASS BRIDGE PLAN




1 / S-2 LONGITUDINAL SECTION ALONG ℄ ROADWAY

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**KULANIHAKOI BRIDGE REPLACEMENT**

**BYPASS ROAD PLAN AND LONGITUDINAL SECTION**

FIGURE 2-6

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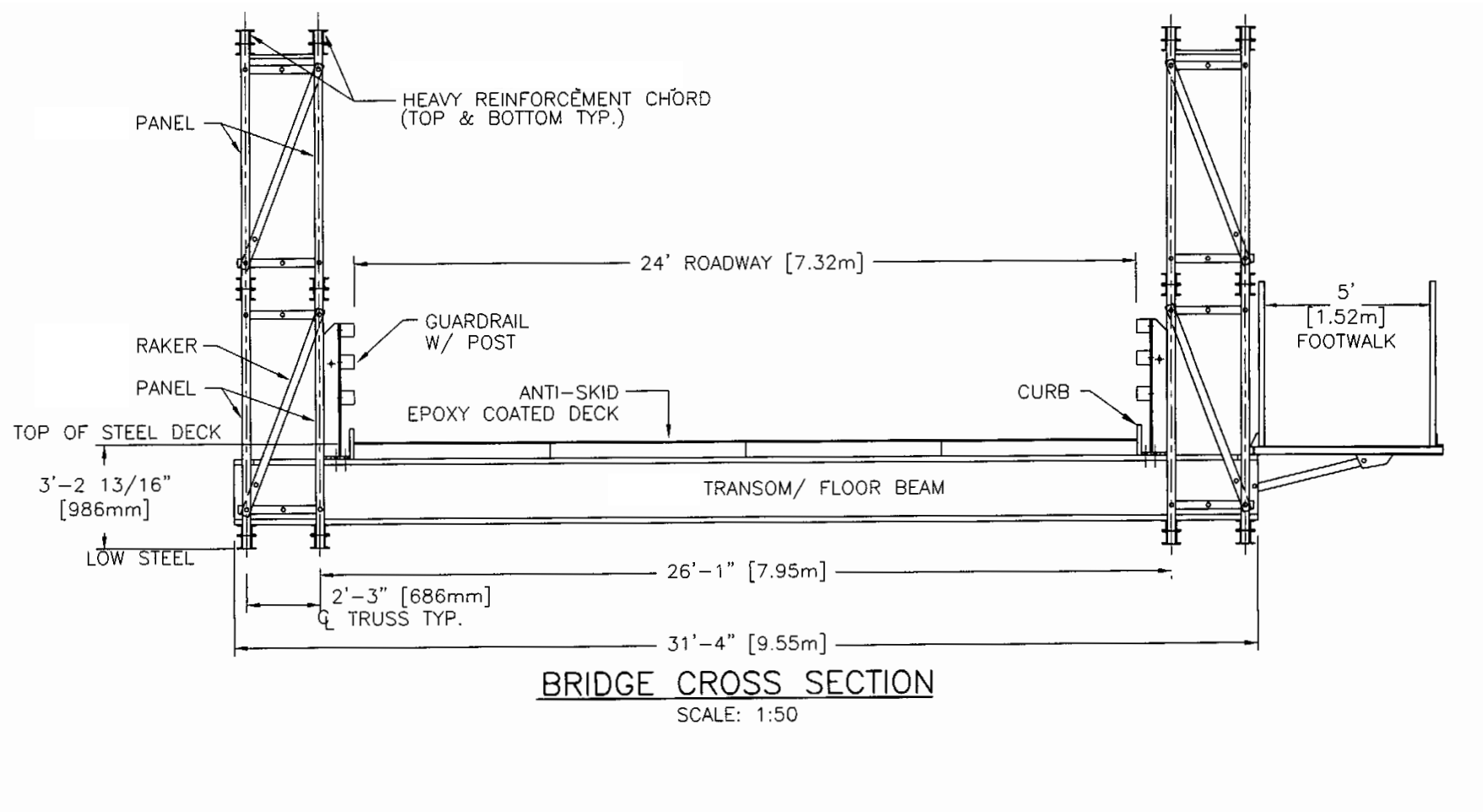


Source: Acrow Corporation of America

**KULANIHAKOI BRIDGE REPLACEMENT**

**TEMPORARY BRIDGE REPRESENTATIONAL CROSS SECTION VIEW**

FIGURE

2-7

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# 3. DESCRIPTION OF EXISTING ENVIRONMENT, IMPACTS, AND MITIGATION MEASURES

## 3.1 Climate

Maui's climate varies by terrain but is relatively uniform year round with mild temperatures, moderate humidity, and relatively consistent northeasterly trade winds. Regional topography and climatic conditions attribute to a variety of micro-climates found across the island. The project site is located in the semi-arid Kīhei-Mākena region.

The mean annual temperature of the island of Maui, near sea level, is approximately 75 degrees Fahrenheit (°F). The Kīhei coast is known to be sunny, warm, and dry throughout the year. Annual temperatures for the Kīhei region average in the mid to high 70s. During the summer months and dry season, average daily temperatures in Kīhei range from 77.0°F to 77.6°F.

Average rainfall distribution in the Kīhei-Mākena region varies from under 10 inches per year along the coastline to more than 20 inches per year in the higher elevations. Rainfall in the Kīhei-Mākena region is highly seasonal with most of the precipitation occurring during the winter months. Trade winds out of the northeast average 10 to 15 miles per hour (mph) in the Kīhei-Mākena region during the afternoon. Typically, lighter winds are felt during the morning and evening. Storms are infrequent and generally occur during the winter months in Hawai'i, although tropical storms and hurricanes occasionally approach the island between June and November.

**Impacts and Mitigation Measures**

No significant impacts on climate in the project area are anticipated. Construction and operation of the proposed project are not anticipated to affect temperatures, wind, or rainfall levels in the project area.

## 3.2 Physiography

### 3.2.1 Geology and Topography

The Island of Maui was formed by the merging of two volcanoes, Haleakalā, and the West Maui Mountains. The merging of these volcanoes created the second largest island in the Hawaiian island chain. Dominating East Maui, Haleakalā is a dormant volcano rising 10,025 feet above sea level. The western and northern slopes are relatively smooth but are sloping to moderately steep. The land is rough and rocky near the summit of Haleakalā Crater and on the eastern and southwestern slopes. The West Maui Mountains are a deeply dissected volcano rising 5,788 feet. Canyons and steep ridges comprise the central area of West Maui making it not easily accessible.

The project site is located near the makai terminus of Kūlanihāko'i Gulch, a major geomorphic feature along the south slope of Haleakalā. The drainage watershed which feeds into Kūlanihāko'i Gulch starts at the approximately 9,600 foot elevation near the summit of Haleakalā. The southwestern slope of Haleakalā is characterized by widely spaced erosional gullies. While slopes can be quite extreme at upper elevations, the project site is located within the relatively flat coastal plain. The elevation of South Kīhei Road at the project site is approximately 5.5 feet above sea level. The inverts of the existing culverts

range from between sea level to 1 foot above sea level. Immediately upstream and downstream of the culverts, the invert of the drainageway usually holds standing water. The elevations of the swale in the immediate vicinity range from 0.5 to 1.6 feet above sea level. Downstream of the swale, a sand plug is formed by wave action. Elevations may range between 0.5 to 4.5 feet. This may be quite variable depending on wind and wave action.

**Impacts and Mitigation Measures**

In the short- and long-term, no significant impacts on geology or topography are anticipated during construction or operation of the proposed project. Construction of the proposed project will require cut and fill activities for grading and excavations for the new culverts as well as the road widening. None of the proposed cuts involve further excavation into the dune system on the makai side of the bridge. Grading within the project site will slightly alter the existing topography, however, graded and excavated areas will be backfilled to restore the topography similar to existing conditions.

### 3.2.2 Soils

According to the U.S. Department of Agriculture, Natural Resource Conservation Service, soils within the project site are classified as Dune Land (DL) and Keālia Silt Loam (KMW) (see Figure 3-1).

Dune Land (DL) consists of hills and ridges of sand-size particles drifted and piled by wind. The hills and ridges are actively shifting or are so recently fixed or stabilized that no soil horizons have developed. The sand is dominantly coral and seashells with elevations ranging from seal level to 150 feet.

Keālia Silt Loam (KMW) consists of deep, poorly drained soils that formed in alluvium. Keālia soils are on nearly level coastal flats that are affected by a fluctuating salt water table and can be found in elevations ranging from sea level to 10 feet. Ponding occurs in low areas after heavy rain and when the soil dries, salt crystals form on the surface. Slope of the soil varies between 0 to 1 percent. Permeability is moderately rapid. Hazard of water erosion is slight, but can be severe when dry and windy.

A Dune Investigation Report was prepared by Sea Engineering, Inc. in August 2012 to determine the location of the coastal dune in relation to the project site to comply with the Maui County Grading Ordinance Section 20.08.035 (I) which prohibits the grading of coastal dunes. The report is included in Appendix A and is summarized below.

The County ordinance defines a coastal dune as “one of possibly several continuous or nearly continuous mounds or ridges of unconsolidated sand contiguous and parallel to the beach, situated so that it may be accessible to storm waves and seasonal high waves for release to the beach or offshore waters.” Thus, there are three main criteria that are used to establish the presence or limits of a dune: unconsolidated sandy soil, a mound or ridge formation, and the possible reach of storm or seasonal high waves.

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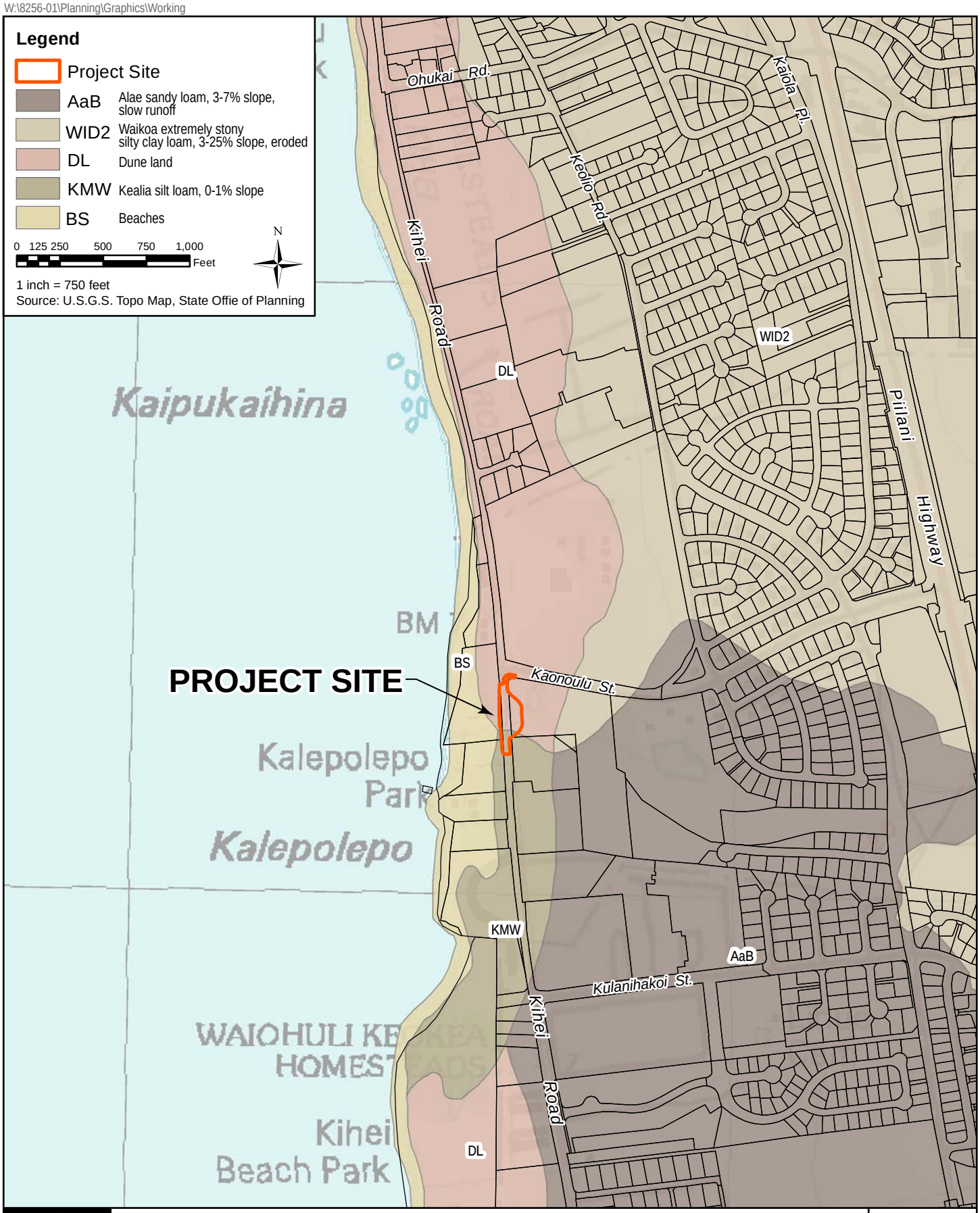


KULANIHAKOI BRIDGE REPLACEMENT

SOIL SURVEY MAP

FIGURE 3-1

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However, the limits of a coastal dune may not always be definitive. Sometimes there is no clearly defined break in slope, sometimes the terrain is obscured by heavy underbrush, or there may be several lines of dunes. In heavily used areas the coastal dune structure can be obscured by terrain alteration due to vehicle or foot traffic, or by previous grading and construction activities.

Kūlanihāko'i Gulch is an intermittently flowing stream channel, which during heavy rains erodes a stream channel through the beach and discharges runoff waters into the ocean. When the rain stops, and flow ceases, a beach berm reforms in front of the stream, and a muliwai typically forms. A muliwai is the Hawaiian word for brackish water pools near the mouths of streams created by seasonal barriers of sand or sediment. The muliwai and stream channel occupy the zone immediately seaward of the bridge and road for a distance of approximately 160 feet north and 130 feet south of the bridge. When the stream is not flowing, a visible low elevation swale is present in the beach and backshore marking the location of the channel. Seaward of Kūlanihāko'i Bridge is Kalepolepo Beach, a sand beach approximately 750 feet long extending from the revetment fronting the Maui Lu Hotel in the north, to the Kalepolepo Fishpond in the south.

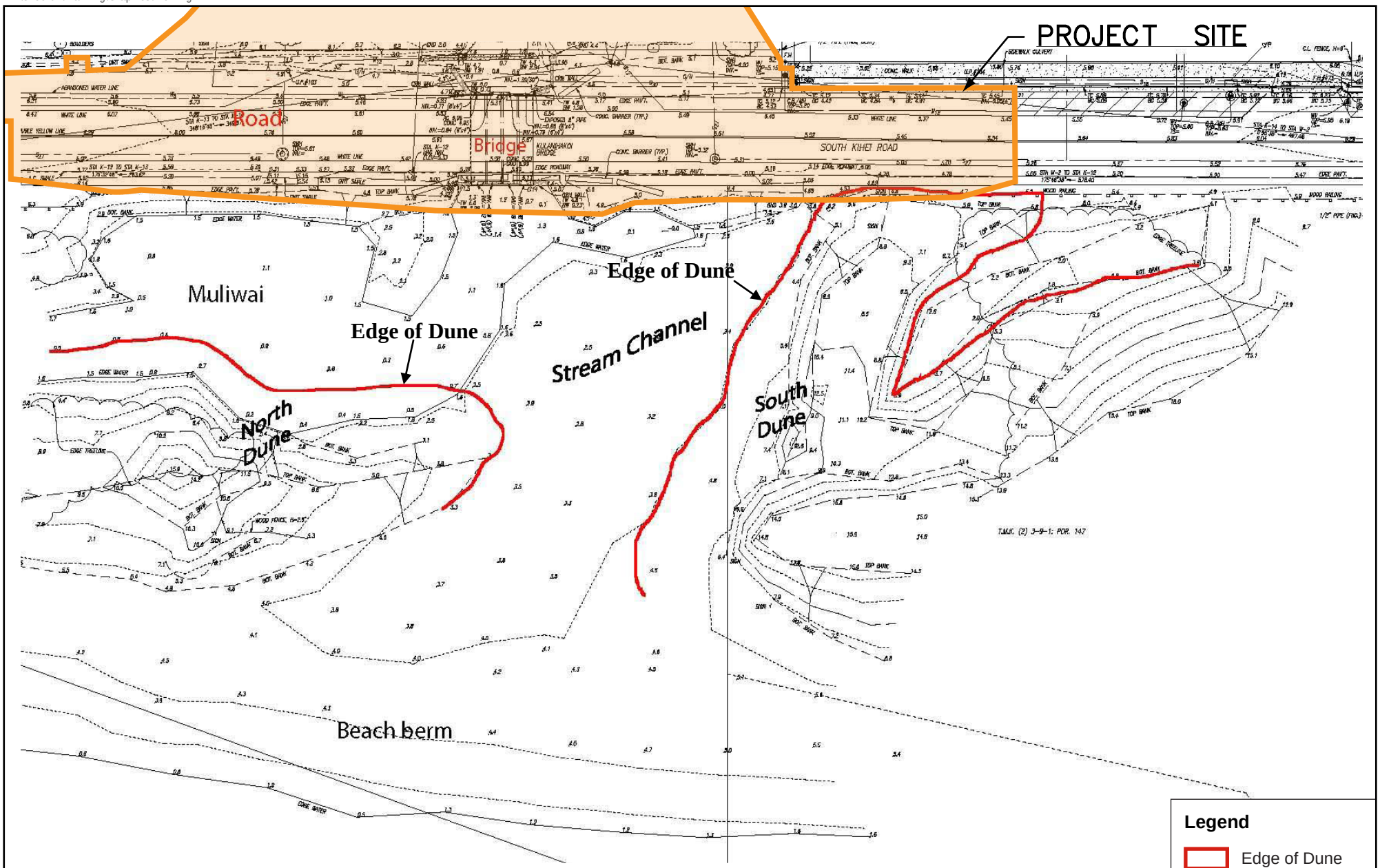
Dune formation is active in this area as the prevailing tradewinds are modified by the local effects of Haleakalā and blow strongly from the northwest in the afternoons, transporting dry beach sand inland. Coastal dunes up to 16 feet high are present to the north and the south of the stream channel/swale.

The north coastal dune lies seaward of the muliwai, and forms the north side of the stream channel. The landward limit of the north dune is located at the base of the slope along the seaward waterline of the muliwai. The south dune forms the south side of the stream channel. The landward limit of the south dune follows the south edge of the stream channel/swale, and then along the edge of South Kīhei Road to the south. The edges of the dunes are illustrated by the red lines in Figure 3-2. A beach berm lies between the dunes and stream channel, and the ocean.

**Impacts and Mitigation Measures**

Construction activities will involve land-disturbing activities, such as grubbing, clearing, grading, and excavation that may result in some soil erosion and potential construction-related impacts to the quality of surface and coastal waters in the greater project vicinity. Various mitigative measures will be incorporated into the project's construction plan to minimize soil disturbances and potential short-term erosion impacts during construction activities. Excavation and grading activities associated with construction of the proposed improvements will be regulated by the County's grading ordinance.

A DOA Nationwide Permit, pursuant to Section 404 of the Clean Water Act and a WQC, issued by the DOH, pursuant to Section 401 of the Clean Water Act will be required. In conjunction with the Section 401 and 404 permits, a BMP plan will be prepared for construction activities within the project site. Erosion and sediment control measures will be instituted in accordance with site specific assessments, incorporating appropriate structural and/or non-structural BMPs ~~such as minimizing time of exposure between construction and landscaping, and implementing erosion~~




Topographic Map of the Project Site Showing Coastal Morphologies and the Edge of the Dunes.

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KULANIHAKOI BRIDGE REPLACEMENT

DUNE DELINEATION MAP

FIGURE 3-2

~~control measures such as silt fences and filter berms~~. Specific BMPs may include, but may not be limited to the following:

1. Minimizing soil loss and erosion by revegetation and stabilization of slopes and disturbed areas of soil, possibly using hydromulch, geotextiles, or other applicable alternatives, as soon as possible after working;
2. Minimizing time of exposure between construction and landscaping;
3. Application of protective covers to soil and material stockpiles;
4. Minimizing disturbance of soil during periods of heavy rain;
5. Implementing erosion control measures by emplacement of structural controls such as silt fences, filter berms, gravel bags, fiber rolls, sandbag barriers and other barriers in order to retard and prevent the loss of sediment from the site;
6. Phasing of the project to disturb the minimum area of soil at a particular time;
7. Use of drip pans beneath vehicles not in use in order to trap vehicle fluids;
8. Routine maintenance of BMPs by adequately trained personnel;
9. Significant leaks or spills, if they occur, shall be properly cleaned up and disposed of at an approved site.

Following construction, exposed soils at the project site will have been built over, paved over, or re-vegetated to control erosion.

Dewatering may be required for the proposed project. Should dewatering be deemed necessary, the contractor will be responsible to obtaining all applicable permits including, but not limited to, a National Pollutant Discharge Elimination System (NPDES) Permit for Dewatering Activities. The permit application will require a BMP plan, an erosion control plan, and a water quality monitoring plan. Water quality impacts associated with the disposal of dewatering effluent will also be addressed in the BMP plan, including appropriate characterization of any potential pollutants such as sediments and nutrients in the effluent.

Based on the findings of the dune study, the proposed limits of construction of the project do not extend to the coastal sand dune, as defined by the County grading ordinance.

## 3.3 Hydrology

### 3.3.1 Surface Water

The project site traverses near the Kūlanihāko'i Gulch ocean outlet. The Kūlanihāko'i Gulch originates at the 9,600 foot elevation contour near summit of Haleakalā, extending downslope and westward approximately 16-miles to its Pacific Ocean outlet adjacent to Kalepolepo Beach Park on Mā'alaea Bay. At the project site, the gulch is a broad, flat open area with minimal relief and a substratum of dark sand.

Surface water is present at the project site where the outlet is blocked by a deposit of sand (Kalepolepo Beach), forming a muliwai (brackish water pond or estuary) extending inland through the project site. For the majority of the time, this area of the gulch is permanently wet, estuarine, and tidal.

A Water Quality and Biological Survey for the project site was prepared by AECOS Inc. in March 2013 and revised January 20, 2015. The survey extended from 115 feet upstream of South Kīhei Road to just offshore of Kalepolepo Beach. The revised Water Quality and Biological Survey is included as Appendix B and a summary of the water quality findings are summarized below.

Based on the Water Quality Survey, it was determined that the brackish gulch waters near the project site were nutrient, sediment, and chlorophyll laden, relative to State of Hawai'i water quality criteria for estuaries. The results indicate that generally poor water quality conditions were present during the survey, however, it is not an unusual situation for a muliwai.

~~Kūlanihāko'i Gulch appears on the DOH, 2012 list of impaired waters in Hawai'i, prepared under the Clean Water Act. The listing indicates that the water body may not meet State of Hawai'i water quality criteria for estuaries. The estuary is listed as impaired for total nitrogen, nitrate+nitrate, turbidity, and chlorophyll. It has been assigned a low priority for total Maximum Daily Load (TMDL) studies.~~ The coastal waters fronting Kūlanihāko'i Gulch may also be impaired. Nearshore marine waters fronting the gulch were nutrient, sediment and cholorophyll laden, well oxygenated, and had a pH near 8.10.

**Impacts and Mitigation Measures**

In the short- and long-term, no significant impacts on surface waters in the project vicinity are anticipated during construction or operation of the proposed project as the proposed project is not anticipated to adversely affect the already poor water quality of the muliwai at the site.

A DOA Nationwide Permit, pursuant to Section 404 of the Clean Water Act and a WQC, issued by the DOH, pursuant to Section 401 of the Clean Water Act will be required. In conjunction with the Section 401 and 404 permits, a BMP plan will be prepared for construction activities within the project site. Erosion and sediment control measures will be instituted in accordance with site specific assessments, incorporating appropriate structural and/or non-structural BMPs ~~such as minimizing time of exposure between construction and landscaping, and implementing erosion control measures such as silt fences and filter berms~~. Specific BMPs may include, but may not be limited to the following:

1. Minimizing soil loss and erosion by revegetation and stabilization of slopes and disturbed areas of soil, possibly using hydromulch, geotextiles, or other applicable alternatives, as soon as possible after working;
2. Minimizing time of exposure between construction and landscaping;
3. Application of protective covers to soil and material stockpiles;
4. Minimizing disturbance of soil during periods of heavy rain;
5. Implementing erosion control measures by emplacement of structural controls such as silt fences, filter berms, gravel bags, fiber rolls, sandbag barriers and other barriers in order to retard and prevent the loss of sediment from the site;
6. Phasing of the project to disturb the minimum area of soil at a particular time;
7. Use of drip pans beneath vehicles not in use in order to trap vehicle fluids;

8. Routine maintenance of BMPs by adequately trained personnel;
9. Significant leaks or spills, if they occur, shall be properly cleaned up and disposed of at an approved site.

In addition, the proposed project will also require a DOA permit pursuant to Section 10 of the Rivers and Harbors Act of 1899, which regulates work within, over and beneath navigable waters of the U.S.

Following construction, exposed soils at the project site will have been built over, paved over, or re-vegetated to control erosion.

Dewatering may be required for the proposed project. Should dewatering be deemed necessary, the contractor will be responsible to obtaining all applicable permits including, but not limited to, an NPDES Permit for Dewatering Activities. The permit application will require a BMP plan, an erosion control plan, and a water quality monitoring plan. Water quality impacts associated with the disposal of dewatering effluent will also be addressed in the BMP plan, including appropriate characterization of any potential pollutants such as sediments and nutrients in the effluent.

### 3.3.2 Wetlands

According to the Water Quality and Biological Study prepared by AECOS Inc. in March 2013 and revised in January 2015 (refer to Appendix B), the U.S. Fish and Wildlife Service (USFWS), National Wetland Inventory (NWI) ;"Wetlands Mapper" shows the area of the muliwai classified as PUBHh: diked or impounded, permanently flooded, freshwater wetland (palustrine) with unconsolidated (sand or mud) bottom; and a much larger area extending to the south ~~thorough~~ through several resort complexes as PEM1C: seasonally flooded freshwater wetland with persistent emergent vegetation. The AECOS study updates these findings.

The AECOS study found that the muliwai should be classified as E1UB2: estuarine subtidal with sand bottom; as the area is not "dike" or unnaturally impounded. In addition, the wetland corresponding to the area in the NWI as PEM1C is no longer present as the area is now a fully developed landscape.

The study also attempted to delineate the wetland boundary using soil sampling and certain species of vegetation as key indicators of a wetland environment. However, the vegetation in the project area is limited and its use as an indicator problematic because the area is a part of a native plant restoration project where the "natural" distribution of pickleweed (*Batis maritima*) has been removed and the native 'ākulikuli encouraged to thrive. 'Ākulikuli is considered a facultative wetland species that is nearly always found around the margins of coastal wetlands in sand material. Consequently, the area surveyed, with the exception of the muliwai, is difficult to demarcate as a wetland.

~~There are two possible wetland delineations for the project area. The first is based on the acceptance that the soils and plants found at the project site are generally indicative of a coastal wetland, and therefore the boundary of the 'ākulikuli demarcates the wetland area. The second is based on the acceptance that the soils and plants are not natural and have been affected by the native plant restoration efforts in the area, therefore they are not good~~

~~indications of a wetland and thus the clearest boundary is that of the muliwai shore.~~ While a wetland delineation is not official until accepted by the Corps of Engineers, it is believed that the historical distribution of the wetlands at the mouth of the gulch could be supported based upon the existing topography and distribution of the native coastal plant, *'ākulikuli*.

**Impacts and Mitigation Measures**

~~In the long-term, no significant impacts to wetland resources associated with the project site are anticipated during construction or operation of the proposed project.~~

During construction, as ~~it is difficult to demarcate~~ the boundary of the wetland and jurisdictional waters are uncertain, the County will need to work with the applicable agencies to determine appropriate permitting requirements. ~~the~~ The area of the proposed bypass road based on the distribution of 'ākulikuli ~~through the two different wetland boundaries~~ would be on the order of ~~600 square feet (muliwai only) to~~ 4,600 square feet (dune sand dominated by 'ākulikuli). The existing culverts are located within the area designated as the muliwai.

A DOA Nationwide Permit, pursuant to Section 404 of the Clean Water Act and a WQC, issued by the DOH, pursuant to Section 401 of the Clean Water Act will be required. In conjunction with the Section 401 and 404 permits, a BMP plan will be prepared for construction activities within the project site. Erosion and sediment control measures will be instituted in accordance with site specific assessments, incorporating appropriate structural and/or non-structural BMPs ~~such as minimizing time of exposure between construction and landscaping, and implementing erosion control measures such as silt fences and filter berms~~. Specific BMPs may include, but may not be limited to the following:

1. Minimizing soil loss and erosion by revegetation and stabilization of slopes and disturbed areas of soil, possibly using hydromulch, geotextiles, or other applicable alternatives, as soon as possible after working;
2. Minimizing time of exposure between construction and landscaping;
3. Application of protective covers to soil and material stockpiles;
4. Minimizing disturbance of soil during periods of heavy rain;
5. Implementing erosion control measures by emplacement of structural controls such as silt fences, filter berms, gravel bags, fiber rolls, sandbag barriers and other barriers in order to retard and prevent the loss of sediment from the site;
6. Phasing of the project to disturb the minimum area of soil at a particular time;
7. Use of drip pans beneath vehicles not in use in order to trap vehicle fluids;
8. Routine maintenance of BMPs by adequately trained personnel;
9. Significant leaks or spills, if they occur, shall be properly cleaned up and disposed of at an approved site.

Dewatering may be required for the proposed project. Should dewatering be deemed necessary, the contractor will be responsible to obtaining all applicable permits including, but not limited to, an NPDES Permit for Dewatering Activities. The permit application will require a BMP plan, an erosion control plan, and a water quality monitoring plan. Water quality impacts associated with the disposal of dewatering

effluent will also be addressed in the BMP plan, including appropriate characterization of any potential pollutants such as sediments and nutrients in the effluent.

Following construction, ~~the wetland area is~~ areas affected by the temporary road and bridge are proposed to be restored to its existing conditions.

### 3.3.3 Groundwater

The State Department of Land and Natural Resources (DLNR), Commission on Water Resource Management (CWRM) has established a groundwater hydrologic unit and coding system for groundwater resource management. The proposed project site is located within the Central Aquifer Sector Area which is comprised of four (4) Aquifer System Areas identified as Kahului, Pā‘ia, Makawao, and Kam‘aole. The project site is located within the Kama‘ole Aquifer System (60304) area which is a regionally extensive brackish aquifer extending from North Kīhei to Mākena. The Kama‘ole Aquifer System yields 11 million gallons per day (mgd).

**Impacts and Mitigation Measures**

In the short- or long-term, no significant impacts to groundwater resources associated with the project site are anticipated during construction or operation of the proposed project. Construction activities are not likely to introduce to, nor release from the soil any materials which could adversely affect groundwater. Construction material wastes will be appropriately disposed of to prevent leaching.

### 3.3.4 Coastal Waters

The nearest coastal water offshore of the project site is Mā‘alaea Bay, located approximately 0.05-miles west of the project site. Pursuant to Hawai‘i Administrative Rules (HAR) Title 11, Chapter 54, Water Quality Standards, the coastal waters in the vicinity of the project site are classified as Class A marine waters. Class A marine waters are recognized as waters to be used for “recreational purposes and aesthetic enjoyment to be protected. These waters shall not act as receiving waters for any discharge which has not received the best degree of treatment or control compatible with the criteria established for this class”.

A Water Quality and Biological Survey report was prepared by AECOS Inc. in March 2013 (revised January 2015) for the proposed project site (refer to Appendix B). In addition to surveying the water quality of Kūlanihāko‘i Gulch, coastal waters directly offshore of Kalepolepo Beach were also surveyed. It was determined that the coastal waters fronting Kūlanihāko‘i Gulch may also be impaired. The water quality, as monitored by DOH Station Kalepolepo Beach (ID H1000141), just south of the gulch mouth is reported as impaired for total nitrogen, nitrate+nitrite, ammonia, turbidity, and chlorophyll. Water quality data from 2008 to present show that marine waters fronting the gulch were nutrient, sediment, and chlorophyll laden, well oxygenated and had a pH near 8.10.

**Impacts and Mitigation Measures**

No short- or long-term significant impacts on coastal waters in the project vicinity are anticipated during construction or operation of the proposed project.

Construction activities will involve land-disturbing activities, such as grubbing, clearing, grading, and excavation that may result in some soil erosion and potential

construction-related impacts to the quality of surface and coastal waters in the greater project vicinity. Various mitigative measures will be incorporated into the project's construction plan to minimize soil disturbances and potential short-term erosion impacts during construction activities. Excavation and grading activities associated with construction of the proposed improvements will be regulated by the County's grading ordinance.

A DOA Nationwide Permit, pursuant to Section 404 of the Clean Water Act and a WQC, issued by the DOH, pursuant to Section 401 of the Clean Water Act will be required. In conjunction with the Section 401 and 404 permits, a BMP plan will be prepared for construction activities within the project site. Erosion and sediment control measures will be instituted in accordance with site specific assessments, incorporating appropriate structural and/or non-structural BMPs ~~such as minimizing time of exposure between construction and landscaping, and implementing erosion control measures such as silt fences and filter berms~~. Specific BMPs may include, but may not be limited to the following:

1. Minimizing soil loss and erosion by revegetation and stabilization of slopes and disturbed areas of soil, possibly using hydromulch, geotextiles, or other applicable alternatives, as soon as possible after working;
2. Minimizing time of exposure between construction and landscaping;
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4. Minimizing disturbance of soil during periods of heavy rain;
5. Implementing erosion control measures by emplacement of structural controls such as silt fences, filter berms, gravel bags, fiber rolls, sandbag barriers and other barriers in order to retard and prevent the loss of sediment from the site;
6. Phasing of the project to disturb the minimum area of soil at a particular time;
7. Use of drip pans beneath vehicles not in use in order to trap vehicle fluids;
8. Routine maintenance of BMPs by adequately trained personnel;
9. Significant leaks or spills, if they occur, shall be properly cleaned up and disposed of at an approved site.

Following construction, exposed soils at the project site will have been built over, paved over, or re-vegetated to control erosion.

Dewatering may be required for the proposed project. Should dewatering be deemed necessary, the contractor will be responsible to obtaining all applicable permits including, but not limited to, an NPDES Permit for Dewatering Activities. The permit application will require a BMP plan, an erosion control plan, and a water quality monitoring plan. Water quality impacts associated with the disposal of dewatering effluent will also be addressed in the BMP plan, including appropriate characterization of any potential pollutants such as sediments and nutrients in the effluent.

In the long-term, as the proposed culverts will be constructed at a 0.5% slope, the drainage capacity will increase slightly from essentially 204 cfs to 306 cfs. In the event of a 100-year storm, this increase in capacity will increase the likelihood of storm flows breaking through the sand plug. This could slightly relieve some of the upstream flooding, but may slightly increase flows past the sand plug.

## 3.4 Natural Hazards

### 3.4.1 Flood and Tsunami Hazard

According to the Flood Insurance Rate Map (FIRM) (Community Panel Numbers 1500030586F and 1500030567F, Effective Date: September 19, 2012) prepared by the Federal Emergency Management Agency (FEMA), the project site is designated Zone VE and Zone AE (see Figure 3-3).

Zone VE includes areas with a 1% or greater chance of flooding and have an additional hazard associated with storm waves. In general, these areas have a 26% chance of flooding over the life of a 30-year mortgage.

Zone AE is characterized as a "special flood hazard area subject to inundation by the 1% annual chance flood." Zone AE is also a "floodway," in which "the channel of the stream plus any adjacent floodplain areas that must be kept free of the encroachment so that the 1% annual chance flood can be carried without substantial increases in flood height." The 1% annual flood is also commonly referred to as the 100-year flood or the base flood.

According to the Tsunami Evacuation Zone maps for Maui, the project site lies entirely within the tsunami evacuation zone (see Figure 3-4).

**Impacts and Mitigation Measures**

In the short- and long-term, no significant impacts on flood hazards in the project area are anticipated as the proposed improvements are not anticipated to increase flood risks or cause any adverse flood-related impacts at the project site or lower elevation properties.

Construction activities within the respective flood hazard districts will be conducted in accordance with regulations set forth in Section 19.62.060, Maui County Code. Before construction of any development begins within any flood hazard area, flood-related erosion hazard area, or mudslide area, a special flood hazard area development permit shall be obtained from the Director of the Department of Planning.

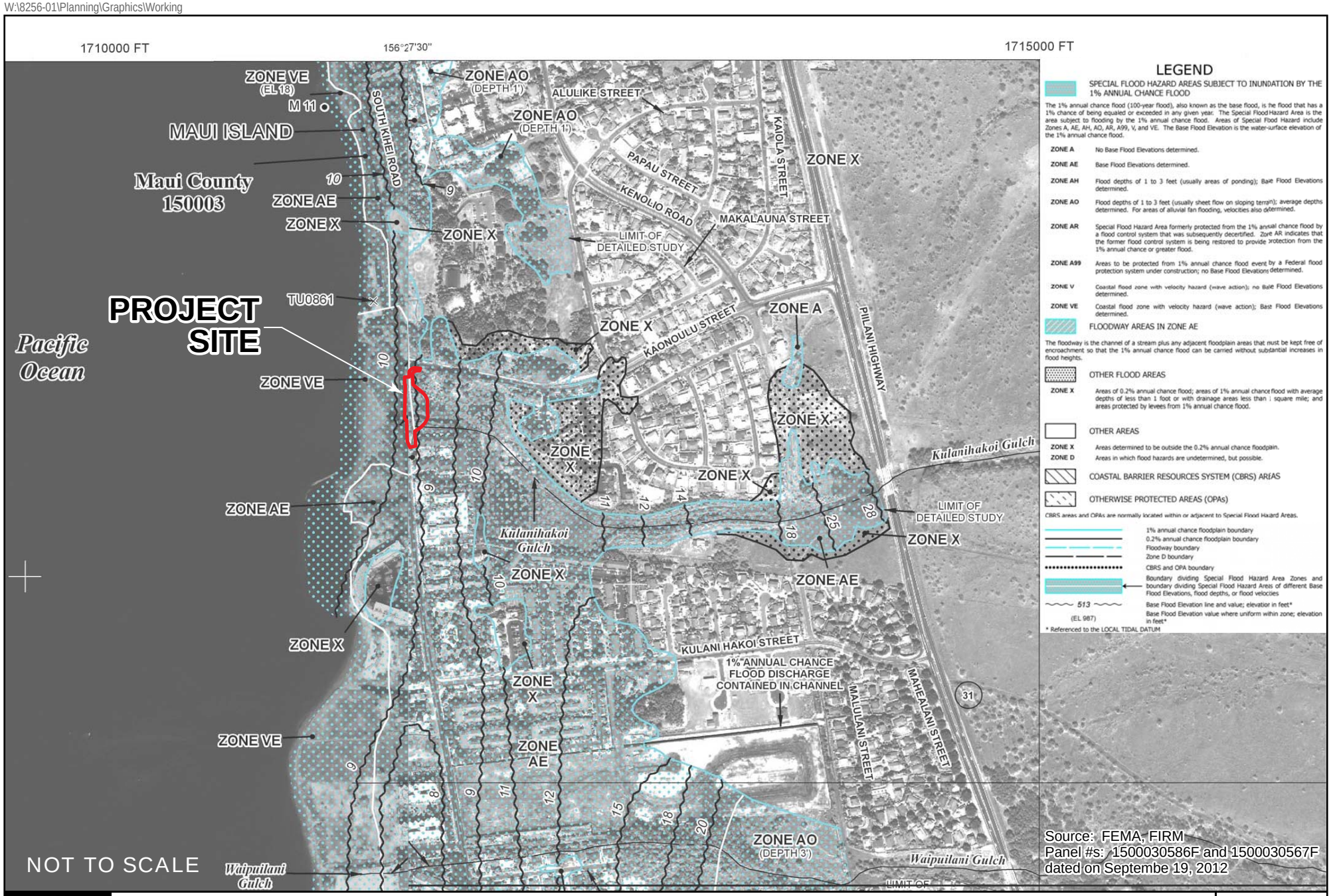
The project will also comply with the rules and regulations for the National Flood Insurance Program (NFIP) present in Title 44, of the Code of Federal Regulations (44CFR), as the project is within a Special Flood Hazard Area.

## 3.5 Natural Environment

### 3.5.1 Flora

A Water Quality and Biological Survey for the project site was conducted by AECOS Inc. in March 2013 (revised January 2015) (refer to Appendix B). The findings of the botanical survey are summarized below.

The botanical survey found that plant growth is sparse over much of the area, or otherwise consists of a ground cover of 'ākulikuli (*Sesuvium portulacastrum*) that is dense in some

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**KULANIHAKOI BRIDGE REPLACEMENT**

**FLOOD INSURANCE RATE MAP**

FIGURE

3-3

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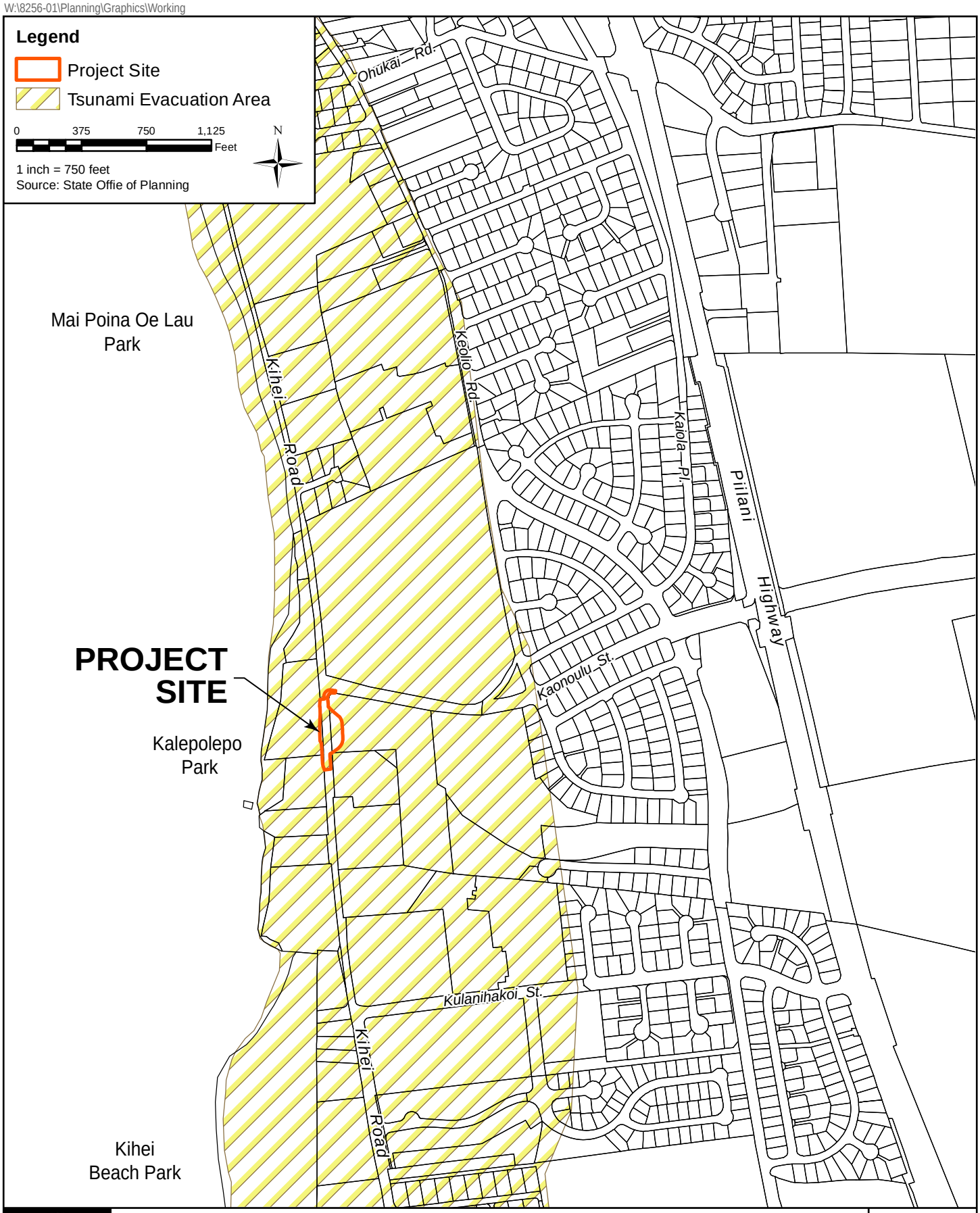


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KULANIHAKOI BRIDGE REPLACEMENT

TSUNAMI EVACUATION MAP

FIGURE 3-4

locations. Less prominent and mostly south of the muliwai, is an area with seaside heliotrope (*Heliotropium curssavicum*). A total of 15 plant species were identified in the project vicinity and all were identified as flowering plants.

It is important to note that typically in most lowland areas on Maui, the native and Polynesian plant numbers are not more than 10 to 16 percent of the total species identified from a location. At the Kūlanihāko'i Gulch mouth, 60 percent are native or early Polynesian introduced plants. While this situation is unusual, it is due to the area being maintained as a native plant restoration project. The area is served by a pipe irrigation system with sprinkler heads, suggesting some current or prior level of artificial watering. While native 'ākulikuli and 'aki'aki are plants associated with coastal dune and muliwai environments, it is unknown to what extent the vegetation patterns have been influenced to their present state by the native planting and maintenance activities. It would be expected that the estuarine area would be dominated by pickleweed (*Batis maritimus*), as this non-native species is found throughout the Kīhei area as coastal wetlands, however, it is noted as rare in the project area.

The dune areas support 'aki'aki (*Sporobolus virginicus*), a native grass common to this habitat. Non-native species are uncommon or rare in the survey area except for a grove of kiawe (*Prosopis pallida*) located on the makai side of South Kīhei Road. The native 'ākia (*Wikstroemia usa-urvi*) has been planted on a low dune.

**Impacts and Mitigation Measures**

No short- or long-term significant impacts on flora species are anticipated due to the construction and operation of the proposed project as there are no rare, threatened, or endangered flora species located within or adjacent to the project site. There are also no federally designated Critical Habitats within or adjacent to the project site. However, as the area is being cared for by a community group with a strong interest in preserving the native flora at this location, it is recommended that the bypass road area be restored back to the appropriate native plants once construction is completed and the temporary bypass road removed.

### 3.5.2 Fauna

A Water Quality and Biological Survey for the project site was conducted by AECOS Inc. in March 2013 (revised January 2015) (refer to Appendix B). The findings of the biological survey are summarized below.

**Aquatic Resources:**

The aquatic biota ~~observed during the September 2012 survey~~ of Kūlanihāko'i Gulch estuary included a mixture of native and naturalized (non-native) species. ~~Native species observed included āholehole, 'ama'ama (*Mugil cephalus*), and 'alamihi crab (*Metopograspus thuhukar*). Non-native species included mixed~~ Mixed schools of Cuban mollies (*Limia vittata*) and hybrid mollies (*Poecilia* sp.)~~,~~ swim just beneath the water surface near the South Kīhei Road crossing. Blackchin tilapia (*Sarotherodon melanotheron*), ~~and~~ Mozambique tilapia (*Oreochromis massambicus*) and mullet *(Mugil cephalus)* are also present in schools throughout the muliwai. Shore crabs *(Metopograpsus thuhukar)* crawl among the 'ākulikuli along the muliwai margins and on the culverts. All these species are common inhabitants of estuarine waters in the main Hawaiian Islands. Rambur's forktail (*Ischnura ramburi*), a naturalized damselfly typically common at low elevations, also utilizes the project area.

Though the reach of the gulch typically containing water is short, it is possible that native *'o'opu 'akupa* (*Eleotris sandwicensis*) and *'ōpaekala'ole* (*Macrobrachium grandimanus*) not observed during the survey may utilize the brackish environment near the project site. Any population present is likely limited in size by the continual blockage of the gulch mouth by deposited sand, as these diadromous species need passage to the open ocean as larva and passage upstream to brackish waters as post-larva to carry out their life cycle.

**Avian Resources:**

The findings of the survey are consistent with the location of the property, and the habitats present on and adjacent to the site. A total of ~~23 individual~~ six water obligate avian species, ~~of six different species, representing six separate families,~~ were recorded during the survey. All but one of the six water bird species detected are native species.

One of these species, the Hawaiian Stilt (*Himantopus mexicanus knudseni*), is an endangered endemic sub-species protected under both federal and state endangered species statutes. One stilt was recorded foraging in the muliwai approximately 30 feet makai of the culvert just behind the beach. Thirteen others were recorded flying over the site from north-to-south.

Another of these species, the Black-crowned Night-Heron (*Nycticoraxnycticorax hoactli*), is a resident indigenous species found widespread across the islands that utilizes a wide range of waterside environments.

The three others, the Pacific Golden-Plover (*Pluvialis fulva*), the Ruddy Turnstone (*Arenaria interpres*) and the Wandering Tattler (*Tringa incana*) are indigenous migratory shorebird species that nest in the high Arctic during the late spring and summer months, returning to Hawai'i and the Tropical Pacific to spend the fall and winter months each year. They usually leave Hawai'i for the trip back to the Arctic in late April or the very early part of May each year.

The remaining species, the Cattle Egret (*Bubulcus ibis*), is alien to the Hawaiian Islands.

Although no seabirds were detected during this survey, it is probable that both endangered Hawaiian Petrel (*Pterodroma sandwichensis*) and threatened endemic sub-species of Newell's Shearwater (*Puffinus auricularis newelli*) overfly the project area between April and the middle of December each year. Both species have been recorded flying to and from their nesting colonies located in the mountains mauka of the project site. Both of these pelagic seabird species nest high in the mountains in burrows excavated under thick vegetation, especially uluhe (*Dicranopteris linearis*) fern. There is no suitable nesting habitat for either of these seabird species on or close to the project site. It is also probable that Wedge-tailed Shearwaters (*Puffinus pacificus*) may occasional overfly the site during the breeding season as they nest in coastal areas in the general Kīhei area. Wedge-tailed Shearwaters are not protected under the endangered species act, but are protected under the federal Migratory Bird Treaty Act as well as under the State of Hawai'i Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife's Administrative Rules Chapter 13, Section 124, which prohibits injuring or killing indigenous wildlife.

**Mammalian Resources:**
No mammalian species currently protected or proposed for protection under either the federal or State of Hawai'i endangered species programs were detected during the course of the survey.

The findings of the mammalian survey are consistent with the location of the property and the habitat currently present on the site. Although no rodents were recorded it is likely that some, if not all, of the four established alien muridae found on Maui, roof rat (*Rattus r. rattus*), Norway rat (*Rattus norvegicus*), and possibly Polynesian rats (*Rattus exulans hawaiiensis*) and European house mice (*Mus musculus domesticus*) use various resources found within the general project area on a seasonal basis. All of these introduced rodents are deleterious to native ecosystems and the native faunal species dependent on them.

No Hawaiian hoary bats were detected during the course of this survey. Given the habitat present on the site, any usage of the area by this species would be of an incidental foraging nature as there are no suitable roosting trees for this species on or within the vicinity of the project site.

**Impacts and Mitigation Measures**
No long-term impacts to fauna are anticipated as a result of the construction and operation of the proposed project.

Aquatic Resources: No impacts on aquatic or marine biota are anticipated as a result of the construction and operation of the proposed project. No rare, threatened or endangered aquatic species are located within or adjacent to the project site. There are also no federally designated Critical Habitats within or adjacent to the project site.

Avian Resources: Potential impacts to listed avian species include temporary disturbance by construction activity of individual birds that may be attracted to the area to forage, and although very unlikely, possibly nest. Nesting may occur in areas away from the construction footprint mauka of the culvert and may be disturbed by construction activities to the point of abandoning the nest which is considered harassment under the Endangered Species Act. The probability of this scenario can be lessened by constructing the bypass road outside of the nesting season, forcing discriminating reproductive pairs to locations upslope of the temporary road.

The primary cause of mortality in the three aforementioned seabirds is thought to be predation by alien mammalian species at the nesting colonies. Collision with man-made structures is considered to be a second 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 on the ground. When disoriented, these birds may collide with manmade structures, and if not killed outright, become injured and easy targets of opportunity for feral mammals. The two main areas 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, 2) following build-out, the potential operation of streetlights and security lighting during the seabird nesting season. As the proposed project does not involve the installation of any new street

lighting nor is any night work anticipated during the construction of the project, no significant impacts to seabirds are anticipated as a result of the construction and operation of the proposed project.

If night-time construction activity or equipment maintenance is proposed during the construction phases of the project, all associated lights should be properly shielded, and when large flood/work lights are used, they should be placed on poles that are high enough to allow the lights to be pointed directly at the ground.

Immediately prior to the initiation of construction a qualified biologist should survey the areas *mauka* of the project site to determine if any nesting stilt are present. If nesting stilt are found, the project will need to consult with the USFWS over appropriate measures and or conditions that may need to be met to ensure that construction activity does not harm or harass nesting stilts.

Mammalian Resources: The principal potential impact that development activities pose to bats is during the clearing and grubbing phases of construction as vegetation is removed. The removal of vegetation within a construction project site may temporarily displace individual bats, which may use the vegetation as a roosting location. During the pupping season, females carrying their pups may be less able to rapidly vacate a roost site while the vegetation is being cleared. Additionally, adult female bats sometimes leave their pups in the roost tree when 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), between June 15 and September 15, the period in which bats are potentially at risk from vegetation clearing. As there is no suitable bat roosting habitat within or close to the project site, it is not expected that the proposed project will result in impacts to this listed species.

## 3.6 Historic and Archaeological Resources

An Archaeological Literature Review and Field Inspection for the project site was conducted by Cultural Surveys Hawai'i, Inc. in October 2012 to evaluate the presence of significant historic properties within the project site. The archaeological literature review included studies of archival sources, historic maps, Land Commission Awards (LCA) and previous archaeological reports to construct a history of land use and to determine if archaeological resources have been recorded on or near the project site. A field inspection of the project area followed to identify any surface archaeological resources and to investigate and assess the potential for impact to such sites. The inspection also sought to identify any sensitive areas that may require further investigation or mitigation before the project proceeds. The Archaeological Literature Review and Field Inspection report is included in Appendix C and is summarized below.

Archaeological projects in the vicinity of the project site identified both pre-Contact and post-Contact site types, many of which were associated with the sugar plantation era and plantation camps, ranching and World War II (WWII) periods in history. Pre-Contact archaeological sites associated with traditional Hawaiian agriculture have also been discovered in the vicinity surrounding the project site.

Previous archaeological studies have led to archaeological interpretation based on the division of the settlement pattern for Maui into three zones: 1) coastal; 2) barren or transitional; and 3) inland. The coastal zone is an approximately one-fourth of a mile wide band running along the shoreline. The inland zone begins approximately five to seven miles from the shoreline and is characterized by larger rainfall accumulation and more lush vegetation. The transitional or barren zone is classified as the area between the edge of the coastal zone and the beginning of the inland zone and characterized by brush/scrub vegetation and low annual rainfall accumulation.

Based on available archaeological evidence and interpretations, and as a result of the settlement pattern, site types expected for coastal zones, where temporary habitations related to marine exploration may be present, may include stacked-stone enclosures, and possibly smaller ceremonial structures, such as stacked-stone fishing shrines. It is possible that human burials would have been interred in the coastal sand dunes where present.

The current project area has experienced ground disturbances as a result of construction of the South Kīhei Road and natural events associated with the surrounding stream and wetland environment, including periodic flooding. In particular, flooding events have caused repeated and extensive damage to the existing bridge over the years. As a result of these disturbances, the likelihood of locating intact cultural deposits or archeological remains would be low.

Conversely, the project area borders Kalepolepo and may have been considered part of a village once located there. Kalepolepo village became a major hub of historic activity in the mid-1800's. Several historically significant places, such as the Koa House, the David Malo Memorial Church, and the Kalepolepo fishpond were located there. Portions of the fishpond have recently been restored. Additionally, due to the coastal location and dune sand environment, human remains could be present in sandy deposits of the project area.

~~Field inspections were conducted in August 2012. The area inspected included the immediate area of Kūlanihāko'i Bridge located at the mouth of Kūlanihāko'i Stream along South Kīhei Road as well as an area approximately 500 feet north and 500 feet south of the bridge along South Kīhei Road and approximately 574 feet upstream and 272 feet downstream from the bridge. The Kalepolepo fishpond is located directly south of the stream mouth in the near shore ocean waters. In recent history, the surrounding area has been transformed by the development of resorts and condominiums along the shoreline. During the field inspection, scattered remains of two domestic cows (*Bos taurus*) were observed in the flood plain, however, no historically significant cultural material was visible on the ground surface.~~

~~Based on the background research and the results of the field inspection, it was concluded that the area has been heavily disturbed and modified by natural flooding events as well as historic and modern activities.~~

<u>During a field visit on December 13, 2012 with Theresa Donham (Archaeology Branch Chief), an archaeological inventory survey of the lands covering the extent of the APE of the proposed detour bridge was recommended. An archaeological inventory survey was</u>

conducted by Cultural Surveys Hawai'i, Inc. dated June 2013. A copy is included as Appendix D. Findings are summarized below.

The survey included shovel testing and pipe coring which enabled mapping a general stratigraphy of the project to a depth of approximately 10 feet below ground surface. Two soil samples were submitted for pollen analysis.

One historic property within the project area is the Kūlanihāko'i Bridge itself. The bridge has been given a site number (SIHP 50-50-10-7606). The bridge was constructed in 1911 and consisted of four individual reinforced concrete box culverts. The paving surface over the existing culverts was applied in the 1930's. This included some shoring-up of the edge of the roadway using a historic construction style attributed to pre-1940's plantation masons. The present day Kūlanihāko'i Bridge appears to consist of two sections of prefabricated concrete culvert welded together to form the length of the existing bridge. A more modern construction style probably occurred because of the many repairs the bridge had undergone due to storm damage.

Presently, the northern and southern wing walls have different construction styles. The northern wall is constructed of water rounded large basalt cobbles with a coarse concrete mortar typical of early 1900's construction methods while the southern wall is a modern day rip-rap construction style where the basalt has been cut to form a level surface and modern concrete has replaced original material.

Through shovel testing and pipe coring, a general stratigraphy of the project to a depth of 10 feet below ground surface was formulated.

Pollen analysis of two samples collected from Stratum IV and VI in Pipe Core 1 provide a record of earlier vegetation. Poaceae pollen is dominant in both samples, accompanied by moderate quantities of various types of Asteraceae pollen indicating that the area may, indeed, be best described as having been a grassland that also supported many plants in the sunflower family (Asteraceae).

*Prosopis* pollen was observed in both samples. Pollen representing other alien plants including Australian pine, filaree, and koa haole, was present only in stratum IV. The pollen record is one of vegetation typical in dry areas and may best be described as mixed grassland. The presence of *Sporormiella* dung fungal spores in Stratum IV reflects use of some of the land on the leeward slopes of Haleakalā for grazing.

The Stratum VI sample contained *Zea mays* pollen which is evidence of the growth of corn in the Kula area of Maui. Corn was grown as a field crop for horses and cattle on Maui, particularly in the Kula District. Pests and mosaic disease, as well as the fact that corn was not well integrated into the local diet, eventually led to a reduction in acres devoted to this crop after 1928. Corn grown at higher elevations and then transported down the Kūlanihāko'i Gulch with the sediment is probably responsible for recovery of this pollen.

The study was able to establish that at least the first 10 feet of sediment can be attributed to historic alluvium from Kūlanihāko'i Gulch. This is generally consistent with the information

collected by Geolabs, the geotechnical engineer, for this project. They recorded a dark gray clay silt to a depth of 10 feet above the grayish tan coralline sand.

**Impacts and Mitigation Measures**

Based on the field inspection findings and background research from the Archaeological Literature Review and Field Inspection Report, there is a low potential for the discovery of previously unidentified historic properties beyond the historic era itself. The area surrounding the bridge includes the Kūlanihāko'i Stream mouth, a natural wetland and associated flood plain. While impacts by flooding episodes and modifications associated with road construction and maintenance have greatly altered sediments of the project areas, the possibility of encountering intact subsurface cultural deposits, including human burials, should not be underestimated. Therefore, archaeological monitoring is recommended for all ground disturbing activities during all phases of the temporary bridge and bypass road work and bridge replacement. It is also recommended that a monitoring report be generated after the construction of the temporary bridge and bypass road and the replacement bridge.

~~A~~ As noted earlier, a site inspection was conducted on December 13, 2012 by SHPD and Cultural Surveys Hawai'i. Based on the site inspection, SHPD requested that an Archaeological Inventory Survey (AIS) be prepared for the project site. ~~The AIS is currently pending and will be submitted to SHPD for approval when it has been completed.~~ Subsequent consultation with SHPD, by letter dated February 1, 2013, indicated that they have concerns that the project area is located within a zone of beach sand dune and Aeolian sand deposits which are known to contain human burial features and historic habitation sites. It is therefore likely that historic properties, including human remains, may be present beneath the previously disturbed road grade and sub-grade or within previously unaffected areas of the right-of-way. SHPD requested that all project associated excavations be monitored by a qualified archaeologist in order to identify and mitigate any subsurface cultural features and deposits. They further recommend that an archaeological monitoring plan be submitted to their office for review and approval prior to initiation of this project.

~~Should any significant archeological, cultural, or historic resources be found during construction activities, all work will cease in the vicinity of the find and SHPD will be notified immediately to determine appropriate mitigation measures.~~

With regard to the bridge itself, the structure was constructed in 1911 and is now ~~102~~ 105 years old. It is therefore considered a historic property and recordation of the bridge would be required under Chapter 13-275, Hawai'i Administrative Rules if deemed eligible based on SHPD's evaluation of the bridge's significance. Consultation with SHPD, by letter dated December 20, 2012, indicated that while the bridge is unique due to age and represents the first generation of concrete bridges in the islands, it is literally falling apart and has lost any distinguishing architectural characteristics. On this basis SHPD has determined that the bridge has lost its integrity and is not eligible to be recorded on the State Inventory of Historic Properties. Therefore, the proposed project will have no effect on historic property.

The archaeological inventory survey noted that the Kūlanihāko'i Bridge (SIHP 50-50-10-7606) has yielded information important to the understanding of the first generation of concrete bridges in the Hawaiian Islands. SIHP -7606 is thus considered significant under Criterion D. Sufficient information concerning SIHP -7606 was collected during the investigation. Based on the additional research, no further work is recommended for the bridge.

The archaeological inventory survey also noted that while subsurface testing was not done beneath South Kīhei Road, boring logs from the Geolabs report recorded the presence of coralline sand around 12 feet below the surface of the road. The presence of this type of sediment deposit may present the potential for encountering sensitive cultural resources in a subsurface context. Monitoring of the culvert removal by a qualified archaeologist is thus recommended.

By letter dated June 25, 2014, the SHPD noted that the archaeological inventory survey meets the requirements of Hawai'i Administrative Rule Section 13-276 and is accepted as final. Refer to Appendix D.

## 3.7 Air Quality

The State of Hawai'i Department of Health (DOH), Clean Air Branch, monitors the ambient air in the State for various gaseous and particulate air pollutants. The U.S. Environmental Protection Agency (EPA) has set national ambient air quality standards (NAAQS) for six criteria pollutants: carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, ozone, and particulate matter ($PM_{10}$ and $PM_2$). Hawai'i has also established a state ambient air standard for hydrogen sulfide. The primary purpose of the statewide monitoring network is to measure ambient air concentrations of these pollutants and ensure that these air quality standards are met.

Air pollution in Hawai'i is caused by many different man-made and natural sources. There are industrial sources of pollution, such as power plants and petroleum refineries; mobile sources, such as cars, trucks and buses; agricultural sources, such as sugar cane burning, and natural sources, such as windblown dust and volcanic activity. The DOH Clean Air Branch is responsible for regulating and monitoring pollution sources to ensure that the levels of criteria pollutants remain well below the State and federal ambient air quality standards.

The State maintains two air monitoring stations on the island of Maui, one in Kīhei and one in Pā'ia. Both stations monitor for particulate matter ($PM_{2.5}$) less than or equal to 2.5 micrograms per cubic meter (µg/m3). Current readings from the Kīhei station indicate that the concentration of $PM_{2.5}$ is well below Federal air quality standards. There are no State standards for $PM_{2.5}$. Although there is very little information available, air quality at the project site is generally considered to be good due to the presence of abundant tradewinds throughout most of the year.

**Impacts and Mitigation Measures**

In the short-term, during construction of the proposed project, two potential types of air pollution emissions will likely occur, resulting in air quality impacts: 1) airborne dust

from construction activities such as grading and excavation within the project site; and 2) exhaust emissions from construction vehicles and equipment from the project site.

Potential air quality impacts during construction of the Preferred Alternative will be mitigated by complying with the State DOH Administrative Rules, Title 11, Chapter 60 "Air Pollution Control". The construction contractor is responsible for complying with the State DOH regulations which prohibit visible dust emissions at property boundaries. Compliance with State regulations will require adequate measures to control airborne dust by methods such as water spraying and sprinkling of loose or exposed soil or ground surface areas and dust-generating equipment during construction. As may be deemed appropriate, planting of landscaping as soon as possible on completed areas will also help to control dust. Increased vehicular emissions due to disruption of traffic by construction equipment and/or commuting construction workers can be alleviated by moving the equipment and personnel to the site during off-peak hours. Exhaust emissions from construction vehicles are anticipated to have negligible impact on air quality in the project vicinity as the emissions would be relatively small and readily dissipated.

In the long-term, operation of the project will have no significant long-term impact on ambient air quality in the project vicinity. Air quality levels would be most affected by vehicular emissions generated by project-related traffic, however, the elevated vehicular emission concentrations are anticipated to dissipate.

## 3.8 Noise

Ambient noise in the project area is predominantly attributed to vehicular traffic traveling along South Kīhei Road and adjacent roadways. Also contributing to the acoustic environment is noise from low pitch sounds of waves along the coast, wind and birds.

**Impacts and Mitigation Measures**

In the short-term, noise from construction activities such as excavation, grading, cutting, and paving will be unavoidable. The increase in noise level will vary according to the particular phase of construction. Noise may also increase as a result of operation of heavy vehicles and other power equipment during the construction period.

Construction noise impacts will be mitigated by compliance with provisions of the State DOH Administrative Rules, Title 11, Chapter 46, "Community Noise Control" regulations. These rules require a noise permit if the noise levels from construction activities are expected to exceed the allowable levels stated in the DOH Administrative Rules. It shall be the contractor's responsibility to minimize noise by properly maintaining noise mufflers and other noise-attenuating equipment, and to maintain noise levels within regulatory limits. Also, the guidelines for heavy equipment operation and noise curfew times, as set forth by the DOH noise control rules, will be adhered to; or if necessary, a noise permit shall be obtained.

In the long-term, no significant noise impacts are anticipated once the construction of the proposed project has been completed. Since the project is not expected to

increase roadway capacity or travel demand, ambient noise levels in the vicinity should not change significantly.

## 3.9 Traffic

In the vicinity of the project site, South Kīhei Road is a predominantly two-lane, two-way roadway generally oriented in the north-south direction that provides access through Kīhei.

A Traffic Assessment Report (TAR) was prepared for the proposed project by Wilson Okamoto Corporation in December 2012. The purpose of the TAR is to assess traffic operating conditions resulting from the proposed project, and to identify recommendations, if appropriate, that would mitigate the traffic impacts. The TAR is included in Appendix D and is summarized below.

Field investigations were conducted in October 2012 and consisted of a 24-hour mechanical count survey near the existing Kūlanihāko'i Bridge.

The highway capacity analysis performed in this TAR is based on procedures presented in the "Highway Capacity Manual", Transportation Research Board, 2010, and the "Highway Capacity Software", developed by the Federal Highway Administration. The analysis is based on the concept of Level of Service (LOS), a quantitative and qualitative assessment of traffic operations. LOS are defined by LOS "A" through "F", with LOS "A" representing ideal or free-flow traffic operating conditions and LOS "F" representing unacceptable or potentially congested traffic operating conditions.

"Volume to Capacity" (v/c) ratio is another measure indicating the relative traffic demand to the road carrying capacity. A v/c ratio of one (1.00) indicates that the roadway is operating at near capacity. A v/c ratio greater than 1.00 indicated that the traffic demand exceeds the road's carry capacity.

In the vicinity of the project site, the morning peak hour of traffic generally occurs between 7:15 and 8:15 AM while the afternoon peak hour generally occurs between 4:30 and 5:30 PM.

Near the existing Kūlanihāko'i Bridge, South Kīhei Road carries 574 vehicles northbound and 443 vehicles southbound during the AM peak period. During the PM peak period, traffic volumes are higher with 657 vehicles traveling northbound and 581 vehicles traveling southbound. The northbound direction of traffic operates at LOS "D" during both peak periods with a v/c ratio of 0.37 and 0.40 during the AM and PM peak periods, respectively. The southbound direction of traffic operates at LOS "C" with a v/c ratio of 0.29 during the AM peak period and at a LOS "D" with a v/c ratio of 0.35 during the PM peak period.

**Impacts and Mitigation Measures**

Traffic conditions were forecasted to year 2015, the anticipated completion date of the project.

Prior to the removal of the existing bridge, a two-lane, two-way temporary bypass road and bridge will be constructed mauka of the existing bridge to accommodate traffic along South Kīhei Road during construction. The peak hour traffic conditions

during this interim construction period are summarized in Table 3-1. The existing LOS is provided for comparison purposes.

Under interim conditions, traffic operations along South Kīhei Road are generally expected to remain similar to existing conditions due to the maintenance of the existing number of travel lanes. The northbound direction of traffic is expected to continue operating at LOS "D" during both peak periods with v/c ratios similar to existing conditions. The southbound direction of traffic is expected to operate at a slightly lower LOS"D" during the AM peak period, but the v/c ratios for that direction are expected to remain similar to existing conditions during both peak periods.

**Table 3-1**
**Existing and Interim LOS Traffic Operating Conditions**

| Direction of Travel | | AM | | PM | |
|---|---|---|---|---|---|
| | | Existing | Interim | Existing | Interim |
| Northbound | LOS | D | D | D | D |
| | v/c ratio | 0.37 | 0.37 | 0.40 | 0.40 |
| Southbound | LOS | C | D | D | D |
| | v/c ratio | 0.29 | 0.29 | 0.35 | 0.35 |

The replacement of Kūlanihāko'i Bridge is expected to be completed by the Year 2015. The 2015 peak traffic conditions with the new bridge are summarized in Table 3-2. The existing levels of service are provided for comparison purposes.

**Table 3-2**
**Existing and Year 2015 Traffic Operating Conditions**

| Direction of Travel | | AM | | PM | |
|---|---|---|---|---|---|
| | | Existing | Year 2015 | Existing | Year 2015 |
| Northbound | LOS | D | D | D | D |
| | v/c ratio | 0.37 | 0.4 | 0.40 | 0.43 |
| Southbound | LOS | C | D | D | D |
| | v/c ratio | 0.29 | 0.31 | 0.35 | 0.38 |

Under Year 2015 conditions, traffic operations along South Kīhei Road are generally expected to remain similar to existing conditions despite the anticipated ambient growth in traffic due to the provision of wider travel lanes and shoulder areas along this segment of South Kīhei Road. The northbound direction of traffic is expected to continue operating at LOS "D" during both peak hours with v/c ratios of 0.40 and 0.43 during the AM and PM peak periods, respectively. The southbound direction of traffic

is also expected to operate at LOS "D" during both peak periods with v/c ratios of 0.31 and 0.38 during the AM and PM peak periods, respectively.

Based on the analysis of the traffic data, the following recommendations should be implemented in conjunction with the proposed project:

1. Provide sufficient sight distances for motorists to safely navigate the proposed temporary bypass road and bridge.
2. Provide sufficient turning radii along the temporary bypass road and bridge to accommodate all anticipated vehicle types. If the provision of these radii is not technically feasible, consider restriction of larger vehicles along this segment of South Kīhei Road and the provision of a detour utilizing Pi'ilani Highway.
3. Prepare a Construction Traffic Management Plan to minimize the impact of construction activities on the surrounding roadways.

Traffic operations during the interim construction period and once the project is complete in Year 2015 are anticipated to remain similar to existing conditions. As such, the proposed project is not expected to have a significant impact on traffic in the project vicinity. In addition, recommendations have been provided to ensure that the temporary detour road and bridge can safely accommodate existing traffic during construction and minimize the impact of construction activities on the surrounding roadways.

The proposed temporary bridge and bypass road on the mauka side of South Kīhei Road has been designed to accommodate larger vehicles such as buses and fire trucks. However, there are limitations to semi-trailers which would need to be re-routed during construction of the replacement bridge. The replacement bridge will be designed to accommodate all vehicle types.

During the construction of the tie-in between the temporary bypass road and the existing South Kīhei Road there will be a period of time (approximately two weeks) when South Kīhei Road will need to be closed. During this time, vehicles are planned to be detoured through Pi'ilani Highway.

## 3.10 Visual Resources

Hawai'i's visual resources are an important component of the state's tourism industry and of the quality of life enjoyed by the state's residents. The state's visual resources include a broad range of natural and developed areas and a tremendous variety of land uses, water bodies, and vegetation types.

The slopes of Haleakalā are visible from the project site, with the West Maui Mountains visible to the northwest. The County of Maui's Maui Island Plan identifies South Kīhei Road in the vicinity of the project site as a "medium" scenic corridor.

**Impacts and Mitigation Measures**

In the short-term, a temporary bypass road and bridge are being proposed on the mauka side of the existing roadway. This use will be generally similar in visual

character to that of the emergency temporary bridge over the existing culverts. Compared to the existing culverts, the temporary bridge on the mauka side of South Kīhei Road would provide a higher view object (approximately 14 feet) for individuals utilizing South Kīhei Road or in close proximity to this portion of the road. However, the temporary bridge and bypass road are necessary in order to maintain usage of this portion of South Kīhei Road during construction of the replacement Kūlanihāko'i Bridge. Once the new bridge is constructed, the temporary bypass road and bridge will be removed.

In the long-term, the proposed replacement bridge is not anticipated to have significant impacts on notable view planes nor adversely affect important public viewing points or visual resources. As an already existing roadway and bridge, the project will not significantly change the scenic and visual character of the surrounding area.

### 3.11 Socio-Economic Characteristics

The project site is located within the Kīhei Census Designated Place (CDP). Demographic and other information was reviewed from the U.S. Census 2010 for the Kīhei CDP and the County of Maui and is shown on Table 3-3.

Based upon the data shown on the table, Kīhei CDP has a slightly younger population than the County of Maui. The median age of the population for Kīhei CDP was 38.4 versus 39.6 for the County.

By racial mix, the Kīhei CDP has a higher percentage of Whites (50.7%) than the County (34.4%). Kīhei CDP also has a slightly lower percentage of Asians (21.7%) and those of two or more races (16.3%) than the County (28.8% and 23.5%, respectively). These three races (Whites, Asians and those with two or more races) make up the majority of the population. Native Hawaiian and other Pacific Islanders comprise a slightly lower proportion than the County as a whole, with 6.5% and 10.4%, respectively.

According to the 2010 Census, Kīhei CDP has a slightly lower housing occupancy rate, 67.5%, than the County, 76.6%. Housing units in this region are evenly occupied by both renters (52.0%) and owners (48.0%). The County data differs slightly to that of the Kīhei CDP data in that the proportion of housing units are occupied more by owners than renters (55.8% and 44.2%, respectively).

**Impacts and Mitigation Measures**

In the short- term, construction expenditures will provide positive benefits to the local economy. This would include creation of some construction and construction support jobs, and the purchase of materials from local suppliers, as well as indirect benefits to local retail businesses resulting from construction activities.

**Table 3-3**
**Demographic Characteristics**

| Subject | Kīhei CDP | | County of Maui | |
|---|---|---|---|---|
| | Number | Percent | Number | Percent |
| **TOTAL POPULATION** | 20,881 | 100 | 154,834 | 100 |
| **AGE** | | | | |
| Under 5 years | 1,273 | 6.1 | 10,020 | 6.5 |
| 5-19 years | 3,694 | 17.7 | 29,117 | 18.8 |
| 20-64 years | 13,832 | 66.2 | 95,894 | 61.9 |
| 65 years and over | 2,082 | 10.0 | 19,803 | 12.8 |
| Median age (years) | 38.4 | --- | 39.6 | --- |
| **RACE** | | | | |
| White | 10,582 | 50.7 | 53,336 | 34.4 |
| Black or African American | 244 | 1.2 | 870 | 0.6 |
| American Indian and Alaskan Native | 134 | 0.6 | 603 | 0.4 |
| Asian | 4,533 | 21.7 | 44,595 | 28.8 |
| Native Hawaiian and other Pacific Islander | 1,359 | 6.5 | 16,051 | 10.4 |
| Two or more races | 3,396 | 16.3 | 36,328 | 23.5 |
| Other | 633 | 3.0 | 3,051 | 2.0 |
| **HOUSEHOLD (BY TYPE)** | | | | |
| **TOTAL HOUSEHOLDS** | 8,095 | 100 | 53,886 | 100 |
| Family households (families) | 4,736 | 58.5 | 35,498 | 65.9 |
| Married-couple family | 3,439 | 42.5 | 25,408 | 47.2 |
| With own children under 18 years | 1,409 | 17.4 | 10,185 | 18.9 |
| Female householder, no children | 823 | 10.2 | 6,623 | 12.3 |
| With own children under 18 years | 470 | 5.8 | 3,427 | 6.4 |
| Nonfamily household | 3,359 | 41.5 | 18,388 | 34.1 |
| Average household size | 2.6 | --- | 2.82 | --- |
| **HOUSING OCCUPANCY AND TENURE** | | | | |
| **TOTAL HOUSING UNITS** | 11,994 | 100 | 70,397 | 100 |
| Occupied Units | 8,095 | 67.5 | 53,886 | 76.6 |
| By owner | 3,889 | 48.0 | 3,005 | 55.8 |
| By renter | 4,206 | 52.0 | 23,831 | 44.2 |
| Vacant Units | 3,899 | 32.5 | 16,493 | 23.4 |

In the long-term, the proposed project will replace the existing deteriorating bridge, which will create safer access over Kūlanihāko'i Bridge. In addition, the roadway improvements to South Kīhei Road will create safer pedestrian and bicycle access that will benefit the public who travel along this route.

## 3.12 Public Services and Facilities

### 3.12.1 Police and Fire Protection

Police protection in the project area is provided by the County of Maui Police Department (MPD). The project area is a part of District VI, which covers the Kīhei-Mākena region and ~~is~~ was served by a substation located at the Kīhei Town Center, approximately 2.2 miles from the project site. ~~In addition,~~ MPD is currently located within the ~~proposing a~~ new Kīhei Police Station ~~to be~~ located mauka of Pi'ilani Highway near its intersection with Kanani Road approximately 3.3 miles from the project site.

Fire prevention, protection is provided by the County of Maui, Department of Fire and Public Safety. The project area is served by the Kīhei Fire Station located on South Kīhei Road near Kalama Park approximately 2.1 miles south of the project site. The Wailea Fire Station, located approximately 4.9 miles to the south of the project site, provides back up support for the Kīhei Station when required.

**Impacts and Mitigation Measures**

In the short- and long-term, no significant impacts or increased demand on police and fire services resulting from the project are anticipated. The proposed project will replace the current, deteriorating bridge and enhance safety for motorists, bicyclists and pedestrians along this section of roadway. No additional vehicular lanes are proposed that could increase roadway capacity or traffic flow. Therefore, the project is not anticipated to induce population growth and associated demands on police and fire protection.

During construction of the temporary bypass road and bridge and the new Kūlanihāko'i Bridge, access through South Kīhei Road will be maintained at existing levels of service, therefore, the proposed project is not anticipated to have significant impacts on fire and police access through the project site.

### 3.12.2 Health Care Services

The only major medical facility on the island is the Maui Memorial Medical Center, which is located in Wailuku, approximately 11.3 miles from the project site. The 231 bed facility provides general, acute, and emergency care services.

Various clinics and physician's offices are situated throughout the Kīhei and Wailea areas, however, these facilities provide medical services on a smaller scale. Clinics within the project vicinity include Kīhei Clinic and Wailea Medical Services, Kīhei Pediatric Clinic, Kīhei Physicians, Kīhei-Wailea Medical Center, Maui Medical Group, and Kaiser Permanente.

**Impacts and Mitigation Measures**

In the short- and long-term, no significant impacts or increased demand on medical services are anticipated. The proposed project will replace the current, deteriorating bridge and enhance safety for motorists, bicyclists and pedestrians along this section of roadway. No additional vehicular lanes are proposed that could increase roadway capacity or traffic flow. Therefore, the project is not anticipated to induce population growth and associated demands on medical facilities and services.

### 3.12.3 Education

The project site is located within the State Department of Education's (DOE) Baldwin-Kekaulike-Maui complex area which includes Kamali'i Elementary School, Kīhei Elementary School, Lokelani Intermediate, and Kīhei Public Charter School.

The closest education facility to the project site is Kīhei Public Charter School located 0.7 miles northeast from the project site. Kīhei Public Charter School serves children from kindergarten to 12th grade. The other schools within the project vicinity are all located over one mile away from the project site.

**Impacts and Mitigation Measures**

In the short- and long-term, no significant impacts or increased demand on educational facilities are anticipated. The proposed project will replace the current, deteriorating bridge and enhance safety for motorists, bicyclists and pedestrians along this section of roadway. No additional vehicular lanes are proposed that could increase roadway capacity or traffic flow. Therefore, the project is not anticipated to induce population growth and associated demands on medical facilities and services.

During construction of the temporary bypass road and bridge and the new Kūlanihāko'i Bridge, access through South Kīhei Road will be maintained at existing levels of service, therefore, the proposed project is not anticipated to have significant impacts on students who travel along this route to and from school.

In the long-term, safer pedestrian and bicycle access over Kūlanihāko'i Bridge will benefit students who travel along this route.

### 3.12.4 Recreational Facilities

The County has several parks located in the project vicinity. The nearest County recreational facility to the project site is the 1.5 acre Kalepolepo Beach Park, located approximately 500 feet west of the project site along South Kīhei Road. Located approximately 0.25 miles north of the project site is the 5.3 acre Mai Poina O'e Ia'u Beach Park. Amenities available at this park include parking, picnic areas, and restrooms. Further south of the project site is the 20.22 acre Kīhei Beach Reserve, also known as Waipu'ilani Park located approximately 0.5 miles from the project site. Amenities available at this park include restrooms, a soccer field, and tennis courts.

Other recreational facilities in the project vicinity include the Kīhei Community Center and Aquatic Center, as well as resort affiliated, world-class golf courses and tennis centers.

**Impacts and Mitigation Measures**

In the short- and long-term, no significant impacts or increased demand on recreational facilities in the project vicinity are anticipated. The proposed project will replace the current, deteriorating bridge and enhance safety for motorists, bicyclists and pedestrians along this section of roadway. No additional vehicular lanes are proposed that could increase roadway capacity or traffic flow. Therefore, the project is not anticipated to induce population growth and associated demands on recreational facilities and parks.

### 3.12.5 Solid Waste Collection and Disposal

The County of Maui, Environmental Management Solid Waste Division Refuse Collection Program collects residential solid waste in the project vicinity. On an island-wide basis, solid waste from residential properties is disposed at three landfill locations: Central Maui Sanitary Landfill, Olowalu residential Recycling & Refuse Convenience Center, and Hāna Sanitary Landfill. Construction waste is disposed at Maui Construction & Demolition Landfill. Refuse collection for non-single family residential properties are provided by private refuse companies.

**Impacts and Mitigation Measures**

In the short- and long-term, no significant impacts to municipal solid waste collection and disposal facilities are anticipated during the construction of the proposed project.

Construction of the proposed project will generate solid waste typical of roadway construction related activities over the short-term. The contractor will be required to remove all debris from the site, and properly dispose of it at the Maui Construction and Demolition Landfill in conformance with County regulations.

## 3.13 Infrastructure and Utilities

### 3.13.1 Water System

Water service in the Kīhei-Mākena area is provided by the County of Maui Department of Water Supply (DWS). The DWS serves five main sections within the County; Central Maui, Upcountry Maui, West Maui, East Maui, and Molokaʻi. The project area is a part of the Central Maui system which includes Wailuku, Pāʻia, Kahului, Puʻunēnē, and Kīhei.

Within the project site, there is an existing 12-inch waterline located within the right-of-way of South Kīhei Road.

**Impacts and Mitigation Measures**

In the short-term, as the new culverts extend further across South Kīhei Road than the existing culverts, a portion of the existing 12-inch waterline will need to be replaced under the new culverts. All relocation work will be coordinated with DWS prior to construction.

In the long-term, the project is not anticipated to result in increased demand on the water system in the area. The proposed project will replace the current, deteriorating bridge and enhance safety for motorists, bicyclists and pedestrians along this section of roadway. No additional vehicular lanes are proposed that could increase roadway

capacity or traffic flow. Therefore, the project is not anticipated to induce population growth and associated demand on water. The proposed project is not anticipated to require using water on a regular basis.

### 3.13.2 Wastewater System

Wastewater service in the Kīhei area is provided by the County of Maui Department of Environmental Management. The Kīhei Wastewater Reclamation facility is responsible for handling all wastewater needs in the Kīhei area. Wastewater flows from the area are conveyed through a series of force mains, pump stations, and gravity lines to the reclamation facility for processing.

Within the vicinity of the project site there is a 30-foot wide sewer line easement located adjacent to the South Kīhei Road right-of-way. Within the easement lies a 27-inch sewer pipeline.

**Impacts and Mitigation Measures**

In the short- and long-term, the proposed project is not anticipated to result in increased demand on the wastewater system in the area. The proposed project will replace the current, deteriorating bridge and enhance safety for motorists, bicyclists and pedestrians along this section of roadway. No additional vehicular lanes are proposed that could increase roadway capacity or traffic flow. Therefore, the project is not anticipated to induce population growth and associated demand on the wastewater system. The proposed project will not generate any wastewater and the existing wastewater pipeline is not proposed to be altered. Construction plans for the project will be circulated to the Department of Environmental Management for review.

### 3.13.3 Drainage System

According to the County of Maui's Draft Report, *Kīhei Drainage Master Plan Waiakoa Gulch to Kilohana Drive Existing Conditions*, dated April 2009, there are eight different flood districts in the Kīhei region. The Kūlanihāko'i Bridge is located in the Kūlanihāko'i District, which is the largest district in the region that extends from an area adjacent to the summit of Haleakalā down to the ocean. For the Kūlanihāko'i District, runoff flows from a 100-year storm event are contributed by six drainage areas; Pi'ilani Basins 5, 6, 7, and 8 and Makai Basins Kula 2_1 and Kula 2_2. All runoff flows eventually discharge into Kūlanihāko'i Gulch where they continue to flow toward South Kīhei Road and the existing four culverts. For a 100-year storm event, at the point where the flows reach the existing culverts, the total flow for the 100-year storm event is approximated at 14,148 cfs. In addition, sand dunes which accumulate downstream of the gulch cause flooding problems and backwater effects during heavy storm events.

A Drainage Report for the project site was prepared by Wilson Okamoto Corporation in March 2013. The Drainage Report is included in Appendix E and is summarized below.

For a 100-year storm event, calculations show that the downstream elevations of the existing culverts are slightly higher than the upstream elevations, which may be caused by the accumulating sand dunes which prevent runoff from flowing out to the ocean and causing backwater effects that flood neighboring properties. Results also show that the existing culverts are not capable of handling large volumes of runoff which leads to runoff overtopping

the roadway. The existing culverts currently have no drainage capacity as they are essentially level with the surrounding area. This in turn, along with the presence of the sand plug, creates a pooling effect in which water rises and fills the area rather than allowing the water to flow.

**Impacts and Mitigation Measures**

In the short- and long-term, no significant impacts are anticipated on the existing storm drainage system as a result of the construction and operation as the proposed project itself will not generate any additional runoff

In the short-term, the temporary bridge on the mauka side of the existing bridge would have a drainage capacity of 705 cfs as the finished grade of the temporary bypass bridge would be approximately three feet above the top bank of the existing drainageway. Based on this runoff value, it was determined that the largest storm event that the temporary bypass bridge could handle would be a 1-year, 24 hour storm event. The location and the elevation of the temporary bridge is constrained due to the physical location of the project area, making it difficult to raise the bridge over the drainageway to accommodate a greater volume of flow. For a 100-year storm event, the temporary bridge is likely to be flooded due to large amounts of runoff flowing from upstream. In addition, the sand dunes would continue to impede the ability of the runoff to flow out to the ocean and continue to cause backwater effects that flood neighboring properties. For the temporary bridge to accommodate a 100-year storm event, the bridge would have to be raised. However, due to the physical constraints of the project site, raising the bridge would increase the slope of the bypass road, making it too steep for vehicles to travel on.

In the long-term, as the project involves increasing the number of culverts from four to six culverts and constructing them at a 0.5% slope, the proposed replacement bridge will provide an incremental increase in drainage capacity from 204 cfs to 306 cfs. This increase in drainage capacity would not be enough to accommodate the 100-year storm event. The new culverts would still be incapable of handling large volumes of runoff from severe storm events. In addition, the sand dunes would continue to impede the ability of the runoff to flow out to the ocean. Though the proposed project does slightly increase drainage capacity, the purpose of the project is to replace the deteriorating culverts and is not intended to address flooding issues on a regional basis.

### 3.13.4 Electrical and Communications Systems

Electrical power on the island of Maui is provided by Maui Electric Company (MECO), a subsidiary of Hawaiian Electric Company, Inc. The electrical source for the project area is the Mā'alaea Power Plant.

Telephone service in the Kīhei area, like the rest of the State, is provided by Hawaiian Telcom.

Oceanic Time Warner Cable of Hawai'i is the local CATV provider in the region.

Within the project site, two electrical overhead utility poles are located in the right-of-way on the mauka side of South Kīhei Road.

**Impacts and Mitigation Measures**

In the short-term, the two electrical poles will need to be relocated as they are currently located where the paved walkway is being proposed. All relocation work will be coordinated with MECO prior to construction.

In the long-term, the proposed project is not anticipated to significantly impact or increase demand on electrical and communication systems in the area. The proposed project will replace the current, deteriorating bridge and enhance safety for motorists, bicyclists and pedestrians along this section of roadway. No additional vehicular lanes are proposed that could increase roadway capacity or traffic flow. Therefore, the project is not anticipated to induce population growth and associated demand for electric and communication services. The proposed project is not anticipated to require electrical and communication services for its operation.

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# 4. RELATIONSHIP TO PLANS, POLICIES, AND CONTROLS

This section discusses the State and County of Maui land use plans, policies and controls relating to the proposed project.

## 4.1 State Land Use Plans and Policies

### 4.1.1 Hawai'i State Plan

The Hawai'i State Plan, Chapter 226, HRS, provides goals, objectives, policies, and priorities for the State. The Hawai'i State Plan also provides a basis for determining priorities, allocating limited resources, and improving coordination of State and County Plans, policies, programs, projects, and regulatory activities. It establishes a set of themes, goals, objectives, and policies that are meant to guide the State's long-range growth and development activities. The proposed project is consistent with the following applicable objectives and policies:

*Sec. 226-11 Objectives and policies for the physical environment – land-based, shoreline, and marine resources.*

*(a) Planning for the State's physical environment with regard to land-based shoreline, and marine resources shall be directed towards achievement of the following objectives:*

*(1) Prudent use of Hawai'i's land-based, shoreline, and marine resources.*

*(2) Effective protection of Hawai'i's unique and fragile environmental resources.*

*(b) To achieve the land-based, shoreline, and marine resources objectives, it shall be the policy of this State to:*

*(3) Take into account the physical attributes of areas when planning and designing activities and facilities.*

*(4) Manage natural resources and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage.*

*(6) Encourage the protection of rare or endangered plant and animal species and habitats native to Hawai'i.*

*(8) Pursue compatible relationships among activities, facilities, and natural resources.*

**Discussion:** Construction activities will involve land-disturbing activities, such as grubbing, clearing, grading, and excavation that may result in some soil erosion and potential construction-related impacts to the quality of surface and coastal waters in the greater project vicinity. Various mitigative measures will be incorporated into the project's construction plan

to minimize soil disturbances and potential short-term erosion impacts during construction activities. Excavation and grading activities associated with construction of the proposed improvements will be regulated by the County's grading ordinance.

A DOA Nationwide Permit, pursuant to Section 404 of the Clean Water Act and a WQC, issued by the DOH, pursuant to Section 401 of the Clean Water Act will be required. In conjunction with the Section 401 and 404 permits, a BMP plan will be prepared for construction activities within the project site. Erosion and sediment control measures will be instituted in accordance with site specific assessments, incorporating appropriate structural and/or non-structural BMPs ~~such as minimizing time of exposure between construction and landscaping, and implementing erosion control measures such as silt fences and filter berms~~. Specific BMPs may include, but may not be limited to the following:

1. Minimizing soil loss and erosion by revegetation and stabilization of slopes and disturbed areas of soil, possibly using hydromulch, geotextiles, or other applicable alternatives, as soon as possible after working;
2. Minimizing time of exposure between construction and landscaping;
3. Application of protective covers to soil and material stockpiles;
4. Minimizing disturbance of soil during periods of heavy rain;
5. Implementing erosion control measures by emplacement of structural controls such as silt fences, filter berms, gravel bags, fiber rolls, sandbag barriers and other barriers in order to retard and prevent the loss of sediment from the site;
6. Phasing of the project to disturb the minimum area of soil at a particular time;
7. Use of drip pans beneath vehicles not in use in order to trap vehicle fluids;
8. Routine maintenance of BMPs by adequately trained personnel;
9. Significant leaks or spills, if they occur, shall be properly cleaned up and disposed of at an approved site.

The proposed project is not anticipated to have any long-term impacts to land-based, shoreline, and marine resources. Following construction, exposed soils at the project site will have been built over, paved over, or re-vegetated to control erosion.

Dewatering may be required for the proposed project. Should dewatering be deemed necessary, the contractor will be responsible to obtaining all applicable permits including, but not limited to, an NPDES Permit for Dewatering Activities. The permit application will require a BMP plan, an erosion control plan, and a water quality monitoring plan. Water quality impacts associated with the disposal of dewatering effluent will also be addressed in the BMP plan, including appropriate characterization of any potential pollutants such as sediments and nutrients in the effluent.

*Sec. 226-17 Objective and policies for facility systems – transportation.*

*(a) Planning for the State's facility systems with regard to transportation shall be directed towards the achievement of the following objectives:*

*(1) An integrated multi-modal transportation system that services statewide needs and promotes the efficient, economical, safe, and convenient movement of people and goods.*

**Discussion:** The proposed project will replace the current, deteriorating bridge and enhance safety for motorists, bicyclists, and pedestrians along this section of roadway by providing an exclusive bike lane and paved walkway on the mauka side of the road. In addition, the makai side of the bridge and immediately adjacent areas will accommodate a bike lane and paved walkway. Improvements to additional segments can be implemented if and when future improvements are pursued on the makai side of South Kīhei Road.

### 4.1.2 State Land Use District

The State Land Use Law, Chapter 205, HRS, is intended to preserve, protect and encourage the development of lands in the State for uses that are best suited to the public health and welfare of Hawaiʻi's people. Under Chapter 205, HRS all lands in the State of Hawaiʻi are classified by the State Land Use Commission (LUC) into four major categories referred to as State Land Use Districts. These districts are identified as the Urban District, Agricultural District, Conservation District, and Rural District.

The LUC's Land Use District Boundary map for the Island of Maui depicts the lands within the project area as being designated within the State Urban District (see Figure 4-1). Permitted uses within the State Urban district are prescribed under Title 12, Chapter 205 (Land Use Commission), HRS, and the State Land Use Commission's Administrative Rules prescribed under Title 15, Subtitle 3, Chapter 15 HAR.

Pursuant to §15-15-24, HAR, pertaining to permissible uses within the Urban District, permitted uses include any and all uses permitted by the counties, either by ordinances or rules, and are subject to any conditions imposed by the Land Use Commission pursuant to Section 205-4.5, HRS. Since roadways, such as the proposed project, are considered an incidental use that is permitted in each of the County's zoning districts, the proposed project is a permitted use within the Urban District.

### 4.1.3 Hawaiʻi Coastal Zone Management Program

The National Coastal Zone Management (CZM) Program was created through passage of the Coastal Zone Management Act of 1972. Hawaiʻi's CZM Program, adopted as Chapter 205A, HRS, provides a basis for protecting, restoring and responsibly developing coastal communities and resources. The Hawaiʻi CZM area includes all lands within the State and the areas seaward to the extent of the State's management jurisdiction. Hence, the proposed project site is located in the CZM area. A discussion of the project's consistency with the objectives and policies of the CZM Program is provided below.

*(1) Recreational Resources*

*Objective:*
*Provide coastal recreational opportunities accessible to the public.*

*Policies:*
*(A) Improve coordination and funding of coastal recreational planning and management; and*

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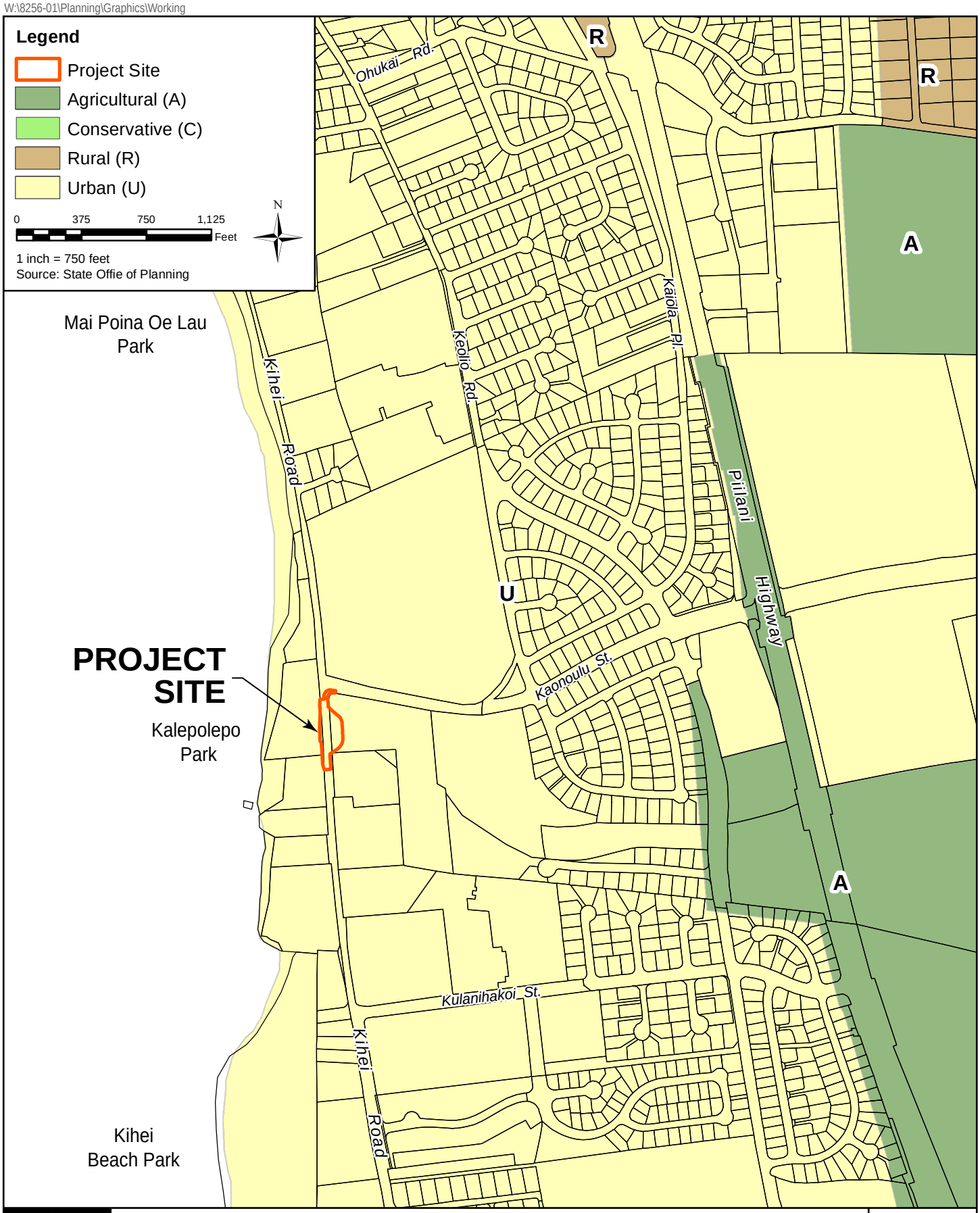



KULANIHAKOI BRIDGE REPLACEMENT

STATE LAND USE DISTRICTS MAP

FIGURE 4-1

WILSON OKAMOTO CORPORATION
ENGINEERS | PLANNERS | CONSULTANTS

*(i) Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by: Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;*

*(ii) Requiring replacement of coastal resources having significant recreational value, including but not limited to surfing sites, fishponds, and sand beaches, when such resources will be unavoidably damaged by development; or requiring reasonable monetary compensation to the state for recreation when replacement is not feasible or desirable;*

*(iii) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;*

*(iv) Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;*

*(v) Ensuring public recreational use of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources;*

*(vi) Adopting water quality standards and regulating point and nonpoint sources of pollution to protect, and where feasible, restore the recreational value of coastal waters.*

*(vii) Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing; and*

*(viii) Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, and county authorities; and crediting such dedication against the requirements of section 46-6.*

The proposed project, at its closest point, is located approximately ~~120~~ 72-feet from the ~~draft~~ certified shoreline.

In the short-term, storm water runoff may carry increased amounts of sediment into the storm drain system due to erosion from soils exposed during excavation and grading activities. This runoff could potentially impact the water quality of coastal waters in the area. However, excavation and grading activities associated with the construction of the proposed project will be regulated by the County's grading ordinance.

A DOA Nationwide Permit, pursuant to Section 404 of the Clean Water Act and a WQC, issued by the DOH, pursuant to Section 401 of the Clean Water Act will be required. In conjunction with the Section 401 and 404 permits, a BMP plan will be prepared for construction activities within the project site. Erosion and sediment control measures will be instituted in accordance with site specific assessments, incorporating appropriate structural and/or non-structural BMPs ~~such as minimizing time of exposure between construction and landscaping, and implementing erosion control measures such as silt fences and filter berms~~. Specific BMPs may include, but may not be limited to the following:

1. Minimizing soil loss and erosion by revegetation and stabilization of slopes and disturbed areas of soil, possibly using hydromulch, geotextiles, or other applicable alternatives, as soon as possible after working;
2. Minimizing time of exposure between construction and landscaping;
3. Application of protective covers to soil and material stockpiles;
4. Minimizing disturbance of soil during periods of heavy rain;
5. Implementing erosion control measures by emplacement of structural controls such as silt fences, filter berms, gravel bags, fiber rolls, sandbag barriers and other barriers in order to retard and prevent the loss of sediment from the site;
6. Phasing of the project to disturb the minimum area of soil at a particular time;
7. Use of drip pans beneath vehicles not in use in order to trap vehicle fluids;
8. Routine maintenance of BMPs by adequately trained personnel;
9. Significant leaks or spills, if they occur, shall be properly cleaned up and disposed of at an approved site.

Following construction, exposed soils at the project site will have been built over, paved over, or re-vegetated to control erosion.

Dewatering may be required for the proposed project. Should dewatering be deemed necessary, the contractor will be responsible to obtaining all applicable permits including, but not limited to, an NPDES Permit for Dewatering Activities. The permit application will require a BMP plan, an erosion control plan, and a water quality monitoring plan. Water quality impacts associated with the disposal of dewatering effluent will also be addressed in the BMP plan, including appropriate characterization of any potential pollutants such as sediments and nutrients in the effluent.

In the long-term, as the proposed culverts will be constructed at a 0.5% slope, the drainage capacity will increase slightly from 204 cfs to 306 cfs. In the event of a 100-year storm, this increase in capacity will increase the likelihood of storm flows breaking through the sand plug. This could slightly relieve some of the upstream flooding, but may slightly increase flows past the sand plug. No significant impacts are anticipated on recreational resources.

*(2) Historic Resources*

*Objective:*

*(A) Protect, preserve and, where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.*

*Policies:*

*(A) Identify and analyze significant archaeological resources;*
*(B) Maximize information retention through preservation of remains and artifacts or salvage operations; and*
*(C) Support state goals for protection, restoration, interpretation, and display of historic resources.*

An Archaeological Literature Review and Field Inspection (LR&FI) for the project site was conducted for the property in December 2012. Based on the field inspection findings and

background research, there is a low potential for the discovery of previously unidentified historic properties beyond the historic era itself. The area surrounding the bridge includes the Kūlanihāko‘i Stream mouth, a natural wetland and associated flood plain. While impacts by flooding episodes and modifications associated with road construction and maintenance have greatly altered sediments of the project areas, the possibility of encountering intact subsurface cultural deposits, including human burials, should not be underestimated. Therefore, the LR&FI recommended that archaeological monitoring be conducted ~~is recommended~~ for all ground disturbing activities during all phases of the temporary bridge and bypass road work and bridge replacement. It is also recommended that a monitoring report be generated after the construction of the temporary bridge and bypass road and the replacement bridge.

~~A site inspection was conducted on December 13, 2012 by SHPD and Cultural Surveys Hawai‘i. Based on the site inspection, SHPD requested that an AIS be prepared for the project site. The AIS is currently pending and will be submitted to SHPD for approval when it has been completed. Subsequent consultation with SHPD, by letter dated February 1, 2013, indicated that they have concerns that the project area is located within a zone of beach sand dune and Aeolian sand deposits which are known to contain human burial features and historic habitation sites. It is therefore likely that historic properties, including human remains, may be present beneath the previously disturbed road grade and sub-grade or within previously unaffected areas of the right-of-way. SHPD requested that all project associated excavations be monitored by a qualified archaeologist in order to identify and mitigate any subsurface cultural features and deposits. They further recommend that an archaeological monitoring plan be submitted to their office for review and approval prior to initiation of this project.~~

~~Should any significant archeological, cultural, or historic resources be found during construction activities, all work will cease in the vicinity of the find and SHPD will be notified immediately to determine appropriate mitigation measures.~~

During a field visit on December 13, 2012 with Theresa Donham (Archaeology Branch Chief), an archaeological inventory survey of the lands covering the extent of the APE of the proposed detour bridge was recommended. An archaeological inventory survey was conducted by Cultural Surveys Hawai‘i, Inc. dated June 2013.

The survey included shovel testing and pipe coring which enabled mapping a general stratigraphy of the project to a depth of approximately 10 feet below ground surface. Two soil samples were submitted for pollen analysis.

One historic property within the project area is the Kūlanihāko‘i Bridge itself. The bridge has been given a site number (SIHP 50-50-10-7606). The bridge was constructed in 1911 and consisted of four individual reinforced concrete box culverts. The paving surface over the existing culverts was applied in the 1930’s. This included some shoring-up of the edge of the roadway using a historic construction style attributed to pre-1940’s plantation masons. The present day Kūlanihāko‘i Bridge appears to consist of two sections of prefabricated concrete culvert welded together to form the length of the existing bridge. A more modern construction style probably occurred because of the many repairs the bridge had undergone due to storm damage.

The study was able to establish that at least the first 10 feet of sediment can be attributed to historic alluvium from Kūlanihāko‘i Gulch. This is generally consistent with the information collected by Geolabs, the geotechnical engineer, for this project. They recorded a dark gray clay silt to a depth of 10 feet above the grayish tan coralline sand.

Like the LR&FI, the inventory survey notes that there is a low potential for the discovery of previously unidentified historic properties beyond the historic era itself. The area surrounding the bridge includes the Kūlanihāko‘i Stream mouth, a natural wetland and associated flood plain. While impacts by flooding episodes and modifications associated with road construction and maintenance have greatly altered sediments of the project areas, the possibility of encountering intact subsurface cultural deposits, including human burials, should not be underestimated. Therefore, archaeological monitoring is recommended for all ground disturbing activities during all phases of the temporary bridge and bypass road work and bridge replacement. It is also recommended that a monitoring report be generated after the construction of the temporary bridge and bypass road and the replacement bridge.

With regard to the bridge itself, the structure was constructed in 1911 and is now ~~102~~ 105 years old. It is therefore considered a historic property and recordation of the bridge would be required under Chapter 13-275, Hawai‘i Administrative Rules if deemed eligible based on SHPD’s evaluation of the bridge’s significance. Consultation with SHPD, by letter dated December 20, 2012, indicated that while the bridge is unique due to age and represents the first generation of concrete bridges in the islands, it is literally falling apart and has lost any distinguishing architectural characteristics. On this basis, SHPD has determined that the bridge has lost its integrity and is not eligible to be recorded on the State Inventory of Historic Properties. Therefore, the proposed project will have no effect on historic property.

The archaeological inventory survey noted that the Kūlanihāko‘i Bridge (SIHP 50-50-10-7606) has yielded information important to the understanding of the first generation of concrete bridges in the Hawaiian Islands. SIHP -7606 is thus considered significant under Criterion D. Sufficient information concerning SIHP -7606 was collected during the investigation. Based on the additional research, no further work is recommended for the bridge.

The archaeological inventory survey also noted that while subsurface testing was not done beneath South Kīhei Road, boring logs from the Geolabs report recorded the presence of coralline sand around 12 feet below the surface of the road. The presence of this type of sediment deposit may present the potential for encountering sensitive cultural resources in a subsurface context. Monitoring of the culvert removal by a qualified archaeologist is thus recommended.

By letter dated June 25, 2014, the SHPD noted that the archaeological inventory survey meets the requirements of Hawai‘i Administrative Rule Section 13-276 and is accepted as final. Refer to Appendix D.

*(3) Scenic and Open Space Resources*

*Objective:*

*(A) Protect, preserve, and where desirable, restore or improve the quality of coastal scenic and open space resources.*

*Policies:*

*(A) Identify valued scenic resources in the coastal zone management area;*

*(B) Ensure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;*

*(C) Preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources; and*

*(D) Encourage those developments which are not coastal dependent to locate in inland areas.*

In the short-term, a temporary bypass road and bridge are being proposed on the mauka side of the existing roadway. This use will be generally similar in visual character to that of the temporary bridge over the existing culverts. Compared to the existing culverts, the temporary bridge on the mauka side of South Kīhei Road would provide a higher view object (approximately 14 feet) for individuals utilizing South Kīhei Road or in close proximity to this portion of the road. However, the temporary bridge and bypass road are necessary in order to maintain usage of this portion of South Kīhei Road during construction of the replacement Kūlanihākoʻi Bridge. Once the new bridge is constructed, the temporary bypass road and bridge will be removed.

In the long-term, the proposed replacement bridge is not anticipated to have significant impacts on notable view planes nor adversely affect important public viewing points or visual resources. As an already existing roadway and bridge, the project will not significantly change the scenic and visual character of the surrounding area.

*(4) Coastal Ecosystems*

*Objective:*

*(A) Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.*

*Policies:*

*(A) Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;*

*(B) Improve the technical basis for natural resource management;*

*(C) Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance;*

*(D) Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and*

*(E) Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and*

> *enhance water quality through the development and implementation of point and nonpoint source water pollution control measures.*

The proposed project, at its closest point, is located approximately ~~120~~ 72-feet from the ~~draft~~ certified shoreline.

In the short-term, storm water runoff may carry increased amounts of sediment into the storm drain system due to erosion from soils exposed during excavation and grading activities. This runoff could potentially impact the water quality of coastal waters in the area. However, excavation and grading activities associated with the construction of the proposed project will be regulated by the County's grading ordinance.

A DOA Nationwide Permit, pursuant to Section 404 of the Clean Water Act and a WQC, issued by the DOH, pursuant to Section 401 of the Clean Water Act will be required. In conjunction with the Section 401 and 404 permits, a BMP plan will be prepared for construction activities within the project site. Erosion and sediment control measures will be instituted in accordance with site specific assessments, incorporating appropriate structural and/or non-structural BMPs ~~such as minimizing time of exposure between construction and landscaping, and implementing erosion control measures such as silt fences and filter berms~~. Specific BMPs may include, but may not be limited to the following:

1. Minimizing soil loss and erosion by revegetation and stabilization of slopes and disturbed areas of soil, possibly using hydromulch, geotextiles, or other applicable alternatives, as soon as possible after working;
2. Minimizing time of exposure between construction and landscaping;
3. Application of protective covers to soil and material stockpiles;
4. Minimizing disturbance of soil during periods of heavy rain;
5. Implementing erosion control measures by emplacement of structural controls such as silt fences, filter berms, gravel bags, fiber rolls, sandbag barriers and other barriers in order to retard and prevent the loss of sediment from the site;
6. Phasing of the project to disturb the minimum area of soil at a particular time;
7. Use of drip pans beneath vehicles not in use in order to trap vehicle fluids;
8. Routine maintenance of BMPs by adequately trained personnel;
9. Significant leaks or spills, if they occur, shall be properly cleaned up and disposed of at an approved site.

The proposed project is not anticipated to have any long-term impacts on coastal ecosystems. Following construction, exposed soils at the project site will have been built over, paved over, or re-vegetated to control erosion.

Dewatering may be required for the proposed project. Should dewatering be deemed necessary, the contractor will be responsible to obtaining all applicable permits including, but not limited to, an NPDES Permit for Dewatering Activities. The permit application will require a BMP plan, an erosion control plan, and a water quality monitoring plan. Water quality impacts associated with the disposal of dewatering effluent will also be addressed in the BMP plan, including appropriate characterization of any potential pollutants such as sediments and nutrients in the effluent.

In the long-term, as the proposed culverts will be constructed at a 0.5% slope, the drainage capacity will increase slightly from 204 cfs to 306 cfs. In the event of a 100-year storm, this increase in capacity will increase the likelihood of storm flows breaking through the sand plug. This could slightly relieve some of the upstream flooding, but may slightly increase flows past the sand plug. No significant impacts are anticipated on coastal ecosystems.

*(5) Economic Uses*

*Objective:*

*(A) Provide public or private facilities and improvements important to the State's economy in suitable locations.*

*Policies:*

*(A) Concentrate coastal dependent development in appropriate areas;*

*(B) Ensure that coastal dependent developments such as harbors and ports, and coastal related development such as visitor facilities and energy generating facilities, are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area; and*

*(C) Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:*

*(i) Use of presently designated locations is not feasible;*

*(ii) Adverse environmental effects are minimized; and*

*(iii) The development is important to the State's economy.*

The proposed project provides the necessary infrastructure to promote the safe and efficient movement of people, goods and services important to the State's economy. The project will provide direct construction and operational jobs and will also have beneficial secondary economic benefits by promoting the procurement of materials and supplies from local vendors.

*(6) Coastal Hazards*

*Objectives:*

*(A) Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution.*

*Policies:*

*(A) Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and nonpoint source pollution hazards;*

*(B) Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and nonpoint pollution hazards;*

*(B) Ensure that developments comply with requirements of the Federal Flood Insurance Program;*

*(C) Prevent coastal flooding from inland projects.*

According to the Flood Insurance Rate Map (FIRM) (Community Panel Numbers 1500030586F and 1500030567F, Effective Date: September 19, 2012) prepared by the Federal Emergency Management Agency (FEMA), the project site is designated Zone VE and Zone AE.

Zone VE includes areas with a 1% or greater change of flooding and have an additional hazard associated with storm waves. In general, these areas have a 26% chance of flooding over the life of a 30-year mortgage.

Zone AE is characterized as a "special flood hazard area subject to inundation by the 1% annual chance flood." Zone AE is also a "floodway," in which "the channel of the stream plus any adjacent floodplain areas that must be kept free of the encroachment so that the 1% annual chance flood can be carried without substantial increases in flood height." The 1% annual flood is also commonly referred to as the 100-year flood or the base flood.

According to the Tsunami Evacuation Zone maps for Maui, the project site lies entirely within the tsunami evacuation zone.

Construction activities within the respective flood hazard districts will be conducted in accordance with regulations set forth in Section 19.62.060, Maui County Code. Before construction of any development begins within any flood hazard area, flood-related erosion hazard area, or mudslide area, a special flood hazard area development permit shall be obtained from the Director of the Department of Planning.

The project will also comply with the rules and regulations for the National Flood Insurance Program (NFIP) present in Title 44, of the Code of Federal Regulations (44CFR), as the project is within a Special Flood Hazard Area.

*(7) <u>Managing Development</u>*

*<u>Objective</u>:*

*(A) Improve the development review process, communication, and public participation in the management of coastal resource and hazards.*

*<u>Policies</u>:*

*(A) Use, implement, and enforce existing law effectively to the maximum extent possible in managing present and future coastal zone development;*

*(B) Facilitate timely processing of applications for development permits and resolve overlapping or conflicting permit requirements; and*

*(C) Communicate the potential short- and long-term impacts of proposed significant coastal developments early in their life cycle and in terms understandable to the public to facilitate public participation in the planning and review process.*

The Hawai'i State environmental review process, HRS 343, requires project review by government agencies and affords the public the opportunity to provide comments on the proposed project. The proposed improvements are also subject to the Special Management

Area (SMA) permit process. Applicable State and County requirements will be adhered to in the design and construction phases of the proposed improvements.

*(8)* *Public Participation*

*Objective:*

*(A) Stimulate public awareness, education, and participation in coastal management.*

*Policies:*

*(A) Promote public involvement in coastal zone management processes;*

*(B) Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal issues, developments, and government activities; and*

*(C) Organize workshops, policy dialogues, and site-specific mediations to respond to coastal issues and conflicts.*

The Hawai'i State environmental review process, Chapter 343, HRS, requires project review by government agencies and affords organizations and the general public the opportunity to provide comments on the proposed project. The proposed improvements are also subject to the SMA and Shoreline Setback Variance permit process as discussed in Section 4.2.~~2~~3, which includes public notification and a public hearing.

*(9)* *Beach Protection*

*Objective:*

*(A) Protect beaches for public use and recreation.*

*Policies:*

*(A) Locate new structures inland from the shoreline setback to conserve open space, minimize interference with natural shoreline processes, and minimize loss of improvements due to erosion;*

*(B) Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and*

*(C) Minimize the construction of public erosion-protection structures seaward of the shoreline.*

The proposed project will involve some construction activities within the shoreline setback area and will, therefore, need a shoreline setback variance from the County of Maui Planning Department.

The shoreline was re-certified by the Department of Land and Natural Resources on September 18, 2015. ~~Currently, a draft of the certified shoreline is in the process of being reviewed by the State Department of Land and Natural Resources (DLNR).~~ In accordance with the *Shoreline Setback Rules and Regulations for the Maui Planning Commission*, the

shoreline setback was calculated by utilizing the annual erosion hazard rate (AEHR) ~~erosion~~ based setback line which is located further mauka than the average lot depth based setback line. No portion of the proposed improvements extend makai of the average lot depth based setback line. However, portions of the proposed culverts and the outlet wing walls are located within the AEHR based setback line. The AEHR setback line cuts diagonally across a portion of the proposed six 6' wide x 4' high culverts. Approximately 6 feet to 30 feet of makai portions of the culverts are proposed within the AEHR setback line. The remaining mauka portions of the culverts ranging from 54 feet to 20 feet are outside of the AEHR setback line. ~~The~~ Both proposed outlet wing walls ~~adjacent to the southernmost culvert~~ will be located within the AEHR shoreline setback. The dimensions of the wing walls within the shoreline setback are 10-feet long, 6-feet to 2-feet high (the wall will slope towards the ocean), and 1-foot wide. The wing walls ~~is~~ are a part of the culvert structure and ~~is~~ are intended to retain and protect the foundation of South Kīhei Road.

~~Depending on the location of the final certified shoreline, other portions of the project may or may not be located in the shoreline setback, including the outlet wing wall adjacent to the northernmost culvert. Similar to the southern outlet wing wall, the northern outlet wing wall is also part of the culvert structure that is intended to help retain and protect the foundation of South Kīhei Road.~~

The proposed six (6) culverts, two (2) inlet wing walls, and other roadway improvements are located within the existing County right-of-way. These areas have been utilized for roadway and drainage purposes for slightly over a century. In addition, the proposed temporary bridge and bypass road on the mauka side of the existing bridge will be removed and the area would be restored once the permanent culvert improvements are constructed. As the proposed project involved the replacement and upgrade of existing aging infrastructure, the construction and operation of the project is not anticipated to have any significant impacts on beaches for public use and recreation.

*(10) Marine Resources*

*Objective:*

*(A) Promote the protection, use, and development of marine and coastal resources to assure their sustainability.*

*Policies:*

*(D) Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;*

*(E) Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;*

*(F) Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;*

*(G) Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources; and*

*(H) Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.*

The proposed project is not anticipated to have any significant adverse impacts on marine and coastal resources. Potential water quality impacts to nearshore coastal waters during construction of the improvements will be mitigated by adherence to State water quality regulations governing grading, excavation and stockpiling.

In the short-term, storm water runoff may carry increased amounts of sediment into the storm drain system due to erosion from soils exposed during excavation and grading activities. This runoff could potentially impact the water quality of coastal waters in the area. However, excavation and grading activities associated with the construction of the proposed project will be regulated by the County's grading ordinance.

A DOA Nationwide Permit, pursuant to Section 404 of the Clean Water Act and a WQC, issued by the DOH, pursuant to Section 401 of the Clean Water Act will be required. In conjunction with the Section 401 and 404 permits, a BMP plan will be prepared for construction activities within the project site. Erosion and sediment control measures will be instituted in accordance with site specific assessments, incorporating appropriate structural and/or non-structural BMPs ~~such as minimizing time of exposure between construction and landscaping, and implementing erosion control measures such as silt fences and filter berms~~. Specific BMPs may include, but may not be limited to the following:

1. Minimizing soil loss and erosion by revegetation and stabilization of slopes and disturbed areas of soil, possibly using hydromulch, geotextiles, or other applicable alternatives, as soon as possible after working;
2. Minimizing time of exposure between construction and landscaping;
3. Application of protective covers to soil and material stockpiles;
4. Minimizing disturbance of soil during periods of heavy rain;
5. Implementing erosion control measures by emplacement of structural controls such as silt fences, filter berms, gravel bags, fiber rolls, sandbag barriers and other barriers in order to retard and prevent the loss of sediment from the site;
6. Phasing of the project to disturb the minimum area of soil at a particular time;
7. Use of drip pans beneath vehicles not in use in order to trap vehicle fluids;
8. Routine maintenance of BMPs by adequately trained personnel;
9. Significant leaks or spills, if they occur, shall be properly cleaned up and disposed of at an approved site.

The proposed project is not anticipated to have any significant long-term impacts on marine resources. Following construction, exposed soils at the project site will have been built over, paved over, or re-vegetated to control erosion.

Dewatering may be required for the proposed project. Should dewatering be deemed necessary, the contractor will be responsible to obtaining all applicable permits including, but not limited to, an NPDES Permit for Dewatering Activities. The permit application will require a BMP plan, an erosion control plan, and a water quality monitoring plan. Water quality impacts associated with the disposal of dewatering effluent will also be addressed in the

BMP plan, including appropriate characterization of any potential pollutants such as sediments and nutrients in the effluent.

### 4.1.4 Complete Streets, Act 54 Session Laws of Hawai'i 2009

Act 54, Session Laws of Hawai'i 2009 requires that DOT and county transportation departments ensure the accommodation of all users of the road, regardless of their age, ability, or preferred mode of transportation. It also calls for the creation of a statewide task force to review existing state and county highway design standards and guidelines and requires the DOT and county transportation department to adopt a Complete Streets Policy. Complete streets are defined as "*transportation facilities that are planned, designed, operated, and maintained to provide safe access and mobility for all users, including bicyclists, pedestrians, transit riders, freight, and motorists, and that are appropriate to the function and context of the facility."* Complete streets principles for Hawai'i include the following:

- *Safety – Plan, design, and construct transportation facilities and land developments to create an environment that reduces risk and supports the safe movement of people and goods by all modes.*
- *Flexible design – Design transportation facilities using best practices that integrate community values and recognize the importance of the surrounding context and environment.*
- *Accessibility and mobility for all – Plan and design transportation facilities for ease of use and access to destinations by providing an appropriate path of travel for all users, and enhance the ability to move people and goods throughout the state and its counties.*
- *Use and comfort of all users – Ensure all users of all abilities including bicyclists, pedestrians, transit riders, and drivers feel comfortable and safe using the transportation system.*
- *Consistency of design standards and guidelines – Encourage consistent use of national best practices to generate consistency in the application of striping and pavement markings for all users on all islands. References of national best practices include the Manual on Uniform Traffic Control Devices (MUTCD) and A Policy on Geometric Design of Highways and Streets (American Association of State Highway and Transportation Officials [AASHTO] Green Book).*
- *Energy efficient – Plan, design, and construct a transportation system that offers transportation choices for residents and visitors and reduces reliance on single-occupant vehicles to improve energy efficiency in travel, and mitigates vehicle emissions.*
- *Health – Recognize the health benefits in providing alternative mode choices, while acknowledging that some routes may be healthier than others.*
- *Appropriate funding – Support a jurisdiction's ability to secure funding for multimodal facilities and provide a framework to consider and pursue funding sources and opportunities.*
- *Building partnerships with organizations statewide – Build partnerships among the HDOT, the Counties, other governmental agencies, and stakeholders to implement complete streets throughout the state.*

- *Green infrastructure/streets – Use trees and landscaping as integral components of a Complete Street to provide both human and ecosystem benefits, such as shade, to reduce the urban heat island effect, vegetation for carbon sequestration, reducing/filtering non-point source pollution and sediments, retaining stormwater, increasing groundwater storage recharge, and providing wildlife habitat.*

The above policies should be considered on all public highways, roadways, and streets statewide when updating long-term planning documents and/or ordinances and when considering project alternatives. Agency design standards should also be updated to incorporate complete streets principles.

**Discussion:** The proposed project is consistent with the policies of the complete streets. The proposed project will replace the current, deteriorating bridge and provide a bike lane and a paved walkway on the mauka side of the roadway making the area safer for pedestrians, bicyclists, and vehicles. In addition, the makai side of the bridge will be built to accommodate a bike lane and paved walkway if and when future improvements are pursued on the makai side of South Kīhei Road.

## 4.2 County of Maui Land Use Plans and Policies

### 4.2.1 County of Maui General Plan 2030

The Maui County General Plan is a long-term, comprehensive blueprint for the physical, economic, environmental development and cultural identity of the County. The General Plan is comprised of three parts; The Countywide Policy Plan, The Maui Island Plan, and Community Plans.

#### 4.2.1.1 Countywide Policy Plan

As part of the 2030 Maui County General Plan Update, the County adopted a *Countywide Policy Plan* in March 2010, which replaces the *General Plan of the County of Maui 1990 Update.* The *Countywide Policy Plan* provides broad goals, objectives, policies, and implementing actions that portray the desired direction of the County's future. This includes: (1) a vision statement and core values for the County to the year 2030; (2) an explanation of the plan-making process; (3) a description and background information regarding Maui County today; (4) identification of guiding principles; and (5) a list of countywide goals, objectives, policies, and implementing actions related to the following themes:

- Protect the Natural Environment
- Preserve Local Culture and Traditions
- Improve Education
- Strengthen Social and Healthcare Services
- Expand Housing Opportunities for Residents
- Strengthen the Local Economy
- Improve Parks and Public Facilities
- Diversify Transportation Options
- Improve Physical Infrastructure
- Promote Sustainable Land Use and Growth Management

- Strive for Good Governance

The proposed project is consistent with the following *Countywide Policy Plan* objectives and policies relating to diversifying transportation options:

***H. Diversify Transportation Options***

*Goal:* *Maui County will have an efficient, economical, and environmentally sensitive means of moving people and goods.*

*Objective:*
1. *Provide an effective, affordable, and convenient ground-transportation system that is environmentally sustainable.*

*Policies:*
e. *Ensure that roadway systems are safe, efficient, and maintained in good condition.*
g. *Design new road and roadway improvements to retain and enhance the existing character and scenic resources of the communities through which they pass.*
l. *Evaluate all alternatives to preserve quality of life before widening roads.*

*Objective:*
2. *Reduce the reliance on the automobile and fossil fuels by encouraging walking, bicycling, and other energy-efficient and safe alternative modes of transportation.*

*Policies:*
a. *Make walking and bicycling transportation safe and easy between and within communities.*
c. *Design and retrofit existing rights-of-way with adequate sidewalks, bicycle lanes, or separated multi-use transit corridors.*

*Implementing Actions:*
a. *Design, build, and modify existing bikeways to improve safety and separation from automobiles.*

**Discussion:** The proposed project will replace the current, deteriorating bridge and provide a bike lane and a paved walkway on the mauka side of the roadway making the area safer for pedestrians, bicyclists, and vehicles. In addition, the makai side of the bridge and immediately adjacent areas will accommodate a bike lane and paved walkway. Improvements to additional segments can be implemented if and when future improvements are pursued on the makai side of South Kīhei Road.

#### 4.2.1.2 Maui Island Plan

As part of the 2030 Maui County General Plan Update, the County adopted the *Maui Island Plan* in December 2012. The *Maui Island Plan* establishes a pro-active planning process by establishing urban and rural growth areas that indicated where development is intended and will be supported. It is comprised of goals, policies, programs, and actions based on an assessment of current and future needs and available resources.

The purpose of the *Maui Island Plan* is to:

- Assess existing conditions, trends, and issues specific to Maui;
- Provide policy direction for the use and development of land, the extension and improvement of transportation services and infrastructure, the development of community facilities, the expansion of the island's economic base, the provision of housing, and the protection of natural and cultural resources;
- Establish policies to manage change and to direct decision about future land use and development; and
- Provide the foundation to set capital improvement priorities, revise zoning regulations, and develop other implementation tools.

The proposed project is consistent with or promotes the following *Maui Island Plan* objectives and policies relating to transportation:

*Goal:*
*6.4 An interconnected, efficient, and well maintained, multimodal transportation system.*

*Objective:*
*6.4.1 More integrated island-wide transportation and land use planning program that reduces congestion and promotes more efficient (transit-friendly) land use patterns.*

*Policies:*
*6.4.1.a Plan for an integrated multi-modal transportation system comprised of public transit, bicycle, pedestrian, automobile, and other transportation modes.*

*Objective:*
*6.4.2 Safe, interconnected transit, roadway, bicycle, equestrian, and pedestrian network.*

*Policies:*
*6.4.2.d Identify and improve hazardous and substandard sections of roadways, drainage infrastructure, and bridges, provided that the historical integrity of the roads and bridges are protected.*

**Discussion:** The proposed project will replace the current, deteriorating bridge and provide a bike lane and a paved walkway on the mauka side of the roadway making the area safer for pedestrians, bicyclists, and vehicles. In addition, the makai side of the bridge and

immediately adjacent areas will accommodate a bike lane and paved walkway. Improvements to additional segments can be implemented if and when future improvements are pursued on the makai side of South Kīhei Road.

#### 4.2.1.3 Kīhei-Mākena Community Plan

The Kīhei-Mākena Community Plan is one of the nine Community Plans for Maui County that reflects current and anticipated conditions in the Kīhei-Mākena region. The Kīhei-Mākena Community Plan provides specific recommendations to address the goals, objectives, and polices contained in the General Plan, while recognizing the values and unique attributes of the Kīhei-Mākena area in order to enhance the region's overall living environment.
According to the Kīhei-Mākena Community Land Use Map, the project site is designated as open space (OS) and park (see Figure 4-2). The OS designation is intended to limit development on certain urban and non-urban designated lands which may be inappropriate for intensive development due to environmental, physical, or scenic constraints; this category includes, but is not limited to shoreline buffer areas, landscape buffers, drainageways, view planes, flood plains, and tsunami areas. The park designation applies to land developed or to be developed for recreational use. This includes all public and private active and passive parks. The proposed project is consistent with these designations as the proposed project is a roadway which is considered to be an incidental use by the County.

In addition, the proposed project is consistent with the Kīhei-Mākena Community Plan goals, objectives, policies, and implementing actions as follows:

***Environment***

***Goal***

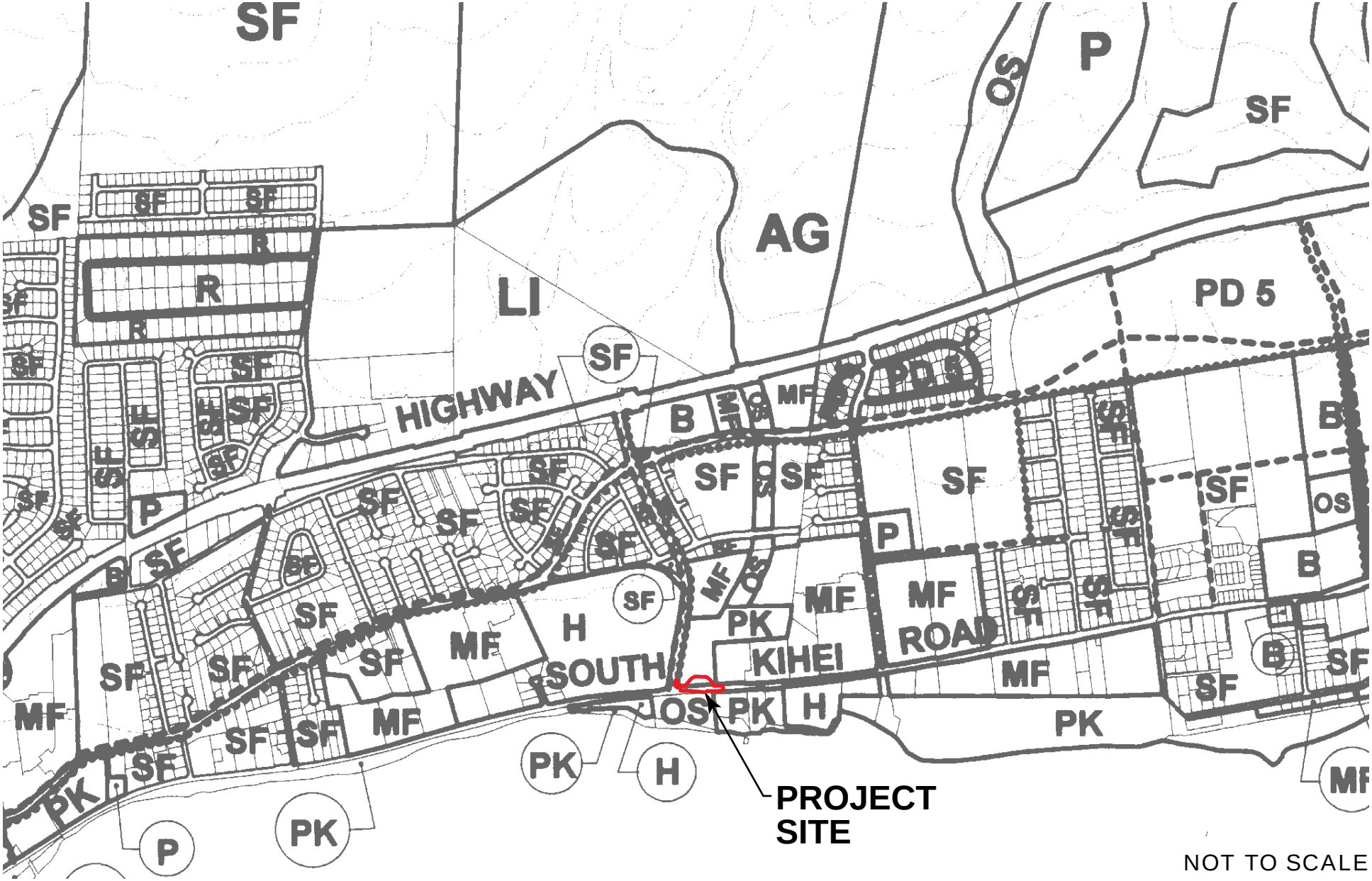
*Preservation, protection, and enhancement of Kīhei-Mākena's unique and fragile environmental resources.*

***Objectives and Policies***

*b. Preserve, protect and restore unique natural areas with significant conservation values.*

*f. Protect all wetland resources, such as those at Keālia Pond and near Road 'C." These open space and wildlife habitat resources are important for flood control and for their natural beauty.*

**Discussion:** Construction activities will involve land-disturbing activities, such as grubbing, clearing, grading, and excavation that may result in some soil erosion and potential construction-related impacts to the quality of surface and coastal waters in the greater project vicinity. Various mitigative measures will be incorporated into the project's construction plan to minimize soil disturbances and potential short-term erosion impacts during construction activities. Excavation and grading activities associated with construction of the proposed improvements will be regulated by the County's grading ordinance.




NOT TO SCALE

Source: County of Maui, Planning Department

WILSON OKAMOTO CORPORATION
ENGINEERS | PLANNERS | CONSULTANTS

KULANIHAKOI BRIDGE REPLACEMENT

KIHEI - MAKENA COMMUNITY PLAN

FIGURE

4-2

A DOA Nationwide Permit, pursuant to Section 404 of the Clean Water Act and a WQC, issued by the DOH, pursuant to Section 401 of the Clean Water Act will be required. In conjunction with the Section 401 and 404 permits, a BMP plan will be prepared for construction activities within the project site. Erosion and sediment control measures will be instituted in accordance with site specific assessments, incorporating appropriate structural and/or non-structural BMPs ~~such as minimizing time of exposure between construction and landscaping, and implementing erosion control measures such as silt fences and filter berms~~. Specific BMPs may include, but may not be limited to the following:

1. Minimizing soil loss and erosion by revegetation and stabilization of slopes and disturbed areas of soil, possibly using hydromulch, geotextiles, or other applicable alternatives, as soon as possible after working;
2. Minimizing time of exposure between construction and landscaping;
3. Application of protective covers to soil and material stockpiles;
4. Minimizing disturbance of soil during periods of heavy rain;
5. Implementing erosion control measures by emplacement of structural controls such as silt fences, filter berms, gravel bags, fiber rolls, sandbag barriers and other barriers in order to retard and prevent the loss of sediment from the site;
6. Phasing of the project to disturb the minimum area of soil at a particular time;
7. Use of drip pans beneath vehicles not in use in order to trap vehicle fluids;
8. Routine maintenance of BMPs by adequately trained personnel;
9. Significant leaks or spills, if they occur, shall be properly cleaned up and disposed of at an approved site.

The proposed project is not anticipated to have any long-term impacts to land-based, shoreline, and marine resources. Following construction, exposed soils at the project site will have been built over, paved over, or re-vegetated to control erosion. The wetland area is proposed to be restored back to its existing conditions.

Dewatering may be required for the proposed project. Should dewatering be deemed necessary, the contractor will be responsible to obtaining all applicable permits including, but not limited to, an NPDES Permit for Dewatering Activities. The permit application will require a BMP plan, an erosion control plan, and a water quality monitoring plan. Water quality impacts associated with the disposal of dewatering effluent will also be addressed in the BMP plan, including appropriate characterization of any potential pollutants such as sediments and nutrients in the effluent.

### ***Cultural Resources***

#### ***Goal***

*Identification, preservation, enhancement, and appropriate use of cultural resources, cultural practices, and historic sites that:*

a. *Provides a sense of history and defines a sense of place for the Kīhei-Mākena region*

#### ***Objectives and Policies***

a. *Identify, preserve, protect and restore historical and cultural sites.*

b. *Protect those areas, structures and elements that are a significant and functional part of Hawai'i's ethnic and cultural heritage.*

**Discussion:** An Archaeological Literature Review and Field Inspection for the project site was conducted for the property in December 2012. Based on the field inspection findings and background research, there is a low potential for the discovery of previously unidentified historic properties beyond the historic era itself. The area surrounding the bridge includes the Kūlanihāko'i Stream mouth, a natural wetland and associated flood plain. While impacts by flooding episodes and modifications associated with road construction and maintenance have greatly altered sediments of the project areas, the possibility of encountering intact subsurface cultural deposits, including human burials, should not be underestimated. Therefore, archaeological monitoring is recommended for all ground disturbing activities during all phases of the temporary bridge and bypass road work and bridge replacement. It is also recommended that a monitoring report be generated after the construction of the temporary bridge and bypass road and the replacement bridge.

During a field visit on December 13, 2012 with Theresa Donham (Archaeology Branch Chief), an archaeological inventory survey of the lands covering the extent of the APE of the proposed detour bridge was recommended. An archaeological inventory survey was conducted by Cultural Surveys Hawai'i, Inc. dated June 2013.

The survey included shovel testing and pipe coring which enabled mapping a general stratigraphy of the project to a depth of approximately 10 feet below ground surface. Two soil samples were submitted for pollen analysis.

One historic property within the project area is the Kūlanihāko'i Bridge itself. The bridge has been given a site number (SIHP 50-50-10-7606). The bridge was constructed in 1911 and consisted of four individual reinforced concrete box culverts. The paving surface over the existing culverts was applied in the 1930's. This included some shoring-up of the edge of the roadway using a historic construction style attributed to pre-1940's plantation masons. The present day Kūlanihāko'i Bridge appears to consist of two sections of prefabricated concrete culvert welded together to form the length of the existing bridge. A more modern construction style probably occurred because of the many repairs the bridge had undergone due to storm damage.

The study was able to establish that at least the first 10 feet of sediment can be attributed to historic alluvium from Kūlanihāko'i Gulch. This is generally consistent with the information collected by Geolabs, the geotechnical engineer, for this project. They recorded a dark gray clay silt to a depth of 10 feet above the grayish tan coralline sand.

Like the LR&FI, the inventory survey notes that there is a low potential for the discovery of previously unidentified historic properties beyond the historic era itself. The area surrounding the bridge includes the Kūlanihāko'i Stream mouth, a natural wetland and associated flood plain. While impacts by flooding episodes and modifications associated with road construction and maintenance have greatly altered sediments of the project areas, the possibility of encountering intact subsurface cultural deposits, including human burials,

should not be underestimated. Therefore, archaeological monitoring is recommended for all ground disturbing activities during all phases of the temporary bridge and bypass road work and bridge replacement. It is also recommended that a monitoring report be generated after the construction of the temporary bridge and bypass road and the replacement bridge.

With regard to the bridge itself, the structure was constructed in 1911 and is now ~~102~~ 105 years old. It is therefore considered a historic property and recordation of the bridge would be required under Chapter 13-275, Hawai'i Administrative Rules if deemed eligible based on SHPD's evaluation of the bridge's significance. Consultation with SHPD, by letter dated December 20, 2012, indicated that while the bridge is unique due to age and represents the first generation of concrete bridges in the islands, it is literally falling apart and has lost any distinguishing architectural characteristics. On this basis, SHPD has determined that the bridge has lost its integrity and is not eligible to be recorded on the State Inventory of Historic Properties. Therefore, the proposed project will have no effect on historic property.

The archaeological inventory survey noted that the Kūlanihāko'i Bridge (SIHP 50-50-10-7606) has yielded information important to the understanding of the first generation of concrete bridges in the Hawaiian Islands. SIHP -7606 is thus considered significant under Criterion D. Sufficient information concerning SIHP -7606 was collected during the investigation. Based on the additional research, no further work is recommended for the bridge.

The archaeological inventory survey also noted that while subsurface testing was not done beneath South Kīhei Road, boring logs from the Geolabs report recorded the presence of coralline sand around 12 feet below the surface of the road. The presence of this type of sediment deposit may present the potential for encountering sensitive cultural resources in a subsurface context. Monitoring of the culvert removal by a qualified archaeologist is thus recommended.

By letter dated June 25, 2014, the SHPD noted that the archaeological inventory survey meets the requirements of Hawai'i Administrative Rule Section 13-276 and is accepted as final. Refer to Appendix D.

***Physical and Social Infrastructure***

***Goal***

*Provision of facility systems, public services and capital improvement projects in an efficient, reliable, cost effective, and environmentally sensitive manner which accommodates the needs of the Kīhei-Mākena community, and fully support present and planned land uses, especially in the case of project district implementation*

***Transportation***

***Objectives and Policies***

*b. Develop and implement a well-planned road and public transportation system to allow residents and visitors to move safely, effectively, and comfortably within the*

*region. Roadway improvements should be planned, designed, and constructed as prioritized under the Implementing Actions section below, and as generally described in the Kīhei Traffic Master Plan.*

*g. Plan, design, and construct a pedestrian and bikeway network throughout the Kīhei-Mākena region which considers the utilization of existing stream beds, drainageways, wetlands and public rights-of-way along coastal and inland areas.*

**Discussion:** The proposed project will replace the current, deteriorating bridge and provide a bike lane and a paved walkway on the mauka side of the roadway making the area safer for pedestrians, bicyclists, and vehicles. In addition, the makai side of the bridge and immediately adjacent areas will accommodate a bike lane and paved walkway. Improvements to additional segments can be implemented if and when future improvements are pursued on the makai side of South Kīhei Road.

### 4.2.2 County of Maui Zoning

The purpose and intent of the County of Maui Comprehensive Zoning Ordinance (Title 19, Article II), is to regulate the utilization of land in a manner encouraging orderly development in accordance with the land use directives of the Hawaii Revised Statutes, the revised charter of the County, and the general plan and the community plans of the County.

According to the County of Maui Planning Department, the project site is zoned Drainage (DR), Park (PK), and Apartment (A-1). However, roadways, such as the proposed project, are considered an incidental use that is permitted in each of the County's zoning districts. Thus the proposed project is consistent with the County zoning districts.

### 4.2.3 County of Maui Special Management Area

Pursuant to the Hawaiʻi CZM Program, Chapter 205A, HRS, the counties have enacted ordinances establishing Special Management Areas (SMA). Any "development" within the SMA requires an SMA Use Permit administered by the County of Maui Planning Department. Through the SMA permit system, the County assesses and regulates developments proposed for areas located within the SMA and the proposed developments are evaluated for compliance with the CZM objectives and policies and SMA guidelines set forth in Chapter 205A, HRS. Figure ~~2-2~~ 4-3 shows that the entire project site is located within the SMA. Since the project has a total cost fair market value greater than ~~$125,000~~ $500,000 in value and is considered a "development," an SMA Use Permit will be required for the proposed project. The proposed project is consistent with the CZM objectives and policies as described in Section 4.1.3 of this document.

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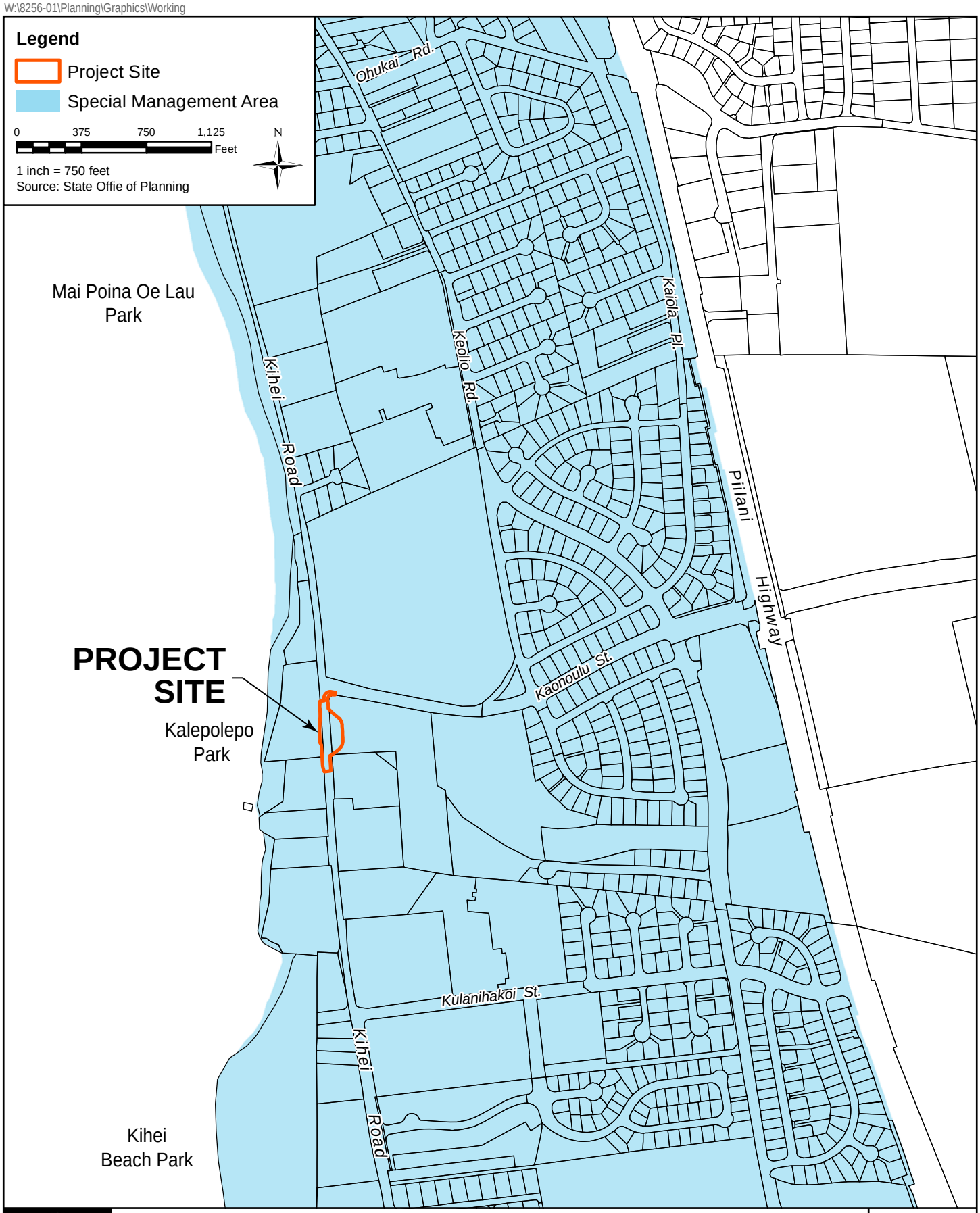


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KULANIHAKOI BRIDGE REPLACEMENT

SPECIAL MANAGEMENT AREA MAP

FIGURE 4-3

## 4.3 Permits and Approvals

The following is a list of permits, approvals, and reviews that may be required prior to construction and operation of the proposed project.

Federal

Department of the Army
- Department of the Army, Nationwide Permit, Section 404, Clean Water Act
- Department of the Army, Section 10 Permit, Rivers and Harbors Act

Federal Highways Administration
- National Environmental Policy Act (NEPA) Categorical Exclusion
- Section 7 of the Endangered Species Act
- Section 106 of the National Historic Preservation Act

State of Hawai'i

Department of Health
- Section 401, Clean Water Act, Water Quality Certification
- National Pollutant Discharge Elimination System (NPDES) Permit for Dewatering Activity
- Noise Permit

Department of Land and Natural Resources
- Chapter 6E, HRS, State Historic Preservation Law
- Stream Channel Alteration Permit

Office of Planning
- Coastal Zone Management (CZM) Federal Consistency Certification

County of Maui

Planning Department
- Special Management Area Use Permit
- Shoreline Setback Variance
- Special Flood Hazard Area Development Permit
- Grading/Grubbing Permit
- Permit to Perform Work within County Right-of-Way

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# 5. ALTERNATIVES

## 5.1 No Action Alternative

Under the no action alternative, the replacement of the deteriorating culverts and the proposed roadway improvements would not be pursued. Environmental impacts would be avoided, construction costs spared, and the need for permits precluded.

The existing culverts would continue to deteriorate and substandard conditions for motorists, pedestrians, and bicyclists would continue. As the bridge is structurally deficient, the culverts have the potential to collapse in the near future due to vehicles traversing over it. If the bridge should collapse, this portion of South Kīhei Road would need to be closed and vehicles rerouted causing increased congestion on other nearby roadways such as Ohukai Road, Ka‘ono‘ulu Road, Kūlanihāko‘i Street, Waipu‘ilani Road, and Pi‘ilani Highway. This would inconvenience residents and businesses who depend on that portion of South Kīhei Road as a through road for their needs.

## 5.2 Alternative 1: Construction of Four (4) 6-Feet Wide and 4-Feet High Culverts

This alternative proposes constructing four (4) new culverts to replace the existing four (4) deteriorating culverts. As stated in earlier sections, the proposed six (6) culverts only provides a slight increase in drainage capacity for a 100-year, 24-hour storm event. Currently because of the relatively flat topography of the area, installation of four (4) new 6-feet wide by 4-feet high culverts at South Kīhei Road would basically ensure that the same flooding parameters which result from the existing four (4) culverts would continue. Since the sand plug is a natural occurrence at the ocean outlet, flows would continue to be impeded. Silt and sediment would continue to accumulate at the muliwai. With the replacement of the four culverts, South Kīhei Road can continue to be utilized as a collector road. Basically, the replacement of the four (4) culverts represents a continuation of the status quo.

## 5.3 Alternative 2: Construction of Eight (8) 6-Feet Wide and 4-Feet High Culverts

This alternative proposes constructing a total of eight (8) culverts, each 6-feet wide and 4-high. Drainage capacity of the culverts was analyzed, assuming the downstream end of the stream was not blocked off from the existing accumulated sand plug at the shoreline. The results showed that the eight (8) culverts would have an increased flow capacity (409 cfs) and could handle more flow than the existing four culverts as well as the proposed culverts (204 cfs and 306 cfs, respectively). However, this increased capacity does not significantly reduce the amount of runoff overtopping South Kīhei Road. This is due to the accumulated sand dunes blocking the natural flow of the outlet of the stream as well as the relatively flat topography of lands around South Kīhei Road and the shoreline. This causes runoff to pond until water levels reach a height higher than the sand plug or the sand plug is breached. Therefore, adding additional culverts will not reduce the existing flooding in the area.

Although there is an increase in drainage capacity and depth of flow over the roadway is slightly decreased, the proposed bridge replacement ultimately does not resolve the existing flooding that occurs near and around the project site during heavy storm events. This is due to the accumulating sand dunes blocking off the downstream path causing runoff to back up and flood the roadway. The eight (8) culverts were also analyzed assuming that the outlet is

not blocked. The results from the model and calculations show that the depth overtopping the roadway is reduced significantly by about three feet.

While the additional culverts would provide a slight decrease in flows overtopping South Kīhei Road, the decrease is not significant enough that it would address the regional flooding problem in the area. While flooding is a concern, it is beyond the scope of this project as it is a regional issue and should be addressed by a drainage master plan. The County of Maui is currently updating their Kīhei Drainage Master Plan which is anticipated to be completed within two years.

### 5.4 Alternative 3: Construction of Larger Culverts or Construction of a Bridge over South Kīhei Road to Accommodate the 100-Year Storm

This alternative proposes installation of larger culverts or a bridge over the existing culverts to handle the 100-year storm.

As discussed earlier in Section 3.13.3, at the point where the 100-year storm runoff flows reach the existing culverts, the total flow would be approximately 14,148 cfs. To accommodate this flow, the size of the culverts, as well as the velocity of the peak flows need to be considered. For example, if the velocity of the flow is assumed to travel at 10 feet per second, the culverts would need to be a total of 10-feet high and 140-feet wide. However, if the velocity of the flow is assumed to travel at 25 feet per second, the culverts would need to be a total of 10-feet high and 56-feet wide. Freeboard requirements for the bridge present another safety factor that needs to be considered. This would result in wider and/or deeper channels, therefore, at a minimum, the roadway would also need to be raised, the invert of the culverts deepened, and/or the span of the culverts would need to be widened to accommodate the 100-year storm flow. The roadway would need to be constructed at a slight incline, but due to the physical constraints of the project site, neighboring properties. would require extensive improvements which may require reconstruction of the Kaʻonoʻulu intersection and the existing drainage system along South Kīhei Road to prevent flooding of the Kīhei Bay Vista complex from the proposed bridge. Although in this alternative the storm flows would not overtop the roadway, flooding would still be an issue for the surrounding areas because of the sand plug and the flat topography of the area.

Similarly for the bridge alternative, the bridge could sit approximately 3-feet higher than the existing road with a mid-span pier to help reduce the amount of runoff overtopping the roadway during heavy storm events. Assuming that the outlet is not blocked off by the existing accumulating sand dunes, it was determined that storm runoff from the 100-year storm event would still overtop the bridge, but not as severe as the proposed six (6) culverts. To compensate for this occurrence, the bridge could be raised higher. This is a similar situation to the larger culvert in which, due to the physical constraints of the project site, constructing a bridge would require extensive improvements which may require reconstruction of the Kaʻonoʻulu intersection and the existing drainage system along South Kīhei Road to prevent flooding of the Kīhei Bay Vista complex from the proposed bridge.

## 5.5 Alternative 4: Increasing Drainage Channel Capacity

This alternative proposes construction of a drainage channel. The makai portions of Kūlanihāko‘i Gulch are not a well-defined water course. There are limited channel capacities that are unable to contain peak flows during storm periods. As a result, during significant rainfall events, runoff from the upper areas of the watershed descends onto the Kīhei flood plains in voluminous quantities. Thus, during significant rains, the existing drainage channel will be overtopped before it reaches the existing culvert even if the culvert is properly sized for the 100 year storm. In order to fully accommodate the 100-year storm flows, the upstream and downstream drainageways need to have the capacity to accommodate peak flows. This would require a drainage channel to be excavated from Ka‘ono‘ulu Estates IV, near Pi‘ilani Highway, to the ocean.

Due to the relatively flat coastal topography and the sand dunes which tend to form at the stream mouth, the drainage channel would likely need to extend partially into the ocean. Makai portions of the channel would most likely contain sea water on a relatively permanent basis. Such a channel would likely involve land acquisition and involve view and aesthetic impacts. Portions of existing beach areas would be occupied by a drainage structure at the stream mouth.

A significantly larger and more direct drainage route to the ocean would likely mean increased sediment and other pollutants deposited into the nearshore environment. The increased volume and velocity of runoff may affect the bathymetry of the area, which in turn affects wave action, coral growth and sand transport. Since the watershed is significant in terms of its size, impacts to the nearshore environment would need to be studied carefully. Possible effects on coral, aquatic biota, fish and marine mammals need to be considered.

While increasing the drainage channel capacity is an alternative, the scope and assessment of impacts for this alternative is much larger than replacing a single deteriorated culvert bridge at South Kīhei Road. As drainage in this area is a regional problem, a coordinated drainage master plan for the region is needed to address how drainage throughout the area will be handled. The County of Maui is currently updating their Kīhei Drainage Master Plan which is anticipated to be completed in approximately two years.

## 5.6 Alternative 5: Installation of Upstream Detention

This alternative proposes upgrading the culverts at South Kīhei Road and installing appropriately sized detention basins located mauka of Pi‘ilani Highway. Detention basins would allow for controlled release of runoff so water would likely be flowing downstream of the basins for a period of time after rain has stopped. Depending on its size and the percolation capacity of the soil, retention basins can allow significant portions of peak runoff to percolate into the ground and allows some settlement and removal of sediment and other pollutants.

Upstream detention does not only involve the excavation of basins. Analysis must be undertaken to ensure that drainageways leading to the basin and leaving the basin are adequate to carry flows. If not, excavation to provide for adequate drainage capacity will be needed. It should be noted that this alternative will require a significant amount of land from upstream owners.

As mentioned earlier, the total flows for a 100-year storm would be approximately 14,148 cfs. The 100-year storm is measured over a 24-hour period. Therefore, a 24-hour period would yield flows of approximately 1,222,387,200 cubic feet of storm flow per day. To accommodate this maximum amount of flow and to not allow any flow to enter the ocean, the upstream detention basin would need to be approximately the size of 1-mile in length by 1-mile in width by approximately 44-feet in depth.

To ensure that the detention basins and related drainageways function properly over time, maintenance concerns need to be addressed. Debris, silt and sediment which accumulate in the basin and drainageways must be removed in order to ensure adequate capacity. Personnel needed to maintain the system as well as the cost of maintenance needs to be taken into consideration. Access through private property must also be provided so that maintenance activities can be undertaken.

While installing detention basins and related draingeways are an alternative, the scope and assessment of impacts for this alternative is much larger than replacing a single deteriorated culvert bridge at South Kīhei Road. As drainage within this watershed is a regional problem, a coordinated drainage master plan for the region is needed to address how drainage throughout the area will be handled. The County of Maui is currently updating their Kīhei Drainage Master Plan which is anticipated to be completed in approximately two years.

### 5.7 Alternative 6: Diversion of Upstream Flows to Another Drainage District

This alternative proposes diverting runoff flows generated mauka of Pi‘ilani Highway within the Kūlanihāko‘i drainage district to other nearby drainage districts. This alternative may lessen flooding and environmental impacts in the area of Kūlanihāko‘i Gulch from Pi‘ilani Highway to the shoreline, however, it would exacerbate flooding issues in the neighboring districts.

Although the Kūlanihāko‘i Gulch generates most of the flows within the Kūlanihāko‘i District, there are smaller subdistricts which contribute to the total amount of flow. In terms of the 100-year storm flows, the Kūlanihāko‘i District generates more than 13,000 cfs mauka of Pi‘ilani Highway. Under this alternative, these flows would be diverted to neighboring drainage districts.

Waiakoa District which is the neighboring district to the north, generates 100-year storm flows of approximately 9,000 cfs mauka of Pi‘ilani Highway. If Kūlanihāko‘i District flows were diverted to the Waiakoa District, approximately 22,000 cfs of peak flows would need to be accommodated. Similarly, Waipu‘ilani Gulch, which is the neighboring district to the south, generates 100-year storm flows of more than 10,000 cfs. If flows from the Kūlanihāko‘i Distict were diverted to the Waipu‘ilani District to the south, then 23,000 cfs of peak flows would need to be accommodated.

Should this alternative be pursued, analysis would have to be undertaken to ensure that the neighboring drainageways have the capacity to accommodate the peak flows from the Kūlanihāko‘i District. This would most likely require that channel(s) of adequate size to accommodate peak flows would likely need to be excavated in which ever neighboring district was chosen. Roadway culverts also have to be significantly enlarged. Because of

the relatively flat coastal topography and the sand dunes which tend to form at the stream mouth, the drainage channel may need to extend partially into the ocean. Makai portions of the channel may also contain sea water on a relatively permanent basis.

Such channel(s) would likely involve land acquisition and involve view and aesthetic impacts. Portions of existing beach areas would be occupied by a drainage structure at the stream mouth(s) of the neighboring drainage district.

A significantly larger and more direct route to the ocean would likely mean increased sediment and other pollutants deposited into the nearshore environment of the neighboring drainage district. The increased volume and velocity of runoff may also affect the bathymetry of the area, which in turn would affect wave action, coral growth and sand transport. Since the drainage area and peak runoff have significantly increased within the adjoining drainage district, impacts to the nearshore environment would need to be studied carefully. Possible effects on coral, aquatic biota, fish and marine mammals are likely to be significant and concentrated.

While the general concept of diversion of upstream flows to another drainage district is a possible alternative, diversion of peak runoff to other areas further away would only add more expense and concentrate the issues of dealing with peak runoff to another area besides the Kūlanihāko'i Drainage District. In addition, the scope and assessment of impacts for this alternative is much larger than replacing a single deteriorated culvert bridge at South Kīhei Road. As drainage in this area is a regional problem, a coordinated drainage master plan for the region is needed to address how drainage throughout the area will be handled. The County of Maui is currently updating their Kīhei Drainage Master Plan which is anticipated to be completed in approximately two years.

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## 6. ~~ANTICIPATED~~ DETERMINATION OF FONSI

The proposed project involves the following improvements:

Potential impacts of the proposed improvements have been evaluated in accordance with the significance criteria of Section 11-200-12 of the Department of Health's Administrative Rules. Discussion of the project's conformance to the criteria is presented as follows:

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

An Archaeological Literature Review and Field Inspection for the project site was conducted for the property in December 2012. Based on the field inspection findings and background research, there is a low potential for the discovery of previously unidentified historic properties beyond the historic era itself. The area surrounding the bridge includes the Kūlanihāko‘i Stream mouth, a natural wetland and associated flood plain. While impacts by flooding episodes and modifications associated with road construction and maintenance have greatly altered sediments of the project areas, the possibility of encountering intact subsurface cultural deposits, including human burials, should not be underestimated. Therefore, archaeological monitoring is recommended for all ground disturbing activities during all phases of the temporary bridge and bypass road work and bridge replacement. It is also recommended that a monitoring report be generated after the construction of the temporary bridge and bypass road and the replacement bridge.

A site inspection was conducted on December 13, 2012 by SHPD and Cultural Surveys Hawai‘i. Based on the site inspection, SHPD requested that an AIS be prepared for the project site. An AIS was conducted by Cultural Surveys Hawai‘i, Inc. dated June 2013. The survey included shovel testing and pipe coring which enabled mapping a general stratigraphy of the project to a depth of approximately 10 feet below ground surface. Two soil samples were submitted for pollen analysis. ~~The AIS is currently pending and will be submitted to SHPD for approval when it has been completed. Subsequent consultation with SHPD, by letter dated February 1, 2013, indicated that they have concerns that the project area is located within a zone of beach sand dune and Aeolian sand deposits which are known to contain human burial features and historic habitation sites. It is therefore likely that historic properties, including human remains, may be present beneath the previously disturbed road grade and sub-grade or within previously unaffected areas of the right-of-way. SHPD requested that all project associated excavations be monitored by a qualified archaeologist in order to identify and mitigate any subsurface cultural features and deposits. They further recommend that an archaeological monitoring plan be submitted to their office for review and approval prior to initiation of this project.~~

~~Should any significant archeological, cultural, or historic resources be found during construction activities, all work will cease in the vicinity of the find and SHPD will be notified immediately to determine appropriate mitigation measures.~~

The AIS noted that while subsurface testing was not done beneath South Kīhei Road, boring logs from the Geolabs, the geotechnical engineer for the project, recorded the presence of coralline sand around 12 feet below the surface of the road. The presence of this type of

sediment deposit may present the potential for encountering sensitive cultural resources in a subsurface context. The AIS recommended monitoring of the culvert removal. The County is committed to implement archaeological monitoring in accord with the AIS recommendation.

With regard to the bridge itself, the structure was constructed in 1911 and is now ~~102~~ 105 years old. It is therefore considered a historic property and recordation of the bridge would be required under Chapter 13-275, Hawai'i Administrative Rules if deemed eligible based on SHPD's evaluation of the bridge's significance. Consultation with SHPD, by letter dated December 20, 2012, indicated that while the bridge is unique due to age and represents the first generation of concrete bridges in the islands, it is literally falling apart and has lost any distinguishing architectural characteristics. On this basis SHPD has determined that the bridge has lost its integrity and is not eligible to be recorded on the State Inventory of Historic Properties. Therefore, the proposed project will have no effect on historic property.

The archaeological inventory survey noted that the Kūlanihāko'i Bridge (SIHP 50-50-10-7606) has yielded information important to the understanding of the first generation of concrete bridges in the Hawaiian Islands. SIHP -7606 is thus considered significant under Criterion D. Sufficient information concerning SIHP -7606 was collected during the investigation. Based on the additional research, no further work is recommended for the bridge.

There will be no destruction or loss of any significant, endangered, or threatened botanical, faunal, geological, or other natural resources. With the exception of the Hawaiian Stilt, none of the plant or animal species identified within the project site are threatened or endangered, or are a species of concern. Prior to construction, it is recommended that a qualified biologist survey areas mauka of the proposed project site to determine if any nesting stilt are present. If nesting stilt are found, the County will need to consult with the USFWS over appropriate measures or conditions that may need to be met to ensure that construction activity does not harm nesting stilts. There are no federally delineated Critical Habitat within or close to the project corridor, thus construction and operation of the proposed project will not result in any impacts to federally designated Critical Habitats.

*(2) Curtails the range of beneficial uses of the environment;*

The proposed project will not curtail the beneficial uses of the environment. Use of the project site for the proposed project would be consistent with its current use as a culvert bridge and a roadway.

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

The proposed project does not conflict with long-term environmental policies, goals, and guidelines of the State of Hawai'i. As presented in this EA, the project's potential temporary adverse impacts are associated primarily with short-term construction-related activities and can be mitigated through adherence to standard construction mitigation practices.

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

In the short-term, the proposed project will confer positive benefits in the local economy. Direct economic benefits will result from construction expenditures both through the purchase of material from local suppliers and through the employment of local labor, thereby stimulating that sector of the economy. Indirect economic benefits may include benefits to local retailing businesses resulting from construction activities.

There are no significant adverse long-term socio-economic impacts anticipated with the proposed improvements. The replacement of the culverts and the associated improvements to South Kīhei Road are not expected to induce growth beyond that which is anticipated for the region. The improvements are intended to benefit the entire Kīhei region without impacting a specific ethnicity or income group. The proposed project will not result in a disproportionality high adverse impact on minority and low-income populations.

*(5) Substantially affects public health;*

No significant adverse short or long-term impacts are anticipated as a result of the proposed project.

In the long-term, the proposed project will provide positive effects as the proposed project will replace the existing, deteriorating culverts and provide a bike lane and a paved walkway on the mauka side of the roadway. This will enhance the safety of motorists, bicyclists, and pedestrians along this section of roadway.

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

No secondary effects are anticipated with the construction or operation of the proposed project. The improvements, in and of themselves, are not anticipated to affect the population of the Kīhei District. Rather, the project is proposed to fulfill an essential community need to provide safe access to and from the region for vehicles, bicyclists, and pedestrians alike.

*(7) Involves a substantial degradation of environmental quality;*

The proposed project is not anticipated to involve a substantial degradation of environmental quality.

Construction activities associated with the proposed improvements will create some adverse short-term impacts such as unavoidable noise impacts and air quality impacts from soil excavation and other ground disturbance activities. Unavoidable construction noise impacts on nearby land uses in the immediate vicinity of the proposed project will be mitigated to some degree by complying with the provisions of the State DOH Administrative Rules, Title 11, Chapter 46, Community Noise Control. Potential air quality impacts during construction of the proposed project will be mitigated by complying with the State DOH Administrative Rules, Title 11, Chapter 60, Air Pollution Control.

Potential water quality impacts to surface and near shore coastal waters during construction of the proposed improvements will be mitigated by adherence to State and County water quality regulations governing grading, excavation, and stockpiling. A DOA Nationwide Permit, pursuant to Section 404 of the Clean Water Act and a

WQC, issued by the DOH, pursuant to Section 401 of the Clean Water Act will be required. In conjunction with the Section 401 and 404 permits, a BMP plan will be prepared for construction activities within the project site. Erosion and sediment control measures will be instituted in accordance with site specific assessments, incorporating appropriate structural and/or non-structural BMPs ~~such as minimizing time of exposure between construction and landscaping, and implementing erosion control measures such as silt fences and filter berms~~. Specific BMPs may include, but may not be limited to the following:

1. Minimizing soil loss and erosion by revegetation and stabilization of slopes and disturbed areas of soil, possibly using hydromulch, geotextiles, or other applicable alternatives, as soon as possible after working;
2. Minimizing time of exposure between construction and landscaping;
3. Application of protective covers to soil and material stockpiles;
4. Minimizing disturbance of soil during periods of heavy rain;
5. Implementing erosion control measures by emplacement of structural controls such as silt fences, filter berms, gravel bags, fiber rolls, sandbag barriers and other barriers in order to retard and prevent the loss of sediment from the site;
6. Phasing of the project to disturb the minimum area of soil at a particular time;
7. Use of drip pans beneath vehicles not in use in order to trap vehicle fluids;
8. Routine maintenance of BMPs by adequately trained personnel;
9. Significant leaks or spills, if they occur, shall be properly cleaned up and disposed of at an approved site.

Following construction, exposed soils at the project site will have been built over, paved over, or re-vegetated to control erosion.

Dewatering may be required for the proposed project. Should dewatering be deemed necessary, the contractor will be responsible to obtaining all applicable permits including, but not limited to, an NPDES Permit for Dewatering Activities. The permit application will require a BMP plan, an erosion control plan, and a water quality monitoring plan. Water quality impacts associated with the disposal of dewatering effluent will also be addressed in the BMP plan, including appropriate characterization of any potential pollutants such as sediments and nutrients in the effluent.

In the long-term, no significant air quality, noise, or water quality impacts are anticipated from the operation of the proposed project.

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

No cumulative effects are anticipated, inasmuch as the proposed project involves replacing an existing culvert bridge and roadway improvements in an already urbanized setting.

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

No listed, candidate, or proposed rare, threatened, or endangered species of flora or fauna under either the Federal or State endangered species statutes nor any critical habitat units will be disturbed as a result of the proposed improvements.

Prior to construction, it is recommended that a qualified biologist survey areas mauka of the proposed project site to determine if any nesting Hawaiian stilt are present. If nesting stilt are found, the County will need to consult with the USFWS over appropriate measures or conditions that may need to be met to ensure that construction activity does not harm nesting stilts. There are no federally delineated Critical Habitat within or close to the project corridor, thus construction and operation of the proposed project will not result in any impacts to federally designated Critical Habitats.

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

No long-term significant impacts to air quality, water quality, or noise levels within the project site are anticipated with the construction of the proposed project.

During construction of the proposed project, two potential types of air pollution emissions will likely occur, resulting in air quality impacts: 1) airborne dust from construction activities such as grading and excavation within the project site; and 2) exhaust emissions from construction vehicles and equipment from the project site.

Potential air quality impacts during construction of the proposed project will be mitigated by complying with the State DOH Administrative Rules, Title 11, Chapter 60-11.1 "Air Pollution Control." The construction contractor is responsible to complying with the State DOH regulations which prohibit visible dust emissions at property boundaries. Compliance with State regulations will require adequate measures to control airborne dust by methods such as water spraying and sprinkling of loose or exposed soil or ground surface areas and dust-generating equipment during construction. As may be deemed appropriate, planting of landscaping or re-paving as soon as possible on completed areas will also help to control dust. During construction, air quality levels would be most affected by vehicular emissions generated by project-related traffic, however, the elevated vehicular emission concentrations are anticipated to dissipate.

> Potential water quality impacts to surface and near shore coastal waters during construction of the proposed improvements will be mitigated by adherence to State and County water quality regulations governing grading, excavation, and stockpiling. A DOA Nationwide Permit, pursuant to Section 404 of the Clean Water Act and a WQC, issued by the DOH, pursuant to Section 401 of the Clean Water Act will be required. In conjunction with the Section 401 and 404 permits, a BMP plan will be prepared for construction activities within the project site. Erosion and sediment control measures will be instituted in accordance with site specific assessments, incorporating appropriate structural and/or non-structural BMPs ~~such as minimizing time of exposure between construction and landscaping, and implementing erosion control measures such as silt fences and filter berms~~. <u>Specific BMPs may include, but may not be limited to the following:</u>

1. Minimizing soil loss and erosion by revegetation and stabilization of slopes and disturbed areas of soil, possibly using hydromulch, geotextiles, or other applicable alternatives, as soon as possible after working;
2. Minimizing time of exposure between construction and landscaping;
3. Application of protective covers to soil and material stockpiles;
4. Minimizing disturbance of soil during periods of heavy rain;
5. Implementing erosion control measures by emplacement of structural controls such as silt fences, filter berms, gravel bags, fiber rolls, sandbag barriers and other barriers in order to retard and prevent the loss of sediment from the site;
6. Phasing of the project to disturb the minimum area of soil at a particular time;
7. Use of drip pans beneath vehicles not in use in order to trap vehicle fluids;
8. Routine maintenance of BMPs by adequately trained personnel;
9. Significant leaks or spills, if they occur, shall be properly cleaned up and disposed of at an approved site.

Following construction, exposed soils at the project site will have been built over, paved over, or re-vegetated to control erosion.

Construction activities are not likely to introduce to, nor release from the soil any materials which could adversely affect groundwater. Construction material wastes will be appropriately disposed of and must also be prevented from leaching into receiving bodies of water.

Dewatering may be required for the proposed project. Should dewatering be deemed necessary, the contractor will be responsible to obtaining all applicable permits including, but not limited to, an NPDES Permit for Dewatering Activities. The permit application will require a BMP plan, an erosion control plan, and a water quality monitoring plan. Water quality impacts associated with the disposal of dewatering effluent will also be addressed in the BMP plan, including appropriate characterization of any potential pollutants such as sediments and nutrients in the effluent.

No long-term significant impacts to noise levels within the project site are anticipated as a result of construction and operation of the proposed project.

In the short-term, noise from construction activities such as excavation, grading, cutting and paving will be unavoidable. The increase in noise level will vary according to the particular phase of construction. Noise may also increase as a result of operating heavy construction vehicles and other power equipment during the construction period.

Construction noise impacts will be mitigated by compliance with provisions of the State DOH Administrative Rules, Title 11, Chapter 46, "Community Noise Control" noise control regulations. These rules require a noise permit if the noise levels from construction activities are expected to exceed the allowable levels stated in the DOH Administrative Rules. It shall be the contractor's responsibility to minimize noise by properly maintaining noise mufflers and other noise-attenuating equipment, and to maintain noise levels within regulatory limits. Also, the guidelines for heavy equipment operation and noise curfew times, as set forth by the DOH noise control rules, will be adhered to; or if necessary, a noise permit shall be obtained. ~~These rules require a noise variance for any night work. Night work is anticipated for the project and, as such, a noise variance will be obtained. Further, DOH rules require a~~

~~noise permit if the noise levels from construction activities are expected to exceed the allowable levels stated in the DOH Administrative Rules. It shall be the contractor's responsibility to minimize noise by properly maintaining noise mufflers and other noise-attenuating equipment, and to maintain noise levels within regulatory limits. Also, the guidelines for hours of heavy equipment operation and noise curfew times as set forth by the DOH noise control rules will be adhered to; or if necessary, a noise permit will be obtained.~~

In the long-term, no significant noise impact is anticipated once the proposed project has been completed. Noise from vehicles will continue to be the primary noise source along the project site, however, no adverse noise effects from the project are anticipated since the project is not expected to generate additional traffic in the vicinity.

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

No short- or long-term significant impacts are anticipated as the project site is not located within an environmentally sensitive area.

According to the Flood Insurance Rate Map (FIRM) (Community Panel Numbers 1500030586F and 1500030567F, Effective Date: September 19, 2012) prepared by the Federal Emergency Management Agency (FEMA), the project site is designated Zone VE and Zone AE.

Zone VE includes areas with a 1% or greater change of flooding and have an additional hazard associated with storm waves. In general, these areas have a 26% chance of flooding over the life of a 30-year mortgage.

Zone AE is characterized as a "special flood hazard area subject to inundation by the 1% annual chance flood." Zone AE is also a "floodway," in which "the channel of the stream plus any adjacent floodplain areas that must be kept free of the encroachment so that the 1% annual chance flood can be carried without substantial increases in flood height." The 1% annual flood is also commonly referred to as the 100-year flood or the base flood.

According to the Tsunami Evacuation Zone maps for Maui, the project site lies entirely within the tsunami evacuation zone.

Construction activities within the respective flood hazard districts will be conducted in accordance with regulations set forth in Section 19.62.060, Maui County Code. Before construction of any development begins within any flood hazard area, flood-related erosion hazard area, or mudslide area, a special flood hazard area development permit shall be obtained from the Director of the Department of Planning.

The project will also comply with the rules and regulations for the National Flood Insurance Program (NFIP) present in Title 44, of the Code of Federal Regulations (44CFR), as the project is within a Special Flood Hazard Area.

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

In the short-term, a temporary bypass road and bridge are being proposed on the mauka side of the existing roadway. This use will be generally similar in visual character to that of the temporary bridge over the existing culverts. Compared to the existing culverts, the temporary bridge on the mauka side of South Kīhei Road would provide a higher view object (approximately 14 feet) for individuals utilizing South Kīhei Road or in close proximity to this portion of the road. However, the temporary bridge and bypass road are necessary in order to maintain usage of this portion of South Kīhei Road during construction of the replacement Kūlanihāko‘i Bridge. Once the new bridge is constructed, the temporary bypass road and bridge will be removed.

In the long-term, the proposed replacement bridge is not anticipated to have significant impacts on notable view planes nor adversely affect important public viewing points or visual resources. As an already existing roadway and bridge, the project will not significantly change the scenic and visual character of the surrounding area.

*(13) Requires substantial energy consumption.*

Operation of the proposed project will not result in a significant increase in energy consumption.

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# 7. CONSULTATION

## 7.1 Pre-Assessment Consultation

The following agencies and organization were consulted during the preparation of the Draft EA. Of the 14 parties that formally replied during the pre-assessment period, some had no comments while others provided substantive comments as indicated by the ✓ and ✓✓, respectively. All written comments are reproduced in Appendix F.

**Federal Agencies**

✓✓ U.S. Army Corps of Engineers (COE)
U.S. Fish and Wildlife Service
National Oceanic and Atmospheric Administration (NOAA)
NOAA, National Marine Fisheries Service

**State Agencies**

✓ Department of Accounting and General Services
Department of Business, Economic Development & Tourism (DBEDT)
DBEDT, Land Use Commission
✓✓ DBEDT, Office of Planning
Department of Education
Department of Health (DOH)
✓✓ DOH, Clean Water Branch
DOH, Environmental Management Division
✓✓ DOH, Environmental Planning Office
✓✓ DOH, Office of Environmental Quality Control
Department of Land and Natural Resources (DLNR)
✓✓ DLNR, Engineering Division
DLNR, Land Division
DLNR, State Historic Preservation Division
✓✓ DLNR, Office of Conservation and Coastal Lands
✓ Department of Transportation
Office of Hawaiian Affairs

**County of Maui**

✓✓ Department of Environmental Management
✓✓ Department of Fire and Public Safety
✓ Department of Parks and Recreation
Department of Planning
✓ Department of Public Works
Department of Transportation
Department of Water Supply
Police Department

**Other Interested Parties and Individuals**

✓✓ Kīhei Community Association

## 7.2 Draft Environmental Assessment Consultation

The following agencies and organizations ~~will be~~ were consulted during the public review period of the Draft EA. Of the 16 parties that formally replied during the public review period, some had no comments while others provided substantive comments as indicated by the ✓ and ✓✓, respectively. All written comments are reproduced in Appendix G.

**Federal Agencies**

U.S. Army Corps of Engineers (COE)
COE, Civil Works Technical Branch
✓✓ COE, Regulatory Branch
U.S. Fish and Wildlife Service
✓ U.S. Geological Survey
National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service

**State Agencies**

✓✓ Department of Business, Economic Development, and Tourism (DBEDT)
DBEDT, Office of Planning*
Department of Health (DOH)
✓✓ DOH, Clean Water Branch
✓✓ DOH, Environmental Planning Office
✓✓ DOH, Maui District Health Office**
DOH, Office of Environmental Quality Control
Department of Land and Natural Resources (DLNR)
✓✓ DLNR, Engineering Division
✓✓ DLNR, Land Division
DLNR, Office of Conservation and Coastal Lands
DLNR, State Historic Preservation Division
Office of Hawaiian Affairs
University of Hawai'i Environmental Center
Department of Transportation

**County of Maui**

Department of Environmental Management
✓✓ Department of Fire and Public Safety
✓✓ Department of Parks and Recreation
✓✓ Department of Planning
Department of Public Works
✓ Department of Transportation
✓✓ Department of Water Supply
✓✓ Police Department

**Utility Companies**

Maui Electric Company
Oceanic Time Warner Cable
Hawai'i Gas
Hawaiian Telcom

**Other Interested Parties and Individuals**

✓✓ Kīhei Community Association
Kenranes, Ltd.
✓✓ Ann Blyde
✓✓ Annette Probst

* Office of Planning letter and response was not included as part of the FEA-FONSI but is included in the RFEA-FONSI.

** The DOH Maui District Health Office letter and response was included in the FEA-FONSI. However, an additional letter and response were not included in the FEA-FONSI. A third letter was received after the filing of the FEA-FONSI. The additional letter, third letter and responses are included as part of the RFEA-FONSI.

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## 8. REFERENCES

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# APPENDIX A

***Dune Investigation, Kūlanihāko‘i Bridge***

***Sea Engineering, Inc.***

***August 13, 2012***

*Sea Engineering, Inc.*
*Makai Research Pier 41-305 Kalanianaole Hwy.*
*Waimanalo, Hawaii 96795-1820*
*Ph: (808) 259-7966 Fax: (808) 259-8143*
*Email: sei@seaengineering.com*
*Website: www.seaengineering.com*

# Memorandum

| | |
|---|---|
| DATE: | August 13, 2012 |
| TO: | Milton Arakawa, Wilson Okamoto |
| FROM: | Marc Ericksen |
| SUBJECT: | Dune Investigation, Kulanihakoi Bridge |

On August 8, 2012 Sea Engineering, Inc. (SEI) conducted a site investigation of the Kulanihakoi Bridge in Kihei, Maui to determine the location of the coastal dune. Figure 1 presents an aerial photograph of the project site. The site investigation was conducted in order to determine the dune location to comply with the Maui County Grading Ordinance, Sect 20.08.035, which prohibits the grading of coastal dunes.

The county ordinance defines a coastal dune as "one of possibly several continuous or nearly continuous mounds or ridges of unconsolidated sand contiguous and parallel to the beach, situated so that it may be accessible to storm waves and seasonal high waves for release to the beach or offshore waters." Thus, there are three main criteria that are used to establish the presence or limits of a dune: unconsolidated sandy soil, a mound or ridge formation, and the possible reach of storm or seasonal high waves. The limits of a coastal dune may not always definitive, however. Sometimes there is no clearly defined break in slope, sometimes the terrain is obscured by heavy underbrush, or there may be several lines of dunes. In heavily used areas the coastal dune structure can be obscured by terrain alteration due to vehicle or foot traffic, or by previous grading and construction activities.

The project site is Kulanihakoi Bridge in Kihei, Maui, located approximately 200 feet south of the Kaonoulu Street – South Kihei Road intersection. The bridge consists of four 6 x 4 ft culverts spanning Kulanihakoi Gulch. The gulch is an intermittently flowing stream channel, which during heavy rains erodes a stream channel through the beach and discharges runoff waters into the ocean. When the rain stops, and flow ceases, a beach berm reforms in front of the stream, and a muliwai typically forms. A muliwai is the the Hawaiian word for brackish water pools near the mouths of streams created by seasonal barriers of sand or sediment. Figures 2 – 4 show Google Earth images of the project area on March 23, 2011, December 5, 2004, and November 7, 2000. On March 23, 2011 the stream is not flowing and a large muliwai is present. On December 5, 2004 the stream is not flowing and a small muliwai is present. On November 5, 2004 the stream has cut a narrow channel through the beach and is flowing into the ocean. Figure 5 shows the muliwai present during the site visit on August 8, 2012. When the stream is not flowing, a visible low elevation swale is present in the beach and backshore marking the location of the channel (Figure 6).

Seaward of Kalanihakoi Bridge is Kalepolepo Beach, a sand beach approximately 750 feet long extending from the revetment fronting the Maui Lu Hotel in the north, to the Kalepolepo Fishpond in the south. Dune formation is active in this area as the prevailing tradewinds are modified by the local effects of Haleakala and blow strongly from the northwest in the afternoons, transporting dry beach sand inland. Coastal dunes up to 16 feet high are present to the north and the south of the stream channel/swale. The north coastal dune is shown in Figure 5 and Figure 7. The landward limit of the north dune is located at the base of the slope along the seaward waterline of the muliwai. Photographs of the south dune are presented in Figures 8 and 9. The limit of the south dune follows the south edge of the stream channel/swale, and then along the edge of South Kihei Road to the south (Figure 9).

Figures 10 and 11 present photographs of the muddy sediment deposited in the stream channel and muliwai areas.

Figure 12 presents a topographic map illustrating the coastal morphologies present in the project area. The muliwai and stream channel occupy the zone immediately seaward of the bridge and road for a distance of approximately 160 feet north and 130 feet south of the bridge. The north coastal dune lies seaward of the muliwai, and forms the north side of the stream channel. The south dune forms the south side of the stream channel. The edges of the dunes are illustrated by the red lines in Figure 12. A beach berm lies between the dunes and stream channel, and the ocean.

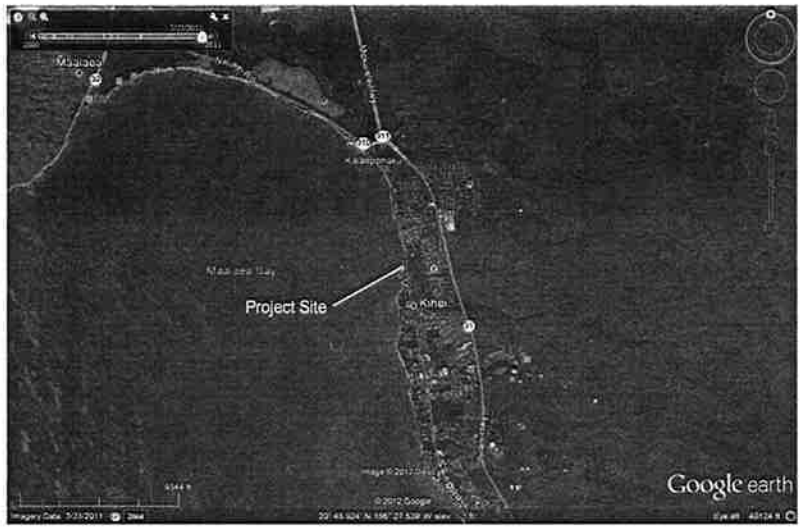


Figure 1 – Google Earth aerial photograph of project site

Figure 2. Google Earth image of the project site on March 23, 2011 showing large muliwai

Figure 3. Google image of the project site on December 5, 2004

Figure 4. Google Earth image of the project site on November 7, 2000 showing the stream channel through the beach

Figure 5. Muliwai present behind north coastal dune

Figure 6. Low elevation swale in the beach marking location of stream channel between the north (left) and south (right) dunes

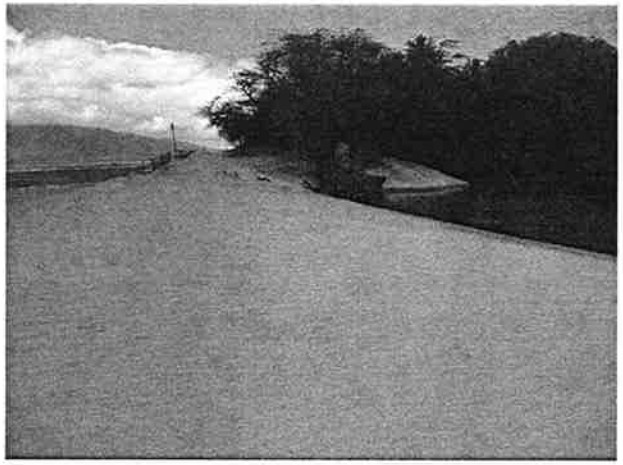

Figure 7. North coastal dune

Figure 8. South coastal dune

Figure 9. Landward edge of the south dune, along South Kihei Road

Figure 10. Muddy sediment in the stream channel

Figure 11. Mud along the banks of the muliwai

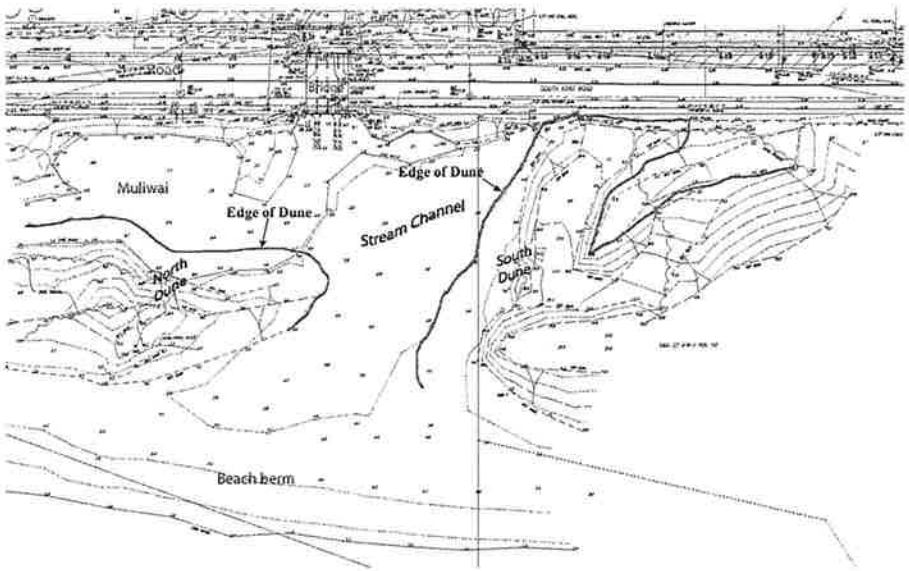


Figure 12. Topographic map of the project site showing coastal morphologies and the edge of the dunes.

# APPENDIX B

***Water Quality/Biological Surveys and a Wetland Delineation for a Bridge Repair on Lower Kūlanihāko‘i Gulch in Kīhei, Maui***

***AECOS, Inc.***

***March 5, 2013 Revised January 20, 2015***

*AECOS* No. 1314A

# Water quality/biological surveys and a wetlands delineation for a bridge repair on lower Kūlanihākoʻi Gulch in Kīhei, Maui

Prepared by:

*AECOS*, Inc.
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March 5, 2013
*Revised January 20, 2015*

# Water quality/biological surveys and a wetlands delineation for a bridge repair on lower Kūlanihākoʻi Gulch in Kīhei, Maui

March 5, 2013 *AECOS* No. 1314A
*Rev.: January 20, 2015*

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## Introduction

The bridge (culvert)[2] on South Kīhei Road at Kūlanihākoʻi Gulch on the Island of Maui (Figure 1) is slated to be replaced. This project will involve construction of a temporary bypass road *mauka* (inland side) of the existing road at a distance of approximately 55 ft (17 m) from the *mauka* edge of the existing road. The ~25-ft wide bypass road will cross the drainageway on fill and a temporary bridge.

*AECOS* Inc. was contracted by Wilson Okamoto Inc[3] to investigate biological resources and water quality at the proposed project site (TMK: (2) 3-9-001: 162) and in September 2012, *AECOS* biologists conducted field surveys in the project area. This report details findings of those surveys. The report also provides an assessment of the federal jurisdictional boundary at the project location.

### Kūlanihākoʻi Gulch

Kūlanihākoʻi Gulch arises as several gulches extending upslope as far as the 1,500-m (4900-ft) elevation contour on East Maui Mountain. The gulch extends

[1] Rana Biological Consultants, Inc.
[2] Kulanihakoa #76 (Box Culvert), bridge No. 009000310900001 (NOEI, 2012).
[3] This document will be incorporated into the Kulanhakoi Bridge Replacement Environmental Assessment (EA) and will become part of the public record.

west-southwest approximately 19.3 km (12 mi) from its origin above Kula Highway to its Pacific Ocean outlet at Kalepolepo Beach Park on Maʻalaea Bay.

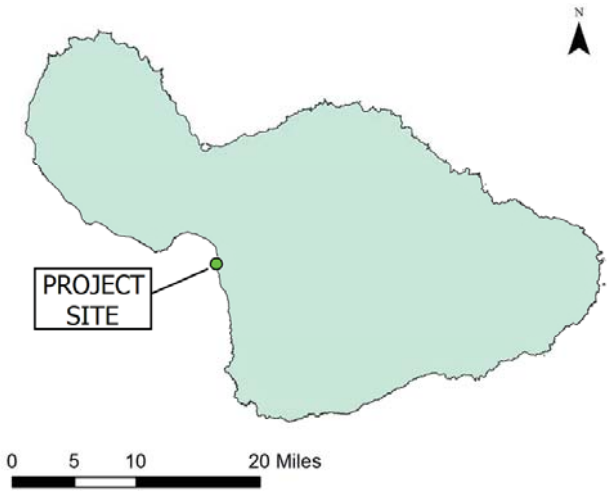


Figure 1. General location of the project on the Island of Maui.

Although water flow is intermittent, the gulch is a well-defined feature with a bottom of exposed bedrock and boulders at higher elevations. In the project area, the "gulch" is a broad, flat open area with minimal relief and a substratum of dark sand. Much of the floodplain of this drainage has been developed in houses and condominium units.

Surface water is present at the South Kīhei Road project site, where the outlet is typically blocked by a deposit of sand (Kalepolepo Beach), forming a *muliwai* (brackish water pond or estuary) extending inland through the project site. Under most circumstances, the short wetted section of Kūlanihākoʻi Gulch here is permanently wetted, estuarine, and tidal.





# Methods

## Water Quality

Field measurements for temperature, dissolved oxygen, and pH were conducted and water samples were collected for total suspended solids (TSS), turbidity, nitrate-nitrite nitrogen, total nitrogen (TN), total phosphorus (TP), and chlorophyll from four stations in the project area. Additionally, samples for oil & grease, pesticides, polyaromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), benzene, toluene, ethylbenzene, and xylenes (BTEX) were collected from the project site for the permitting of construction dewatering under the National Pollution Discharge Elimination System (NPDES). All water samples were collected in screw cap-polypropylene or glass bottles and vials on September 17, 2012 and delivered to *AECOS* laboratory in Kāneʻohe, Oʻahu for laboratory analyses (*AECOS* Log No. 28604). Table 1 lists analytical methods and instrumentation used in the analyses.

Table 1. Analytical methods and instruments used for water quality analysis.

| Analysis | Method | Reference | Instrument |
|---|---|---|---|
| Ammonia | EPA 350.1 | USEPA (1993) | Technicon Auto Analyzer II |
| Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX) | EPA 602 | USEPA (1993) | Gas chromatograph |
| Chlorophyll | SM 10200H (M) | Standard Methods 20th Edition (1998) | Turner fluorometer |
| Dissolved Oxygen | SM 4500-O G | Standard Methods 20th Edition (1998) | YSI Model Pro 2030 Dissolved Oxygen Meter |
| Nitrate + Nitrite | EPA 353.2 Rev 2.0 | USEPA (1993) | Technicon AutoAnalyzer II |
| Oil & grease | EPA 1664A | USEPA (1993) | Separatory funnel; Balance |
| pH | SM 4500 H+ | Standard Methods 20th Edition (1998) | Hannah pocket pH meter |
| Pesticides and PCBs | EPA 608.1/608.2 | USEPA (1993) | Gas chromatograph |
| PAHs | EPA 610 | USEPA (1993) | High performance liquid chromatograph (HPLC) or gas chromatograph (GC) |

Table 1 (continued).

| Analysis | Method | Reference | Instrument |
|---|---|---|---|
| Salinity | SM 2520B | Standard Methods 20th Edition (1998) | YSI Model Pro 2030 Dissolved Oxygen Meter |
| Temperature | thermister calibrated to NBS. Cert. thermometer SM 2550 B | Standard Methods 20th Edition (1998) | YSI Model Pro 2030 Dissolved Oxygen Meter |
| Total Nitrogen | persulfate digestion/EPA 353.2 | Grasshoff et al (1986)/ USEPA (1993) | Technicon AutoAnalyzer II |
| Total Phosphorus | EPA 365.30 | USEPA (1993) | Technicon AutoAnalyzer II |
| Total Suspended Solids | Method 2540 D | Standard Methods 20th Edition (1998) | Mettler H31 balance |
| Turbidity | EPA 180.1 Rev 2.0 | EPA (1993) | Hach 2100N Turbidimeter |

Water quality sampling locations are shown in Figure 2. Station "Upstream" was located 35 m (115 ft) upstream from South Kīhei Road. Station "Bridge" was located at the upstream end of the bridge culvert slated for repair. Station "Downstream" was located 35 m (115 ft) downstream from South Kīhei Road near where the stream mouth is blocked by a sand berm. Station "Ocean" was located just offshore of Kalepolepo Beach in coastal waters 1 m (3 ft) deep. All water samples were collected from just below the water surface. Sampling occurred during a predicted low tide estimated at +0.36 ft (NOAA, 2012) for Kīhei, Maui.

## Jurisdictional Waters Considerations

Kūlanihākoʻi Gulch is a drainage feature that discharges directly into Maʻalaea Bay, a tidal waterbody subject to federal jurisdiction under Section 10 of the Rivers and Harbors Act and Sections 402 and 404 of the Clean Water Act. Because flow of water in the gulch itself is intermittent, this feature is a "not relatively permanent", non-navigable tributary that is jurisdictional by virtue of a significant nexus or influence on the adjacent coastal waters (Grumbles and Woodley, 2008; USACE & USEPA, 2014). The *muliwai* within the project area, although not directly connected to the ocean for much of the time, is separated only by the beach and considered waters of the U.S. because it is *adjacent* to navigable waters (the Pacific Ocean at Maʻalaea Bay).





The channel of the *muliwai* is well-defined and the jurisdictional boundary (in the absence of adjacent wetlands) could be the elevation contours corresponding to the mean high (or mean higher high; MHW or MHHW) water marks, depending upon the applicable regulatory authority (Rivers and Harbors Act or Clean Water Act, respectively): +0.78 ft (0.238 m) or +1.14 ft (0.347 m) relative to mean sea level (MSL; NOAA, 2003). The *muliwai* is tidal to some degree. The surveyor's contour map prepared for the project (Control Point Surveying, Inc., 2013) shows both MHW and MHHW elevations extending under the existing bridge and, in the channel of the *muliwai*, up to 116 ft (35 m) further upstream. Surface water extends yet further inland (see Fig. 2; marked in Fig. 6).

Figure 2. The locations of water quality stations for the South Kīhei Road crossing of lower Kūlanihākoʻi Gulch. The *muliwai* is quite evident in this image.

In non-tidal waters, the limit of jurisdiction extends to the ordinary high water mark (OHWM). If wetlands are adjacent to the mean high or mean higher high or ordinary high water marks, then the jurisdictional limits extend to the wetland boundary. Based on the site topographic survey, the invert of the *muliwai* at the proposed bypass road location is between 0.8 and 1.6 ft above

MSL. The surveyors' "bottom of bank" is around 1.6 ft. and "top of bank" typically over 5 ft. Thus, a conservative jurisdictional boundary that would encompass all three possible jurisdictional limits (MHW, MHHW, OHWM), are effectively the relatively steep banks extending upstream to the limit of "permanent" water (well beyond the proposed project site). The question then to be answered: are adjacent wetlands present that would extend the jurisdictional boundary out beyond the banks of the *muliwai*?

In order to help establish wetland lateral boundaries for the Kūlanihākoʻi *muliwai*, a transect line was laid out from the NE corner of the road culvert structure in an eastward direction for a distance of 40 m (131 ft), a point well "upstream" of the proposed bypass road. This "base" line was then used to conduct soil testing and mark vegetation patterns on lines set perpendicular at 10-m (33-ft) intervals. Most of this effort was undertaken on the right (north) bank of the estuary, as the left bank was higher, steeper, and more densely vegetated (and, as demonstrated, characterized by a deep aeolian sand deposit). Our field investigation followed methods of wetland delineation described in *Corps of Engineers Wetland Delineation Manual* ("Manual"; USACE, 1987) and *Regional Supplement* (USACE, 2012a). The wetland status of plant species follows the 2012 National Wetland Plant List (Lichvar, 2012; Lichvar et al, 2014). No boundary (wetland delineation) flags were set out.

Location information (GIS) was gathered in the field using a Trimble 6000 Series GeoXT (submeter) GNSS unit. Data obtained were subsequently subjected to differential correction using base audit data provided by the CORS Haleakala download site.

### Botanical

Botanical resources were identified by walking around the area on September 17, 2012 and noting the names and relative abundances of all ferns, fern allies, gymnosperms, and flowering plants growing there. The survey area extended well-beyond the actual project site in all directions: from Kaonoulu Street to the property fence of Kīhei Bay Vista in the north-south direction, and from the beach shore to a little beyond the upper end of the *muliwai* in the east-west direction. Field notes were translated into a flora listing. For the most part, plant names given in the listing follow *Manual of the Flowering Plants of Hawaiʻi* (Wagner et al., 1990, 1999) for native and naturalized flowering plants, and *A Tropical Garden Flora* (Staples and Herbst, 2005) for ornamental plants. Names have been updated as appropriate to reflect more recent taxonomic or nomenclatural name changes.





### Aquatic Biota

Aquatic resources in Kūlanihākoʻi Gulch were identified by visually observing and sampling *muliwai* waters with hand nets to identify biota present. The September 17, 2012 survey area included the entire *muliwai* in the project area which extended 100 m (330 ft) upstream from the S. Kīhei Road culvert.

### Avian Biota

One avian count station was sited approximately 15 m (50 ft) *mauka* of the S. Kīhei Road bridge and a second was sited approximately 15 m (50 ft) *makai* of the bridge on the beach on the morning of September 17. A single thirty-minute time dependent waterbird count was made at each station. Field observations were made with the aid of Leica 8 X 42 binoculars and by listening for vocalizations. Time not spent counting at point count stations was used to search the rest of the site for species and habitats not detected during the point counts. Weather conditions were ideal, with no rain, unlimited visibility and winds of between 3 and 10 km per hour.

### Terrestrial Mammals

With the exception of the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), or *ʻōpeʻapeʻa* as it is known locally, all terrestrial mammals currently found on the Island of Maui are alien species, and most are ubiquitous. The survey of mammals 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 the survey.

## Survey Results

### Water Quality

The results from *in situ* measurements and analyses of water samples collected from three stations near the project site are provided in Table 2. As is typical, waters in the estuarine reach of Kūlanihākoʻi Gulch were not flowing into Māʻalaea Bay as a sand berm blocked flow toward the ocean (although seepage through the sand would be occurring). Salinity readings ranged from 24 to 26 ppt within gulch, and indicate brackish water composed of a mix of seawater and freshwater. Gulch waters in close proximity to the culvert, as evidenced by Stas. Upstream, Bridge, and Downstream were super-saturated with oxygen

during the sampling event with DO concentrations of 7.33 to 7.88 mg/l, representing 110 to 116% saturation at the measured temperatures. All three stations in the *muliwai* had basic pH values with readings ranging only slightly, from 8.01 to 8.07.

Table 2. Results for *in situ* measurements and analysis of water samples collected on September 17, 2012 at Kūlanihākoʻi Gulch.

| Station | Temp. (°C) | Dissolved Oxygen (mg/l) | Dissolved Oxygen (% sat.) | pH -- | Salinity (psu) | TSS (mg/l) |
|---|---|---|---|---|---|---|
| Upstream | 29.6 | 7.33 | 110 | 8.07 | 25 | 40 |
| Bridge | 27.4 | 7.88 | 114 | 8.01 | 24 | 33 |
| Downstream | 31.5 | 7.40 | 116 | 8.04 | 26 | 33 |
| Ocean | 26.5 | 6.85 | 103 | 8.11 | 34 | 74 |

| | Turbidity (ntu) | Nitrate+ Nitrite (µg N/l) | Ammonia (µg N/l) | Total N (µg N/l) | Total P (µg P/l) | Chlorophyll (µg /l) |
|---|---|---|---|---|---|---|
| Upstream | 10.4 | 331 | 32 | 2310 | 49 | 12.6 |
| Bridge | 9.98 | 260 | 1500 | 2100 | 680 | 10.8 |
| Downstream | 10.8 | 221 | 25 | 1710 | 48 | 13.3 |
| Ocean | 3.60 | 103 | 8 | 674 | 70 | 0.66 |

Particulates, as measured by TSS, were high in gulch waters, ranging from 33 to 40 mg/l at the three *muliwai* stations. Turbidity levels, an indication of cloudiness of the water, ranged from 9.98 to 10.8 ntu, reflecting the turbid green water observed during sampling. Nitrate-nitrite levels ranged from 221 to 331 µgN/l with total nitrogen concentrations in excess of 1700 µgN/l at all three *muliwai* stations. Chlorophyll concentrations of 12.6, 10.8, and 13.3 µg/l at Stas. Upstream, Bridge, and Downstream, respectively, are high and indicate an abundance of phytoplankton in the water column, contributing to elevated





suspended solids and turbidity readings. Such conditions are common in estuaries in Hawaiʻi as nutrients in runoff accumulates in the stagnant water, promoting algal blooms; these blooms may persist until a freshet flow in the gulch breaks through the sand barrier and flushes out the estuary.

Nearshore marine waters sampled at Sta. Ocean revealed typical conditions for upper Maʻalaea Bay: turbid, well-oxygenated seawater with a pH near 8.00. Total suspended solids (TSS) of 74 mg/l is high for coastal waters, and likely a result of wind and waves suspending sediments in the water column at this station just off the beach.

## Physiography, Soils, and Wetlands

The South Kīhei Road culvert at Kūlanihākoʻi Gulch crosses over a small and more or less permanent water body that is fed by brackish groundwater and regularly isolated from the nearby ocean by a broad deposit of sand that is Kalepolepo Beach. This *muliwai* or estuary at the mouth of the gulch lies between developed lots on Kaonoulu Street to the north and the Kīhei Bay Vista resort condominium to the south (see Fig. 2, above). The ground is low-lying, with gentle undulations of wind-blown sand (dunes), most prominent towards the seaward end of the survey area. Prevailing winds blow onshore, moving sand inland. This sand intermixes with sediment brought into the area by freshets in Kūlanihākoʻi Gulch, resulting in a gradient of greater proportion of calcareous sand at the beach end, and a darker, more terrigenous sand at the inland end of the survey area.

Soils in the project area are classified as dune land (DL), consisting of "hills and ridges of sand-size particles drifted and piled by wind [aeolian]. The hills and ridges are actively shifting or are so recently fixed or stabilized that no soil horizons have developed" (Foote, et al., 1972, p. 29). It is worth noting that sand dune fences, intended to catch sand and stabilize dunes, are installed at Kalepolepo Park on the *makai* side of South Kīhei Rd. Although dune lands are not hydric soils, wetlands can develop in dune lands where groundwater intersects (is exposed in) low areas between dunes. The present situation is one of a jurisdictional *muliwai* (see p. 4-6, above) in a dune setting. Close-ups of two soil pits in the dune land are provided in Figure 3.

The USFWS, National Wetland Inventory (NWI) "Wetlands Mapper" (USFWS, 2012c) shows the area of the *muliwai* classified "PUBHh": diked or impounded, permanently flooded, freshwater wetland (palustrine) with unconsolidated (sand or mud) bottom; and a much larger area extending to the south through several resort complexes as PEM1C (seasonally flooded freshwater wetland

Figure 3A. Soil pit at SP-01. Note absence of vegetation and dryness of ~1 inch surface layer of sand.

Figure 3B. Soil pit at SP-02. Dry surface layer closer to 4 inches thick. Deeper sand is moist (darker) in both locations.





with persistent emergent vegetation). Neither of these designations match what is on the ground in the locations indicated by USFWS. The *muliwai* should be classified as E1UB2[4] (estuarine subtidal with sand bottom); it is not "diked" or unnaturally impounded (it is naturally isolated by a sand beach). A wetland corresponding to the area in the NWI designated PEM1C is no longer present (now a fully developed landscape).

## Botanical

Plant growth is sparse over much of the area, or otherwise consists of a ground cover of *ʻākulikuli* (*Sesuvium portulacastrum*) that is dense in some locations (Fig. 4). Less prominent and mostly to the south of the *muliwai*, occurs seaside heliotrope (*Heliotropium curassavicum*).

A total of 15 plant species was identified from the project vicinity (Table 3). All are flowering plants (no ferns or fern allies or gymnosperms). Note that our table is divided into two sections: **3a** for non-native plant species and **3b** for native (or Polynesian-introduced) plant species. Typically, in most lowland areas on Maui, the native and Polynesian plant numbers are no more than 10-16% of the total species identified from a location (see, for example, David, Guinther, and Miranda, 2012). At Kūlanihākoʻi Gulch mouth, 60% of the species are in the 1b part of the table. While this situation is highly unusual, there is an explanation: this area is maintained as a Native Plant Restoration Project (Fig. 5). The area is also served by a pipe irrigation system with sprinkler heads, suggesting some current or prior level of artificial watering. While native *ʻakulikuli* and *ʻakiʻaki* are plants associated with coastal dune and *muliwai* environments, it is unknown to what extent the vegetation patterns have been influenced to their present state by the native planting and maintenance activities. One would expect the estuarine area to be dominated by pickleweed (*ʻakulikuli kai* or *Batis maritimus*), as this non-native is conspicuous throughout the Kīhei area in coastal wetlands. This species was noted as rare in the project area in September 2012.

Dune areas support *ʻakiʻaki* (*Sporobolus virginicus*), a native grass common to this habitat. Non-natives (other than *kiawe* [*Prosopis pallida*], which forms a grove on the *makai* side of South Kīhei Rd.) are uncommon or rare in the survey area. The native *ʻakia* (*Wikstroemia usa-urvi*) has been planted on a low dune, where it is presently not doing very well.

[4] Although a valid code according to USFWS (2006) and Cowardin et al. (1979), this code cannot be decoded by the Service's NWI decoder (USFWS, 2012c). However, SCDNR (undated) will correctly decode this sequence as an estuarine, subtidal, sand bottom environment.

Figure 4. View of the *muliwai* looking upstream from a point between "Bridge" and "Upstream" water quality stations. Plant growth is mostly native *ʻākulikuli*. The foamy material on the surface is moving seaward on a falling tide (earlier accumulated by wind and tide at the very upper end of the *muliwai*).

Table 3. Flora survey results for the South Kīhei Road crossing at Kūlanihākoʻi Gulch (September 2012)

**3a. Non-native (ornamentals and naturalized) plants**

| Family<br>Species | Common name | Status | Abundance | Notes |
|---|---|---|---|---|
| | *FLOWERING PLANTS*<br>DICOTYLEDONS | | | |
| ANACARDIACEAE | | | | |
| *Schinus terebinthefolius* Raddi | Christmas berry | Nat | R | FACU |
| BATACEAE | | | | |
| *Batis maritima* L. | pickleweed, *ʻakulikuli kai* | Nat | R1 | OBL |





Table 3 (continued).

| Family<br>Species | Common name | Status | Abundance | Notes |
|---|---|---|---|---|
| FABACEAE | | | | |
| *Prosopis pallida* (Humb. & Bonpl. ex Willd.) Kunth | *kiawe* | Nat | O | FACU |
| SOLANACEAE | | | | |
| *Nicotiana glauca* R.C. Graham | tree tobacco | Nat | R | UPL |
| *Solanum lycopersicum* var. *cerasiforme* (Dunal) Spooner, Anderson, & Jansen | cherry tomato | Nat | | UPL |
| | MONOCOTYLEDONES | | | |
| POACEAE (GRAMINEAE) | | | | |
| *Cynodon dactylon* (L.) Pers. | Bermuda grass | Nat | U2 | FACU |

**Table 3b. Native (and early Polynesian introduced) Plants**

| Family<br>Species | Common name | Status | Abundance | Notes |
|---|---|---|---|---|
| | *FLOWERING PLANTS*<br>DICOTYLEDONS | | | |
| AIZOACEAE | | | | |
| *Sesuvium portulacastrum* (L.) L. | *ʻākulikuli* | **Ind** | AA | FAC |
| BORAGINACEAE | | | | |
| *Cordia subcordata* Lam. | *kou* | Pol | O | FACU |
| *Heliotropum curassavicum* L. | *kīpūkai* | **Ind** | A | FAC |
| GOODENIACEAE | | | | |
| *Scaevola sericea* Vahl. | *naupaka* | **Ind** | O | FACU |
| MALVACEAE | | | | |
| *Thespesia populnea* (L.) Sol. ex Corrêa | *milo* | **Ind?** | O3 | FAC |
| *Waltheria indica* L. | *ʻuhaloa* | **Ind?** | U12 | FACU |
| THYMELAEACEAE | | | | |
| *Wikstroemia uva-ursi* A. Gray | *ʻākia* | **End** | R | UPL |
| | MONOCOTYLEDONES | | | |
| CYPERACEAE | | | | |
| *Bolboschoenus maritimus* (L.) Palla | *kaluhā* | **Ind** | R2 | OBL |
| POACEAE (GRAMINEAE) | | | | |
| *Sporobolus virginicus* (L.) Kunth | *ʻakiʻaki* | **Ind** | A | FAC |

Legend to Table 3:

Status = distributional status

- **End** = endemic; native to Hawaiʻi and found naturally nowhere else.
- **Ind** = indigenous; native to Hawaiʻi, but not unique to the Hawaiian Islands.
- **Ind?** = possibly indigenous or a very early Polynesian introduction.
- Nat = naturalized, exotic, plant introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778, and well-established outside of cultivation.
- Pol = early Polynesian introduction ("canoe plant").

Abundance = occurrence ratings for plants

- R – Rare - only one or two plants seen.
- U - Uncommon - several to a dozen plants observed.
- O - Occasional - found regularly, but not abundant anywhere.
- C - Common - considered an important part of the vegetation and observed numerous times.

Table 3 (continued).

A - Abundant - found in large numbers; may be locally dominant.
AA - Abundant - very abundant and dominant; defining vegetation type.
Numbers (as in R3) offset occurrence ratings (1 – several plants; 2 – many plants; 3 – abundant in a limited area) in cases where distribution across the survey area may be limited, but individuals seen are more than indicated by the occurrence rating alone.

Notes:

Plant wetland status after Lichvar (2012) and Lichvar et al. (2014). Codes explained in the text..

Figure 5. Keiki o ka ʻaina eco.village ohana sign at project site.

## Wetland Determination

Work proposed to replace the existing culvert structure is within jurisdictional (tidal) waters as defined physically by the vertical elements of the structure itself, and a Section 404 permit will be required for this work, presumably Nationwide No. 3 authorizing maintenance and replacement activities, including placement of fill or other temporary structures necessary to conduct maintenance activities (USACE, 2012b). A second element of the project is the proposed bypass road to be built across the floodplain of Kūlanihākoʻi Gulch (see Fig. 6). This road crosses the *muliwai* some 50 ft (15 m) upstream of the culvert and would be considered necessary to the work associated with the culvert replacement.





The actual jurisdictional area beyond the *muliwai* as described above depends upon whether the floodplain out to some boundary is considered to be a wetland. Figure 6 summarizes the field work done by combining (georectifying) our GIS shapefile with the project plan view map. After adjusting both images to the same scale and matching the north arrows, a series of eight position points obtained at recognizable locations on the culvert (open circles) were lined up with the plan view drawing of the structure. Other recorded points (some not shown) were used to show the location of the 40-m base transect and the approximate edge of the *ʻakulikuli* (as well, interpreted from satellite images). The GPS recorded positions of five soil sampling pits (SP-01 through SP-05) are superimposed on the project map. Results from each of these sampling locations are summarized in the wetland data sheets (Appendix B).

The aeolian (windblown) nature of the "soil" is most evident in the photo of SP-02 (Fig. 3b, above). The dry surface layer transitions to a moist layer underneath. This moistened sand appears naturally dark (low chroma), but generally lacking properties indicating reduced conditions resulting from long-term submergence in anoxic groundwater. However, SP-03, located in a depression (or dry side-channel of the *muliwai*), has properties suggestive of reducing conditions that are interpreted here as indicating a hydric soil. None of the pits reached groundwater or even saturated sediment. A couple of the pits (SP-03 and SP-05) showed layering; in the case of SP-05 a thin layer of alluvial sediment was present near the bottom of the pit. Outcrops of this layered silt material are evident further upstream in the vicinity of the top end of the *muliwai*.

A drainage ditch parallels the east side of South Kīhei Road in the project area. This ditch is connected to the *muliwai* near the northeast corner of the culvert structure. The proposed bypass road would cross this ditch at a point 90 ft north of the culvert. A portion of this ditch appears to be permanently wetted as a narrow arm of the *muliwai*. However, in the area where the bypass road is proposed to cross, the invert of the ditch is more than +3 ft above MSL.

## Aquatic Biota

The aquatic biota of the Kūlanihākoʻi Gulch *muliwai* in the proposed project area comprises a mixture of native and naturalized (non-native) species (Table 4). Mixed schools of Cuban mollies (*Limia vittata*) and hybrid mollies (*Poecilia* sp.) swim just beneath the water surface near the South Kīhei Road crossing. Blackchin tilapia (*Sarotherodon melanotheron*), Mozambique tilapia (*Oreochromis massambicus*), and mullet (*Mugil cephalus*) are also present in

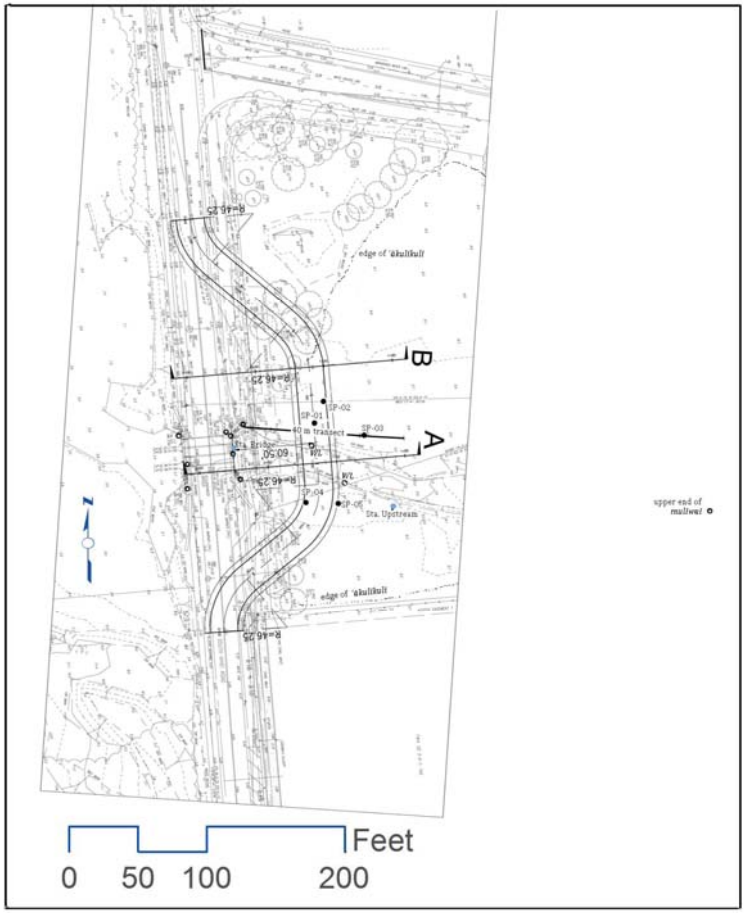


Figure 6. Light grey tilted rectangle is plan view of the project site georectified with the GIS shapefile of field collected points (see text). Proposed bypass road is shown as darker lines, and "A" and "B" are locations of profile sections in Fig. 7.





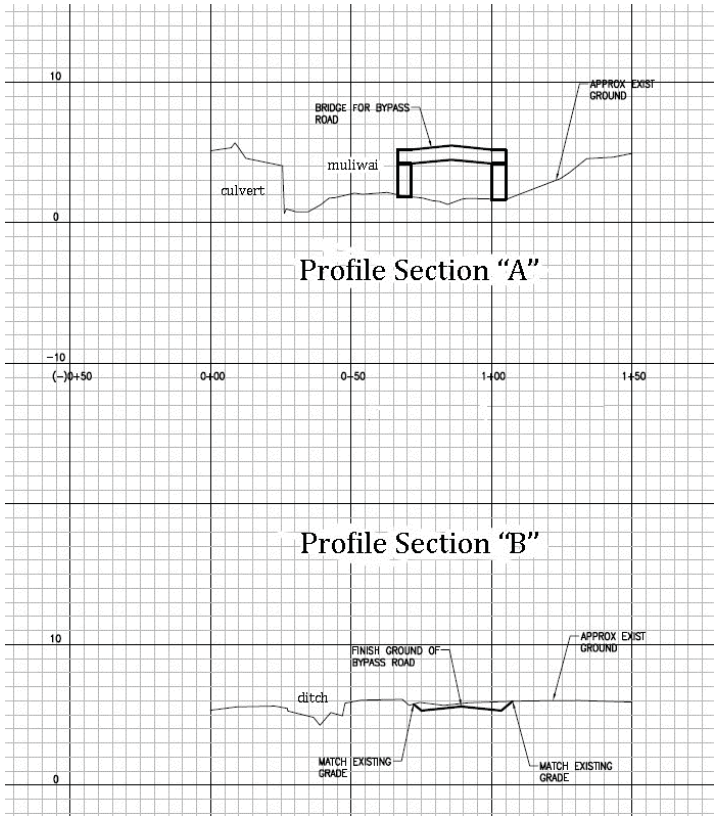


Figure 7. Sections "A" and "B" (see Fig. 6 for locations) of proposed bypass road.

schools throughout the length of the *muliwai*. Shore crabs (*Metopograpsus thuhukar*) crawl among the *ʻakulikuli* along *muliwai* margins and on the culvert proposed for repair. All these species are common inhabitants of estuarine

waters in the main Hawaiian Islands. Rambur's forktail (*Ischnura ramburi*), a naturalized damselfly typically common at low elevations, also utilizes the project area.

Table 4. List of aquatic species observed in the estuarine reach (*muliwai*) of Kūlanihākoʻi Gulch.

| PHYLUM, CLASS, ORDER, FAMILY *Genus species* | Common name | Abundance | Status | ID Code |
|---|---|---|---|---|
| | **INVERTEBRATES** | | | |
| **ARTHROPODA,INSECTA** | | | | |
| **ODONATA** | | | | |
| **COENAGRIONIDAE** | | | | |
| *Ischnura ramburii* Selys | Rambur's forktail | R | Nat | 1 |
| **ARTHROPODA, MALACOSTRACA, DECAPODA** | | | | |
| **GRAPSIDAE** | | | | |
| *Metopograpsus thukuhar* Owen | *ʻalamihi, kukuau*; purple-clawed shorecrab | R | **Ind** | 1 |
| **OCYPODIDAE** | | | | |
| *Ocypode pallidula* Jacquinot | *ʻōhiki* pallid ghost crab | R | **Ind** | 2 |
| | **FISHES** | | | |
| **CHORDATA, ACTINOPTERYGII** | | | | |
| **CICHLIDAE** | | | | |
| *Oreochromis mossambicus* | Mozambique tilapia | C | Nat | |
| *Sarotherodon melanotheron* Rüppell | blackchin tilapia | C | Nat | 1 |
| indet. | tilapia hybrid | R | Nat | |
| **MUGILIDAE** | | | | |
| *Mugil cephalus* Linneaus | *ʻamaʻama*; striped mullet | O | **Ind** | 1 |
| **POECILIIDAE** | | | | |
| *Poecilia reticulata* Peters | rainbow fish | U | Nat | 1 |
| *Poecilia* sp. | indet. mollies | C | Nat | 1 |
| *Limia vittata* Guichenot | Cuban molly | O | Nat | 1 |

Key to Table 4:

Abundance categories:
R – Rare – only one or two individuals observed.
U – Uncommon – several to a dozen individuals observed.





Table 4 (continued).

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 Hawaii
**Ind.** – Indigenous – species found in Hawaii and elsewhere
Nat. – Naturalized – species introduced to Hawaii intentionally, or accidentally.

Identification codes:
1 – identified in the *muliwai* on September 17, 2012.
2 – identified on the beach berm on September 17, 2012.

## Avian Biota

A total of 23 individual water obligate avian species, of six different species, representing six separate families, were recorded during station counts (Table 5). All but one of the six waterbird species detected are native species. One species, the Hawaiian Stilt (*Himantopus mexicanus knudseni*), is an endangered endemic sub-species. Another, the Black-crowned Night-Heron (*Nycticorax nycticorax hoactli*), is a resident indigenous species. Three others (Pacific Golden-Plover [*Pluvialis fulva*], Ruddy Turnstone [*Arenaria interpres*], and Wandering Tattler [*Tringa incana*]) are indigenous migratory shorebird species. The remaining species, Cattle Egret (*Bubulcus ibis*), is alien to the Hawaiian Islands.

Table 5. Bird species detected near the Kūlanihākoʻi Gulch crossing of S. Kīhei Road.

| Common Name | Scientific Name | ST | Mauka | Makai |
|---|---|---|---|---|
| | PELECANIFORMES | | | |
| | ARDEIDAE - Herons, Bitterns & Allies | | | |
| Cattle Egret | *Bubulcus ibis* | A | 4 | - |
| Black-crowned Night-Heron | *Nycticorax nycticorax hoactli* | IR | 2 | - |
| Black-necked Stilt | *Himantopus mexicanus knudseni* | **EE** | 13 | 1 |

Table 5 (continued).

| Common Name | Scientific Name | ST | Mauka | Makai |
|---|---|---|---|---|
| | CHARADRIIFORMES | | | |
| | CHARADRIIDAE - Lapwings & Plovers | | | |
| | Charadriinae - Plovers | | | |
| Pacific Golden-Plover | *Pluvialis fulva* | IM | 1 | - |
| | RECURVIROSTRIDAE - Stilts&Avocets | | | |
| | SCOLOPACIDAE - Sandpipers, Phalaropes & Allies | | | |
| | Scolopacinae - Sandpipers & Allies | | | |
| Wandering Tattler | *Tringa incana* | IM | - | 1 |
| Ruddy Turnstone | *Arenaria interpres* | IM | 1 | - |

Key to Table 5:

| | |
|---|---|
| **ST** | Status |
| A | Alien – Introduced to the Hawaiian Islands by humans |
| IR | Indigenous Resident – A resident native species naturally found in Hawaiʻi and elsewhere |
| IM | Indigenous Migratory – native but not unique to the Hawaiian Islands, does not breed in Hawaiʻi |
| **EE** | Endangered Endemic – A species which is unique to the Hawaiian Islands, and is listed as endangered |
| Mauka | Count station inland form the culvert. |
| Makai | Count station on the beach, oceanside of the culvert. |

# Assessment

## Water Quality

Kūlanihākoʻi Gulch appears on the Department of Health list of impaired waters in Hawaiʻi (HDOH, 2012a) prepared under Clean Water Act, §303(d). The listing, described as Kīhei Coast-Kaonoulu Estuary (ID HIW00040), indicates the water body may not meet State of Hawaiʻi water quality criteria for estuaries (Table 6). The estuary is listed as impaired for total nitrogen, nitrate+nitrite, turbidity, and chlorophyll and has been assigned a low priority for Total Maximum Daily Load (TMDL) studies.





Table 6. State of Hawaiʻi water quality criteria for estuaries from HAR §11-54-05.2(b) (HDOH, 2009).

| Parameter | Total Nitrogen (µg N/l) | Nitrate + Nitrite (µg N/l) | Total Phosphorus (µg P/l) | Turbidity (NTU) | Chlorophyll (mg/l) |
|---|---|---|---|---|---|
| Geometric mean not to exceed given value | 200.0 | 8.0 | 25.0 | 1.5 | 2.0 |
| Not to exceed more than 10% of the time | 350.0 | 25.0 | 50.0 | 3.0 | 5.00 |
| Not to exceed more than 2% of the time | 500.0 | 35.0 | 75.0 | 5.0 | 10.0 |

pH – shall not deviate more than 0.5 units from ambient and shall not be < 7.0 nor > 8.6.
Dissolved oxygen – not less than 75% saturation.
Temperature – shall not vary more than 1 °C from ambient.
Salinity – not more than 10% from ambient conditions.

During the September 17, 2012 water quality survey, brackish gulch waters near the S. Kīhei Road project site were nutrient, sediment, and chlorophyll laden relative to State of Hawaiʻi water quality criteria for estuaries. Values obtained in our survey cannot be directly compared with the criteria in Table 6 to assess compliance with the standards, because a comparison requires a representative geometric mean calculated from a minimum of three sampling events. The results do indicate that generally poor water quality conditions were present during the survey, although not an unusual situation for a *muliwai*.

The coastal waters fronting Kūlanihākoʻi Gulch may also be impaired. The water quality as monitored by HDOH Station Kalepolepo Beach (ID HI000141) just south of the gulch mouth is reported as impaired for total nitrogen, nitrate+nitrite, ammonia, turbidity, and chlorophyll. Water quality data from 2008 to present for the HDOH station is presented in Table 7. Nearshore marine waters fronting the gulch, as measured by Sta. Ocean on September 17, 2012 (Table 2), were nutrient, sediment and chlorophyll laden, well oxygenated, and had a pH near 8.10.

Table 7. Nearshore water quality data for HDOH Sta. Kalepolepo Beach located just south of the coastal outlet of Kūlanihākoʻi Gulch (after HDOH, 2012b).

| Date | Time | Temp. | Salinity | D. O. | % Sat. | pH | Turbidity |
|---|---|---|---|---|---|---|---|
| 2012 | | | | | | | |
| Aug 14 | 6:12 AM | 22.94 | 31.74 | 5.84 | 83.6 | 8.19 | 5.47 |
| Apr 25 | 6:09 AM | 21.68 | 32.48 | 6.20 | 86.7 | 8.20 | 5.99 |
| Jan 1 | 6:08 AM | 22.91 | 35.04 | 6.14 | 88.6 | 8.19 | 7.54 |
| 2011 | | | | | | | |
| Sep 14 | 6:03 AM | 24.90 | 34.26 | 5.92 | 88.1 | 8.12 | 6.37 |
| 2010 | | | | | | | |
| Dec 14 | 6:19 AM | 24.89 | 34.86 | 5.63 | 84.0 | 8.14 | 2.12 |
| Oct 5 | 6:22 AM | 25.33 | 34.36 | 5.86 | 88.0 | 8.16 | 2.64 |
| Jun 30 | 6:32 AM | 24.36 | 33.06 | 4.88 | 71.9 | 7.99 | 3.15 |
| May 4 | 6:40 AM | 24.65 | 33.37 | 5.24 | 77.0 | 8.14 | 4.15 |
| Mar 30 | 6:51 AM | 22.61 | 33.92 | 5.93 | 84.3 | 8.02 | 2.73 |
| 2009 | | | | | | | |
| Dec 8 | 6:59 AM | 23.84 | 33.69 | 5.47 | 79.9 | 8.21 | 5.90 |
| Sep 2 | 6:57 AM | 24.55 | 33.51 | 5.26 | 77.5 | 8.14 | 2.52 |
| Jul 21 | 7:15 AM | 24.96 | 33.90 | 5.76 | 85.2 | 8.10 | 4.38 |
| May 27 | 7:16 AM | 26.32 | 32.35 | 4.83 | 73.0 | 8.07 | 5.56 |
| Apr 7 | 7:10 AM | 21.51 | 33.64 | 6.14 | 85.3 | 8.05 | 3.29 |
| Jan 1 | 7:12 AM | 23.91 | 34.35 | -- | -- | 7.98 | 3.28 |
| 2008 | | | | | | | |
| Oct 1 | 7:04 AM | 24.89 | 33.97 | 5.31 | 78.6 | 8.03 | 11.3 |
| Jul 29 | 7:06 AM | 24.62 | 32.41 | 5.45 | 79.9 | 8.01 | 2.94 |
| | mean | 24.05 | 33.58 | 5.61 | 82.0 | 8.10 | 4.67 |
| | st. dev. | 1.31 | 0.92 | 0.43 | 5.3 | 0.08 | 2.35 |
| | min | 21.51 | 31.74 | 4.83 | 71.9 | 7.98 | 2.12 |
| | max | 26.32 | 35.04 | 6.20 | 88.6 | 8.21 | 11.3 |
| | *n* | *17* | *17* | *16* | *16* | *17* | *17* |





## Jurisdictional ("Waters of the U.S.") Boundary

As noted above, the vegetation in the project area is limited and problematic because it is the result of removal of an unknown "natural" distribution of *Batis martima* and encouragement of native *ʻākulikuli*. *ʻĀkulikuli* is considered a facultative wetland species (FAC; Lichvar, 2012; Lichvar et al., 2014). This plant is nearly always found around the margins of coastal wetlands in sandy material, although (on low-sloping coastal lands) typically grows just outside the wetland boundary as well as inside it. Consequently, the entire area surveyed, with the exception of the *muliwai*, is difficult to demarcate as wetland. If one accepts that the soils and plants are generally indicative of a coastal wetland, then the only definable boundary is the boundary of the *ʻākulikuli* (shown in Fig. 5). If the soils and the plants are problematic at best, the clearest boundary is that of the *muliwai* banks. On the other hand, the entire mouth of the gulch, at one time covering a much larger area than at present due to encroachment by surrounding developments on fill, likely supported the low-growing, obligate wetland shrub known as *ʻakulikuli kai* (*Batis maritima*). This non-native plant was very probably removed from the area by the native plant restoration project. Although we attempted to located satellite images that might demonstrate this distribution, older images were found to be inadequate in determining the nature of the vegetation. We can approximate this distribution based on topography and the distribution of *ʻakulikuli*, which has successfully established after planting and some watering in the past. This boundary is shown in Fig. 6.

The area of the proposed bypass road within essentially two potential "wetland" boundaries—a minimal area based on the *muliwai* banks and a maximal representing the most likely historical wetland boundary—would be on the order of 600 sq.ft (*muliwai* only) to 4600 sq.ft (dune sand dominated by *ʻākulikuli*). The latter boundary is represented as a blue line on the wetland boundary map submitted as Appendix A.

## Botanical Resources

No species of plants were noted that are of particular concern or are listed as threatened or endangered (DLNR, 1998; USFWS, 2005a, 2012). However, the site is being cared for by a community group (see Fig. 5) with a strong interest in preserving the native flora at this location. Therefore, it would be prudent to consider restoring the bypass road area back to appropriate native plants once the culvert repairs are completed and the temporary road removed.

## Aquatic Resources

The aquatic biota observed during the September 2012 survey of Kūlanihākoʻi Gulch estuary included some native species: *āholehole*, *ʻamaʻama*, and *ʻalamihi* crab. Though the reach of the gulch typically containing water is short, it is possible that native *ʻoʻopu ʻakupa* (*Eleotris sandwicensis*) and *ʻōpaekalaʻole* (*Macrobrachium grandimanus*)—not observed during the survey—may utilize the brackish environment near the project site. Any population present is likely limited in size by the continual blockage of the gulch mouth by deposited sand, as these diadromous species need passage to the open ocean as larva and passage upstream to brackish waters as post-larva to carry out their life cycle. Project work is not anticipated to have long term adverse effects on any aquatic or marine biota within or nearby the project site.

## Waterbird Resources

The findings of the waterbird survey are consistent with the location of the survey and the habitats present on and adjacent to the site. A total of six water obligate avian species were recorded here. As previously discussed, five of the species detected are native to the Hawaiian Islands (Table 5). One of these species, Hawaiian Stilt, is an endangered species protected under both federal and state endangered species statutes. One stilt was recorded foraging in the *muliwai* approximately 30 feet *makai* of the culvert just behind the beach. Thirteen others were recorded flying over the site from north-to-south. One species—Black-crowned Night-Heron—is an indigenous resident widespread across the islands that utilizes a range of waterside environments. Three of the species detected—Pacific Golden-Plover, Ruddy Turnstone and Wandering Tattler—are indigenous migratory shorebirds that nest in the high Arctic during the late spring and summer months, returning to Hawaiʻi and the Tropical Pacific to spend the fall and winter months each year. They usually leave Hawaiʻi for the trip back to the Arctic in late April or the very early part of May. The Cattle Egret is alien to the Hawaiian Islands.

Although no seabirds were detected during this survey, it is probable that both endangered Hawaiian Petrel (*Pterodroma sandwichensis*) and threatened endemic sub-species of Newell's Shearwater (*Puffinus auricularis newelli*) over-fly the project area between April and the middle of December each year. Both species have been recorded flying to and from their nesting colonies located in the mountains *mauka* of the project site (Cooper and Day, 2003, 2004; Day and Cooper, 1999; Hamer Environmental, 2010; Planning Solutions and Rana Biological Consulting, 2010). Both of these pelagic seabird species nest high in the mountains in burrows excavated under thick vegetation, especially *uluhe* (*Dicranopteris linearis*) fern. There is no suitable nesting habitat for either of





these seabird species on or close to the project site. It is also probable that Wedge-tailed Shearwaters (*Puffinus pacificus*) may occasional overfly the site during the breeding season as they nest in coastal areas in the general Kīhei area. Wedge-tailed Shearwaters are not protected under the endangered species act, but are protected under the federal Migratory Bird Treaty Act.

The primary cause of mortality in the three aforementioned seabirds 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 a second significant cause of mortality of these seabird species in Hawaiʻi. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting on the ground. When disoriented, these birds may collide with manmade structures, and if not killed outright, become injured and easy targets of opportunity for feral mammals (Hadley, 1961; Telfer, 1979; Sincock, 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).

## Mammalian Resources

No mammalian species currently protected or proposed for protection under either the federal or State of Hawaiʻi endangered species programs were detected during the course of this survey (DLNR, 1998; USFWS, 2005a, 2012).

The findings of the mammalian survey are consistent with the location of the survey and the habitat currently present on the site. Although no rodents were recorded, it is likely that some, if not all, of the four established alien Muridae found on Maui—roof rat (*Rattus r. rattus*), Norway rat (*Rattus norvegicus*), Polynesian rat (*Rattus exulans hawaiiensis*), and European house mouse (*Mus musculus domesticus*)—use various resources found within the general project area on a seasonal basis. All of these introduced rodents are deleterious to native ecosystems and the native faunal species.

No Hawaiian hoary bats were detected during the course of this survey. Given the habitat present on the site any usage of the area by this species would be of an incidental foraging nature – there are no suitable roosting trees for this species on or close to the project site

## Seabirds

The principal potential impact that development activity 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 are: 1) if during construction it is deemed necessary to illuminate night-time construction activities, or 2) streetlights are incorporated in project plans.

### Waterbirds

Potential impacts to listed waterbird species include temporary disturbance by construction activity of individual birds that may be in the area foraging and possibly nesting in areas away from the construction site *mauka* of the culvert (nesting is extremely unlikely anywhere in Kalepolepo Beach Park). Although very unlikely (but theoretically possible), a pair of Hawaiian stilt could, during the nesting season, set up a nest close to the *mauka* side of the culvert and be disturbed by construction activities to the point of abandoning the nest; the disturbance could then be interpreted as harassment under the Endangered Species Act. The probability of this scenario can be lessened by constructing the by-pass road outside of the nesting season, forcing discriminating reproductive pairs to locations inland of the temporary road.

### Hawaiian hoary bat

The principal potential impact that development activity poses to bats is during the clearing and grubbing phases of construction as vegetation is removed. The removal of vegetation within a construction project site may temporarily displace individual bats using the vegetation as a roosting location. During the pupping season, females carrying pups may be unable to rapidly vacate a roost site when trees are being felled. Further, adult female bats sometimes leave their pups in the roost tree when 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 m (15 ft), between June 15 and September 15, the period in which bats are potentially at risk from vegetation clearing. As there is no suitable bat roosting habitat within or close to the project site, it is not expected that the proposed action will result in impact to this listed species.

## Conclusions and Recommendations

None of the plants or aquatic species observed in the project area is listed as threatened or endangered (DLNR, 1998; USFWS, 2012). Furthermore, the proposed action will not result in modification of any federally designated





Critical Habitat, as there is none present on or adjacent to the South Kīhei Road crossing of Kūlanihākoʻi Gulch.

Aside from possible short term turbidity plumes associated with project, the proposed work is not anticipated to adversely affect the already poor water quality in *muliwai* at the site. A Best Management Practices (BMP) plan should be designed and implemented to minimize and localize adverse environmental impacts to protect water quality and aquatic biota in the vicinity of the project site during construction.

If night-time construction activity or equipment maintenance is proposed during the construction phases of the project, all associated lights should be properly shielded, and when large flood/work lights are used, they should be placed on poles that are high enough to allow the lights to be pointed directly at the ground.

Immediately prior to the initiation of construction a qualified biologist should survey the areas *mauka* of the project site to determine if any nesting stilt are present. If nesting stilt are found, the project will need to consult with the USFWS over appropriate measures and or conditions that may need to be met to ensure that construction activity does not harm or harass nesting stilts.

### Wetland Boundary

Section 404 of the Clean Water Act (CWA) assigns regulatory authority to the U.S. Army Corps of Engineers (USACE) over certain activities in waters of the U.S., including discharge of dredged and fill material into "Waters of the United States" or jurisdictional waters, which includes adjacent wetlands. An initial step in the permit process is a determination of the limits of federal jurisdiction in relation to Project activities. A bounding limit of federal jurisdiction in an estuarine situation is the MHHW mark, unless the presence of adjacent wetlands extends the limit to the edge of the wetlands. For reasons discussed above regarding the problematical vegetation and relatively rapid burial of wetland soils by wind-borne sand, our wetland survey could not establish a specific boundary for surrounding wetlands at the mouth of Kūlanihākoʻi Gulch. However, we believe that an argument for considering the historical distribution of the wetlands at the mouth of this gulch could be supported, and our best professional judgment is a line as indicated in Appendix A based upon the existing topography and distribution of the native coastal plant, ʻ*akulikuli*. Federal jurisdiction is solely determined by the USACE, and is based upon the Corps first accepting our delineation and then deciding whether other factors warrant taking jurisdiction. Our delineated line is not official until accepted by the USACE as a prelude to the permitting process.

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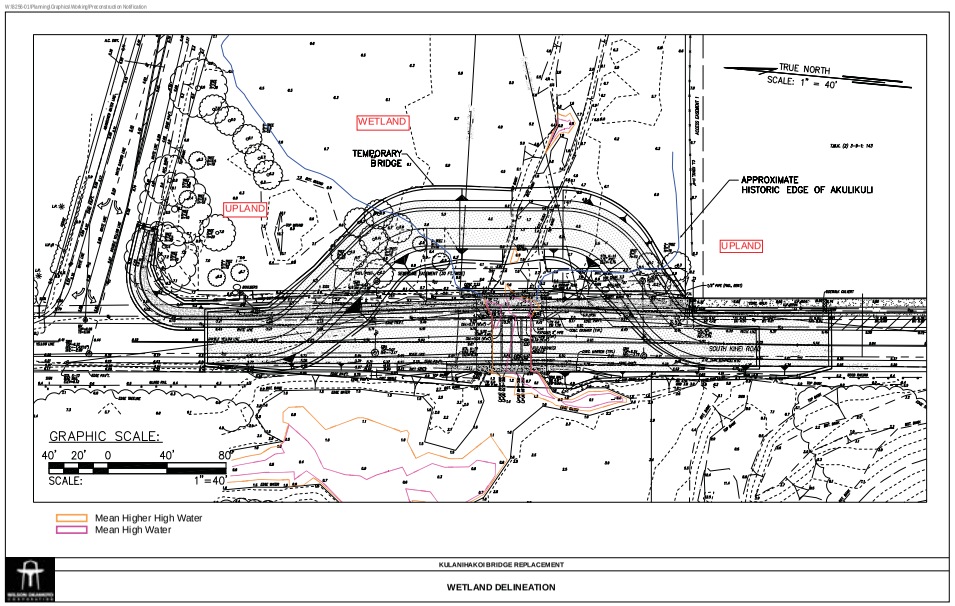
# Attachment A

# Wetland map




# Attachment B

# Wetland data sheets

## WETLAND DETERMINATION DATA FORM—Hawai'i and Pacific Islands

Project/Site: Kulanihakoi Culvert at South Kihei Road City: Kihei Sampling Date: 9/17/2012 Time: 10:30

Applicant/Owner: County of Maui State/Terr./Comm.: Hawaii Island: Maui Sampling Point: **SP-01**

Investigator(s): Eric Guinther, AECOS Inc. TMK/Parcel: (2) 3-9-001: 162

Landform (hillslope, coastal plain, etc.): coastal estuary and floodplain Local relief (concave, convex, none): minimal/flat

Lat: 20° 45' 56.110" N Long: 156°27'29.408" W Datum: NAD83 Slope (%):

Soil Map Unit Name: Dune Land (DL) NWI classification: PUBHh/upland border

Are climactic/hydrologic conditions on the site typical for this time of year: Yes X No (If no, explain in Remarks)

Are Vegetation X, Soil, or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes No X

Are Vegetation, Soil X, or Hydrology X naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS—Attach a site map showing sampling point locations transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No | |
| Hydric Soil Present? | Yes | No X | **Is the Sampled Area within a Wetland? Yes ____ No X** |
| Wetland Hydrology Present? | Yes | No X | |

Remarks: 5 m north on line normal to 20 m mark.

### VEGETATION—Use scientific names of plants.

| Tree Stratum (Plot size: ) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | =Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: ) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | =Total Cover | | |
| **Herb Stratum** (Plot size: 10 sq.ft) | | | |
| 1. *Sesuvium portulacastrum* | 10 | Y | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | 10 =Total Cover | | |
| **Woody Vine Stratum** (Plot size: ) | | | |
| 1. | | | |
| 2. | | | |
| | =Total Cover | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 **(B)**

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species | x1= |
| FACW species | x2= |
| FAC species | x3= |
| FACU species | x4= |
| UPL species | x5= |
| Column Totals: (A) | (B) |

Prevalence Index = B/A=

**Hydrophytic Vegetation Indicators:**

- 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤3.0[1]
- Problematic Hydrophytic Vegetation [1] (Explain in Remarks or in the delineation report)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present? Yes X No**

Remarks
Flora is entirely natives planted in appropriate habitats and possibly watered at some time in the past. 90% bare sand.



### SOIL

**Sampling Point:** SP-01

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type [1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0 - 8 | 5YR 2.5/1 | 100 | | | | | loamy sand | |
| 8 - 14 | 5YR 5/1 | 75 | | | | | loamy sand | varves present |
| " | 5 YR 3/3 | 25 | | | | | silty sand | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains [2]Location: PL=Pore Lining, M=Matrix

**Hydric Soil Indicators:**

- Histisols (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Muck Presence (A8)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Glayed Matrix (S4)
- Sandy Redox (S5)
- Dark-Surface (S7)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- Stratified Layers (A5)
- Sandy Mucky Mineral (S1)
- Red Parent Material (TF2)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type:

Depth (inches):

**Hydric Soil Present: Yes No X**

Remarks: "Soil" is aolean: sand blown inland and mixed to various degrees with terrigenous sediments brought into area by freshets; evidence of layering (aeolian or alluvial?) below 8 inches. Breaking apart in blocks with very thin fluorescent purple surfaces on exposed joints. Dark color reflects source material (volcanic sand).

### HYDROLOGY

**Wetland Hydrology Indicators:** (Explain observations in Remarks, if needed.)

Primary Indicators (minimum of one required: check all that apply)

- Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Innundation Visible on Aerial Imagery (B7)
- Water Stained Leaves (B9)
- Aquatic Fauna (B13)
- Tilapia Nests (B17)
- Hydrogen Sulfide Odor (C1)
- Oxidized Rhizospheres on Living Roots (C3)
- Presence of Reduced Iron (C4)
- Recent Iron Reduction in Tiled Soils (C6)
- Thin Muck Surface (C7)
- Fiddler Crab Burrows (C10) (Guam, CNMI, and American Samoa)
- Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- Surface Soil Cracks (B6)
- Sparsely Vegetated Concave Surface (B8)
- Drainage Patterns (B10)
- Dry-Season Water Table (C2)
- Salt Deposits (C5)
- Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes | No X | Depth (inches): |
| Water Table Present? | Yes | No X | Depth (inches): |
| Saturation Present? (includes capillary fringe) | Yes | No X | Depth (inches): |

**Wetland Hydrology Present? Yes No X**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Drifted wood deposits indicate area is subject to infrequent freshet flooding and not in any pattern suggestive of wave-distributed material at high tide, or regular flow deposited material.

## WETLAND DETERMINATION DATA FORM—Hawai'i and Pacific Islands

Project/Site: Kulanihakoi Culvert at South Kihei Road City: Kihei Sampling Date: 9/17/2012 Time: 10:30

Applicant/Owner: County of Maui State/Terr./Comm.: Hawaii Island: Maui Sampling Point: **SP-02**

Investigator(s): Eric Guinther, AECOS Inc. TMK/Parcel: (2) 3-9-001: 162

Landform (hillslope, coastal plain, etc.): coastal estuary and floodplain Local relief (concave, convex, none): minimal/flat

Lat: 20° 45' 56.278" N Long: 156° 27' 29.357" W Datum: NAD83 Slope (%): _____

Soil Map Unit Name: Dune Land (DL) NWI classification: upland

Are climactic/hydrologic conditions on the site typical for this time of year: Yes X No _____ (If no, explain in Remarks)

Are Vegetation X, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No X

Are Vegetation _____, Soil X, or Hydrology X naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS—Attach a site map showing sampling point locations transects, important features, etc.

Hydrophytic Vegetation Present? Yes _____ No X

Hydric Soil Present? Yes _____ No X

Wetland Hydrology Present? Yes _____ No X

**Is the Sampled Area within a Wetland? Yes _____ No X**

Remarks: 10 m north on line normal to 20 m mark.

### VEGETATION—Use scientific names of plants.

| Tree Stratum (Plot size: _____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | =Total Cover | | |

| Sapling/Shrub Stratum (Plot size: _____) | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | =Total Cover | | |

| Herb Stratum (Plot size: 25 sq ft) | | | |
|---|---|---|---|
| 1. Sesuvium portulacastrum (nearby, only) | 0 | n/a | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | 0 =Total Cover | | |

| Woody Vine Stratum (Plot size: _____) | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| | =Total Cover | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 0 **(B)**

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species _____ | x1= _____ |
| FACW species _____ | x2= _____ |
| FAC species _____ | x3= _____ |
| FACU species _____ | x4= _____ |
| UPL species _____ | x5= _____ |
| Column Totals: _____ (A) | _____ (B) |

Prevalence Index = B/A= _____

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation [1] (Explain in Remarks or in the delineation report)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present? Yes _____ No X**

Remarks
Flora is entirely natives planted in appropriate habitats and possibly watered at some time in the past. Problematic because windblown sand is countering the effort to grow *Sesuvium* through infrequent watering.



### SOIL

**Sampling Point: SP-02**

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type [1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0 – 4 | | 100 | | | | | dry sand | sand is fine |
| 4- 19 | 5YR 5/1 | 99 | | | | | loamy sand | |
| | 5 YR 3/3 | 1 | | | | | silty sand | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains [2]Location: PL=Pore Lining, M=Matrix

**Hydric Soil Indicators:**

___ Histisols (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Muck Presence (A8)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Glayed Matrix (S4)
___ Sandy Redox (S5)
___ Dark-Surface (S7)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

___ Stratified Layers (A5)
___ Sandy Mucky Mineral (S1)
___ Red Parent Material (TF2)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: _____

Depth (inches): _____

**Hydric Soil Present: Yes _____ No X**

Remarks:

Soil is aolean sand blown inland, mixed to various degrees with terrigenous sediments brought into area by freshets. Here, recently deposited sand lies over the dark layer.

### HYDROLOGY

**Wetland Hydrology Indicators:** (Explain observations in Remarks, if needed.)

Primary Indicators (minimum of one required: check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Innundation Visible on Aerial Imagery (B7)
___ Water Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Tilapia Nests (B17)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tiled Soils (C6)
___ Thin Muck Surface (C7)
___ Fiddler Crab Burrows (C10) (Guam, CNMI, and American Samoa)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Sparsely Vegetated Concave Surface (B8)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Salt Deposits (C5)
___ Stunted or Stressed Plants (D1)
X Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes _____ No X Depth (inches): _____

Water Table Present? Yes _____ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No X Depth (inches): _____

**Wetland Hydrology Present? Yes _____ No X**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM—Hawai'i and Pacific Islands

Project/Site: Kulanihakoi Culvert at South Kihei Road City: Kihei Sampling Date: 9/17/2012 Time: 11:30

Applicant/Owner: County of Maui State/Terr./Comm.: Hawaii Island: Maui Sampling Point: **SP-03**

Investigator(s): Eric Guinther, AECOS Inc. TMK/Parcel: (2) 3-9-001: 162

Landform (hillslope, coastal plain, etc.): coastal estuary and floodplain Local relief (concave, convex, none): minimal/flat

Lat: 20° 45' 56,075 N Long: 156° 27' 29.043" W Datum: NAD83 Slope (%): _____

Soil Map Unit Name: Dune Land (DL) NWI classification: PUBHh

Are climactic/hydrologic conditions on the site typical for this time of year: Yes X No _____ (If no, explain in Remarks)

Are Vegetation X, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No X

Are Vegetation _____, Soil X, or Hydrology X naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS—Attach a site map showing sampling point locations transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No _____

Hydric Soil Present? Yes X No _____

Wetland Hydrology Present? Yes X No _____

**Is the Sampled Area within a Wetland? Yes X No _____**

Remarks: 6.1 m (20 ft) north of *muliwai* WL (1.9 m north of transect 30 m mark).

### VEGETATION—Use scientific names of plants.

| Tree Stratum (Plot size: _____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | _____ =Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: _____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | _____ =Total Cover | | |
| **Herb Stratum** (Plot size: 100 sq .ft ) | | | |
| 1. *Sesuvium portulacastrum* | 10 | Y | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | 10 =Total Cover | | |
| **Woody Vine Stratum** (Plot size: _____) | | | |
| 1. | | | |
| 2. | | | |
| | _____ =Total Cover | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 **(B)**

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species _____ | x1= _____ |
| FACW species _____ | x2= _____ |
| FAC species _____ | x3= _____ |
| FACU species _____ | x4= _____ |
| UPL species _____ | x5= _____ |
| Column Totals: _____ (A) | _____ (B) |

Prevalence Index = B/A= _____

**Hydrophytic Vegetation Indicators:**

____ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

____ 3 - Prevalence Index is ≤3.0[1]

____ Problematic Hydrophytic Vegetation [1] (Explain in Remarks or in the delineation report)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present? Yes X No _____**

Remarks
Flora is entirely natives planted in appropriate habitats and possibly watered at some time in the past.



### SOIL

**Sampling Point: SP-03**

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type [1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0 - 1 | 10 YR 2.5/1 | 100 | | | | | loamy sand | aolean |
| 1 - 15 | 10 YR 2.5/2 | 100 | black inclusions | <1% | | | loamy sand | oxidation w/exposure |
| 15 - 17 | 7.5 YR 4/3+ | 100 | | | | | sandy clay | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains [2]Location: PL=Pore Lining, M=Matrix

**Hydric Soil Indicators:**

- ___ Histisols (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Muck Presence (A8)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Glayed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Dark-Surface (S7)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- X Stratified Layers (A5)
- ___ Sandy Mucky Mineral (S1)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: _____

Depth (inches): _____

**Hydric Soil Present: Yes X No _____**

Remarks:

Soil is aolean sand blown inland, mixed to various degrees with terrigenous sediments brought into area by freshets. Deeper layer is flood deposited sediment with evidence of stratification layers .

### HYDROLOGY

**Wetland Hydrology Indicators:** (Explain observations in Remarks, if needed.)

Primary Indicators (minimum of one required: check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Innundation Visible on Aerial Imagery (B7)
- ___ Water Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Tilapia Nests (B17)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- X Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tiled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Fiddler Crab Burrows (C10) (Guam, CNMI, and American Samoa)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Salt Deposits (C5)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes _____ No X Depth (inches): _____

Water Table Present? Yes _____ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No X Depth (inches): _____

**Wetland Hydrology Present? Yes X No _____**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Located 6.1 m (20 ft) away from shore of flooded *muliwai* within an unvegetated depression between 4.6 m (15 ft) and 7.4 m (24 ft) on line perpendicular to transect. Depression separated from *muliwai* shore by low dune covered in *Sesuvium portulacastrum*.

## WETLAND DETERMINATION DATA FORM—Hawai'i and Pacific Islands

Project/Site: Kulanihakoi Culvert at South Kihei Road City: Kihei Sampling Date: 9/17/2012 Time: 12:05

Applicant/Owner: County of Maui State/Terr./Comm.: Hawaii Island: Maui Sampling Point: **SP-04**

Investigator(s): Eric Guinther, AECOS Inc. TMK/Parcel: (2) 3-9-001: 162

Landform (hillslope, coastal plain, etc.): coastal estuary and floodplain Local relief (concave, convex, none): minimal/flat

Lat: 20° 45' 55.511" N Long: 156° 27' 29.509" W Datum: NAD83 Slope (%): _____

Soil Map Unit Name: Dune Land (DL) NWI classification: PUBHh

Are climactic/hydrologic conditions on the site typical for this time of year: Yes X No _____ (If no, explain in Remarks)

Are Vegetation X, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No X

Are Vegetation _____, Soil X, or Hydrology X naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS—Attach a site map showing sampling point locations transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No _____ | **Is the Sampled Area within a Wetland? Yes _____ No X** |
| Hydric Soil Present? | Yes _____ | No X | |
| Wetland Hydrology Present? | Yes _____ | No X | |

Remarks: Located 6.4 m (20 ft) south of *muliwai* water line on elevated ground.

### VEGETATION—Use scientific names of plants.

| Tree Stratum (Plot size: _____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | =Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: _____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | =Total Cover | | |
| **Herb Stratum** (Plot size: 100 sq. ft) | | | |
| 1. *Sesuvium portulacastrum* | 80 | Y | FAC |
| 2. *Heliotropum currasavicum* | 10 | N | FAC |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | 90 =Total Cover | | |
| **Woody Vine Stratum** (Plot size: _____) | | | |
| 1. | | | |
| 2. | | | |
| | =Total Cover | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species _____ | x1= _____ |
| FACW species _____ | x2= _____ |
| FAC species _____ | x3= _____ |
| FACU species _____ | x4= _____ |
| UPL species _____ | x5= _____ |
| Column Totals: _____ (A) | _____ (B) |

Prevalence Index = B/A= _____

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation [1] (Explain in Remarks or in the delineation report)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present? Yes X No _____**

Remarks
Flora is entirely natives planted in appropriate habitats and possibly watered at some time in the past.



### SOIL

**Sampling Point: SP-04**

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | % | Redox Features Color (moist) | % | Type [1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0 - 16 | 5 YR 2.5/2 | 100 | | | | | loamy sand | |
| 16 - 17 | | | | | | | gravel | over sand w/pebbles |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains [2]Location: PL=Pore Lining, M=Matrix

**Hydric Soil Indicators:**

___ Histisols (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Muck Presence (A8)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Glayed Matrix (S4)
___ Sandy Redox (S5)
___ Dark-Surface (S7)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

___ Stratified Layers (A5)
___ Sandy Mucky Mineral (S1)
___ Red Parent Material (TF2)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: _____

Depth (inches): _____

**Hydric Soil Present: Yes _____ No X**

Remarks:

Soil is aolean sand blown inland, mixed to various degrees with terrigenous sediments brought into area by freshets. Possible fill layer below 16 in

### HYDROLOGY

**Wetland Hydrology Indicators:** (Explain observations in Remarks, if needed.)

Primary Indicators (minimum of one required: check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Innundation Visible on Aerial Imagery (B7)
___ Water Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Tilapia Nests (B17)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tiled Soils (C6)
___ Thin Muck Surface (C7)
___ Fiddler Crab Burrows (C10) (Guam, CNMI, and American Samoa)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Sparsely Vegetated Concave Surface (B8)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Salt Deposits (C5)
___ Stunted or Stressed Plants (D1)
X Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes _____ No X Depth (inches): _____

Water Table Present? Yes _____ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No X Depth (inches): _____

**Wetland Hydrology Present? Yes _____ No X**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM—Hawai'i and Pacific Islands

Project/Site: Kulanihakoi Culvert at South Kihei Road City: Kihei Sampling Date: 9/17/2012 Time: 12:25

Applicant/Owner: County of Maui State/Terr./Comm.: Hawaii Island: Maui Sampling Point: **SP-05**

Investigator(s): Eric Guinther, AECOS Inc. TMK/Parcel: (2) 3-9-001: 162

Landform (hillslope, coastal plain, etc.): coastal estuary and floodplain Local relief (concave, convex, none): minimal/flat

Lat: 20° 45' 55.509" N Long: 156° 27' 29.244" W Datum: NAD83 Slope (%): _____

Soil Map Unit Name: Dune Land (DL) NWI classification: PUBHh

Are climactic/hydrologic conditions on the site typical for this time of year: Yes X No _____ (If no, explain in Remarks)

Are Vegetation X, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No X

Are Vegetation _____, Soil X, or Hydrology X naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS—Attach a site map showing sampling point locations transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No _____

Hydric Soil Present? Yes _____ No X

Wetland Hydrology Present? Yes _____ No X

**Is the Sampled Area within a Wetland? Yes _____ No X**

Remarks: 4.8 m (16 ft) south of *muliwai* shore opp. transect 30 m mark.

### VEGETATION—Use scientific names of plants.

| Tree Stratum (Plot size: _____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | =Total Cover | | |

| Sapling/Shrub Stratum (Plot size: _____) | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | =Total Cover | | |

| Herb Stratum (Plot size: 100 sq.ft) | | | |
|---|---|---|---|
| 1. *Sesuvium portulacastrum* | 80 | Y | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | 80 =Total Cover | | |

| Woody Vine Stratum (Plot size: _____) | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| | =Total Cover | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 **(B)**

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species _____ | x1= _____ |
| FACW species _____ | x2= _____ |
| FAC species _____ | x3= _____ |
| FACU species _____ | x4= _____ |
| UPL species _____ | x5= _____ |
| Column Totals: _____ (A) | _____ (B) |

Prevalence Index = B/A= _____

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation [1] (Explain in Remarks or in the delineation report)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present? Yes X No _____**

Remarks
Flora is entirely natives planted in appropriate habitats and possibly watered at some time in the past.



### SOIL

**Sampling Point: SP-05**

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type [1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0 - 16 | 5YR 2.5/2 | 100 | | | | | loamy sand | |
| 16 - 17 | 5YR 2.5/1 | 100 | | | | | clay | |
| 17- 24 | | | | | | | gravel | over sand w/pebbles |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains [2]Location: PL=Pore Lining, M=Matrix

**Hydric Soil Indicators:**

___ Histisols (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Muck Presence (A8)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Glayed Matrix (S4)
___ Sandy Redox (S5)
___ Dark-Surface (S7)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

___ Stratified Layers (A5)
___ Sandy Mucky Mineral (S1)
___ Red Parent Material (TF2)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: _____

Depth (inches): _____

**Hydric Soil Present: Yes _____ No X**

Remarks:

Soil is aolean sand blown inland, mixed to various degrees with terrigenous sediments brought into area by freshets. Some evidence of alluvial layering below 16 inches.

### HYDROLOGY

**Wetland Hydrology Indicators:** (Explain observations in Remarks, if needed.)

Primary Indicators (minimum of one required: check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Innundation Visible on Aerial Imagery (B7)
___ Water Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Tilapia Nests (B17)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tiled Soils (C6)
___ Thin Muck Surface (C7)
___ Fiddler Crab Burrows (C10) (Guam, CNMI, and American Samoa)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Sparsely Vegetated Concave Surface (B8)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Salt Deposits (C5)
___ Stunted or Stressed Plants (D1)
X Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes _____ No X Depth (inches): _____

Water Table Present? Yes _____ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No X Depth (inches): _____

**Wetland Hydrology Present? Yes _____ No X**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# APPENDIX C

***An Archaeological Literature Review and Field Inspection for Kūlanihāko‘i Bridge Replacement Project, Ka‘ono‘ulu Ahupua‘a, Wailuku District, Maui Island***

***TMK: (2) 3-9-001: 999, 015, 147, 162 (pors)***

***Cultural Surveys Hawai‘i, Inc.***

***October 2012***

# An Archaeological Literature Review and Field Inspection for Kūlanihāko'i Bridge Replacement Project, Ka'ono'ulu Ahupua'a, Wailuku District, Maui Island
## TMK: (2) 3-9-001: 999, 015, 147, 162 (pors)

**Prepared for**

**Wilson Okamoto Corporation**


**Prepared by**

**Colleen P. Medeiros, B.S.**

**Robert H. Hill, B.A.**

**And**

**Hallett H. Hammatt, Ph.D.**

**Cultural Surveys Hawai'i, Inc.**

**Wailuku, Hawai'i**


**(Job Code: KONOULU 4)**

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## Section 1 Management Summary

| | |
|---|---|
| **Reference** | An Archaeological Literature Review and Field Inspection for Kūlanihāko'i Bridge Replacement Project, Ka'ono'ulu Ahupua'a, Kula District, Maui Island TMK:(2) 3-9-001: 999, :015, 147, 162 (pors.) |
| **Date** | August 2012 (Draft) |
| **Project Number (s)** | Cultural Surveys Hawai'i, Inc. (CSH) Job Code: KAONOULU 4 |
| **Investigation Permit Number** | CSH completed this literature review and field inspection for the proposed Kūlanihāko'i Bridge Replacement Project South Kīhei Road under State Archaeological Permit No. 11-17 (2012) issued by the Department of Land & Natural Resources/State Historic Preservation Division (DLNR/ SHPD), per Hawai'i Administrative Rules (HAR) § 13-13-282. |
| **Project Location** | The Kūlanihāko'i Bridge is located along South Kīhei Road, in the Ka'ono'ulu Ahupua'a, Kula District, Maui Island TMK: (2) 3-9-001: 999, 015, 147, 162 (pors). This area is depicted on the Mā'alaea (1996) and Puu O Kali (1992) quadrangle 7.5-minute USGS topographic map (Figure 1). |
| **Project Funding and Land Jurisdiction** | Project Funding: Maui County Department of Public Works<br>Land Jurisdiction: Private and County |
| **Agencies** | County: Maui County, Department of Public Works<br>State: Department of Land and Natural Resources State Historic Preservation Division (SHPD) |

| | |
|---|---|
| **Project Description** | The County of Maui Department of Public Works has proposed a two step process to replace the existing deteriorating Kūlanihāko'i Bridge. The existing bridge consists of four (4) reinforced concrete box culverts. Each cell is six (6) feet wide and four (4) feet high by 38 feet long. A March 2012 bridge inspection report notes that there is severe spalling and advanced corrosion of the reinforcing of the top slab of the culvert. The report recommends that immediate repairs or shoring of the top slab be implemented.<br><br>In order to immediately address repair of the bridge, the first step involves the erection of a temporary steel bridge to extend over the existing bridge. The temporary steel bridge would span approximately 60 feet and would be approximately 24 feet wide to accommodate two lanes of traffic. The first step involves County funding.<br><br>The second step involves more extensive and time-consuming permitting involving Federal, State and County wetland and shoreline issues. Since the existing culverts are proposed to be replaced, the temporary steel bridge over the culverts would be located in close proximity and would inconvenience construction. Thus, the initial temporary steel bridge is proposed to be removed and a new temporary steel bridge and roadway is proposed to be erected *mauka* of the existing culverts. After the new temporary steel bridge and roadway are constructed, then the existing culverts will be removed and replaced with six (6) new culverts, each six (6) feet wide and four (4) feet high with inlet and outlet wing walls. The second step involves Federal and County funding |
| **Project Acreage** | Approximately 3.65 acres |
| **Area of Potential Effect (APE)** | The APE for this project will be limited to the immediate area surrounding the Kūlanihāko'i Bridge and stream. Field investigations examined an area 500 feet both north and south of the bridge along South Kīhei Road, as well as 574 feet upstream and 272 feet downstream to the beach. |
| **Historic Preservation Regulatory Context** | The project area is subject to Hawai'i State environmental and historic preservation review legislation [Hawai'i Revised Statutes (HRS) Chapter 343 and HRS 6E-8/ Hawai'i Administrative Rules (HAR) Chapter 13-13-275 respectively]. This document is intended to assist in the project planning, and informs planners of further requirements to complete the project's historic preservation review. |
| **Fieldwork Effort** | The fieldwork for the project was conducted by Colleen P. Medeiros, B.S., on August 15 2012 and was completed in 1.5 hours. |





| | |
|---|---|
| **Number of Historic Properties Identified** | Historic properties identified in the current project area include the Kūlanihāko'i Bridge and associated culverts constructed in 1911 and over 50 years old. |
| **Summary and Recommendations** | Based on the field inspection findings and background research archaeological monitoring is recommended for all ground disturbing activities during all phases of temporary bridge work, bridge repair and bridge replacement.<br><br>Additionally, the Kūlanihāko'i Bridge was constructed in 1911 and is 101 years old. It is therefore considered a historic property and archaeological recordation of the bridge is required under Chapter 13-275, Hawaii Administrative Rules.<br><br>The following are the specific monitoring recommendations:<br>• Onsite archaeological monitoring for all ground disturbing activities for both steps one and two.<br>• It is recommended that monitoring reports are generated after each step of bridge work;<br>▪ Step one, temporary ACROW bridge installation;<br>▪ Step two, temporary *mauka* bridge construction, and bridge replacement;<br>• It is recommended that documentation of the bridge is included in the monitoring plan provisions and that recording occur during the monitoring phase of work. Archaeological or architectural recordation of the bridge should take place prior to crews beginning construction work in the project area.<br>• Additional consultation with the Archaeological and Architectural branches of the SHPD is recommended prior to drafting of a monitoring plan. |

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# Section 2 Introduction

## 2.1 Project Background

At the request of Wilson Okamoto Corporation and on behalf of the Maui County Department of Public Works, Cultural Surveys Hawai'i, Inc. (CSH) prepared this Literature Review and Field Inspection for the proposed Kūlanihāko'i Bridge Replacement Project located along South Kīhei Road between the Aston Maui Lu Resort and the Kihei Bay Vista Condominium in the Ka'ono'ulu Ahupua'a, Kula District, Maui Island TMK:(2) 3-9-001: 999, 015, 147, 162 (pors.) (Figure 1 and Figure 2).

The Kūlanihāko'i Stream and Gulch is one of several drainage channels of South Maui that experiences flooding during the heavy *nāulu* or southern-exposure rains which occur during the winter months. The flooding is often accompanied by debris carried down from the *mauka,* or Kula, reaches of this gulch. The County of Maui Department of Public Works has proposed to replace the 6 foot wide by 4 foot high by 38 foot long culverts that form the existing bridge in response to severe deterioration of the culverts. In a March 2012 assessment of the structural condition of the bridge, Nagamine Okawa Engineers, Inc. (2012) concluded that due to "severe spalling and advanced corrosion of the reinforcing in the top slab of the culvert, the structural capacity of the culvert has been affected. Immediate repairs or shoring of the top slab is recommended in the engineering report. Posting of the bridge may be necessary". Because of safety issues associated with the deteriorated condition of the existing bridge, the County is working towards an expedited design-build process.

The County of Maui Department of Public Works has proposed a two step process to replace the existing deteriorating Kūlanihāko'i Bridge. In order to immediately address repair of the bridge, the first step involves the erection of a temporary steel bridge to extend over the existing bridge. The temporary steel bridge (ACROW) would span approximately 60 feet and would be approximately 24 feet wide to accommodate two lanes of traffic. Footings for the temporary bridge need to be established on both ends of the bridge. The exact calculations for the footings have not been done as of this writing. However, it is anticipated that excavations for footings will be approximately 8 feet long by 24 feet wide and 5 feet deep on each end of the temporary bridge. Excavation will be contained within the existing S. Kihei Road right of way and will not alter the existing culverts. In order to expedite the installation of the temporary bridge, use of a design build process is anticipated. The first step involves County funding.

The second step involves more extensive and time-consuming permitting involving Federal, State and County wetland and shoreline permit compliance. Since the existing culverts are proposed to be replaced, the temporary steel bridge over the culverts would be located in close proximity and would inconvenience construction. Thus, the initial temporary steel bridge is proposed to be removed and a new temporary steel bridge and roadway is proposed to be erected *mauka* of the existing culverts. After the new temporary steel bridge and roadway are constructed, then the existing culverts will be removed and replaced with six (6) new culverts, each six (6) feet wide and four (4) feet high with inlet and outlet wing walls. The second step involves Federal and County funding.

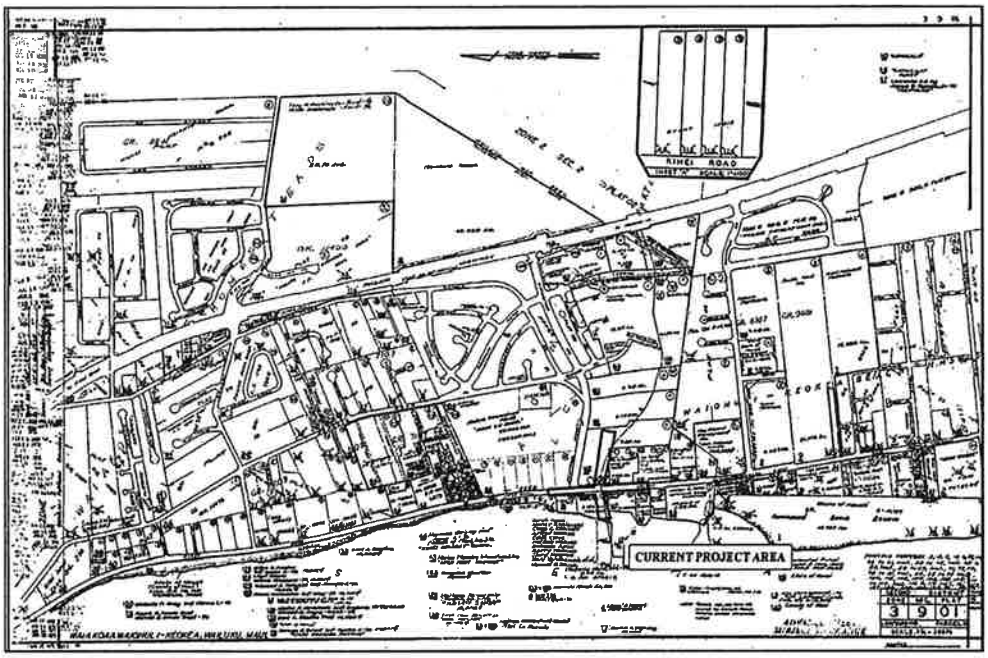



Figure 2. TMK showing Kūlanihāko'i project area outlined in red.





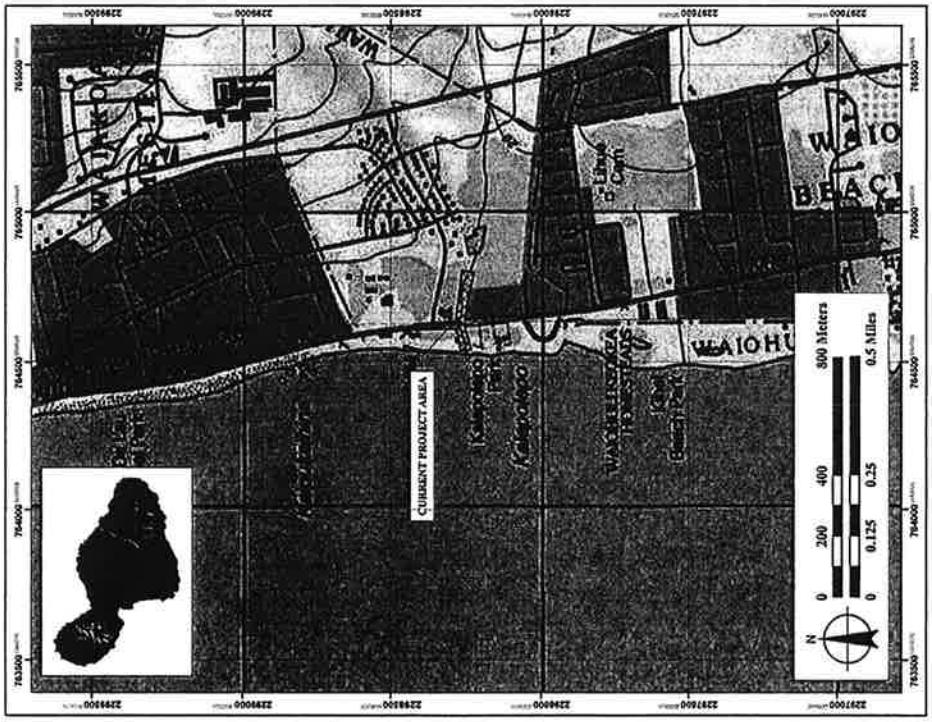



Figure 1. Mā'alaea (1996) and Pu'u O Kali (1992) 7.5 minute USGS topographic quadrangles showing project area.

## 2.2 Scope of Work

The scope of work included:

1. Historical research to include study of archival sources, historic maps, Land Commission Awards and previous archaeological reports to construct a history of land use and to determine if archaeological sites have been recorded on or near this property.

2. Limited field inspection of the project area to identify any surface archaeological features and to investigate and assess the potential for impact to such sites. This assessment will identify any sensitive areas that may require further investigation or mitigation before the project proceeds.

3. Preparation of a report to include the results of the historical research and the limited fieldwork with an assessment of archaeological potential based on that research, with recommendations for further archaeological work, if appropriate. It will also provide mitigation recommendations if there are archaeologically sensitive areas that need to be taken into consideration.





## 2.3 Environmental Setting

### 2.3.1 Natural Environment

Located on the leeward facing slopes of Haleakalā, the current project area is located adjacent to the Kīhei coastline at mean sea level. The overall topography of the lands comprising the Kūlanihāko'i project area is flat to gently sloping, on arid lands composed chiefly of alluvium covered in dune sands drained between the Waiakoa and Waiohuli Gulches. The mouth of the Kūlanihāko'i Gulch makes up the study area for the current project area. The main soils within the project area are of the Pūlehu-'Ewa-Jaucas association. This soil association is mainly found in alluvial fans and in the basins of central Maui. The specific soils of the lands surrounding the project area include those of the Kealia Soil Series (KMW soil units), which include Dune Land (DL), Beach Sand (BS), and 'Alae (Aab soil units), while the soil series within the project area are predominantly Kealia Soil Series (KMW soil units), Dune Land (DL), and Beach Sand (BS) (Figure 3).

The Kealia Soil Series consists of somewhat poorly drained soils on the coastal flats. The upland portion of the Kealia Series is influenced more by the presence of volcanic ash and was developed from material weathered from basic igneous rock (Foote et al. 1972:12). Keālia soils are geographically associated with Pūlehu, Mala -and Jaucas soils, which are used for wildlife, pasture and urban development (Foote et al. 1972:8). The Pūlehu Soil Series consists of well-drained soils on alluvial fans, stream terraces, and basins and are developed in alluvium washed from basic igneous rock (Foote et al. 1972:115). The soils of the 'Ewa Series are nearly level to moderately sloping and are characterized by well-drained soils found in basins and on alluvial fans. These soils have developed in alluvium derived from basic igneous rock (Foote et al. 1972:28). The 'Alae Series soils consist of excessively drained soils on alluvial fans that have developed in the volcanic ash and recent alluvium derived from basic volcanic igneous rock. For the most part, the soils of this series are nearly level to gently sloping with cobblestones covering most of the surface (Foote et al. 1972:14). Finally, the Jaucas Soil Series is characterized by excessively drained, calcareous soils of the coastal area next to the ocean. These soils are developed from coral and shells deposited by wind and wave action. They are level to strongly sloping (Foote et al. 1972:48).

Rainfall accumulation within the project area averages less than 15 to 19 inches annually with the heaviest rainfall occurring during the winter months (December through February) and little to no rainfall during the summer months (June through August) (Giambelluca et al. 1986; Stearns and MacDonald 1942). This pattern of rainfall and low annual precipitation rate may have once sustained a lowland, dry shrubland, and grassland native ecosystem (Pratt and Gon 1998). The majority of the landscape within the project area, however, has been modified by historic era ranching activities and modern development.

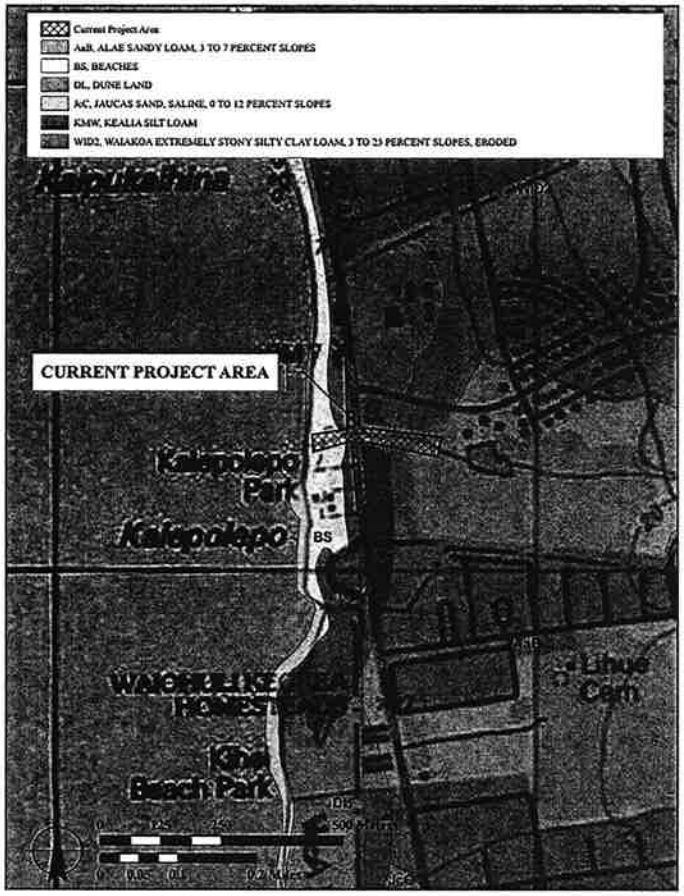



Figure 3. Mā'alaea (1996) and Pu'u O Kali (1992) 7.5 minute USGS topographic quadrangles showing soils of and surrounding project area.





### 2.3.2 Built Environment

The project area is located along South Kīhei Road at Kūlanihāko'i Gulch. The Kalepolepo Park, the Kihei Bay Vista condominium, and the Pacific Whale Foundation visitor center is located to the south of the project area and the ASTON Maui Lu Resort is located to the north and northeast of the project area. The surrounding area has been built up and includes several large condominium developments, including the Villas at Kenolio, located inland and east of the project area. The project area is located south of the Mokulele-Pi'ilani Highway junction on South Kīhei Road.

Figure 4. Google Earth aerial image showing project area location in relation to the surrounding built environment.

# Section 3 Methods

An archaeological field inspection of the project area was conducted by CSH archaeologist Colleen P. Medeiros, B.S., under the general supervision of Hallett H. Hammatt, Ph.D. The fieldwork was conducted on August 15, 2012. The field investigation required 1.5 hours to complete.

## 3.1 Field Methods

The project area includes the Kūlanihāko'i Stream drainage way which South Kīhei Road crosses, and the limited land area immediately surrounding the drainage way and South Kīhei Road. The field inspection method involved a pedestrian inspection of the land areas on the northern side of the Kūlanihāko'i Stream and the southern side of the stream along South Kīhei Road. Photographs were taken and a photo log completed. The project area was inspected for evidence of traditional cultural architecture and/or cultural materials present, vegetation and general surroundings noted.

## 3.2 Document Review

A variety of resources devoted to historical perspectives of the region and traditional stories and accounts were reviewed. Research venues included the Hawai'i State Historic Preservation Division of the Department of Land and Natural Resources and the Survey Office of the Department of Accounting and General Services. All relevant Land Commission Awards (LCAs) and Royal Patents were researched using resources associated with the Waihona 'Aina online database (Waihona 'Aina 2002).





# Section 4 Background Research

## 4.1 Traditional and Historic Background

The division of Maui's lands into political districts occurred during the rule of Kaka'alaneo, under the direction of his *kahuna*, Kalaiha'ōhi'a (Beckwith 1970:383). This division resulted in twelve districts or *moku* during traditional times: Honua'ula, Kahikinui, Kaupō, Kīpahulu, Hāna, Ko'olau, Hāmākua Loa, Hāmākua Poko, Ka'anapali, Lahaina, and Kula. The current project area is located on the leeward flank of Haleakalā in the *moku* of Kula and in the *ahupua'a* of Ka'ono'ulu (Figure 5) along the shoreline at Kīhei.

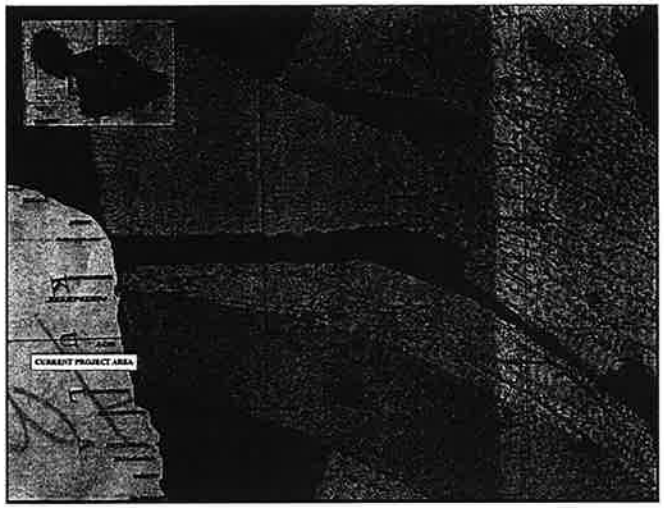



Figure 5. A portion of the F.S Dodge map (1885) showing Ka'ono'ulu Ahupua'a in relation to the traditional *moku* of Kula (crown lands in yellow, government lands in green).

## 4.2 Traditional and Historical Background

### 4.2.1 Mythological and Traditional Accounts

While the mythological and traditional accounts of the Kīhei area are relatively scarce, an analysis of the place name meanings for the region surrounding the project area may yield some insight into the patterns of life in an area. Literal translations of several of the place names for

land areas and divisions near to the project area are listed below. Unless otherwise noted, the translations are taken from Pukui et al. (1974):

Table 1. Place Names in the vicinity of Kalepolepo.

| | |
|---|---|
| Akolea | A species of fern (*Polypodium keraudreniana*) traditionally known to have grown in plentiful quantities at Kalepolepo, according to Fornander (see Kama'oma'o below). Handy states that the region was known to support only the sweet potato (Handy 1991:511). |
| Alakoa | Lit., "soldiers' street." |
| Kaipukai Hina | Lit., Hina's meat dish." Name given to the coastal region just north of the present-day "Gordon Gibson monument to Vancouver," which is seaward at a promontory fronting the Maui Lu Resort property. |
| Kalaepōhaku | Lit., "the stone promontory," located south of the Kīhei Landing pier. A rocky promontory which is a boundary marker in North Kīhei. |
| Kale'ia | Lit., "the abundance", possibly in reference to the resources available from the fishponds and offshore fishing grounds at Mā'alaea. |
| Kalepolepo | Lit., "the dirt." According to Fornander, Kalepolepo was known as the seaward extremity of the plain of Kama'oma'o. In Fornander's "The Legend of Kekuhaupio," the story's pivotal battle occurs at the edge of Kama'oma'o, at Kalepolepo (Fornander 1919:456). Again, in Fornander's "A Story of Puupehe," a battle is fought at the edge of the plains of Kama'oma'o at Kalepolepo. |
| Kaluaihākōkō (Point) | *Lit.*, the pit [for] wrestling. Hākōkō is said to have been the name of a chief. A coastal promontory at the Kalama Park area of Kīhei. |
| Kalepeamoa | *Lit.*, "the comb [acquired] by [a] chicken. The crest of Haleakalā's southwest rift zone, where the eastern boundary line of Ka'ono'ulu Ahupua'a terminates and returns west to the shoreline of Kīhei along its boundary with Waiohuli Ahupua'a. |
| Kama'oma'o | Lit., "the greenness." Plain near Kalepolepo, where, according to Fornander, the large pond of Keālia is located. In Fornander's "A Story of Puupehe, two prophets, Pueonuiokona and Pumaia fought over the fate of spirits of the dead who were destined to wander across the isthmus of Maui. The battle took place at Kalepolepo, near Keālia Pond. Pumaia was killed by the owl, Pueonuiokona, who disemboweled Pumaia and spread his remains across the *akolea*, a species of fern (*Polypodium keraudreniana*) once found on the arid plains of Kama'oma'o (Fornander 1919:554). |
| Ka'ono'ulu | Lit., "the desire [for] breadfruit." Ahupua'a land division in the Kula District of Maui, with a land area of 5,715 acres. The eastern boundary of this *ahupua'a* terminates at a point named Kalepeamoa before |





| | |
|---|---|
| | running west back to the shoreline of Kīhei |
| Ka'ōpala | literally "the rubbish"; the traditional boundary line between Pūlehu Nui Ahupua'a and Waikapū Ahupua'a |
| Kawililipoa | Kawililipoa is an *'ili* of Kama'ole Ahupua'a, cited by Stokes in 1918 as the site of three *heiau* south of Kalepolepo (See Section 4.3, Previous Archaeological Research). |
| Ka'ie'ie | "a plaything for floating in the rapids", an ancient name for Kalepolepo (Sterling 1998:252) |
| Keālia | literally "salt encrustation"; a pond near Kīhei and major salt pan location (Sterling 1998:95) |
| Keāhuaiwi | literally "the bone pile"; the name of a gulch immediately adjacent to and north of Waiakoa Gulch in North Kīhei |
| Kenolio | Prominent South Maui family name. |
| Kīhei | literally "cape or cloak"; sandy point and boundary marker between Pūlehu Nui and Waikapū (Sterling 1998:255); commonly used place name for the coastal south Maui area |
| Kīheipūko'a | *kīhei* literally translates as "cape or cloak" and *pūko'a* literally translates as "coral head"; Kīheipūko'a was a traditional place-name for the shoreline near Keālia between Kalepolepo and Mā'alaea (Sterling 1998:257) |
| Kikaupōhaku | Lit., "rock of Kikau." In the traditional story of the building of the Kalepolepo pond walls by Wilcox, Kikau's rock was placed at the northwest corner of the fish pond wall by *na menehune*. |
| Kohemālamalama | *Lit.*, "the vagina"; also the ancient name for the island of Kaho'olawe, an island located approximately six miles southwest of the Kīhei coastline. |
| Kula (*moku*) | literally translated as "plain"; traditionally known as an arid flat region (Handy in Sterling 1995:242) |
| Kūlanihāko'i | *Lit.*, "agitated heaven that stands." Named for a mythical floating land in the sky. |
| Waiakoa | *Lit.*, "water (used) by warrior." |
| Pohaku Ki'i | "tilted stone"; a resting place for travelers |
| Pūlehu Nui (*ahupua'a*) | Large *pūlehu* where *pūlehu* is literally translated as "broiled" |

The above place names, together with the environmental data, suggest that the lands of and surrounding coastal Ka'ono'ulu were fairly dry and barren in an agricultural sense but rich in

marine resources. Previous research on pre-Contact settlement in the Kula District (Kolb et al. 1997) has suggested that most permanent habitations were in the uplands with a smaller permanent population located along the coastline. While a reconstruction of the coastal and archaeological landscape of Kula Moku underscores the importance of the uplands as a focus of agriculture and habitation, Hawaiian traditions and the presence of four fishponds are evidence that the coastal environs were also a focus of settlement and marine exploitation. The relative scarcity of recorded coastal place names, however, may be an indication of a smaller population that was widely spread out across the leeward coastal line. The vicinity surrounding the current project area was also a site of conflict between the Hawai'i Island chief Kalaniopu'u and Maui Island chief Kahekili and is perhaps the origin for such place names as "Waiakoa" and "Keāhuaiwi".

Note that many of the place names are associated with regional shoreline fishponds. Kalepolepo Fishpond (also named Ka'ono'ulu Kai and Ko'ie'ie) is located along the shoreline of Ka'ono'ulu Ahupua'a, within the traditional district of Kula, Island of Maui. The *ahupua'a* of Ka'ono'ulu is one of six major Kula land divisions which extend from the Ocean to the upper reaches of Haleakalā. Ka'ono'ulu is situated near the center of the Kula District, with Pūlehu Nui and Waiakoa to the north and Waiohuli, Kēōkea and Kama'ole to the south. Ka'ono'ulu is approximately 0.4 mile wide at the shoreline, and 0.7 mile wide at Kalepamoa (9,000 ft AMSL). The *ahupua'a* has a maximum width of one mile, which occurs at 800 ft AMSL. Kalepolepo Pond is at the southern boundary of the *ahupua'a* (Donham 1996:1).

### 4.2.2 Traditional Accounts

The earliest account concerning Kīhei and Hawaiian politics is given by Kamakau (1991) during the time of Alapa'i and Kekaulike:

> Alapa'i sailed from Kohala on Hawai'i...But when he landed at Mokulau in Kaupō (Maui) and heard that Ke-kau-like was dying, he gave up all thought of war and wished only to meet Ke-kau-like and his (half) sister Ke-ku'i-apo-iwa-nui...He landed at Kīheipuko'a with all his chiefs and fighting men...While he was at Kīhei, Alapa'i heard that the ruling chief of Oahu was making war upon Molokai. Most of the chiefs of Moloka'i...were of Hawai'i...Alapa'i's sympathy was aroused, for these were his own brothers and children (relatives), and he made ready to go to their help on Moloka'i (Kamakau 1991:70).

Other accounts involve the continuing conflict between Kahekili of Maui Island and Kalani'opu'u of Hawai'i Island during the late 18th century. Following a losing battle at Kaupō in 1775, Kalani'opu'u dedicated several war *heiau* on Hawai'i Island to aid in the defeat of Kahekili. Upon hearing this news Kahekili sent for the *kahuna* (priest) Kaleopu'upu'u who directed construction of the *heiau* of Kaluli and Pu'uohala on the north side of Wailuku. When Kaluli Heiau was completed Kaleopu'upu'u said to Kahekili:

> This is the house of your god; open the sluice gate that the fish may enter (Kamakau 1991:85).

In the year 1776, the army of Kalani'opu'u landed at Keoneo'o'io with their war canoes extending to Makena at Honua'ula and proceeded to ravage the countryside. Kalani'opu'u landed with additional forces at Kīheipūko'a at Keālia to Kapa'ahu, 800 strong and eager to drink the waters of Wailuku:





> Across the plains of Pu'u'ainako (Cane-trash-hill) and Kama'oma'o shone the feather cloaks of the soldiers ... Ka-hekili was at Kalanihale just below Kihahale and above the plateau of Ka'ilipoe at Pohakuaokahi ... Kaleopu'upu'u [said] to Ka-hekili, "The fish have entered the sluice; draw in the net." (Kamakau 1991:85)

The forces of Kahekili descended on and destroyed the soldiers of Kalani'opu'u, slaying the Alapa (elite soldiers of Kalani'opu'u) on the sandhills at the southeast of Kalua [an area close to the present-day Waikapū, according to the accounts]. Only two men escaped to Kīheipūko'a to tell Kalani'opu'u the news of their defeat. After a second day of warfare, Kalani'opu'u sued for peace and was granted such by Kahekili and his messengers at Kīheipūko'a (Kamakau 1991:88-89).

Fornander (1880) notes that Kalaniopu'u, a ruling chief of Hawai'i, was temporarily at Kalepolepo in the 1750's (Fornander 1880:142).

Fornander's traditional accounts for the portion of Kīhei including Kalepolepo and plains of Kama'oma'o at the edge of Keālia Pond includes "A Story of Puupehe," about two prophets, Pueonuiokona and Pumaia who fought each other over the fate of sprits of the dead who were said to wander across the central isthmus of Maui. The battle took place at Kalepolepo, near Keālia Pond. Pumaia was killed by the owl, Pueonuiokona, who disemboweled Pumaia and spread his remains across the *akolea*, a species of fern (*Polypodium keraudreniana*) once found on the arid plains of Kama'oma'o in the vicinity of Keālia Pond (Fornander 1919:554).

Fornander's account of the chief Kauholanuimahu, who resided at Honua'ula and exercised royal authority names him as the builder of the fishpond at Keone'o'io (in Kalihi Ahupua'a) (Fornander 1880:70-71). When Charles Wilcox wrote about Kalepolepo for the monthly magazine of Hawai'i named "Paradise of the Pacific" in December, 1921, his article included the traditional story of how the race of Hawaiians known as *Na Menehune*, constructed the Ko'ie'ie fishpond.

> Koieie is the ancient name of Kalepolepo, and the ruined sea walls of fishponds are the hallmarks of its importance to the rulers of ancient Hawaii. When the Konohiki summoned the people of Maui to build fish ponds for the king at Kēōkea-kai, Waiohuli-kai and Kaonoulu-kai, one man, Kikau, a *kilo* [fish-spotter], protested that no such works could be completed without the help of the *Menehune*. For this Kikau was told that when the king's ponds were completed he should be baked in the *imu*[ underground oven].
>
> In building the sea walls men were stationed in long lines, passing stones by hand from the rocky sidehills miles away to the workmen laying the courses for the walls in the sea. The trampings of so many busy feet raised much dust, and workmen throwing dust at one another prompted the konohiki to call them derisively "Kanaka o Kalepolepo eku i ka lepo," or "Kelepolepo root in the dirt."
>
> At the completion of the Keokea-kai pond the konohiki gave splendor to the event by riding on the capstone while it was being carried in a litter of stout poles on the shoulders of over twenty men to its resting place at the northeast corner of the pond.

After the ceremony he summoned Kikau and asked him he thought of it, and Kikau replied that the works were still unfinished. "When the last stone of the last pond is laid your life shall be forfeited," replied the konohiki.

The completion of the sea walls of the Waiohuli Pond was marked by a similar ceremony, and two heavy boulders were carried on separate litters from the quarry a mile away to the northwest corner of the pond. The konohiki rode on the larger of the two capstones and, on the other, his wife was carried ahead of him, both dressed in the costume of their rank, attended by kahili-bearers and kaukaus [warrior chiefs] chanting meles.

As the seawalls of the Kaonoulu pond neared completion a block of lava fully a ton in weight was selected for the capstone and forty men put their shoulders to the litter of stout poles and waited. The konohiki mounted the ceremonial stone dressed in his war cloak and gave the word. With kahilis waving and kaukaus reciting the glories of his *mele-inoa*, the rock was lifted and the procession moved. When but a third of the distance had been covered the litter broke down, the big stone fell to the earth, and the konohiki was thrown to the ground and fell sprawling, face down in the dirt.

That night a great storm arose – rain, wind, hail, thunder and lightning and an earthquake and heavy storm waves from the sea, with a flood of red waters from the hillsides, spent its fury on Kalepolepo. In the midst of the storm the elves or *eepa*, birth brothers of Kikau, gathered, and each lightning flash revealed the host of elves busily tearing down the seawalls, undoing the work of the konohiki, so that Kikau might not die.

In the morning the storm had passed – and the seawalls of the ponds built with so much labor were seen to have been torn down, and the heavy boulder last ridden by the konohiki which, when set in place, meant the completion of the work, had disappeared.

Again the people were summoned to rebuild the ruined fishponds, only to have the final ceremony end with an accident. Another storm came up, a swarm of elves at night, and the whole work mysteriously undone as before.

The konohiki acknowledged his fault and offered to be guided by Kikau in rebuilding the ruined ponds which must be completed or his own life would be forfeited to the king. Kikau told him to summon the people of Koolau to bring opae and the people of Wailuku to bring baby taro or taro shoots (hā kalo)in great quantities and when this was done Kikau would invoke his aumakuas [guardian spirits] to summon the menehunes to do the work.

When these supplies were brought in, the taro cooked and the opae laid in the ti-leaves, Kikau advised the konohiki to proclaim a tabu of silence for the people to remain silent and stay indoors; that no pig be allowed to squeal, no dog to bark, no rooster to crow, on that particular night – and so it was proclaimed.





That evening the first signs of the bestirring of the menehunes were seen in the rising of spirals of red dust from afar off – from the uplands – as they came trooping to the lower lands there were swirling clouds of red dust to the north and east of Koieie (former name of Kalepolepo).

In no time (manawa ole) the ruined walls of the ponds were rebuilt and then, to mark the completion of their work, they fell to the final task of laying, in a select spot at the northwest corner of Kalepolepo pond, the huge boulder now known as Kikaupohaku.

### 4.2.3 Early Historic Period

Kīhei was one of the locations visited by the English explorer Captain George Vancouver. A monument at Mai Poina 'Oe Ia'u Beach Park in Kīhei commemorates Vancouver's on-shore expedition in 1792, when he first met the ruling chief Kahekili. With its sheltered coastline and easy access to upcountry resources over a vast slope, Kīhei would continue to be a common stop for visiting ships. In 1841, Wilkes commented, "At Malaea [Mā'alaea] Bay there is good anchorage for vessels of any size, and a fine fishery" (Wilkes 1845).

During the early and middle 1800s, the Hawaiian demography was affected by two dramatic factors: radical depopulation resulting from Western disease; and nucleation around the developing port towns. The traditionally Hawaiian population was largely dispersed and, although there were royal centers and areas of more concentrated population, these areas never came close to rivaling the populations of the historic port towns that developed on Hawai'i's shorelines during the 1800s. In this regard, Kuykendall (1938:313) notes that in the period from 1830 to 1854:

> The commercial development during this period, by magnifying the importance of a few ports, gave momentum and direction to a townward drift of population; the population of the kingdom as a whole was steadily going down, but the population of Honolulu, Lahaina and Hilo was growing.

We believe that Kuykendall's observation was most likely the demographic pattern at the Kalepolepo entrepot, an area that may have included the project area when it existed, and a hub of early historic activity for Kīhei and eventually all of Kula Moku (Kolb et al. 1997:69). The development of Kalepolepo as an entrepot and a focus of Christian life in the 1840s and 1850s most likely increased the population in the immediate vicinity above the pre-Contact population figures, contrary to the island-wide trend of depopulation.

On the 2nd of September [1853], David Malo was ordained pastor of the church at Keokea, Kula. The church at Kalepolepo became his outstation, where he spent a great deal of time. Malo's father had been connected to Kamehameha's court and army. Malo was born in Keahou, in the northern part of the Kona district (Island of Hawai'i) in 1795. In his youth Malo was part of the entourage of Kuakini, brother of Queen Ka'ahumanu. Malo then became the pupil of 'Auwae, Kamehameha's bard, genealogist and ritual expert. Malo then studied at Lahainaluna when it opened in 1831. Malo authored a cultural history of Hawai'i about 1840 to assist missionary Lorrin Andrews with his research on developing a dictionary and a grammar for the Hawaiian language; Malo's *Moolelo Hawaii* was translated by Nathaniel B. Emerson (Malo 1951) and published (Valeri 1985:xxv).

That the population and areal extent of the Kalepolepo community reached its zenith during the mid 1800's appears to be supported by Kolb (*et al.* 1997:68):

The ancient village of Kalepolepo was relatively small, and was built around an economy primarily based upon the exploitation of ocean resources--primarily the excellent fishing grounds as well as three large fishponds. However, as the number of visiting ships increased, Kalepolepo soon became an important provisioning area. By 1850 we know that the economic opportunities were attracting a number of European entrepreneurs.

In 1820, the whaling industry was introduced in Hawai'i. Although the whaling trade centered on Lahaina, mainly affecting the Kula/Kīhei area through agricultural demands, Clark (1980:47) notes that "From the 1840s to the 1860s a small whaling station was maintained at Kalepolepo [Kīhei]." The introduction of whaling to the Maui community brought with it an increased demand for foodstuffs and in particular the long-lasting Irish potato. After 1830, dryland agriculture in the old Kula District expanded with a focus on Irish potato cultivation. The California Gold Rush of 1849 further intensified the demand as a California-Hawai'i potato trade began to flourish. Kula became the area of highest potato production and was known as "the potato district" (the area between 2000 and 5000 ft. amsl). During this time period sugar cultivation and ranching were established in the Kula region. Sugar was present prior to 1846, with six sugar producers operating on the slopes of Haleakalā (Wong Smith in Brown and Haun 1989:C-7). As Wong Smith points out (Brown and Haun 1989: C-6), ranching was present in the area prior to the 1840s. Much of the produce, sugar and livestock moved down the Kalepolepo and Kekuawaha'ula'ula Trails to the landing at Kalepolepo, adjacent to the project area. Donham (1992:5) notes that the inundation of land clearing and cultivation associated with the Gold Rush resulted in "deforestation [which] adversely affect[ed] the amount of rainfall in the district, and periods of drought became more common."

In the early 1850's John Halstead built the Koa House at Kalepolepo in Kīhei. At the time Halstead was contemplating the construction of the three-story frame house, neighbors wagered that the house "would not be able to stand up to the blasts of *Kaumuku* wind which sweeps the place at times like a localized tornado. The builder went on with his work and won the wager." Mauian Charles Wilcox wrote about the Koa House for the monthly magazine of Hawai'i named "Paradise of the Pacific" in March, 1905:

> No one remembers the actual date of its [Koa House] construction, but the fact that King Liholiho (Kamehameha IV) visited Kalepolepo on a royal tour immediately after accession to the throne in the fall of 1854, and stayed overnight as the guest of its owner, is proof it was built before that time.
>
> John Joseph Halstead was a scion of a notable New York family of the early colonial days who....went to sea as a whaler. He came to Hawaii and left ship in Lahaina in the early thirties. He engaged in business first as a carpenter and cabinet maker for the king and later as a trader He was said to have put up the first frame house in Lahaina. While there in the king's service he married Kauwaikikilani, a young woman of the chiefess class, being a granddaughter of Isaac Davis, commander of the royal artillery in Kamehameha's wars of conquest.





> With the news of the discovery of gold in California in 1848 came orders from San Francisco merchants for Irish potatoes and other food supplies for the Argonauts who came hurrying to the new gold fields. Many whites and Hawaiians fitted out and left Lahaina for the new El Dorado but Mr. Halstead did not join the pioneers of 1849. He chose instead to promote the Irish potato industry for the victual ling of whale ships in their seasonal voyages after whales.
>
> He moved over to Kalepolepo with his family and shortly thereafter built for himself the old house.....from the forties to the sixties at Kalepolepo a small whaling station was maintained. During the winter and spring months schools of whales would come to stay or calf in the quiet waters of Maalaea Bay, and at such times whale boats manned by native crews officered by experienced whalers would go out to battle the big mammals and if successful would return towing the carcass in to be cut up and tried for oil.
>
> Some time ago a writer in *The Friend* claimed that the old house at Kalepolepo was Reverend Green's granary during the wheat boom of the fifties and early sixties, when the upper Makawao country from Maliko to Waiohuli was cropped to wheat, Possibly some wheat may have been shipped from Kalepolepo in those days, for from early times to the late sixties it was a shipping port for Wailuku to Kula and Mr. Halstead had one or two big warehouses standing makai of his residence. S. Lono, the oldest resident of Kalepolepo aged over seventy-five years, remembers nothing of Mr. Green's activities in that time, except that the Reverend Green visited Kalepolepo quite often, usually to preach a sermon and take up a collection.
>
> At that time, Kalepolepo was a thriving village, with two churches, one being a Mormon church where George Cannon or Walter Murray Gibson expounded the Christian doctrines of Joseph Smith against Christian Calvinism as preached by the Reverend Green and David Malo. At one time Father Green preached a red hot sermon- a favorite hobby of his – against mixed marriages and caused quite a stir of scoffing from the colony of whites married to Hawaiian women living at Kalepolepo consisting of J.J. Halstead, Mr. Fern, father of the late mayor Fern of Honolulu, and Mr. Fredenberg. Mr. Fern and Fredenberg being in charge of the whaling station (Wilcox 1921).

### 4.2.4 Mid- to late-1800s

The most significant change in land-use patterns and allocation came with The Great Māhele of 1848 and the privatization of land in Hawai'i. This action hastened the shift of the Hawaiian economy from a subsistence-based to a market-based economy. During the Māhele, all of the lands in the Kingdom of Hawai'i were divided between *mō'ī* (king), *ali'i* and *konohiki* (overseer of an *ahupua'a*), and *maka'āinana* (tenants of the land) and passed into the Western land tenure model of private ownership. On March 8, 1848, Kauikeaouli (Kamehameha III) further divided his personal holdings into lands he would retain as private holdings and parcels he would give to the government. This act paved the way for government land sales to foreigners, and in 1850 the

legislature granted resident aliens the right to acquire fee simple land rights (Moffat and Fitzpatrick 1995: 41-51).

Native Hawaiians who desired to claim the lands on which they resided were required to present testimony before the Board of Commissioners to Quiet Land Titles. Upon acceptance of a claim the Board granted a Land Commission Award (LCA) to the individual. The awardee was then required to pay in cash an amount equal to one-third of the total land value or to pay this equivalent in unused land. Following this payment, a Royal Patent was issued that gave full title of ownership to the tenant. But by 1850, the government of Hawaii was offering land for sale to both Native Hawaiians and foreigners. Such lands were referred to as Royal Patent Grants or as Grants.

A number of land commission award parcels were located in the nearshore region of the Ka'ono'ulu Ahupua'a, in close proximity to the present project area. These parcels are tabled below. From these records, it appears that many of the residents of Kalepolepo had agricultural interests inland of the coast.

Table 2. Land Commission claims in Kalepolepo and vicinity.

| LCA | Royal Patent Number | Claimant | Award Type | Acreage |
|---|---|---|---|---|
| 05267 | 2793 | Kuhiahiwa | 1 *'āpana* | 3.12 |
| 02764 | ---- | Hiona | 1 *'āpana* of kula land with 1 *mala* of Irish potatoes at Ka'ono'ulu. | ----- |
| 4120B | 5067 | Kapohaku [Konohiki of Keokea] | 4 *'āpana*, one of which is a house lot at Kalepolepo measuring 0.25 acres. | 17.89 |
| 5407 | 2791 | Mahiai | 3 *mala* [cultivated patches or fields] of Irish potatoes at Ka'ono'ulu. | 3.49 |
| 6720B | 3102 | Nahelu | 4 *'āpana*, one of which is a house lot in the *'ili* [land section] of Kalepolepo, bounded on the *mauka* side by Mahiai's land [see LCA 5407 above]. | 20.18 |
| 5228 | ------ | Kuihelani | --------- | 28.00 |
| 9673 | 6329 | Lonoaea | --------- | 4.06 |
| 5328 | 6575 | Pupuka | 1 *'āpana* | 1.00 |
| 5267 | 7467 | Kauhiahiwa | 3 *'āpana*, one of which is a house lot in the *'ili* of Kalepolepo; bounded on the *muaka* side by Kapohaku's land [see LCA 4120B above]. | 4.50 |
| 7971F | 2205 | Nauliuli | 1 *'āpana* | 3.40 |
| 5279 | 6523 | Palekai | 1 *'āpana* | 10.40 |
| 03237-M | 7447 | Hewahewa, H. | Ka'ono'ulu Ahupua'a as listed in the māhele registry, July 12, 1849 | 5,715 |





### 4.2.5 Brief History of the Ka'ono'ulu Ranch Company

The Ka'ono'ulu Ranch Company was established in the early 1900's by Harold Waterhouse Rice, who was appointed division overseer for the Maui Agricultural Company in 1907, the same year he married Charlotte M. Baldwin. He became assistant manager of the Maui Agricultural Company sugar plantation in 1909. He then purchased the Cornwell cattle ranch in 1916, developing and stocking the ranch with pure-bred cattle and horses and renaming the ranch. Harold Waterhouse Rice became a member of the territorial senate in 1918. Senator Rice and Charlotte Baldwin had four children, Charlotte Emily, Harold Frederick "Oskie," Maud Baldwin and Mary McKinney Rice (Nellist 1925).

As of the time of Statehood, in 1959, some 1,000 acres of the Kula forest district was in the private land holdings of the Ka'ono'ulu Ranch Company. Earlier, in 1920, the Board of Commissioners of Agriculture and Forestry requested that title to 1,006 acres of private land owned by the Ka'ono'ulu Ranch, be acquired by the Territory. Under the law then in effect, "if an area exceeds 40 acres an exchange cannot be made." According to Korte, as there was insufficient money for land purchases, the matter was dropped (Korte 1961).

The ranch is run today by Henry Rice, grandson of Harold Rice (Karp 2010). In a 2010 interview with the Wall Street Journal, Harold Rice described his family circumstances that lead up to his becoming the managing general partner of the Ka'ono'ulu Ranch Company, which included the history of the ranch lands as a potato farm. The article concluded by describing Henry Rice's day-to-day duties, which includes mending fences and taking care of the ranch cattle and employing a number of cowboys to help in these activities (Karp 2010).

At the present time, the cattle ranch operates mostly in the upland reaches of the Ka'ono'ulu Ahupua'a, however, in the lower elevations, a land parcel sold by the Ka'ono'ulu Ranch along Kīhei's Pi'ilani Highway is to be developed into a new high school for Kīhei, as well as a new "outlet center" type of shopping center (Imada 2012).

By the time John Halstead closed shop in 1876, the boom years of Kalepolepo had passed. By 1880 the government survey of the Kula area showed the demarcation of only a few Land Commission Awards and those who had received awards had replaced them with grants. Lower Kula consisted primarily of pastureland for ranching (Wong Smith in Donham 1990b:B-6). Kennedy (1992:7) notes that at this point *kiawe* was imported to feed cattle and provide wood.

Regarding the settlement at Kalepolepo and the impact of the changes associated with the change to ranching on the general area known as Kīhei, Clark comments:

Halstead finally closed his store in 1876, as demands for his goods had steadily decreased, and moved to Ulupalakua . . . By this time the once thriving Hawaiian village at Kalepolepo had been almost totally abandoned as well. The slopes of Haleakala had gradually become denuded of their forests and torrential rains had caused heavy soil runoffs into the Kalepolepo shoreline. Cattle had trampled down the brush and grassy fields, causing sand dunes to drift and fill up the pond. Clouds of dust filed the air instead of cooling winds. Except for a handful of fishing families, Kalepolepo (and likely the Kīhei area in general) was deserted. (Clark 1980:48).

Sugar would soon fill the void and in 1898 the Kīhei Plantation Company (KPC) was founded. The KPC began sugar operations in Kīhei and on the plains across central Maui.

### 4.2.6 Early to Mid-1900s

The Kihei Plantation Company, Ltd. was organized late in 1898 with a capitalization of 60,000 shares at $50 par value. Water was the most critical component in the decision to locate sugar cultivation along the leeward shores of Maui's arid coastline. The discovery of an ample supply of irrigation water early in 1898 led to the drilling of a large, successful well, but the supply of water was limited (Stearns 1942). Over the next four years, two ditches were developed to supplement the water needs of the 4,873 acres of sugar under cultivation at Kīhei (Gilmore 1936).

The history of the Kīhei Plantation Company begins with the annexation of the Hawaiian Islands by the United States in 1898. With annexation came political stability for Hawai'i. Sugar prices were rising due to the outbreak of war between the United States and Spain over the colonies in Cuba, Puerto Rico and the Philippines. Henry P. Baldwin, of the Maui plantation of HC&S, entered into a partnership with O'ahu businessman Benjamin F. Dillingham to convert Lorrin A. Thurston's landholdings in Kīhei into a sugar enterprise.

Up to that time, sugar cultivation within the central isthmus of Maui was centered around the main towns of Wailuku and Kahului. Water tunneled from springs in the West Maui Mountains flowed through ditches in Wailuku to irrigate fields as far away as Mā'alaea. Water from the windward rain belt of Kailua ran through a network of ditches from East Maui to Pā'ia, to irrigate fields in Pu'unēnē.

The McCandless Brothers drilled a successful Maui-Type well (U.S.Geological Survey Well 14 / Hawaiian Commercial & Sugar Well K1) in 1899. It was located just inland from the coast in North Kīhei, between Keālia Pond and the Waiakoa Homestead Lands. This well was drilled vertically to approximately 60 feet through the Honomanū basalts, and tunneled laterally over 1,500 feet in order to skim 10 million gallons of fresh irrigation water per day from sources beneath the Kīhei plains (McCandless 1936).

The Kihei Plantation Company had the McCandless Brothers drill two or three additional Maui-Type wells on the north side of reservoir K2 at the discharge end of the existing pipeline of Well 14. The plantation in Kīhei failed in 1908 before the well site was able to be developed. It would have been named the HC&S K2 well, and would have included a large pumping station (Stearns 1942).

The plantation company in Kīhei built bridges to span streams and gulches flowing through the company fields. The plantation had planned the construction of a mill in North Kīhei, and ordered a plant to be built. It was decided that the new HC&S mill under construction at Pu'unēnē would have more than enough capacity to mill all the cane from the Kīhei fields. The order for the mill was transferred to the 'Ōla'a Sugar Company in Hawai'i, in exchange for a supply of steel rails for new railway requirements at Pu'unēnē. A large scale Kona storm hit the plantation on November 15th, 1900, and caused immense damage to both Kīhei and the HC&S fields in Pu'unēnē (Dean 1950). Bridges were knocked out, buildings were flattened, and washouts filled irrigation ditches with silt. Repairs were effected immediately, with the new HC&S mill at Pu'unēnē commencing operations January 29, 1902.





#### *4.2.6.1 Railway Operations*

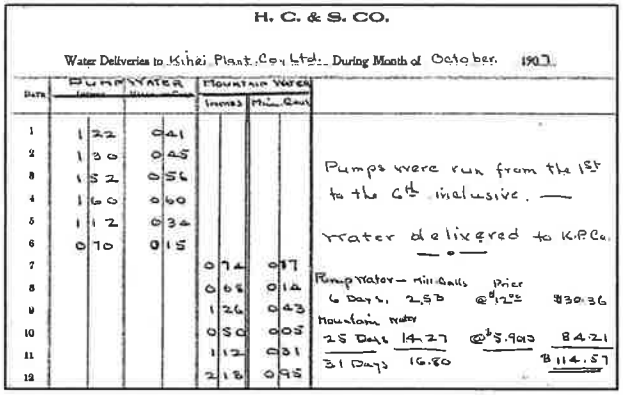
The Kihei Plantation Company planned to construct a railway to move their cane. The sugar agency of William Dimond & Company placed an order for a locomotive from the Baldwin Locomotive Works in Philadelphia. The order was placed April 1899, and the plantation locomotive "Haleakala" was built and sent on to Maui (Conde 1973).

By March of 1900, the first annual report of the Kihei Sugar Company stated, "It was our intention to complete the main [rail]road only as far as Camp #2, or for about 2 miles, but as the development of Camp #3 required pushing on of the road one and a half miles further, this has been done, having been completed the 15th of February." An additional six miles of track connected the Kīhei wharf to the various well pumping stations, and north to meet up with HC&S track (Conde and Best 1973). Establishing the railroad at Kīhei made it possible to harvest and transport over two thousand tons of sugar in a single year (Dean 1950).

The 3-foot gauge track for the Kihei Plantation Company railroad was built to the same specifications as the railway linking the HC&S Company mill at Spreckelsville to its fields; and to the sugar warehouses at the Kahului wharf. By 1902, with the new Pu'unēnē mill completed, a new milling contract with HC&S provided that all cane loaded by the Kihei Plantation Company was to be ground and manufactured into sugar by HC&S.

#### *4.2.6.2 Water Source Development*

The Lowrie Ditch project, named for former HC&S manager William J. Lowrie, brought an additional source of water to the Kīhei plains. His plan was to begin the ditch at the Pāpa'a'ea Reservoir, at the 1,000 ft. elevation, and maintain a four-foot drop per mile following the ditch's initial plunge from the Kailua reservoir. Steep mountain gulches were traversed using the force of the constant weight of water flowing in a series of siphons. The Halehaku Gulch, at 250 feet deep, and the Māliko Gulch, at over 350 feet deep, were both crossed by giant siphons fabricated of three-eighths-inch iron, and set in place by Japanese laborers. At a weir located above Pā'ia, the allocation of water began. The first tenth of the water flow in the Lowrie Ditch was divided out to the Pā'ia Plantation (an 11/20ths share) and the Haikū Plantation (a 9/20ths share). The distance traveled, from Kailua to the plantation's Kīhei boundary, was 21.9 miles (Thrum 1900).More water was required, both from wells and from the East Maui water shed. The manager for the Kihei Plantation Company, W.F. Pogue, asked the management of HC&S for an even larger allocation of water for the Kīhei lands. In 1901, Samuel T. Alexander ordered the construction of a new ditch, tapping the water sources from Nāhiku to Honomanū. It was determined that the Kihei Plantation Company would receive 2/9ths of the capacity from the enterprise (SeeFigure 6) (Dean 1950).



H. C. & S. CO.

Water Deliveries to Kihei Plant. Co. Ltd. During Month of October 1907.

| Date | Pump Water Inches | Pump Water Min. Gals. | Mountain Water Inches | Mountain Water Min. Gals. | |
|---|---|---|---|---|---|
| 1 | 1 22 | 0 41 | | | |
| 2 | 1 30 | 0 45 | | | Pumps were run from the 1st |
| 3 | 1 52 | 0 56 | | | to the 6th inclusive. — |
| 4 | 1 60 | 0 60 | | | |
| 5 | 1 12 | 0 34 | | | water delivered to K.P.Co. |
| 6 | 0 70 | 0 15 | | | — o — |
| 7 | | | 0 74 | 0 37 | |
| 8 | | | 0 68 | 0 12 | Pump Water — Mill Gals. Price |
| 9 | | | 1 26 | 0 43 | 6 Days, 2.58 @ $12.00 $30.36 |
| 10 | | | 0 50 | 0 05 | Mountain Water |
| 11 | | | 1 12 | 0 31 | 25 Days 14.27 @ $5.903 84.21 |
| 12 | | | 2 18 | 0 95 | 31 Days 16.80 $114.57 |

Figure 6. A portion of an accounting statement for water delivered to the Kihei Plantation Company in 1907.

The Kihei Plantation Company failed to live up to the expectations of its promoters with an inadequate water supply as the key difficulty. With the waters of the Ko'olau Ditch flowing to the Kīhei fields, production appeared to have hit its peak. Although 5,609 tons of sugar was delivered in 1903, high costs required a change of managers in Kīhei, and a reduction of the HC&S milling charge to $7 per ton. The incoming HC&S manager, Frank Fowler Baldwin, determined that the best course of action was to buy out the company for $375,000 (Conde 1973).

In 1908, the lands of the Kihei Plantation Company were divided up between five new major business entities of HC&S. The Kahului Railroad, which had already been absorbed by HC&S, acquired the rail lines to Kīhei and the rolling stock of the plantation. The Kailua Plantation Company (994 acres), the Kalialinui Plantation Company (923 acres), the Kula Plantation Company (996 acres), the Makawao Plantation Company (982 acres), and the Pulehu Plantation Company (978 acres) acquired the remaining acreage not included in the railroad right-of-ways. Water rights reverted to HC&S, and were reapportioned between the new plantations. Sugar operations continued in North Kīhei until circa 1968, when the HC&S Company began to lease its marginal sugar lands in north Kīhei to the Trojan Seed Company (a hybrid corn research company from Olivia, Minnesota), an action which continues to the present day with the Monsanto Global Seeds Company.

### 4.2.7 The residential area of Kīhei

The residential community of Kīhei grew in the pre-WWII years because of the sunny weather and white-sand beaches. Truck farming of alfalfa had been done since the turn of the century, on many of the coastal inland Kama'ole homesteads. Civic development in Kīhei included the Kalama Park and the Kīhei Road. An article in the *Maui News* described the





September 9th, 1936 celebration of the completion of the road between Kalepolepo and the Kalama Park (News 1936).

> Approximately 1500 persons attended a luau at Kalama Park Sunday given by the Kihei Community Club to celebrate the opening of the 2-mile stretch of paved highway between Kalepolepo and the [Kalama] Park.
>
> Earlier in the summer the County completed another 2-mile stretch between Maalaea Airport and the new Kihei Park. Work on the remaining unpaved section between Kalepolepo and the Kihei Store is now in progress.

The article continued by describing further progress in other public works projects in Kīhei:

> A new high mark was reached in county road construction during August when slightly more than 3 miles of cold emulsified asphalt pavement was laid in the county during the 1 month period, County engineer A.L. Burdick reported to the Board of Supervisors on Thursday night.
>
> This, he said, brings the total for the first eight months of the year to slightly more than 11 miles of completed grading and paving.
>
> Roads completed so far this year: Kihei Airport towards Kihei, 2.2 miles. Kihei, Kalama Park toward Kalepolepo, 2 miles. Hamakuapoko Road 1.1 miles, Farrington Avenue, Molokai 1.5 miles; Camp 5-6 Road 1.61 miles; Pulehu Road 1.64 miles; Waihee Road .15 miles; Kealahou School driveway .16 miles; Homestead roads, Kula .75 miles; total 11.11 miles.

Figure 7. Aerial photo of Kūlanihāko'i Bridge (School of Ocean and Earth Science Technology [SOEST] 1949)





#### 4.2.8 Impact of the military on the project area

The Department of the Navy constructed a wood-frame two-story structure on the beach fronting the project area in 1948, following the end of World War II. The structure, which remains today as the building housing the Pacific Whale Foundation, was originally constructed to house military equipment used to monitor the effects of atomic bomb testing in the Pacific Ocean (Figure 8).

The complex of wood structures consisted of two transmitter buildings housing a bank of electrical generators in the event that electricity to the complex was interrupted, and a single administrative building manned by engineers who transmitted data gathered on the condition of the upper atmosphere to a laboratory in Boulder, Colorado. The geophysical station was responsible for broadcasting a series of radio signals accurate to within a few millionths of a second. For a brief time, the U.S. Bureau of Standards clock at Kalepolepo was a part of the coastline adjacent to the ancient fishpond. In 1971 this transmitting station was relocated to Barking Sands, on the island of Kaua'i.

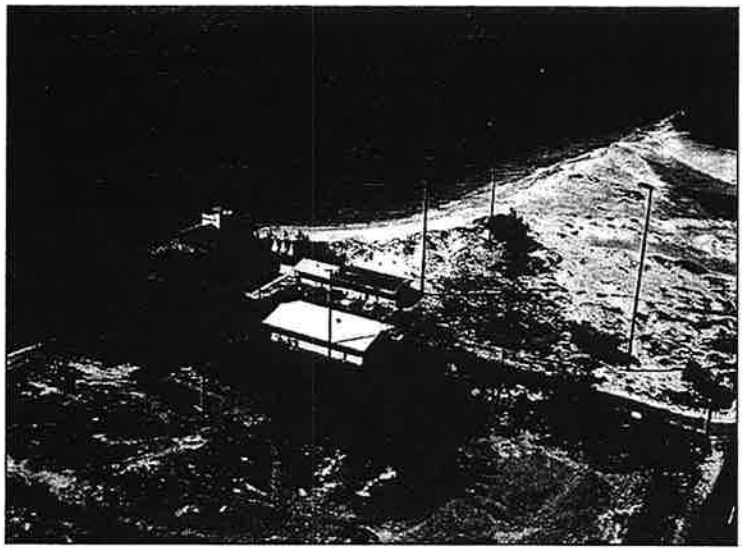


Figure 8. 1971 aerial photo of antenna, transmitter buildings and administrative building for WWVH, just seaward of the project area. Photo courtesy of National Institute of Standards and Technology (http://tf.nist.gov/stations/wwvhtour.html).

#### 4.2.9 Modern Land Use

Beginning in the 1970's, development in the region of the project area shifted from rural residential to vacation condominium development. Between 1970 and 1996 vacation rental units increased from 2,641 to 17,442. The leeward coasts, including Kīhei, became popular tourist destinations (Juvik 1998:14). Today, the ASTON Maui Lu Resort is located to the north of the project area and the Kihei Bay Vista Condominium is located to the south of the project area. The project area is south of the Mokulele-Pi'ilani Highway junction, along South Kīhei Road. The existing drainageway and associated culverts due for replacement are at the Kūlanihāko'i Stream mouth, near Kalepolepo Beach park and fishpond along the shoreline.





## 4.3 Previous Archaeological Research

The majority of archaeological reconnaissance and inventory surveys in the North Kīhei area (Table 3) have produced relatively little significant information in the way of archaeological data. While this may be due in large measure to changes on the land associated with sugar cane cultivation, ranching, and military use, as well as resort and housing construction, it still seems inescapable that there are only few areas in the Hawaiian Islands abutting sandy beaches that have less in the way of documented Hawaiian cultural deposits than Kīhei. Archaeological projects in the vicinity identified both pre-Contact and post-Contact site types. Many of which were associated with the sugar plantation era and plantation Camps, ranching and WWII periods in history. Pre-Contact archaeological sites including dry stacked basalt walls, alignments, possible burial mounds and sites associated with traditional Hawaiian agriculture have also been discovered in the vicinity surrounding the project area.

Each of the fishponds located in the vicinity of the project area are listed on the State Inventory of Historic Places. The Ko'ie'ie Fishpond (SIHP 50-50-09-1288), adjacent to Kalepolepo Park is the smallest of the three fishponds in this region of Kīhei. The Waiohuli Kai Fishpond is just south of Ko'ie'ie Fishpond, is submerged and listed as SIHP 50-50-09-1704. The Kēōkea Kai Fishpond is yet further to the south and is also submerged (SIHP 50-50-09-1738). Kikuchi in 1973 performed a study of fishponds which categorized the Ko'ie'ie Fishpond as a Type I, Loko Kuipā type, or a "fishpond of littoral water whose side or sides facing the sea consist of a stone or coral wall usually containing one or more sluice gates" (Kikuchi 1976:37).

According to an early island-wide survey by Stokes, the closest *heiau* structures to the project area were reportedly south of Kalepolepo in Kama'ole Ahupua'a; and were described in the following manner:

> Heiau of Wailuku at Kawililipoa, land of Kamaole, inland; said to be a platform. Not seen. Heiau of Kolea and Kawililipoa, land of Kamaole. Said to have been for human sacrifice, not seen. Heiau at Kawililipoa, land of Kamaole, between the road and the beach. This foundation, which has been destroyed, was probably a platform originally. It was situated on a sandy flat, quarter of a mile from the sea; 200 feet west of the road and 200 to 300 feet south of the Mormon Church (Stokes 1918:125)

These heiau were also described by Walker in 1931. The Wailuku Heiau was noted as Walker Site 205, the Kolea Heiau as Walker Site 206 and Kawilipoa Heiau as Walker Site 207 (Walker 1931:271-273)

Table 3. Previous Archaeological Studies

| Date | Ahupua'a | Nature of Study | Findings |
|---|---|---|---|
| Stokes 1916 | Island wide | Archaeological Reconnaissance | 3 *heiau* in Kamaole in the *'ili* of Kawililipoa, located directly south of the present project area. Stokes did not see any of these three *heiau*. He noted that they may have been destroyed. |
| Walker 1931 | Island wide | Reconnaissance | 3 *heiau* in Waiohuli Ahupua'a above 3,000 ft. elevation. |
| Kikuchi 1973 | Statewide fish pond survey | Fishpond Survey | Noted 3 fish ponds in Kalepolepo area. |
| (Cox 1976) No project area map | Pūlehu Nui to Kama'ole | Archaeological Inventory Survey | Pi'ilani Highway right-of-way. Identified six sites, including three site complexes containing seven features and three isolated features. |
| (Cordy 1977) | Pūlehu Nui to Paeahu | Archaeological Reconnaissance | Identified 38 sites: 30 in Waiohuli, 0 in Ka'ono'ulu, and 8 in Kēōkea |
| (Neller and Keau 1981) | Ka'ono'ulu | Archaeological Reconnaissance | Finds include two historic fenced areas recorded as sites which were noted as possible graves, and a platform of indeterminate function. Further archaeological survey, data recovery and monitoring was recommended. |
| (Bordner and Cox 1982) | Waiohuli and Keokea | Archaeological Reconnaissance | A total of nine sites were located during the reconnaissance survey which included C-shapes, an L-shapes, a modified bedrock outcrop, a temporary habitation shelter, stone alignments, and a habitation site. Cultural material which consisted of shell midden was present at some of the sites. |
| (Kennedy 1986) | Waiohuli | Archaeological Reconnaissance | Area was cleared by bulldozer, rubble mounds along both east and west boarders of project area, no surface evidence of archaeology. No further archaeological work recommended. |
| (Kennedy 1988b) | Coastal Ka'ono'ulu | Archaeological Reconnaissance | No archaeological findings |
| (Kennedy 1988a) | Waiohuli | Archaeological Reconnaissance | No archaeological findings. No further archaeological work recommended. |
| (Kennedy 1989) | Waiohuli | Archaeological Subsurface Testing Results | No human burial findings |





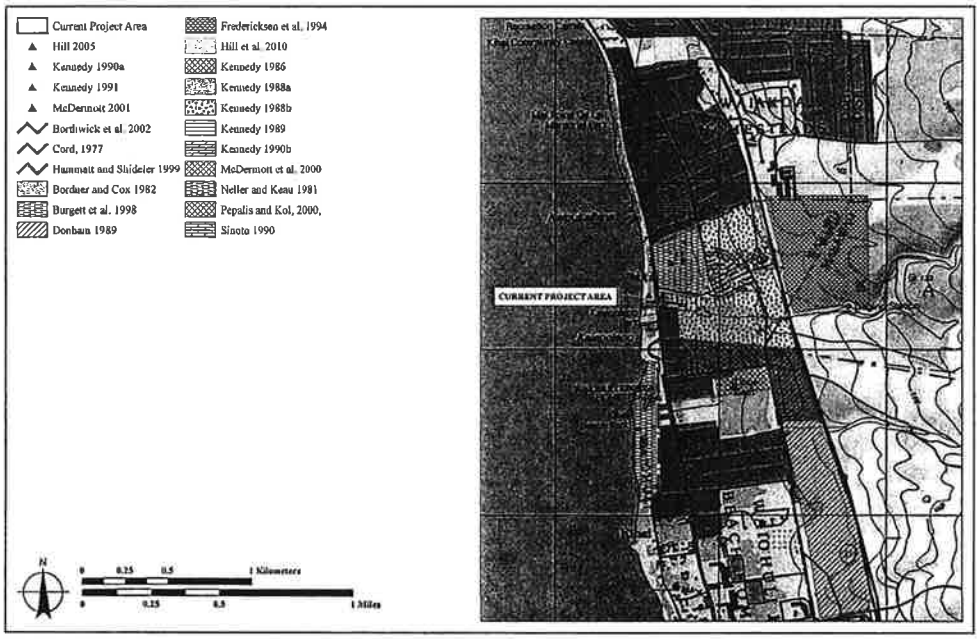



Figure 9. Portions of the Pu'u o Kali (1992) and Mā'alaea (1996) 7.5-minute USGS topographic quadrangles, showing the current project area relative to adjacent areas of previous archaeological study.

Stokes (1918) reported a *heiau* named Wailuku at Kamaole in the *'ili* of Kawililipoa, *mauka* [inland]. He also reported a sacrificial *heiau* named Kolea in about the same area and further stated that he had not seen either of them, but that his informants also reported an unnamed *heiau* in the same *'ili*, on the sea plain, 200 *makai* or west of the lower road and the same distance south of the Mormon church. This *heiau* was reported to have been a *kahua* [foundation] and had been destroyed.

Cordy (1977) identified a total of 38 single component and multi-component archaeological sites within the then proposed Pi'ilani Highway road corridor. Following that study, Cox (1976), performed an archaeological surface survey and excavations for the Pi'ilani Highway right-of-way. Cox identified six sites, including three site complexes containing seven features and three isolated features. The sites are of pre-historic and historic era use and include a cave that was a temporary habitation shelter; a C-shape shelter; a historic house complex; an *ahu* (possible monument/platform burial); and a miscellaneous alignment. No further work was recommended.

Neller and Keau (1981) conducted an archaeological reconnaissance adjacent to the current project area at TMK (2) 3-9-01:17, 1, also known as Kalepolepo with the Kalepolepo fishpond fronting the property. Their findings include two historic fenced areas recorded as sites which were noted as possible graves, and a platform of indeterminate function. Further archaeological survey, data recovery and monitoring was recommended.

In 1990, Kennedy conducted monitoring of the TMK (2) 3-9-01: 015, a portion of which comprises the current project area. Findings resulting from monitoring included midden scatters, a single volcanic glass fragment, animal bone and a bone pick were recorded.

Further north of the current project area, Kennedy (1991) preformed a field inspection for an inadvertent burial find. A profile was drawn of the burial, then a three sided form was constructed to protect the burial and the burial was reburied in place.

Erik Fredericksen of Xamanek Researches (E. M. Fredericksen et al. 1994) conducted an inventory survey in Ka'ono'ulu Ahupua'a east of the current project area and *mauka* of Pi'ilani Highway. A total of 21 archaeological features reflecting pre-contact use of the area, as well as post-contact military and ranch use were recorded. The pre-contact or Early Hawaiian archaeological features included five stone piles possibly representing agricultural use, five surface scatters representing pre-contact temporary habitation, and one petroglyph. Military use of the area is represented by five stone cairns, three alignments, and one enclosure. A single feature, interpreted as an erosion containment area, was recorded in association with ranching activities.

Until recently, the few available radiocarbon dates from the Kihei area were consistent in their rather broad, later prehistoric age determinations, most commonly post A.D. 1500 (D. L. Fredericksen et al. 1993; E. M. Fredericksen and Fredericksen 1995a, b). This fits with the model that the more intensive use of the Kihei area was a later pre contact development that corresponded with the expansion of upland permanent habitation, ceremonial constructions, and agricultural clearing after A.D. 1400-1500 (Kolb et al. 1997:281-282).

Without a doubt, coastal habitation along with more populous inland/upland settlement was firmly established by A. D. 1400-1500. The majority of permanent habitation would have been in the uplands, concentrated in the well-watered and fertile agricultural areas. Coastal permanent





| Date | Ahupua'a | Nature of Study | Findings |
|---|---|---|---|
| (Donham 1989) | Waiohuli | Archaeological Inventory Survey | Identified four sites, including two previously unrecorded sites. Recommended data recovery |
| (Kennedy 1990b) | Coastal Waiakoa | Survey | No archaeological findings |
| (Sinoto 1990) | Coastal Waiakoa | Survey & Testing | No archaeological findings (other than two pieces of midden) |
| (Kennedy 1990a) | Ka'ono'ulu | Monitoring Report | Recorded 4 surface midden scatters, single fragment of volcanic glass, animal bone and bone pick. |
| (Kennedy 1991) | Coastal Waiakoa | Field Inspection | Inadvertent burial find |
| (E. M. Fredericksen et al. 1994) | Ka'ono'ulu, *mauka* of Pi'ilani Highway | Inventory Survey | 21 sites were identified, some military and some pre-contact |
| (Burgett et al. 1998) | Ka'ono'ulu | Inventory Survey | Lots A and B of the Maui Lu Resort. No archaeological findings. |
| (Hammatt and Shideler 1999) | Waiohuli | Archaeological Reconnaissance | No cultural material, no archaeological findings |
| (Pepalis and Kolb 2000) | Waiohuli | Archaeological excavations | Discovered soils from inland pond |
| (McDermott et al. 2000) | Waiohuli | Additional Archaeological Inventory Survey | Confirmation of an inland pond (SIHP 50-50-09-4981) from which 14C radiocarbon were attained that provides evidence of an earlier habitation sequence in Kihei than previously documented. |
| (McDermott 2001) | Coastal Kihei | Graduate Thesis; Historical Ecology of Coastal Kihei | N/A |
| (Borthwick et al. 2002) | Waiohuli | Inventory Survey | No archaeological findings |
| (Hill et al. 2005) | Waiohuli | Letter Report for a Field Inspection and Subsurface Testing | No archaeological findings |
| (Hill et al. 2010) | Pūlehu Nui, Ka'ono'ulu, Waiakoa | Mitigation Program | No cultural deposits or artifacts observed during mitigation work. No historic properties affected. |

habitations were likely less numerous and centered on the ceremonial structures and fish ponds at Kalepolepo. While the fish ponds of the Kula coastline are thought to date to the 1500s (Kolb et al. 1997:66), the chronological timeline for initial settlement of the Kīhei area is still under debate. Based on the results of relatively recent studies (McDermott 2001; McDermott et al. 2000), habitation in the coastal areas may date to as early as A.D. 600-900. Evidence of earlier coastal habitation in the Kīhei area has recently come to light at excavations adjacent to the site of the Kalepolepo Church. Cultural layers described in the work of McDermott and others (2000) and McDermott (2001), in conjunction with those of Pepalis and Kolb (2002), provide some evidence in the form of charcoal concentrations, midden deposits, 14C dates, and palynomorph identification, that settlement in the vicinity of an inland pond feature had occurred by circa A.D. 600-900.





## 4.4 Background Summary and Predictive Model

Previous archaeological studies have led to archaeological site interpretation based on the division of the settlement pattern for Maui into three zones: 1) coastal; 2) barren or transitional; and 3) Inland (Cordy 1977; Cox 1976; Walton 1972). The coastal zone is an approximately one-fourth of a mile wide band running along the shoreline. The inland zoned begins approximately five to seven miles from the shore and is characterized by larger rainfall accumulation and more lush vegetation. The transitional or barren zone is classified as the area between the edge of the coastal zone and beginning of the inland zone and characterized by brush/scrub vegetation and low annual rainfall accumulation.

Based on available archaeological evidence and interpretations, and as a result of the settlement pattern, site types expected for coastal zones, where temporary habitations related to marine exploitation may be present may include stacked-stone enclosures, and possibly smaller ceremonial structures, such as stacked-stone fishing shrines. It is possible that human burials would have been interred in the coastal sand dunes where present.

With that said, the current project area has experienced ground disturbances as a result of construction of the South Kīhei Road and natural events associated with stream and wetland environment, including periodic flooding. Flooding events particularly have caused repeated and extensive damage to the bridge over the years. As a result of these disturbances the likelihood of locating intact cultural deposits or archaeological remains would be low.

Conversely, the project area borders Kalepolepo and may have been considered part of the village once located there. Kalepolepo village became a major hub of early historic activity in the mid-1800's. Several historically significant places, such as the Koa House, the David Malo Memorial Church, and the Kalepolepo fishpond were located there. Portions of the fishpond have recently been restored (see Section 4.2.3 Early Historic Period). Additionally, due to the coastal location and dune sand environment, human remains could be present in sandy deposits of the project area.

# Section 5 Results of Fieldwork

## 5.1 Field Inspection Findings

An archaeological field inspection was conducted by archaeologist Colleen P. Medeiros, B.S., under the general supervision of Principal Archaeologist Hallett H. Hammatt, Ph.D., on August 15, 2012. The inspected area included is the immediate area of Kūlanihāko'i Bridge located at the mouth of the Kūlanihāko'i Stream along South Kīhei Road (Figure 10 and Figure 11) as well as an area approximately 500 feet north and 500 feet south of the bridge along South Kihei Road and approximately 574 feet upstream and 272 feet downstream from the bridge. As described in Section 2.3 Environmental Setting, the lands surrounding the Kūlanihāko'i Stream a remnant of a larger wetland area (Figure 12 and Figure 13). The Kalepolepo fishpond is located directly south of the stream mouth in the near shore ocean waters. In recent history the surrounding area has been transformed by the development of resorts and condominiums along the shoreline and today the project area sits immediately between the Aston Maui Lu Resort to the north, the Kihei Bay Vista Condominium to the south and the Villas at Kenolio to the east.

According to the Maui County Department of Public Works, the existing Kūlanihāko'i Bridge was constructed in 1911 and constructed of four individual reinforced concrete box culverts with each culvert cell measuring 6 ft. wide by 4 ft. high by 38 feet long. The total span of the four culverts is 27 ft. 9 in. Storm damage to the bridge was clearly visible and modern repairs have been made to the bridge over time. Storm damage is evidenced by a section of South Kihei Road which was undermined and subsequently back filled with rocks as a result of a storm. Dune sand has now partially covered this area. Both the *mauka* and *makai* facing sides of the culvert show damage where chunks of the culvert have broken away. The reinforcing-steel bar framing of the culvert is exposed along the entire *makai* side of the bridge, as well as sections of the *mauka* facing side (see Figure 10 and Figure 11).

Portions of intact sand dunes are present at the mouth of Kūlanihāko'i Stream (Figure 14 and Figure 15). Sand drifts are also present in places along the roadway frontage and sporadically covers areas of existing sidewalks and parking lots (Figure 16 through Figure 19).

Figure 10. Kūlanihāko'i Bridge, view Northwest.

Figure 11. Kūlanihāko'i Bridge, view northeast.

Figure 12. View east (*mauka*) from Kūlanihāko'i Bridge of stream and surrounding wetland (currently dry).

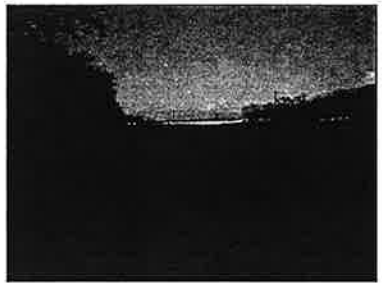


Figure 13. View west (*makai*) towards Kūlanihāko'i Bridge from upstream showing surrounding wetland (currently dry).

Figure 14. Sand dune on northwest side of Kūlanihāko'i Stream mouth.

Figure 15. Sand dune on southwest side of Kūlanihāko'i Stream mouth.

Figure 16. South Kihei Road eastern road frontage from the corner of South Kihei Road and Ka'ono'ulu Street, view south.

Figure 17. South Kihei Road western road frontage across the street from the corner of South Kihei Road and Ka'ono'ulu Street, view south.

Figure 18. South Kihei Road western frontage approximately 500 feet south of Kūlanihāko'i Bridge showing sandy soils along road, view north.

Figure 19. Kihei Bay Vista approximately 250 feet south of Kūlanihāko'i Bridge along South Kihei Road showing sand drifts, view east.

At the time of the field inspection there was standing water in the stream and ground water seeps were visible in the form of "pock" like formations, that are associated with the wetland ecosystem of the area (Figure 20). Signage indicating that a native plant restoration project was in progress within the inspection area was present. Vegetation consisted of both typical wetland plant species and other introduced plants including *akulikuli* (*Sesuvium portulacastrum*), *kiawe* trees (*Prosopis pallida*), *akiaki* (*Sporobolus virginicus*), *milo* (*Thespesia populnea*) *naupaka* (*Scaevola taccada*), and *pōhinahina* (*Vitex rotundifolia*).

Figure 20. Ground water seeps visible in the form of "pock" like formations.

According to Norman Saito, an informant who was once an engineer for the board of water supply for the County of Maui in the 1950's; Mr. Saito, recalled that the paving surface over the existing culvert was applied in the 1930's, which included some shoring-up of the edge of the roadway using a historic construction style attributed to pre-1940's plantation masons. The present-day Kūlanihāko'i Bridge appears to consist of two sections of prefabricated concrete culvert welded together to form the length of the existing bridge. Mr. Saito observed that the more modern construction style probably occurred because of the many repairs the bridge had undergone due to storm damage.

Presently the northern and southern wing walls have different construction styles. The northern wall is constructed of water rounded large basalt cobbles with a coarse concrete mortar typical of early 1900's construction methods while the southern wall is a modern-day rip-rap construction style where the basalt has been cut to form a level surface and modern concrete has replaced original material (Figure 21 and Figure 22). While the scattered remains of two domestic cows (*Bos taurus*) were observed in the flood plain, no historically significant cultural material was visible on the ground surface.

Figure 21. Northern wing wall historic construction.

Figure 22. Southern wing wall modern construction.





# Section 6 Summary and Recommendations

## 6.1 Summary

A review of the historic documentation indicates that not far from the current project area, great events of Maui's pre-history unfolded. It was at Kiheipuko'a that great chiefs such as Alapa'i and Kalani'opu'u of Hawai'i Island landed, came ashore finding Kīheipūko'a (fronting Keālia Pond) an ideal canoe landing site. Alapa'i, who abandoned his plan for war, came ashore hoping to see the ailing Kekaulike, and Kalani'opu'u who landed his army of elite soldiers here, most of whom met their demise in the legendary battle, *Ahulau ka Pi'ipi'i i Kakanilua*, the battle in the sandhills of Kalua (Section 4.2.2 Traditional Accounts). As a result of its sheltered coast line, plentiful fishing resources and access to upcountry food resources, Kīhei then became a regular port for visiting ships primarily from the United States and England. Soon after the time of Captain Vancouver's visit in 1792, activities revolved around the Kalepolepo entrepot and thus became a major hub for Kīhei and Kula Moku. Kalepolepo housed a small whaling station and remained a busy port while the whaling industry in Hawai'i was at its peak (Section 4.2.3 Early Historic Period). Simultaneously, during the mid 1800's, the *Māhele 'Āina*, the Great dividing of the land, began and introduced the private ownership of lands. The Great Māhele, as it was also called, transformed the economy of Hawai'i from one that was subsistence-based to an economy that was market-based and was a catalyst for major cultural shifts. Native tenants had the right to claim their *kuleana* lands and 12 such claims were made in the coastal region of Ka'ono'ulu Aupua'a and ten of these were awarded (see Section 4.2.4 Mid- to late-1800s). With large tracts of land offered for lease or for purchase, some lands throughout Hawai'i were purchased for use as sugar cane plantations. In 1899 a large portion of the central isthmus was purchased by the Kīhei Plantation Company (KPC) and sugar cane dominated the lands surrounding the current project area from this time into the 1960's. Historically, Kīhei was a specific location, a narrowly defined spot fronting the current project area. The town of Kīhei was later founded as a result of both the whaling industry, then the sugar industry having used Kalepolepo (just south of the Kīhei local) as the main hub of early activity and commerce. Kīhei Town is now a popular vacation area and residential town.

In addition to the events and activities of human history impacting lands of the project area, natural flooding events associated with Kūlanihāko'i Gulch have also altered the project area over time. "Kona" storms [southern-exposure rain storms], like the storm recorded on November 15th, 1900, have caused major damage to the Kihei area, specifically this study area. More recent storms have been documented by The Maui News, such as one in January of 1971, which, according to longtime resident Mr. Robert Hill, did considerable damage to the road and culvert at the current project area. More recently, there have been three major flooding episodes between 2007 and 2012, all of which were the result of winter storms which occurred in December 2007, late December 2010, and January 2011. In all instances, flood waters from the *mauka* reaches of Kūlanihāko'i Gulch, overwhelmed the current drainage culvert at the project area location and flood water volume coupled with debris, which blocks the culvert (and water from draining into

the ocean) altogether, has caused major overflowing and subsequent flooding of surrounding roads and condominiums.

Therefore, the background research coupled with the results of the field inspection lead to the conclusion that the area has been heavily disturbed and modified by natural flooding events as well as historic and modern activities.

## 6.2 Potential Project Effect and Recommendations

Based on the field inspection findings and background research there is a low potential for the discovery of previously unidentified historic properties beyond the historic era itself. The area surrounding the bridge includes the Kūlanihāko'i Stream mouth, and a natural wetland and associated flood plain. Consequently, no cultural material was observed on the ground surface. While impacts by flooding episodes and modifications associated with road construction and maintenance have greatly altered sediments of the project area, the possibility of encountering intact subsurface cultural deposits, including human burials, should not be underestimated. Therefore archaeological monitoring is recommended for all ground disturbing activities during all phases of temporary bridge work, bridge repair and bridge replacement.

Additionally, as Kūlanihāko'i Bridge was originally constructed in 1911 and 101 years old, this structure exceeds the 50 year threshold for consideration as a historic property and therefore should be documented at the archaeological inventory survey level.

The following are the specific monitoring recommendations:

- Onsite archaeological monitoring for all ground disturbing activities for both steps one and two.
- It is recommended that monitoring reports are generated after each step of bridge work;
  - Step one, temporary ACROW bridge installation;
  - Step two, temporary *mauka* bridge construction, and bridge replacement;
- It is recommended that documentation of the bridge is included in the monitoring plan provisions and that recording occur during the monitoring phase of work. Archaeological or architectural recordation of the bridge should take place prior to crews beginning construction work in the project area.
- Additional consultation with the Archaeological and Architectural branches of the SHPD is recommended prior to drafting of a monitoring plan.





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# APPENDIX D

***An Archaeological Inventory Survey for the Proposed Kūlanihāko‘i Bridge Replacement Project, Ka‘ono‘ulu Ahupua‘a, Wailuku District, Maui Island***

***TMK: (2) 3-9-001: 999, 162, 143 (pors)***

***Cultural Surveys Hawai‘i, Inc.***

***June 2013***

***Letter from State Historic Preservation Division***

***June 25, 2014***

# FINAL

# An Archaeological Inventory Survey for the Proposed Kūlanihākoʻi Bridge Replacement Project, Kaʻonoʻulu Ahupuaʻa, Wailuku District, Maui Island
## TMK: (2) 3-9-001: 999, 162, 143 (pors)

**Prepared for**

**Wilson Okamoto Corporation**

**Prepared by**

**Todd D. McCurdy, MA**

**and**

**Hallett H. Hammatt, Ph.D.**

**Cultural Surveys Hawaiʻi, Inc.**

**Wailuku, Hawaiʻi**

**(Job Code: KAONOULU 7)**

**June 2013**

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June 25, 2014

Dr. Hallett H. Hammatt
Cultural Surveys Hawaiʻi, Inc.
1860 Main Street
Wailuku, Hawaii 96793

LOG NO: 2014.00115
DOC NO: 1406JP16
Archaeology

Aloha Dr. Hammatt:

SUBJECT: **Chapter 6E-8 and National Historic Preservation Act Section 106 Review -**
**Revised Archaeological Inventory Survey for the Kūlanihakoʻi Bridge Replacement Project**
**Kaʻonoʻulu Ahupuaʻa, Wailuku District, Island of Maui**
**TMK (2) 3-9-001: 143, 162, 999 (portions)**

Thank you for submitting the revised draft report entitled *An Archaeological Inventory Survey for the Kūlanihakoʻi Bridge Replacement Project, Kaʻonoʻulu Ahupuaʻa, Wailuku District, Maui Island, TMK: (2) 3-9-001: 999, 162, 143 (pors)*, Todd D. McCurdy and Hallett Hammatt (2014). We received the revised submittal on January 9, 2014.

The revised draft report was prepared in support of compliance with state and federal historic preservation review regulations Chapter 6E-8 and Section 106 of the National Historic Preservation Act (NHPA). We previously reviewed the draft inventory survey report and recommended revisions (*Log 2013.4397, Doc 1309CG03*). Thank you for including the updated construction plans and maps depicting the approximate 0.9 acre area of potential effect, which consists of the detour bridge, the temporary support structure, and the replacement of the existing bridge. The 1911 Kulanihakoʻi Bridge is listed in the State Inventory as 50-50-10-7606 based on Criterion D. The bridge has suffered severe deterioration so it no longer has any distinguishing architectural characteristics. Therefore, it has lost integrity and is not eligible for the National Register (*Log 2012.3734, Doc 1212RS64*). The historic bridge has yielded information important to the understanding of the first generation of concrete bridges in the Hawaiian Islands. Sufficient information was collected and no further work recommended for Site 7606. No additional historic properties were identified during the survey. An archaeological monitoring program is recommended, and we concur with that assessment.

Changes made according to our requested revisions are adequate; the archaeological inventory survey meets the requirements of Hawaiʻi Administrative Rule § 13-276 and is accepted as final. Please send one hardcopy of the final document, clearly marked FINAL, along with a copy of this review letter and a text-searchable PDF version on CD to the Kapolei SHPD office, attention SHPD Library. We look forward to continued consultation regarding historic properties (36 CFR Part 800.4), and the assessment of adverse effects (36 CFR Part 800.5). Please contact Jenny Pickett at (808) 243-5169 or Jenny.L.Pickett@Hawaii.gov for any questions or concerns about this letter.

Mahalo,

Theresa K. Donham
Deputy Historic Preservation Officer

cc: County of Maui DSA Fax: (808) 270-7972
Department of Planning (planning@mauicounty.gov)
Annalise Kehler (annalise.kehler@mauicounty.gov)
Tanya Lee-Greig (LeeGreig@culturalsurveys.com)

# Management Summary

| | |
|---|---|
| **Reference** | An Archaeological Inventory Survey for the Proposed Kūlanihāko‘i Bridge Replacement Project, Ka‘ono‘ulu Ahupua‘a, Kula District, Maui Island TMK:(2) 3-9-001: 999, 162, 143 (pors.) |
| **Date** | June 2013 (FINAL) |
| **Project Number (s)** | Cultural Surveys Hawai‘i, Inc. (CSH) Job Code: KAONOULU 7 |
| **Investigation Permit Number** | CSH completed archaeological inventory survey for the proposed Kūlanihāko‘i Bridge Replacement Project South Kīhei Road under State Archaeological Permit No. 13-06 (2013) issued by the Department of Land & Natural Resources/State Historic Preservation Division (DLNR/ SHPD), per Hawai‘i Administrative Rules (HAR) § 13-13-282. |
| **Project Location** | The Kūlanihāko‘i Bridge is located along South Kīhei Road, in the Ka‘ono‘ulu Ahupua‘a, Kula District, Maui Island TMK: (2) 3-9-001: 999, 162, 143 (pors). This area is depicted on the Mā‘alaea (1996) and Pu‘u O Kali (1992) quadrangle 7.5-minute USGS topographic map. |
| **Project Funding and Land Jurisdiction** | Project Funding: Maui County Department of Public Works<br>Federal Highway Administration<br>Land Jurisdiction: Private<br>County<br>U.S. Army Corps of Engineers |
| **Agencies** | County: Maui County, Department of Public Works<br>State: Department of Land and Natural Resources State Historic Preservation Division (SHPD) |
| **Project Description** | The County of Maui Department of Public Works (County) has proposed to replace the deteriorating Kūlanihāko‘i Bridge. The existing bridge consists of four reinforced concrete box culverts. Each cell is 6 feet wide and 4 feet high by 38 feet long. A March 2012 bridge inspection report notes that there is severe spalling and advanced corrosion of the reinforcing of the top slab of the culvert. The report recommended that immediate repairs or shoring of the top slab be implemented. The county plans on completely replacing Kūlanihāko‘i Bridge which would involve an extensive and time-consuming permitting process involving Federal, State and County wetland and shoreline issues.<br>In order to address immediate safety concerns a temporary steel bridge will be constructed to encase and extend over the existing bridge. This temporary steel bridge would span approximately 60 feet and be approximately 24 feet wide to accommodate two lanes of traffic. This involves County funding. After another temporary steel bridge and roadway is completed *mauka* (inland) of the existing culverts as a detour route, the initial temporary steel bridge would be removed. Subsequently Kūlanihāko‘i Bridge will be removed and replaced with six new culverts, each 6 feet wide and 4 feet high with inlet and outlet wing walls constructed of concrete. This would involve both Federal and County funding. |
| **Project Acreage** | Approximately 0.9 acres |





| | |
|---|---|
| **Area of Potential Effect (APE)** | The APE is defined as the immediate area of ground disturbance. In this instance the APE consists of the entire project area, approximately 0.35 ha (0.9 acres). This includes the proposed detour bridge, the temporary support structure, and the replacement of the existing bridge. |
| **Historic Preservation Regulatory Context** | The project area is subject to Hawai‘i State environmental and historic preservation review legislation [Hawai‘i Revised Statutes (HRS) 6E-8/ Hawai‘i Administrative Rules (HAR) Chapter 13-13-276 respectively]. As a project with FHWA funding National Historic Preservation Act (NHPA) Section 106 and Department of Transportation Act Section 4(F) also apply. |
| **Fieldwork Effort** | The fieldwork, accomplished by Hallett H. Hammatt, Ph.D., Todd D. McCurdy, M.A., and Jonas Madeus, B.A., took 3 person-days to complete. |
| **Historic Properties Identified** | SIHP (50-50-10-): 7606<br>Site Type: Bridge<br>Function: Transportation<br>Age: Historic<br>Significance Criteria: D |
| **Effect Recommendation** | An architectural review of SIHP 50-50-10-7606 was conducted in December of 2012 by the Architectural Branch of SHPD (LOG: 2012.3734 DOC: 1212RS64) based on the Literature Review and Field Inspection (Medeiros et al. 2012). It was concluded that although the bridge does represent the first generation if concrete bridges in Hawai‘i, it has since lost any distinguishing architectural characteristics. A determination of no effect on historic property was recommended.<br>While sub-surface testing was not completed by CSH beneath S. Kihei road, boring logs from the Geotechnical report completed by Geolabs Inc. (Kwock 2012), recorded the presence of coralline sand around 3.7 m (12 ft) below the surface of the road. The presence of this type of sediment deposit may present the potential for encountering sensitive cultural resources in a sub-surface context. In addition the subsurface testing for traditional fishpond deposits was limited to 3m (10 ft) below the ground surface. Therefore, any sub-surface excavation exceeding 3 m (10) feet or containing coralline sand and the culvert removal should be monitored by a qualified archaeologist. |

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# Section 1 Introduction

## 1.1 Project Background

The County of Maui Department of Public Works (County) has proposed to replace the deteriorating Kūlanihāko‘i Bridge. The project area was located along South Kīhei Road between the Aston Maui Lu Resort and the Kihei Bay Vista Condominium in the Ka‘ono‘ulu Ahupua‘a, Kula District, Maui Island, TMK:(2) 3-9-001: 999, 162, 143 (pors.) (Figure 1 and Figure 2). The APE is defined as the immediate area of ground disturbance. In this instance the APE consists of the entire project area, approximately 0.35 ha (0.9 acres). This includes the proposed detour bridge, the temporary support structure, and the replacement of the existing bridge.

The existing bridge consists of four reinforced concrete box culverts. Each cell is 6 feet wide and 4 feet high by 38 feet long. A March 2012 bridge inspection report notes that there is severe spalling and advanced corrosion of the reinforcing of the top slab of the culvert. The report recommended that immediate repairs or shoring of the top slab be implemented. The county plans on completely replacing Kūlanihāko‘i Bridge which would involve an extensive and time-consuming permitting process involving Federal, State and County wetland and shoreline issues.

In order to address immediate safety concerns a temporary steel bridge will be constructed to encase and extend over the existing bridge. This temporary steel bridge would span approximately 60 feet and be approximately 24 feet wide to accommodate two lanes of traffic.

After another temporary steel bridge and roadway is completed *mauka* (inland) of the existing culverts as a detour route, the initial temporary steel bridge would be removed (Figure 3). Subsequently Kūlanihāko‘i Bridge will be replaced with six new culverts, each 6 feet wide and 4 feet high with inlet and outlet wing walls constructed of concrete (Figure 4). Ground disturbance activities for this project will include grubbing, grading and trench excavation associated with temporary bridge and culvert construction.

During a field visit o n December 13, 2012 with Theresa Donham (Archaeology Branch Chief) an AIS of the lands covering the extent of the APE of the proposed detour bridge was recommended. The primary focus of the AIS would be to address concerns of sub-surface traditional Hawaiian fishpond deposits within the APE through sub-surface testing/coring. Between May 9 and 10, 2013 Cultural Surveys Hawai‘i, Inc. (CSH) complete the archaeological inventory survey (AIS) for the proposed Kūlanihāko‘i Bridge Replacement Project. The investigation was conducted at the request of Wilson Okamoto Corporation and on behalf of the Maui County Department of Public Works.

This would involve both Federal and County funding. As such, the project area is subject to Hawai‘i State environmental and historic preservation review legislation [Hawai‘i Revised Statutes (HRS) 6E-8/ Hawai‘i Administrative Rules (HAR) Chapter 13-13-276 respectively]. As a project with FHWA funding National Historic Preservation Act (NHPA) Section 106 and Department of Transportation Act Section 4(F) also apply.

## 1.2 Scope of Work

The provisions of the AIS were defined during the above mentioned field visit with SHPD archaeologists (Theresa Donham, personal communication December 13, 2012).

The following archaeological inventory survey scope of work is designed to satisfy the Hawai‘i state requirements for archaeological inventory surveys (Hawai‘i Administrative Rules [HAR] Chapter 13-276 and Chapter 13-275/284):

1) Historic and archaeological background research, including a search of historic maps, written records, Land Commission Award documents, and the reports from prior archaeological investigations. This research will focus on the specific project area’s past land use, with general background on the pre-contact and historic settlement patterns of the *ahupua‘a* and district. This background information will be used to compile a predictive model for the types and locations of historic properties that could be expected within the project area.
2) A complete (100 %) systematic pedestrian inspection of the project area to identify any potential surface historic properties. Surface historic properties will be recorded with an evaluation of age, function, interrelationships, and significance. Documentation will include photographs, scale drawings, and, if warranted, limited controlled excavation of select sites and/or features. In addition to sub-surface testing and core sampling to retrieve paleoenvironmental data. The fieldwork should comply with Hawai‘i Administrative Rules [HAR] Chapter 13-275 and 36 CFR Part 800 respectively.
3) As appropriate, consultation with knowledgeable individuals regarding the project area’s history, past land use, and the function and age of the historic properties documented within the project area.
4) As appropriate, laboratory work to process and gather relevant environmental and/or archaeological information from collected samples to determine if any deposits indicative of a traditional fishpond were present within the project area
5) Preparation of an inventory survey report, which will include the following:
   a) A project description;
   b) A section of a USGS topographic map showing the project area boundaries and the location of all recorded historic properties;
   c) Historical and archaeological background sections summarizing prehistoric and historic land use of the project area and its vicinity;
   d) Descriptions of all historic properties, including selected photographs, scale drawings, and discussions of age, function, laboratory results, and significance, per the requirements of HAR 13-276. Each historic property will be assigned a Hawai‘i State Inventory of Historic Properties number;
   e) A summary of historic property categories, integrity, and significance based upon the Hawai‘i Register of Historic Places criteria;
   f) A project effect recommendation;
   g) Treatment recommendations to mitigate the project’s adverse effect on any historic properties identified in the project area that are recommended eligible to the Hawai‘i Register of Historic Places.





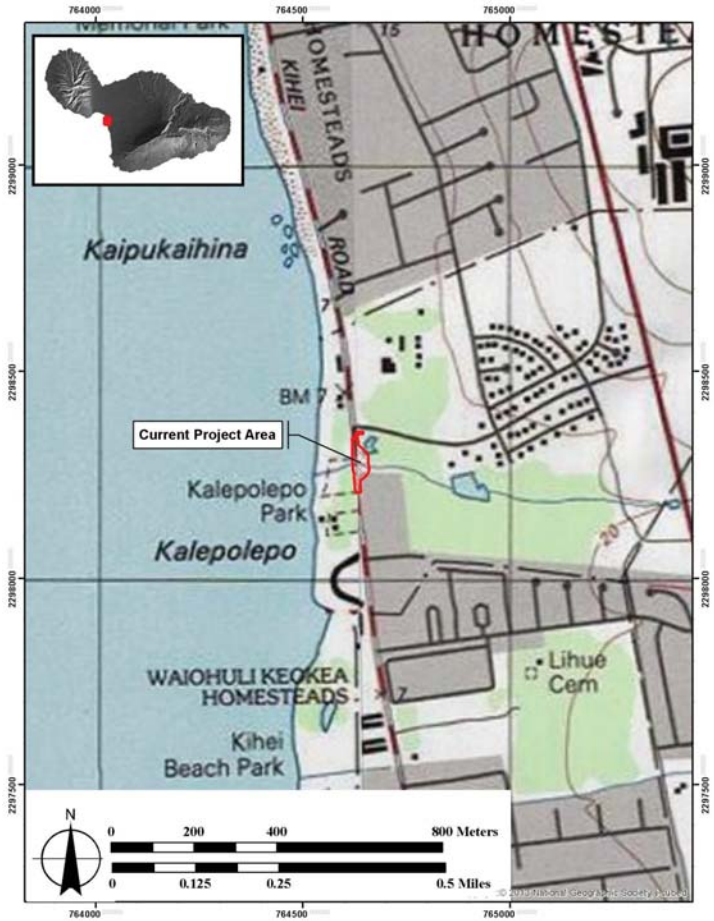



Figure 1. Mā‘alaea (1996) and Pu‘u O Kali (1992) 7.5 minute USGS topographic quadrangles showing project area, project area outlined in red.

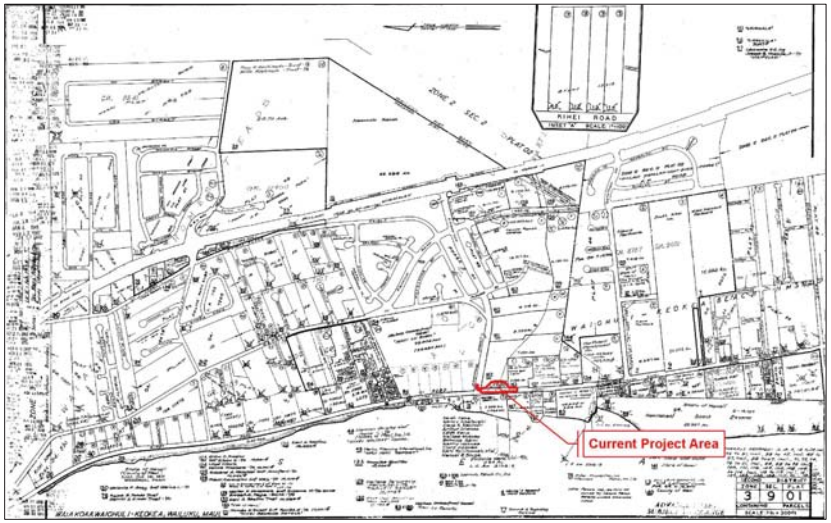



Figure 2. TMK showing (2) 3-9-01, Kūlanihāko‘i Bridge replacement project area outlined in red.





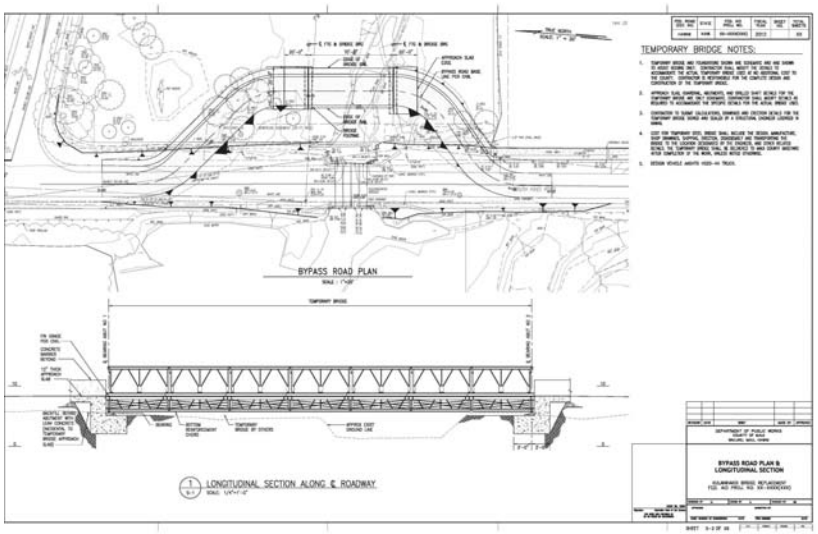



Figure 3. Construction plans showing the proposed temporary bridge (figure courtesy of Wilson Okamoto Corporation).

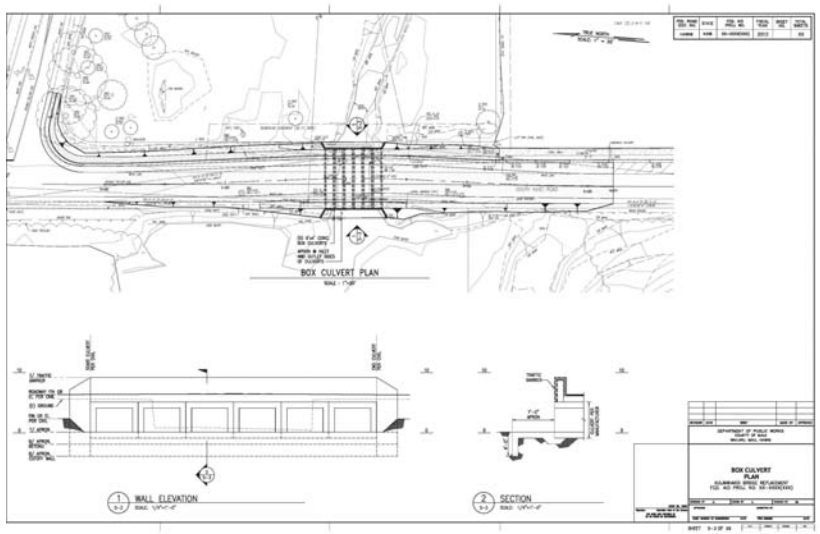



Figure 4. Construction plans showing the proposed permanent bridge (figure courtesy of Wilson Okamoto Corporation).





## 1.3 Environmental Setting

### 1.3.1 Natural Environment

Located on the leeward facing slopes of Haleakalā, the current project area is adjacent to the Kīhei coastline at mean sea level (Figure 5). The overall topography of the lands comprising the Kūlanihāko‘i Bridge project area is flat to gently sloping, on arid lands composed chiefly of alluvium covered in dune sands drained between the Waiakoa and Waiohuli Gulches. The mouth of the Kūlanihāko‘i Gulch makes up the study area. The main soils within the project area are of the Pūlehu-‘Ewa-Jaucas association. This soil association is mainly found in alluvial fans and in the basins of central Maui. The specific soils of the lands surrounding the project area include those of the Kealia Soil Series (KMW soil units), which include Dune Land (DL), Beach Sand (BS), ‘Alae (Aab soil units), and Jaucas sand (JcC), while the soil series within the project area are predominantly Kealia Silt Loam (KMW) and Dune Land (DL) (Figure 6).

The Kealia Soil Series consists of somewhat poorly drained soils on the coastal flats. The upland portion of the Kealia Series is influenced more by the presence of volcanic ash and was developed from material weathered from basic igneous rock (Foote et al. 1972:12). Keālia soils are geographically associated with Pūlehu, Mala -and Jaucas soils, which are used for wildlife, pasture and urban development (Foote et al. 1972:67). The Jaucas Soil Series is characterized by excessively drained, calcareous soils of the coastal area next to the ocean (Foote et al. 1972:48). These soils are developed from coral and shells deposited by wind and wave action. They are level to strongly sloping

Rainfall accumulation within the project area averages less than 15 to 19 inches annually with the heaviest rainfall occurring during the winter months (December through February) and little to no rainfall during the summer months (June through August(Giambelluca et al. 1986; Stearns and MacDonald 1942). This pattern of rainfall and low annual precipitation rate may have once sustained a lowland, dry shrub land, and grassland native ecosystem (Pratt and Gon 1998). The majority of the landscape within the project area, however, has been modified by historic era ranching activities and modern development. Vegetation within the project area consisted of both typical wetland plant species and other introduced plants including *akulikuli* (*Sesuvium portulacastrum*), *kiawe* trees (*Prosopis pallida*), *akiaki* (*Sporobolus virginicus*), *milo* (*Thespesia populnea*) *naupaka* (*Scaevola taccada*), and *pōhinahina* (*Vitex rotundifolia*).

Figure 5 Overview of the current project area facing west.





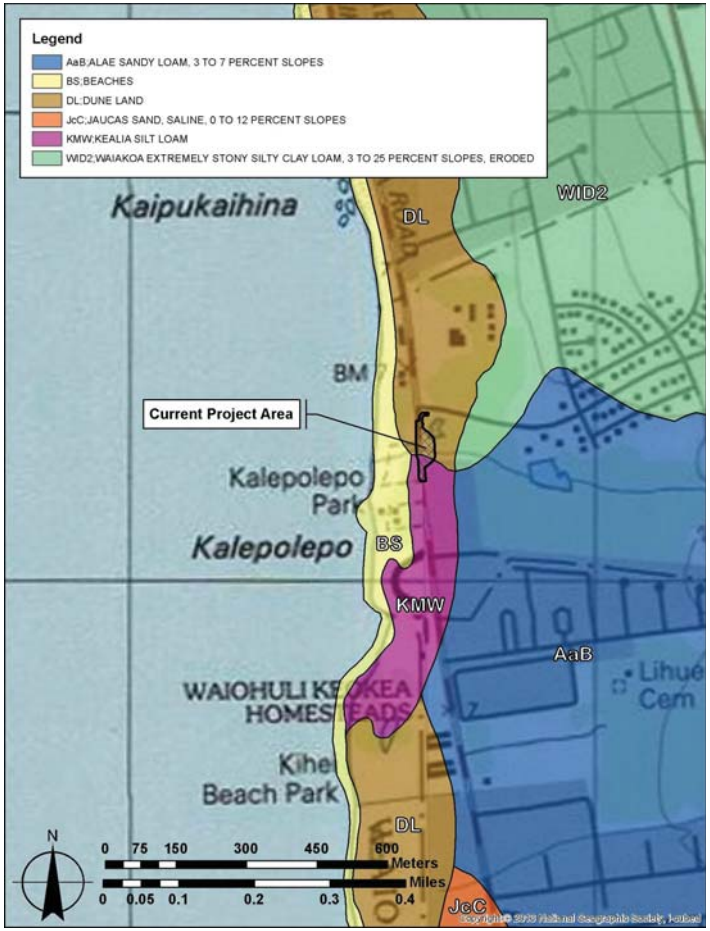



Figure 6. Mā‘alaea (1996) and Pu‘u O Kali (1992) 7.5 minute USGS topographic quadrangles showing the soils of the current project and surrounding area.

### 1.3.2 Built Environment

The project area is located along South Kīhei Road at Kūlanihāko‘i Gulch approximately 61 m (200 ft) south of the intersection with Kaonoulu St. Kalepolepo Park, the Kihei Bay Vista condominium, and the Pacific Whale Foundation visitor center are located to the south and the ASTON Maui Lu Resort is located to the northeast of the project area. The surrounding area has been built up and includes several large condominium developments including the Villas at Kenolio, located inland and east of the project area.

Figure 7. Google Earth (2011) aerial image showing project area location in relation to the surrounding built environment.





# Section 2 Methods

This section details the methods used by CSH personnel during fieldwork and the preparation of this document. CSH completed the AIS under state archaeological permit No. 13-06 issued by the SHPD, per Hawai‘i Administrative Rules (HAR) Chapter 13-13-282 and the AIS was conducted in compliance with HAR Chapter 13-276.

## 2.1 Field Methods

### 2.1.1 Pedestrian Survey

A 100 % pedestrian survey of the entire project area was undertaken for the purpose of historic property identification and documentation. The following methods were used to complete the pedestrian inspection of the current project area:

1. The boundary of the project area was identified and maintained during the course of the pedestrian survey using a Garmin GPSMap 60CSx handheld GPS unit with the project area data uploaded and visible on the map screen;
2. The pedestrian inspection of the study area was accomplished through systematic transects at 5 meter (16 ft) intervals oriented north to south, parallel to the long axis of the study area.

### 2.1.2 Subsurface Testing

Prior to the investigation the Geotechnical Engineering Exploration of the Kulanihakoi Bridge Replacement report from GEOLABS, Inc., (Kwock 2012) was reviewed. The available samples Geolabs, Inc., collected were also examined at their Wailuku facility.

Due to the sandy/wet nature of the soils A "pipe coring" method was used to collect columns for analysis. A shovel test was first hand excavated into the recent alluvium/fill and sifted through a 0.3 cm (0.125 inch) mesh. Once the underlying sediment was exposed a 1.5 m (5 foot) length of 2 in (5 cm) diameter PCV pipe was for driven into the ground to collect samples of the sediment (Figure 8). Subsequently the pipe was capped, removed and taken back to the CSH Wailuku lab. All sub-surface excavations were recorded with a Trimble Pro XH GPS unit and post-processed to sub-meter accuracy. In addition, the topography southern portion of the project area was recorded with a Sokkia Set IIB2 total station for accurate elevations.

## 2.2 Laboratory Methods

Sediment samples collected in the field were brought back to the CSH lab for preparation and submittal for pollen analysis. Two sample, from Pipe Core 1 was submitted to the Paleo Research Institute in Golden, Colorado. No cultural materials (midden, charcoal, or artifacts) were observed or collected during this investigation.

Due to the highly organic nature of these samples, the normal chemical extraction technique was modified. Approximately 1.25 cubic centimeters (cc) of organic-rich sediment was selected for each sample, which received a small amount of hydrochloric acid (10%) to remove any calcium carbonates present in the soil. Next the samples were screened through 250-micron mesh. The samples were allowed to settle for 2 hours, after which the supernatant was poured off and the samples were

transferred to 50 ml tubes. The samples then received a 30 minute treatment in hot hydrofluoric (HF) acid to remove inorganic particles. The samples were acetylated for 5 minutes to remove extraneous, non-pollen organic matter.

A light microscope was used to count pollen at a magnification of 500x. Pollen preservation in these samples varied from good to poor. Comparative reference material collected at the Intermountain Herbarium at Utah State University, the University of Colorado Herbarium, and the Bishop Museum Herbarium was used to identify the pollen to the family, genus, and species level, where possible.

Pollen aggregates were recorded during identification of the pollen. Aggregates are clumps of a single type of pollen and may be interpreted to represent either pollen dispersal over short distances or the introduction of portions of the plant represented into an archaeological setting. The aggregates were included in the pollen counts as single grains, as is customary. The presence of aggregates is noted by an "A" next to the pollen frequency on the percentage pollen diagram. The percentage pollen diagram was produced using Tilia 2.0 and TGView 2.0.2. Total pollen concentrations were calculated in Tilia using the quantity of sample processed in cubic centimeters (cc), the quantity of exotics (spores) added to the sample, the quantity of exotics counted, and the total pollen counted and expressed as pollen per cc of sediment.

“Indeterminate” pollen includes pollen grains that are folded, mutilated, or otherwise distorted[ beyond recognition. These grains were included in the total pollen count since they are part of the pollen record. A more detailed explanation of the methods employed during the laboratory analysis is available in the pollen analysis report, (Appendix A)(Cummings 2013:1).

## 2.3 Document Review

A variety of resources devoted to historical perspectives of the region and traditional stories and accounts were reviewed. Research venues included the Hawai‘i State Historic Preservation Division of the Department of Land and Natural Resources and the Survey Office of the Department of Accounting and General Services. All relevant Land Commission Awards (LCAs) and Royal Patents were researched using resources associated with the Waihona ‘Aina online database (Waihona ‘Aina 2002).

Figure 8. Driving the Pipe Core 1 into the sediment, view to the east.

# Section 3 Background Research

## 3.1 Traditional and Historical Background

The division of Maui’s lands into political districts occurred during the rule of Kaka‘alaneo, under the direction of his *kahuna*, Kalaiha‘ōhi‘a (Beckwith 1970:383). This division resulted in twelve districts or *moku* during traditional times: Honua‘ula, Kahikinui, Kaupō, Kīpahulu, Hāna, Ko‘olau, Hāmākua Loa, Hāmākua Poko, Ka‘anapali, Lahaina, and Kula. The current project area is located on the leeward flank of Haleakalā in the *moku* of Kula and in the *ahupua‘a* of Ka‘ono‘ulu (Figure 9) along the shoreline at Kīhei.

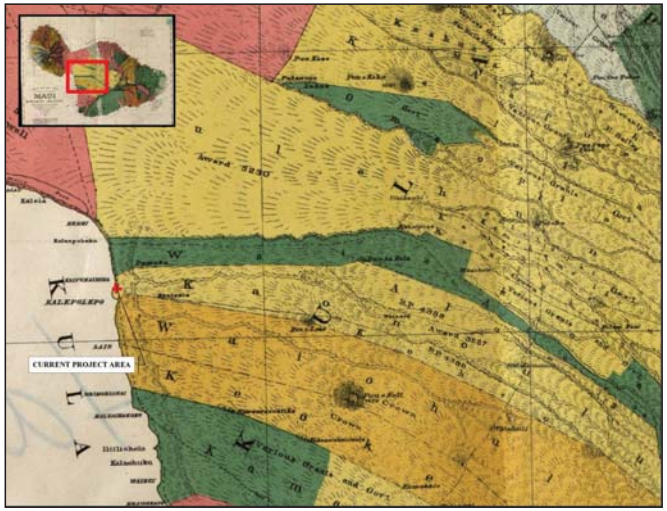



Figure 9. A portion of the F.S Dodge map (1885) showing Ka‘ono‘ulu Ahupua‘a in relation to the traditional *moku* of Kula (crown lands in yellow, government lands in green).

### 3.1.1 Mythological and Traditional Accounts

While the mythological and traditional accounts of the Kīhei area are relatively scarce, an analysis of the place name meanings for the region surrounding the project area may yield some insight into the patterns of life in an area. Literal translations of several of the place names for land





areas and divisions near to the project area are listed below. Unless otherwise noted, the translations are taken from Pukui et al. (1974):

Table 1. Place Names in the vicinity of Kalepolepo.

| | |
|---|---|
| Akolea | A species of fern (*Polypodium keraudreniana*) traditionally known to have grown in plentiful quantities at Kalepolepo, according to Fornander (see Kama‘oma‘o below). Handy states that the region was known to support only the sweet potato (Handy 1991:511). |
| Alakoa | Lit., “soldiers’ street.” |
| Kaipukai Hina | Lit., Hina’s meat dish.” Name given to the coastal region just north of the present-day “Gordon Gibson monument to Vancouver,” which is seaward at a promontory fronting the Maui Lu Resort property. |
| Kalaepōhaku | Lit., “the stone promontory,” located south of the Kīhei Landing pier. A rocky promontory which is a boundary marker in North Kīhei. |
| Kale‘ia | Lit., “the abundance”, possibly in reference to the resources available from the fishponds and offshore fishing grounds at Mā‘alaea. |
| Kalepolepo | Lit., “the dirt.” According to Fornander, Kalepolepo was known as the seaward extremity of the plain of Kama‘oma‘o. In Fornander’s “The Legend of Kekuhaupio,” the story’s pivotal battle occurs at the edge of Kama‘oma‘o, at Kalepolepo (Fornander 1919:456). Again, in Fornander’s “A Story of Puupehe,” a battle is fought at the edge of the plains of Kama‘oma‘o at Kalepolepo. |
| Kaluaihākōkō (Point) | *Lit.*, the pit [for] wrestling. Hākōkō is said to have been the name of a chief. A coastal promontory at the Kalama Park area of Kīhei. |
| Kalepeamoa | *Lit.*, “the comb [acquired] by [a] chicken. The crest of Haleakalā’s southwest rift zone, where the eastern boundary line of Ka‘ono‘ulu Ahupua‘a terminates and returns west to the shoreline of Kīhei along its boundary with Waiohuli Ahupua‘a. |
| Kama‘oma‘o | Lit., “the greenness.” Plain near Kalepolepo, where, according to Fornander, the large pond of Keālia is located. In Fornander’s “A Story of Puupehe, two prophets, Pueonuiokona and Pumaia fought over the fate of spirits of the dead who were destined to wander across the isthmus of Maui. The battle took place at Kalepolepo, near Keālia Pond. Pumaia was killed by the owl, Pueonuiokona, who disemboweled Pumaia and spread his remains across the *akolea*, a species of fern (*Polypodium keraudreniana*) once found on the arid plains of Kama‘oma‘o (Fornander 1919:554). |
| Ka‘ono‘ulu | Lit., “the desire [for] breadfruit.” Ahupua‘a land division in the Kula District of Maui, with a land area of 5,715 acres. The eastern |

| | |
|---|---|
| | boundary of this *ahupua‘a* terminates at a point named Kalepeamoa before running west back to the shoreline of Kīhei |
| Ka‘ōpala | literally “the rubbish”; the traditional boundary line between Pūlehu Nui Ahupua‘a and Waikapū Ahupua‘a |
| Kawililipoa | Kawililipoa is an *‘ili* of Kama‘ole Ahupua‘a, cited by Stokes in 1918 as the site of three *heiau* south of Kalepolepo (See Section 4.3, Previous Archaeological Research). |
| Ka‘ie‘ie | “a plaything for floating in the rapids”, an ancient name for Kalepolepo (Sterling 1998:252) |
| Keālia | literally “salt encrustation”; a pond near Kīhei and major salt pan location (Sterling 1998:95) |
| Keāhuaiwi | literally “the bone pile”; the name of a gulch immediately adjacent to and north of Waiakoa Gulch in North Kīhei |
| Kenolio | Prominent South Maui family name. |
| Kīhei | literally “cape or cloak”; sandy point and boundary marker between Pūlehu Nui and Waikapū (Sterling 1998:255); commonly used place name for the coastal south Maui area |
| Kīheipūko‘a | *kīhei* literally translates as “cape or cloak” and *pūko‘a* literally translates as “coral head”; Kīheipūko‘a was a traditional place-name for the shoreline near Keālia between Kalepolepo and Mā‘alaea (Sterling 1998:257) |
| Kikaupōhaku | Lit., “rock of Kikau.” In the traditional story of the building of the Kalepolepo pond walls by Wilcox, Kikau’s rock was placed at the northwest corner of the fish pond wall by *na menehune*. |
| Kohemālamalama | *Lit.,* “the vagina”; also the ancient name for the island of Kaho‘olawe, an island located approximately six miles southwest of the Kīhei coastline. |
| Kula (*moku*) | literally translated as "plain"; traditionally known as an arid flat region (Handy in Sterling 1995:242) |
| Kūlanihāko‘i | *Lit.,* “agitated heaven that stands.” Named for a mythical floating land in the sky. |
| Waiakoa | *Lit.,* “water (used) by warrior.” |
| Pohaku Ki‘i | “tilted stone”; a resting place for travelers |
| Pūlehu Nui (*ahupua‘a*) | Large *pūlehu* where *pūlehu* is literally translated as “broiled” |





The above place names, together with the environmental data, suggest that the lands of and surrounding coastal Ka‘ono‘ulu were fairly dry and barren in an agricultural sense but rich in marine resources. Previous research on pre-Contact settlement in the Kula District (Kolb et al. 1997) has suggested that most permanent habitations were in the uplands with a smaller permanent population located along the coastline. While a reconstruction of the coastal and archaeological landscape of Kula Moku underscores the importance of the uplands as a focus of agriculture and habitation, Hawaiian traditions and the presence of four fishponds are evidence that the coastal environs were also a focus of settlement and marine exploitation. The relative scarcity of recorded coastal place names, however, may be an indication of a smaller population that was widely spread out across the leeward coastal line. The vicinity surrounding the current project area was also a site of conflict between the Hawai‘i Island chief Kalaniopu‘u and Maui Island chief Kahekili and is perhaps the origin for such place names as “Waiakoa” and “Keāhuaiwi”.

Note that many of the place names are associated with regional shoreline fishponds. Kalepolepo Fishpond (also named Ka‘ono‘ulu Kai and Ko‘ie‘ie) is located along the shoreline of Ka'ono'ulu Ahupua'a, within the traditional district of Kula, Island of Maui. The *ahupua‘a* of Ka‘ono‘ulu is one of six major Kula land divisions which extend from the Ocean to the upper reaches of Haleakalā. Ka‘ono‘ulu is situated near the center of the Kula District, with Pūlehu Nui and Waiakoa to the north and Waiohuli, Kēōkea and Kama'ole to the south. Ka‘ono‘ulu is approximately 0.4 mile wide at the shoreline, and 0.7 mile wide at Kalepamoa (9,000 ft AMSL). The *ahupua‘a* has a maximum width of one mile, which occurs at 800 ft AMSL. Kalepolepo Pond is at the southern boundary of the *ahupua‘a* (Donham 1996:1).

### 3.1.2 Traditional Accounts

The earliest account concerning Kīhei and Hawaiian politics is given by Kamakau (1991) during the time of Alapa‘i and Kekaulike:

> Alapa‘i sailed from Kohala on Hawai‘i...But when he landed at Mokulau in Kaupō (Maui) and heard that Ke-kau-like was dying, he gave up all thought of war and wished only to meet Ke-kau-like and his (half) sister Ke-ku‘i-apo-iwa-nui...He landed at Kīheipuko‘a with all his chiefs and fighting men...While he was at Kīhei, Alapa‘i heard that the ruling chief of Oahu was making war upon Molokai. Most of the chiefs of Moloka‘i...were of Hawai‘i...Alapa‘i's sympathy was aroused, for these were his own brothers and children (relatives), and he made ready to go to their help on Moloka‘i (Kamakau 1991:70).

Other accounts involve the continuing conflict between Kahekili of Maui Island and Kalani‘opu‘u of Hawai‘i Island during the late 18th century. Following a losing battle at Kaupō in 1775, Kalani‘opu‘u dedicated several war *heiau* on Hawai‘i Island to aid in the defeat of Kahekili. Upon hearing this news Kahekili sent for the *kahuna* (priest) Kaleopu‘upu‘u who directed construction of the *heiau* of Kaluli and Pu‘uohala on the north side of Wailuku. When Kaluli Heiau was completed Kaleopu‘upu‘u said to Kahekili:

> This is the house of your god; open the sluice gate that the fish may enter (Kamakau 1991:85).

In the year 1776, the army of Kalani‘opu‘u landed at Keoneo‘o‘io with their war canoes extending to Makena at Honua‘ula and proceeded to ravage the countryside. Kalani‘opu‘u landed with his

Alapa regiment at Kīheipūko’a at Keālia to Kapa‘ahu, 800 strong and eager to drink the waters of Wailuku:

> Across the plains of Pu‘u‘ainako (Cane-trash-hill) and Kama‘oma‘o shone the feather cloaks of the soldiers … Ka-hekili was at Kalanihale just below Kihahale and above the plateau of Ka‘ilipoe at Pohakuaokahi … Kaleopu‘upu‘u [said] to Ka-hekili, “The fish have entered the sluice; draw in the net.” (Kamakau 1991:85)

The forces of Kahekili descended on and destroyed the soldiers of Kalani‘opu‘u, slaying the Alapa (elite soldiers of Kalani‘opu‘u) on the sandhills at the southeast of Kalua [an area close to the present-day Waikapū, according to the accounts]. Only two men escaped to Kīheipūko‘a to tell Kalani‘opu‘u the news of their defeat. After a second day of warfare, Kalani‘opu‘u sued for peace and was granted such by Kahekili and his messengers at Kīheipūko‘a (Kamakau 1991:88-89).

Fornander (1880) notes that Kalaniopu‘u, a ruling chief of Hawai‘i, was temporarily at Kalepolepo in the 1750’s (Fornander 1880:142).

Fornander’s traditional accounts for the portion of Kīhei including Kalepolepo and plains of Kama‘oma‘o at the edge of Keālia Pond includes “A Story of Puupehe,” about two prophets, Pueonuiokona and Pumaia who fought each other over the fate of sprits of the dead who were said to wander across the central isthmus of Maui. The battle took place at Kalepolepo, near Keālia Pond. Pumaia was killed by the owl, Pueonuiokona, who disemboweled Pumaia and spread his remains across the *akolea*, a species of fern (*Polypodium keraudreniana*) once found on the arid plains of Kama‘oma‘o in the vicinity of Keālia Pond (Fornander 1919:554).

Fornander’s account of the chief Kauholanuimahu, who resided at Honua‘ula and exercised royal authority names him as the builder of the fishpond at Keone‘o‘io (in Kalihi Ahupua‘a) (Fornander 1880:70-71). When Charles Wilcox wrote about Kalepolepo for the monthly magazine of Hawai‘i named “Paradise of the Pacific” in December, 1921, his article included the traditional story of how the race of Hawaiians known as *Na Menehune*, constructed the Kō‘ie‘ie fishpond.

> Koieie is the ancient name of Kalepolepo, and the ruined sea walls of fishponds are the hallmarks of its importance to the rulers of ancient Hawaii. When the Konohiki summoned the people of Maui to build fish ponds for the king at Kēōkea-kai, Waiohuli-kai and Kaonoulu-kai, one man, Kikau, a *kilo* [fish-spotter], protested that no such works could be completed without the help of the *Menehune*. For this Kikau was told that when the king’s ponds were completed he should be baked in the *imu*[ underground oven].
>
> In building the sea walls men were stationed in long lines, passing stones by hand from the rocky sidehills miles away to the workmen laying the courses for the walls in the sea. The trampings of so many busy feet raised much dust, and workmen throwing dust at one another prompted the konohiki to call them derisively “Kanaka o Kalepolepo eku i ka lepo,” or “Kelepolepo root in the dirt.”
>
> At the completion of the Keokea-kai pond the konohiki gave splendor to the event by riding on the capstone while it was being carried in a litter of stout poles on the shoulders of over twenty men to its resting place at the northeast corner of the pond.





> After the ceremony he summoned Kikau and asked him he thought of it, and Kikau replied that the works were still unfinished. “When the last stone of the last pond is laid your life shall be forfeited,” replied the konohiki.
>
> The completion of the sea walls of the Waiohuli Pond was marked by a similar ceremony, and two heavy boulders were carried on separate litters from the quarry a mile away to the northwest corner of the pond. The konohiki rode on the larger of the two capstones and, on the other, his wife was carried ahead of him, both dressed in the costume of their rank, attended by kahili-bearers and kaukaus [warrior chiefs] chanting meles.
>
> As the seawalls of the Kaonoulu pond neared completion a block of lava fully a ton in weight was selected for the capstone and forty men put their shoulders to the litter of stout poles and waited. The konohiki mounted the ceremonial stone dressed in his war cloak and gave the word. With kahilis waving and kaukaus reciting the glories of his *mele-inoa*, the rock was lifted and the procession moved. When but a third of the distance had been covered the litter broke down, the big stone fell to the earth, and the konohiki was thrown to the ground and fell sprawling, face down in the dirt.
>
> That night a great storm arose – rain, wind, hail, thunder and lightning and an earthquake and heavy storm waves from the sea, with a flood of red waters from the hillsides, spent its fury on Kalepolepo. In the midst of the storm the elves or *eepa*, birth brothers of Kikau, gathered, and each lightning flash revealed the host of elves busily tearing down the seawalls, undoing the work of the konohiki, so that Kikau might not die.
>
> In the morning the storm had passed – and the seawalls of the ponds built with so much labor were seen to have been torn down, and the heavy boulder last ridden by the konohiki which, when set in place, meant the completion of the work, had disappeared.
>
> Again the people were summoned to rebuild the ruined fishponds, only to have the final ceremony end with an accident. Another storm came up, a swarm of elves at night, and the whole work mysteriously undone as before.
>
> The konohiki acknowledged his fault and offered to be guided by Kikau in rebuilding the ruined ponds which must be completed or his own life would be forfeited to the king. Kikau told him to summon the people of Koolau to bring opae and the people of Wailuku to bring baby taro or taro shoots (hā kalo)in great quantities and when this was done Kikau would invoke his aumakuas [guardian spirits] to summon the menehunes to do the work.
>
> When these supplies were brought in, the taro cooked and the opae laid in the ti-leaves, Kikau advised the konohiki to proclaim a tabu of silence for the people to remain silent and stay indoors; that no pig be allowed to squeal, no dog to bark, no rooster to crow, on that particular night – and so it was proclaimed.

> That evening the first signs of the bestirring of the menehunes were seen in the rising of spirals of red dust from afar off – from the uplands – as they came trooping to the lower lands there were swirling clouds of red dust to the north and east of Koieie (former name of Kalepolepo).
>
> In no time (manawa ole) the ruined walls of the ponds were rebuilt and then, to mark the completion of their work, they fell to the final task of laying, in a select spot at the northwest corner of Kalepolepo pond, the huge boulder now known as Kikaupohaku.

One of several fishponds along the coast of Kīhei, Kō‘ie‘ie Fishpond was one of the most important ones on Maui according to tradition (Kolb et al. 1997:60). The original builder of Kō‘ie‘ie Fishpond is not known but it is believed to have been rebuilt at least three times based on traditional accounts. The first time was during the reign of King Kihapi‘ilani (Kolb et al. 1997:62). Kō‘ie‘ie is the ancient name of Kalepolepo. According to Wilcox (1921:67) upon completion of Kō‘ie‘ie Fishpond the *konohiki* was thrown to the ground when the litters carrying the capstone broke. The workers said "*Ua konohika Kalepolepo, ua eku i ka lepo,*". It translates "the manager of Kalepolepo, one who roots in dirt". The fishpond and region have since been referred to as Kalepolepo.

Both of the fishponds located in the vicinity of the project area are listed on the State Inventory of Historic Places (Figure 10). The Kō‘ie‘ie Fishpond (SIHP 50-50-09-1288), adjacent to Kalepolepo Park is the smallest of the fishponds in this region of Kīhei. The Waiohuli Kai Fishpond is just south of Kō‘ie‘ie Fishpond, is submerged and listed as SIHP 50-50-09-1704. Kikuchi in 1973 performed a study of fishponds which categorized the Kō‘ie‘ie Fishpond as a Type I, Loko Kuipā type, or a “fishpond of littoral water whose side or sides facing the sea consist of a stone or coral wall usually containing one or more sluice gates” (Kikuchi 1976:37).

### 3.1.3 Early Historic Period

Kīhei was one of the locations visited by the English explorer Captain George Vancouver. A monument at Mai Poina ‘Oe Ia‘u Beach Park in Kīhei commemorates Vancouver's on-shore expedition in 1792, when he first met the ruling chief Kahekili. With its sheltered coastline and easy access to upcountry resources over a vast slope, Kīhei would continue to be a common stop for visiting ships. In 1841, Wilkes commented, “At Malaea [Mā‘alaea] Bay there is good anchorage for vessels of any size, and a fine fishery” (Wilkes 1845).





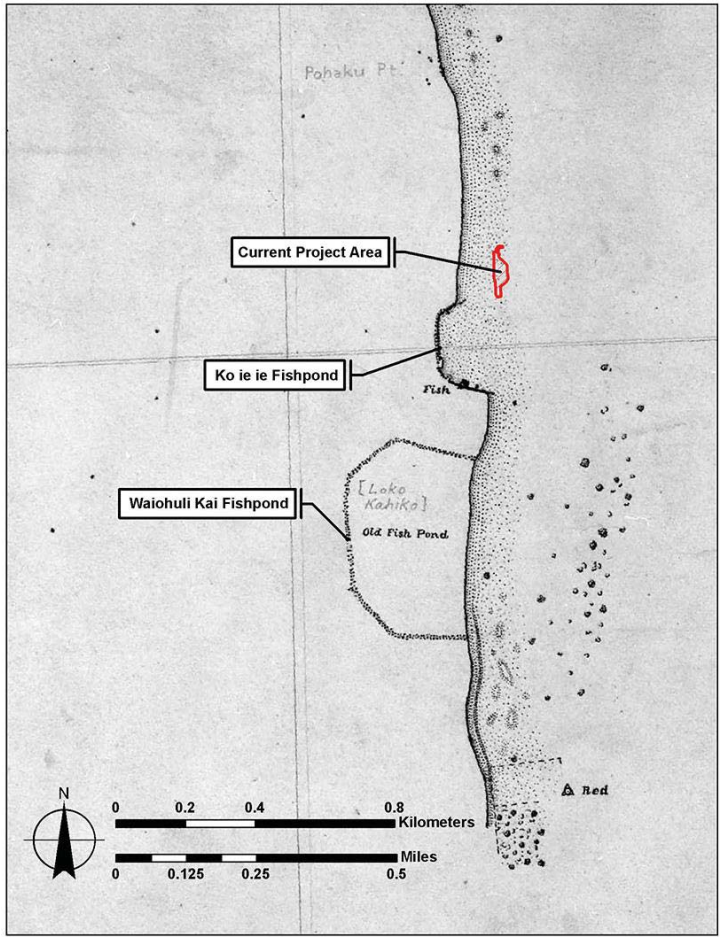



Figure 10. The current project location on a portion of a 1900 Mā‘alaea Harbor showing the nearby fishponds (Frisby 1900).

During the early and middle 1800s, the Hawaiian demography was affected by two dramatic factors: radical depopulation resulting from Western disease; and nucleation around the developing port towns. The traditionally Hawaiian population was largely dispersed and, although there were royal centers and areas of more concentrated population, these areas never came close to rivaling the populations of the historic port towns that developed on Hawai‘i’s shorelines during the 1800s. In this regard, Kuykendall (1938:313) notes that in the period from 1830 to 1854:

> The commercial development during this period, by magnifying the importance of a few ports, gave momentum and direction to a townward drift of population; the population of the kingdom as a whole was steadily going down, but the population of Honolulu, Lahaina and Hilo was growing.

We believe that Kuykendall’s observation was most likely the demographic pattern at the Kalepolepo entrepot, an area that may have included the project area when it existed, and a hub of early historic activity for Kīhei and eventually all of Kula Moku (Kolb et al. 1997:69). The development of Kalepolepo as an entrepot and a focus of Christian life in the 1840s and 1850s most likely increased the population in the immediate vicinity above the pre-Contact population figures, contrary to the island-wide trend of depopulation.

On the 2nd of September [1853], David Malo was ordained pastor of the church at Keokea, Kula. The church at Kalepolepo became his outstation, where he spent a great deal of time.

Malo’s father had been connected to Kamehameha’s court and army. Malo was born in Keahou, in the northern part of the Kona district (Island of Hawai‘i) in 1795. In his youth Malo was part of the entourage of Kuakini, brother of Queen Ka‘ahumanu. Malo then became the pupil of ‘Auwae, Kamehameha’s bard, genealogist and ritual expert. Malo then studied at Lahainaluna when it opened in 1831. Malo authored a cultural history of Hawai‘i about 1840 to assist missionary Lorrin Andrews with his research on developing a dictionary and a grammar for the Hawaiian language; Malo’s *Moolelo Hawaii* was translated by Nathaniel B. Emerson (Malo 1951) and published (Valeri 1985:xxv).

That the population and areal extent of the Kalepolepo community reached its zenith during the mid 1800's appears to be supported by Kolb (*et al*. 1997:68):

> The ancient village of Kalepolepo was relatively small, and was built around an economy primarily based upon the exploitation of ocean resources--primarily the excellent fishing grounds as well as three large fishponds. However, as the number of visiting ships increased, Kalepolepo soon became an important provisioning area. By 1850 we know that the economic opportunities were attracting a number of European entrepreneurs.

In 1820, the whaling industry was introduced in Hawai‘i. Although the whaling trade centered on Lahaina, mainly affecting the Kula/Kīhei area through agricultural demands, Clark (1980:47) notes that "From the 1840s to the 1860s a small whaling station was maintained at Kalepolepo [Kīhei]." The introduction of whaling to the Maui community brought with it an increased demand for foodstuffs and in particular the long-lasting Irish potato. After 1830, dryland agriculture in the old Kula District expanded with a focus on Irish potato cultivation. The California Gold Rush of 1849 further intensified the demand as a California-Hawai‘i potato trade began to flourish. Kula became the area of highest potato production and was known as "the potato district" (the area





between 2000 and 5000 ft. amsl). During this time period sugar cultivation and ranching were established in the Kula region. Sugar was present prior to 1846, with six sugar producers operating on the slopes of Haleakalā (Wong Smith in Brown and Haun 1989:C-7). As Wong Smith points out (Brown and Haun 1989: C-6), ranching was present in the area prior to the 1840s. Much of the produce, sugar and livestock moved down the Kalepolepo and Kekuawaha‘ula‘ula Trails to the landing at Kalepolepo, adjacent to the project area. Donham (1992:5) notes that the inundation of land clearing and cultivation associated with the Gold Rush resulted in "deforestation [which] adversely affect[ed] the amount of rainfall in the district, and periods of drought became more common."

In the early 1850’s John Halstead built the Koa House at Kalepolepo in Kīhei. At the time Halstead was contemplating the construction of the three-story frame house, neighbors wagered that the house “would not be able to stand up to the blasts of *Kaumuku* wind which sweeps the place at times like a localized tornado. The builder went on with his work and won the wager.” Mauian Charles Wilcox wrote about the Koa House for the monthly magazine of Hawai‘i named “Paradise of the Pacific” in March, 1905:

> No one remembers the actual date of its [Koa House] construction, but the fact that King Liholiho (Kamehameha IV) visited Kalepolepo on a royal tour immediately after accession to the throne in the fall of 1854, and stayed overnight as the guest of its owner, is proof it was built before that time.
>
> John Joseph Halstead was a scion of a notable New York family of the early colonial days who….went to sea as a whaler. He came to Hawaii and left ship in Lahaina in the early thirties. He engaged in business first as a carpenter and cabinet maker for the king and later as a trader He was said to have put up the first frame house in Lahaina. While there in the king’s service he married Kauwaikikilani, a young woman of the chiefess class, being a granddaughter of Isaac Davis, commander of the royal artillery in Kamehameha’s wars of conquest.
>
> With the news of the discovery of gold in California in 1848 came orders from San Francisco merchants for Irish potatoes and other food supplies for the Argonauts who came hurrying to the new gold fields. Many whites and Hawaiians fitted out and left Lahaina for the new El Dorado but Mr. Halstead did not join the pioneers of 1849. He chose instead to promote the Irish potato industry for the victualling of whale ships in their seasonal voyages after whales.
>
> He moved over to Kalepolepo with his family and shortly thereafter built for himself the old house…..from the forties to the sixties at Kalepolepo a small whaling station was maintained. During the winter and spring months schools of whales would come to stay or calf in the quiet waters of Maalaea Bay, and at such times whale boats manned by native crews officered by experienced whalers would go out to battle the big mammals and if successful would return towing the carcass in to be cut up and tried for oil.
>
> Some time ago a writer in *The Friend* claimed that the old house at Kalepolepo was Reverend Green’s granary during the wheat boom of the

fifties and early sixties, when the upper Makawao country from Maliko to Waiohuli was cropped to wheat, Possibly some wheat may have been shipped from Kalepolepo in those days, for from early times to the late sixties it was a shipping port for Wailuku to Kula and Mr. Halstead had one or two big warehouses standing *makai* (seaside) of his residence. S. Lono, the oldest resident of Kalepolepo aged over seventy-five years, remembers nothing of Mr. Green's activities in that time, except that the Reverend Green visited Kalepolepo quite often, usually to preach a sermon and take up a collection.

At that time, Kalepolepo was a thriving village, with two churches, one being a Mormon church where George Cannon or Walter Murray Gibson expounded the Christian doctrines of Joseph Smith against Christian Calvinism as preached by the Reverend Green and David Malo. At one time Father Green preached a red hot sermon- a favorite hobby of his – against mixed marriages and caused quite a stir of scoffing from the colony of whites married to Hawaiian women living at Kalepolepo consisting of J.J. Halstead, Mr. Fern, father of the late mayor Fern of Honolulu, and Mr. Fredenberg. Mr. Fern and Fredenberg being in charge of the whaling station (Wilcox 1921).

### 3.1.4 Mid- to late-1800s

The most significant change in land-use patterns and allocation came with The Great Māhele of 1848 and the privatization of land in Hawai‘i. This action hastened the shift of the Hawaiian economy from a subsistence-based to a market-based economy. During the Māhele, all of the lands in the Kingdom of Hawai‘i were divided between *mō‘ī* (king), *ali‘i* and *konohiki* (overseer of an *ahupua‘a*), and *maka‘āinana* (tenants of the land) and passed into the Western land tenure model of private ownership. On March 8, 1848, Kauikeaouli (Kamehameha III) further divided his personal holdings into lands he would retain as private holdings and parcels he would give to the government. This act paved the way for government land sales to foreigners, and in 1850 the legislature granted resident aliens the right to acquire fee simple land rights (Moffat and Fitzpatrick 1995: 41-51).

Native Hawaiians who desired to claim the lands on which they resided were required to present testimony before the Board of Commissioners to Quiet Land Titles. Upon acceptance of a claim the Board granted a Land Commission Award (LCA) to the individual. The awardee was then required to pay in cash an amount equal to one-third of the total land value or to pay this equivalent in unused land. Following this payment, a Royal Patent was issued that gave full title of ownership to the tenant. But by 1850, the government of Hawaii was offering land for sale to both Native Hawaiians and foreigners. Such lands were referred to as Royal Patent Grants or as Grants.

A number of land commission award parcels were located in the nearshore region of the Ka‘ono‘ulu Ahupua‘a, in close proximity to the present project area. These parcels are tabled below. From these records, it appears that many of the residents of Kalepolepo had agricultural interests inland of the coast.





Table 2. Land Commission claims in Kalepolepo and vicinity.

| LCA | Royal Patent Number | Claimant | Award Type | Acreage |
|---|---|---|---|---|
| 05267 | 2793 | Kuhiahiwa | 1 *‘āpana* | 3.12 |
| 02764 | ---- | Hiona | 1 ‘*āpana* of kula land with 1 *mala* of Irish potatoes at Ka‘ono‘ulu. | ----- |
| 4120B | 5067 | Kapohaku [Konohiki of Keokea] | 4 *‘āpana*, one of which is a house lot at Kalepolepo measuring 0.25 acres. | 17.89 |
| 5407 | 2791 | Mahiai | 3 *mala* [cultivated patches or fields] of Irish potatoes at Ka‘ono‘ulu. | 3.49 |
| 6720B | 3102 | Nahelu | 4 *‘āpana*, one of which is a house lot in the *‘ili* [land section] of Kalepolepo, bounded on the *mauka* side by Mahiai's land [see LCA 5407 above]. | 20.18 |
| 5228 | ------ | Kuihelani | ---------- | 28.00 |
| 9673 | 6329 | Lonoaea | ---------- | 4.06 |
| 5328 | 6575 | Pupuka | 1 *‘āpana* | 1.00 |
| 5267 | 7467 | Kauhiahiwa | 3 *‘āpana*, one of which is a house lot in the *‘ili* of Kalepolepo; bounded on the *muaka* side by Kapohaku's land [see LCA 4120B above]. | 4.50 |
| 7971F | 2205 | Nauliuli | 1 *‘āpana* | 3.40 |
| 5279 | 6523 | Palekai | 1 *‘āpana* | 10.40 |
| 03237-M | 7447 | Hewahewa, H. | Ka‘ono‘ulu Ahupua‘a as listed in the māhele registry, July 12, 1849 | 5,715 |

### 3.1.5 Brief History of the Ka‘ono‘ulu Ranch Company

The Ka‘ono‘ulu Ranch Company was established in the early 1900's by Harold Waterhouse Rice, who was appointed division overseer for the Maui Agricultural Company in 1907, the same year he married Charlotte M. Baldwin. He became assistant manager of the Maui Agricultural Company sugar plantation in 1909. He then purchased the Cornwell cattle ranch in 1916, developing and stocking the ranch with pure-bred cattle and horses and renaming the ranch. Harold Waterhouse Rice became a member of the territorial senate in 1918. Senator Rice and Charlotte Baldwin had four children, Charlotte Emily, Harold Frederick "Oskie," Maud Baldwin and Mary McKinney Rice (Nellist 1925).

As of the time of Statehood, in 1959, some 1,000 acres of the Kula forest district was in the private land holdings of the Ka‘ono‘ulu Ranch Company. Earlier, in 1920, the Board of Commissioners of Agricu1ture and Forestry requested that title to 1,006 acres of private land owned by the Ka‘ono‘ulu Ranch, be acquired by the Territory. Under the law then in effect, "if an

area exceeds 40 acres an exchange cannot be made.” According to Korte, as there was insufficient money for land purchases, the matter was dropped (Korte 1961).

The ranch is run today by Henry Rice, grandson of Harold Rice (Karp 2010). In a 2010 interview with the Wall Street Journal, Harold Rice described his family circumstances that lead up to his becoming the managing general partner of the Ka‘ono‘ulu Ranch Company, which included the history of the ranch lands as a potato farm. The article concluded by describing Henry Rice’s day-to-day duties, which includes mending fences and taking care of the ranch cattle and employing a number of cowboys to help in these activities (Karp 2010).

At the present time, the cattle ranch operates mostly in the upland reaches of the Ka‘ono‘ulu Ahupua‘a, however, in the lower elevations, a land parcel sold by the Ka‘ono‘ulu Ranch along Kīhei’s Pi‘ilani Highway is to be developed into a new high school for Kīhei, as well as a new “outlet center” type of shopping center (Imada 2012).

By the time John Halstead closed shop in 1876, the boom years of Kalepolepo had passed. By 1880 the government survey of the Kula area showed the demarcation of only a few Land Commission Awards and those who had received awards had replaced them with grants. Lower Kula consisted primarily of pastureland for ranching (Wong Smith in Donham 1990b:B-6). Kennedy (1992:7) notes that at this point *kiawe* was imported to feed cattle and provide wood.

Regarding the settlement at Kalepolepo and the impact of the changes associated with the change to ranching on the general area known as Kīhei, Clark comments:

Halstead finally closed his store in 1876, as demands for his goods had steadily decreased, and moved to Ulupalakua . . . By this time the once thriving Hawaiian village at Kalepolepo had been almost totally abandoned as well. The slopes of Haleakala had gradually become denuded of their forests and torrential rains had caused heavy soil runoffs into the Kalepolepo shoreline. Cattle had trampled down the brush and grassy fields, causing sand dunes to drift and fill up the pond. Clouds of dust filed the air instead of cooling winds. Except for a handful of fishing families, Kalepolepo (and likely the Kīhei area in general) was deserted. (Clark 1980:48).

Sugar would soon fill the void and in 1898 the Kīhei Plantation Company (KPC) was founded. The KPC began sugar operations in Kīhei and on the plains across central Maui.

### 3.1.6 1900s

The Kihei Plantation Company, Ltd. was organized late in 1898 with a capitalization of 60,000 shares at $50 par value. Water was the most critical component in the decision to locate sugar cultivation along the leeward shores of Maui’s arid coastline. The discovery of an ample supply of irrigation water early in 1898 led to the drilling of a large, successful well, but the supply of water was limited (Stearns 1942). Over the next four years, two ditches were developed to supplement the water needs of the 4,873 acres of sugar under cultivation at Kīhei (Gilmore 1936).

The history of the Kīhei Plantation Company begins with the annexation of the Hawaiian Islands by the United States in 1898. With annexation came political stability for Hawai‘i. Sugar prices were rising due to the outbreak of war between the United States and Spain over Spain's colonies in Cuba, Puerto Rico and the Philippines. Henry P. Baldwin, of the Maui plantation of HC&S, entered into a partnership with O‘ahu businessman Benjamin F. Dillingham to convert Lorrin A. Thurston’s landholdings in Kīhei into a sugar enterprise.





Up to that time, sugar cultivation within the central isthmus of Maui was centered around the main towns of Wailuku and Kahului. Water tunneled from springs in the West Maui Mountains flowed through ditches in Wailuku to irrigate fields as far away as Mā‘alaea. Water from the windward rain belt of Kailua ran through a network of ditches from East Maui to Pā‘ia, to irrigate fields in Pu‘unēnē.

The McCandless Brothers drilled a successful Maui-Type well (U.S. Geological Survey Well 14 / Hawaiian Commercial & Sugar Well K1) in 1899. It was located just inland from the coast in North Kīhei, between Keālia Pond and the Waiakoa Homestead Lands. This well was drilled vertically to approximately 60 feet through the Honomanū basalts, and tunneled laterally over 1,500 feet in order to skim 10 million gallons of fresh irrigation water per day from sources beneath the Kīhei plains (McCandless 1936).

The Kihei Plantation Company had the McCandless Brothers drill two or three additional Maui-Type wells on the north side of reservoir K2 at the discharge end of the existing pipeline of Well 14. The plantation in Kīhei failed in 1908 before the well site was able to be developed. It would have been named the HC&S K2 well, and would have included a large pumping station (Stearns 1942).

The plantation company in Kīhei built bridges to span streams and gulches flowing through the company fields. The plantation had planned the construction of a mill in North Kīhei, and ordered a plant to be built. It was decided that the new HC&S mill under construction at Pu‘unēnē would have more than enough capacity to mill all the cane from the Kīhei fields. The order for the mill was transferred to the ‘Ōla‘a Sugar Company in Hawai‘i, in exchange for a supply of steel rails for new railway requirements at Pu‘unēnē. A large scale Kona storm hit the plantation on November 15th, 1900, and caused immense damage to both Kīhei and the HC&S fields in Pu‘unēnē (Dean 1950). Bridges were knocked out, buildings were flattened, and washouts filled irrigation ditches with silt. Repairs were effected immediately, with the new HC&S mill at Pu‘unēnē commencing operations January 29, 1902.

#### *3.1.6.1 Railway Operations*

The Kihei Plantation Company planned to construct a railway to move their cane. The sugar agency of William Dimond & Company placed an order for a locomotive from the Baldwin Locomotive Works in Philadelphia. The order was placed April 1899, and the plantation locomotive “Haleakala” was built and sent on to Maui (Conde 1973).

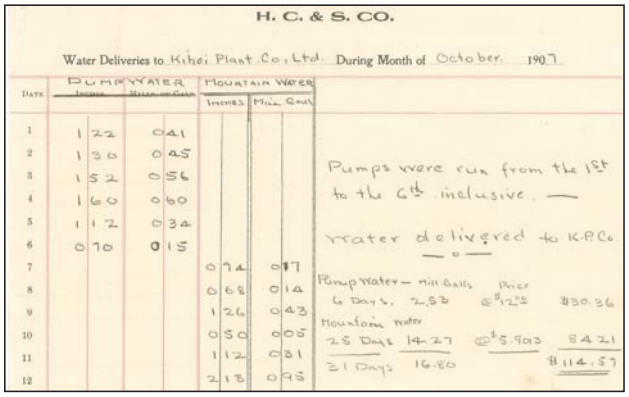
By March of 1900, the first annual report of the Kihei Sugar Company stated, “It was our intention to complete the main [rail]road only as far as Camp #2, or for about 2 miles, but as the development of Camp #3 required pushing on of the road one and a half miles further, this has been done, having been completed the 15th of February.” An additional six miles of track connected the Kīhei wharf to the various well pumping stations, and north to meet up with HC&S track (Conde and Best 1973). Establishing the railroad at Kīhei made it possible to harvest and transport over two thousand tons of sugar in a single year (Dean 1950).

The 3-foot gauge track for the Kihei Plantation Company railroad was built to the same specifications as the railway linking the HC&S Company mill at Spreckelsville to its fields; and to the sugar warehouses at the Kahului wharf. By 1902, with the new Pu‘unēnē mill completed, a

new milling contract with HC&S provided that all cane loaded by the Kihei Plantation Company was to be ground and manufactured into sugar by HC&S.

*3.1.6.2 Water Source Development*

The Lowrie Ditch project, named for former HC&S manager William J. Lowrie, brought an additional source of water to the Kīhei plains. His plan was to begin the ditch at the Pāpa‘a‘ea Reservoir, at the 1,000 ft. elevation, and maintain a four-foot drop per mile following the ditch’s initial plunge from the Kailua reservoir. Steep mountain gulches were traversed using the force of the constant weight of water flowing in a series of siphons. The Halehaku Gulch, at 250 feet deep, and the Māliko Gulch, at over 350 feet deep, were both crossed by giant siphons fabricated of three-eighths-inch iron, and set in place by Japanese laborers. At a weir located above Pā‘ia, the allocation of water began. The first tenth of the water flow in the Lowrie Ditch was divided out to the Pā‘ia Plantation (an 11/20ths share) and the Haikū Plantation (a 9/20ths share). The distance traveled, from Kailua to the plantation’s Kīhei boundary, was 21.9 miles (Thrum 1900).More water was required, both from wells and from the East Maui water shed. The manager for the Kihei Plantation Company, W.F. Pogue, asked the management of HC&S for an even larger allocation of water for the Kīhei lands. In 1901, Samuel T. Alexander ordered the construction of a new ditch, tapping the water sources from Nāhiku to Honomanū. It was determined that the Kihei Plantation Company would receive 2/9$^{ths}$ of the capacity from the enterprise (SeeFigure 11) (Dean 1950).


H. C. & S. CO.

Water Deliveries to Kihei Plant. Co., Ltd. During Month of October 1907

| Date | Pump Water Inches | Pump Water Mill. Gals. | Mountain Water Inches | Mountain Water Mill. Gals. | |
|---|---|---|---|---|---|
| 1 | 1 22 | 0 41 | | | |
| 2 | 1 30 | 0 45 | | | |
| 3 | 1 52 | 0 56 | | | Pumps were run from the 1st |
| 4 | 1 60 | 0 60 | | | to the 6th inclusive. — |
| 5 | 1 12 | 0 34 | | | |
| 6 | 0 70 | 0 15 | | | water delivered to K.P.Co |
| 7 | | | 0 74 | 0 17 | — o — |
| 8 | | | 0 68 | 0 14 | Pump water — Mill. Gals. Price |
| 9 | | | 1 26 | 0 43 | 6 Days. 2.58 @ $12.25 $30.36 |
| 10 | | | 0 50 | 0 05 | Mountain water |
| 11 | | | 1 12 | 0 31 | 28 Days 14.27 @ $5.903 84.21 |
| 12 | | | 2 18 | 0 95 | 31 Days 16.80 $114.57 |

Figure 11. A portion of an accounting statement for water delivered to the Kihei Plantation Company in 1907.

The Kihei Plantation Company failed to live up to the expectations of its promoters with an inadequate water supply as the key difficulty. With the waters of the Ko‘olau Ditch flowing to the Kīhei fields, production appeared to have hit its peak. Although 5,609 tons of sugar was delivered in 1903, high costs required a change of managers in Kīhei, and a reduction of the HC&S milling





charge to $7 per ton. The incoming HC&S manager, Frank Fowler Baldwin, determined that the best course of action was to buy out the company for $375,000 (Conde 1973).

In 1908, the lands of the Kihei Plantation Company were divided up between five new major business entities of HC&S. The Kahului Railroad, which had already been absorbed by HC&S, acquired the rail lines to Kīhei and the rolling stock of the plantation. The Kailua Plantation Company (994 acres), the Kalialinui Plantation Company (923 acres), the Kula Plantation Company (996 acres), the Makawao Plantation Company (982 acres), and the Pulehu Plantation Company (978 acres) acquired the remaining acreage not included in the railroad right-of-ways. Water rights reverted to HC&S, and were reapportioned between the new plantations. Sugar operations continued in North Kīhei until circa 1968, when the HC&S Company began to lease its marginal sugar lands in north Kīhei to the Trojan Seed Company (a hybrid corn research company from Olivia, Minnesota), an action which continues to the present day with the Monsanto Global Seeds Company.

**3.1.7 The residential area of Kīhei**

The residential community of Kīhei grew in the pre-WWII years because of the sunny weather and white-sand beaches. Truck farming of alfalfa had been done since the turn of the century, on many of the coastal inland Kama‘ole homesteads. Civic development in Kīhei included the Kalama Park and the Kīhei Road. An article in the *Maui News* described the September 9$^{th}$, 1936 celebration of the completion of the road between Kalepolepo and the Kalama Park (News 1936).

> Approximately 1500 persons attended a luau at Kalama Park Sunday given by the Kihei Community Club to celebrate the opening of the 2-mile stretch of paved highway between Kalepolepo and the [Kalama] Park.
>
> Earlier in the summer the County completed another 2-mile stretch between Maalaea Airport and the new Kihei Park. Work on the remaining unpaved section between Kalepolepo and the Kihei Store is now in progress.

The article continued by describing further progress in other public works projects in Kīhei:

> A new high mark was reached in county road construction during August when slightly more than 3 miles of cold emulsified asphalt pavement was laid in the county during the 1 month period, County engineer A.L. Burdick reported to the Board of Supervisors on Thursday night.
>
> This, he said, brings the total for the first eight months of the year to slightly more than 11 miles of completed grading and paving.
>
> Roads completed so far this year: Kihei Airport towards Kihei, 2.2 miles. Kihei, Kalama Park toward Kalepolepo, 2 miles. Hamakuapoko Road 1.1 miles, Farrington Avenue, Molokai 1.5 miles; Camp 5-6 Road 1.61 miles; Pulehu Road 1.64 miles; Waihee Road .15 miles; Kealahou School driveway .16 miles; Homestead roads, Kula .75 miles; total 11.11 miles.

Figure 12. Aerial photo of Kūlanihāko‘i Bridge (School of Ocean and Earth Science Technology [SOEST] 1949)





### 3.1.8 Impact of the military on the project area

The Department of the Navy constructed a wood-frame two-story structure on the beach fronting the project area in 1948, following the end of World War II. The structure, which remains today as the building housing the Hawaiian Islands Humpback Whale National Marine Sancturary, was originally constructed to house military equipment used to monitor the effects of atomic bomb testing in the Pacific Ocean (Figure 13).

The complex of wood structures consisted of two transmitter buildings housing a bank of electrical generators in the event that electricity to the complex was interrupted, and a single administrative building manned by engineers who transmitted data gathered on the condition of the upper atmosphere to a laboratory in Boulder, Colorado. The geophysical station was responsible for broadcasting a series of radio signals accurate to within a few millionths of a second. For a brief time, the U.S. Bureau of Standards clock at Kalepolepo was a part of the coastline adjacent to the ancient fishpond. In 1971 this transmitting station was relocated to Barking Sands, on the island of Kaua‘i.

Figure 13. 1971 aerial photo of antenna, transmitter buildings and administrative building for WWVH, just seaward of the project area. Photo courtesy of National Institute of Standards and Technology (http://tf.nist.gov/stations/wwvhtour.html).

### 3.1.9 Modern Land Use

Beginning in the 1970’s, development in the region of the project area shifted from rural residential to vacation condominium development. Between 1970 and 1996 vacation rental units increased from 2,641 to 17,442. The leeward coasts, including Kīhei, became popular tourist destinations (Juvik and Juvic 1998:14).Today, the ASTON Maui Lu Resort is located to the north of the project area and the Kihei Bay Vista Condominium is located to the south of the project area. The project area is south of the Mokulele-Pi‘ilani Highway junction, along South Kīhei Road. The existing drainageway and associated culverts due for replacement are at the Kūlanihāko‘i Stream mouth, near Kalepolepo Beach park and fishpond along the shoreline.

## 3.2 Previous Archaeological Research

This section provides a brief overview of the research and findings of previous archaeological investigations in the general area surrounding the current project. These investigations are listed in Table 3 and their location is presented in Figure 14. A brief summary of the more relevant investigations is presented below.

The majority of archaeological reconnaissance and inventory surveys in the North Kīhei area have produced relatively little significant information in the way of archaeological data. While this may be due in large measure to changes on the land associated with sugar cane cultivation, ranching, and military use, as well as resort and housing construction, it still seems inescapable that there are only few areas in the Hawaiian Islands abutting sandy beaches that have less in the way of documented Hawaiian cultural deposits than Kīhei. Archaeological projects in the vicinity identified both pre-Contact and post-Contact site types. Many of which were associated with the sugar plantation era and plantation camps, ranching and WWII periods in history. Pre-Contact archaeological sites including dry stacked basalt walls, fishponds, alignments, possible burial mounds and sites associated with traditional Hawaiian agriculture have also been discovered in the vicinity surrounding the project area.

Each of the fishponds located in the vicinity of the project area are listed on the State Inventory of Historic Places. The Kō‘ie‘ie Fishpond (SIHP 50-50-09-1288), adjacent to Kalepolepo Park is the smallest of the three fishponds in this region of Kīhei. The Waiohuli Kai Fishpond is just south of Kō‘ie‘ie Fishpond, is submerged and listed as SIHP 50-50-09-1704. The Kēōkea Kai Fishpond is yet further to the south and is also submerged (SIHP 50-50-09-1738). Kikuchi in 1973 performed a study of fishponds which categorized the Kō‘ie‘ie Fishpond as a Type I, Loko Kuipā type, or a “fishpond of littoral water whose side or sides facing the sea consist of a stone or coral wall usually containing one or more sluice gates” (Kikuchi 1976:37).

According to an early island-wide survey by Stokes, the closest *heiau* structures to the project area were reportedly south of Kalepolepo in Kama‘ole Ahupua‘a; and were described in the following manner:

> Heiau of Wailuku at Kawililipoa, land of Kamaole, inland; said to be a platform. Not seen. Heiau of Kolea and Kawililipoa, land of Kamaole. Said to have been for human sacrifice, not seen. Heiau at Kawililipoa, land of Kamaole, between the road and the beach. This foundation, which has been destroyed, was probably a platform originally. It was situated on a





> sandy flat, quarter of a mile from the sea; 200 feet west of the road and 200 to 300 feet south of the Mormon Church (Stokes 1918:125)

These heiau were also described by Walker in 1931. The Wailuku Heiau was noted as Walker Site 205, the Kolea Heiau as Walker Site 206 and Kawilipoa Heiau as Walker Site 207 (Walker 1931:271-273) Stokes (1918) reported a *heiau* named Wailuku at Kamaole in the *‘ili* of Kawililipoa, *mauka* [inland]. He also reported a sacrificial *heiau* named Kolea in about the same area and further stated that he had not seen either of them, but that his informants also reported an unnamed *heiau* in the same *‘ili*, on the sea plain, 200 *makai* or west of the lower road and the same distance south of the Mormon church. This *heiau* was reported to have been a *kahua* [foundation] and had been destroyed.

Cordy (1977) identified a total of 38 single component and multi-component archaeological sites within the then proposed Pi‘ilani Highway road corridor. Following that study, Cox (1976), performed an archaeological surface survey and excavations for the Pi‘ilani Highway right-of-way. Cox identified six sites, including three site complexes containing seven features and three isolated features. The sites are of pre-historic and historic era use and include a cave that was a temporary habitation shelter; a C-shape shelter; a historic house complex; an *ahu* (possible monument/platform burial); and a miscellaneous alignment. No further work was recommended.

Neller and Keau (1981) conducted an archaeological reconnaissance adjacent to the current project area at TMK (2) 3-9-01:17, 1, also known as Kalepolepo with the Kalepolepo fishpond fronting the property. Their findings include two historic fenced areas recorded as sites which were noted as possible graves, and a platform of indeterminate function. Further archaeological survey, data recovery and monitoring was recommended.

In 1990, Kennedy conducted monitoring of the TMK (2) 3-9-01: 015, a portion of which comprises the current project area. Findings resulting from monitoring included midden scatters, a single volcanic glass fragment, animal bone and a bone pick were recorded.

Further north of the current project area, Kennedy (1991) preformed a field inspection for an inadvertent burial find. A profile was drawn of the burial, then a three sided form was constructed to protect the burial and the burial was reburied in place.

Erik Fredericksen of Xamanek Researches (E. M. Fredericksen et al. 1994) conducted an inventory survey in Ka‘ono‘ulu Ahupua‘a east of the current project area and mauka of Pi‘ilani Highway. A total of 21 archaeological features reflecting pre-contact use of the area, as well as post-contact military and ranch use were recorded. The pre-contact or Early Hawaiian archaeological features included five stone piles possibly representing agricultural use, five surface scatters representing pre-contact temporary habitation, and one petroglyph. Military use of the area is represented by five stone cairns, three alignments, and one enclosure. A single feature, interpreted as an erosion containment area, was recorded in association with ranching activities.

Table 3. Previous Archaeological Studies

| Date | Ahupua‘a | Nature of Study | Findings |
|---|---|---|---|
| Stokes 1916 | Island wide | Archaeological Reconnaissance | 3 *heiau* in Kamaole in the *‘ili* of Kawililipoa, located directly south of the present project area. Stokes did not see any of these three *heiau*. He noted that they may have been destroyed. |
| Walker 1931 | Island wide | Reconnaissance | 3 *heiau* in Waiohuli Ahupua‘a above 3,000 ft. elevation. |
| Kikuchi 1973 | Statewide fish pond survey | Fishpond Survey | Noted 3 fish ponds in Kalepolepo area. |
| (Cox 1976) No project area map | Pūlehu Nui to Kama‘ole | Archaeological Inventory Survey | Pi‘ilani Highway right-of-way. Identified six sites, including three site complexes containing seven features and three isolated features. |
| (Cordy 1977) | Pūlehu Nui to Paeahu | Archaeological Reconnaissance | Identified 38 sites: 30 in Waiohuli, 0 in Ka‘ono‘ulu, and 8 in Kēōkea |
| (Neller and Keau 1981) | Ka‘ono‘ulu | Archaeological Reconnaissance | Finds include two historic fenced areas recorded as sites which were noted as possible graves, and a platform of indeterminate function. Further archaeological survey, data recovery and monitoring was recommended. |
| (Bordner and Cox 1982) | Waiohuli and Keokea | Archaeological Reconnaissance | A total of nine sites were located during the reconnaissance survey which included C-shapes, an L-shapes, a modified bedrock outcrop, a temporary habitation shelter, stone alignments, and a habitation site. Cultural material which consisted of shell midden was present at some of the sites. |
| (Kennedy 1986) | Waiohuli | Archaeological Reconnaissance | Area was cleared by bulldozer, rubble mounds along both east and west boarders of project area, no surface evidence of archaeology. No further archaeological work recommended. |
| (Kennedy 1988b) | Coastal Ka‘ono‘ulu | Archaeological Reconnaissance | No archaeological findings |





| Date | Ahupua‘a | Nature of Study | Findings |
|---|---|---|---|
| (Kennedy 1988a) | Waiohuli | Archaeological Reconnaissance | No archaeological findings. No further archaeological work recommended. |
| (Kennedy 1989) | Waiohuli | Archaeological Subsurface Testing Results | No human burial findings |
| (Donham 1989) | Waiohuli | Archaeological Inventory Survey | Identified four sites, including two previously unrecorded sites. Recommended data recovery |
| (Kennedy 1990b) | Coastal Waiakoa | Survey | No archaeological findings |
| (Sinoto 1990) | Coastal Waiakoa | Survey & Testing | No archaeological findings (other than two pieces of midden) |
| (Kennedy 1990a) | Ka‘ono‘ulu | Monitoring Report | Recorded 4 surface midden scatters, single fragment of volcanic glass, animal bone and bone pick. |
| (Kennedy 1991) | Coastal Waiakoa | Field Inspection | Inadvertent burial find |
| (E. M. Fredericksen et al. 1994) | Ka‘ono‘ulu, *mauka* of Pi‘ilani Highway | Inventory Survey | 21 sites were identified, some military and some pre-contact |
| (Burgett et al. 1998) | Ka‘ono‘ulu | Inventory Survey | Lots A and B of the Maui Lu Resort. No archaeological findings. |
| (Hammatt and Shideler 1999) | Waiohuli | Archaeological Reconnaissance | No cultural material, no archaeological findings |
| (Pepalis and Kolb 2000) | Waiohuli | Archaeological excavations | Discovered soils from inland pond |
| (McDermott et al. 2000) | Waiohuli | Additional Archaeological Inventory Survey | Confirmation of an inland pond (SIHP 50-50-09-4981) from which 14C radiocarbon were attained that provides evidence of an earlier habitation sequence in Kihei than previously documented. |

| Date | Ahupua‘a | Nature of Study | Findings |
|---|---|---|---|
| (McDermott 2001) | Coastal Kihei | Graduate Thesis; Historical Ecology of Coastal Kihei | N/A |
| (Borthwick et al. 2002) | Waiohuli | Inventory Survey | No archaeological findings |
| (Hill et al. 2005) | Waiohuli | Letter Report for a Field Inspection and Subsurface Testing | No archaeological findings |
| (Hill et al. 2010) | Pūlehu Nui, Ka‘ono‘ulu, Waiakoa | Mitigation Program | No cultural deposits or artifacts observed during mitigation work. No historic properties affected. |
| (Medeiros et al. 2012) | Ka‘ono‘ulu | Literature Review and Field Inspection | Recorded Kulanihakoi Bridge (50-50-10-7606), constructed in 1911 considered not significant based on a lack of integrity. |

Figure 14. Portions of the Pu‘u o Kali (1992) and Mā‘alaea (1996) 7.5-minute USGS topographic quadrangles, showing the current project area relative to adjacent areas of previous archaeological study.

Until recently, the few available radiocarbon dates from the Kīhei area were consistent in their rather broad, later prehistoric age determinations, most commonly post A.D. 1500 (D. L. Fredericksen et al. 1993; E. M. Fredericksen and Fredericksen 1995a, b). This fits with the model that the more intensive use of the Kīhei area was a later pre contact development that corresponded with the expansion of upland permanent habitation, ceremonial constructions, and agricultural clearing after A.D. 1400-1500 (Kolb et al. 1997:281-282).

Without a doubt, coastal habitation along with more populous inland/upland settlement was firmly established by A. D. 1400-1500. The majority of permanent habitation would have been in the uplands, concentrated in the well-watered and fertile agricultural areas. Coastal permanent habitations were likely less numerous and centered on the ceremonial structures and fish ponds at Kalepolepo. While the fish ponds of the Kula coastline are thought to date to the 1500s (Kolb et al. 1997:66), the chronological timeline for initial settlement of the Kīhei area is still under debate. Based on the results of relatively recent studies (McDermott 2001; McDermott et al. 2000), habitation in the coastal areas may date to as early as A.D. 600-900. Evidence of earlier coastal habitation in the Kīhei area has recently come to light at excavations adjacent to the site of the Kalepolepo Church. Cultural layers described in the work of McDermott and others (2000) and McDermott (2001), in conjunction with those of Pepalis and Kolb (2002), provide some evidence in the form of charcoal concentrations, midden deposits, 14C dates, and palynomorph identification, that settlement in the vicinity of an inland pond feature had occurred by circa A.D. 600-900.

Prior to this investigation a literature review and field inspection was conducted by Cultural Surveys Hawai‘i, Inc., (Medeiros et al. 2012). One historic property was documented, SIHP 50-50-10-7606 (Kūlanihāko‘i Bridge).

## 3.3 Background Summary and Predictive Model

Previous archaeological studies have led to archaeological site interpretation based on the division of the settlement pattern for Maui into three zones: 1) coastal; 2) barren or transitional; and 3) Inland (Cordy 1977; Cox 1976; Walton 1972). The coastal zone is an approximately one-fourth of a mile wide band running along the shoreline. The inland zoned begins approximately five to seven miles from the shore and is characterized by larger rainfall accumulation and more lush vegetation. The transitional or barren zone is classified as the area between the edge of the coastal zone and beginning of the inland zone and characterized by brush/scrub vegetation and low annual rainfall accumulation.

Based on available archaeological evidence and interpretations, and as a result of the settlement pattern, site types expected for coastal zones, where temporary habitations related to marine exploitation may be present may include stacked-stone enclosures, and possibly smaller ceremonial structures, such as stacked-stone fishing shrines. It is possible that human burials would have been interred in the coastal sand dunes where present.

With that said, the current project area has experienced ground disturbances as a result of construction of the South Kīhei Road and natural events associated with stream and wetland environment, including periodic flooding. Flooding events particularly have caused repeated and extensive damage to the bridge over the years. As a result of these disturbances the likelihood of locating intact cultural deposits or archaeological remains would be low.





Conversely, the project area borders Kalepolepo and may have been considered part of the village once located there. Kalepolepo village became a major hub of early historic activity in the mid-1800s. Several historically significant places, such as the Koa House, the David Malo Memorial Church, and the Kalepolepo (Kō‘ie‘ie) fishpond were located there. Portions of the fishpond have recently been restored (see section 3.1.2). Additionally, due to the coastal location and dune sand environment, human remains could be present in sandy deposits of the project area.

# Section 4 Results of Fieldwork

Prior to the investigation the Geotechnical Engineering Exploration of the Kulanihakoi Bridge Replacement report from GEOLABS, Inc., (Kwock 2012) was reviewed. The available samples were characteristic of recent alluvium and not pond deposits. The bore logs showed that the stratigraphy was relatively consistent across the APE (see Section 6.1.2 for more details).

No additional historic properties were observed during the pedestrian survey. The initial field inspection (Medeiros et al. 2012) identified one historic property within the current project area, Kūlanihāko‘i Bridge. The bridge has since been given a site number (SIHP 50-50-10-7606) and is included in this report.

At the conclusion of the sub-surface testing three shovel tests were excavated (STP 1-3) and two pipe cores were extracted (Pipe Cores 1-2) (Figure 19). Two soil samples were submitted for pollen analysis.

## 4.1 Pedestrian Survey Results

SIHP 50-50-10-7606 (Kūlanihāko‘i Bridge) was identified during the initial field inspection designated only as the Kūlanihāko‘i Bridge but a SIHP number was not requested at that time. (Medeiros et al. 2012).During the inventory survey we revisited the historic property and requested a site number. The following site description was adapted from the initial LRFI (Medeiros et al. 2012:34-38). No additional historic properties were observed during the pedestrian survey.

### 4.1.1 SIHP 50-50-10-7606

**Function:** Transportation

**Type**: Bridge

**Total Features**: 1

**Dimension:** 20 m (66 ft) long and 12 m (39 ft) wide

**Condition:** Poor

**Age:** Historic

**Significance Criteria:** D

**Description:** According to the Maui County Department of Public Works, SIHP 50-50-10-7606 (Kūlanihāko‘i Bridge) was constructed in 1911 and consisted of four individual reinforced concrete box culverts. Each culvert cell measured 1.8 m (6 ft) wide by 1.2 m (4 ft) high by 11.6 m (38 ft) long. The total span of the four culverts is 8.5 m (27 ft. 9 in) (Figure 15 and Figure 16).

According to Norman Saito, an informant who was once an engineer for the board of water supply for the County of Maui in the 1950’s, the paving surface over the existing culvert was applied in the 1930’s. This included some shoring-up of the edge of the roadway using a historic construction style attributed to pre-1940’s plantation masons. The present-day Kūlanihāko‘i Bridge appears to consist of two sections of prefabricated concrete culvert welded together to form





the length of the existing bridge. Mr. Saito observed that the more modern construction style probably occurred because of the many repairs the bridge had undergone due to storm damage.

Presently the northern and southern wing walls have different construction styles. The northern wall is constructed of water rounded large basalt cobbles with a coarse concrete mortar typical of early 1900’s construction methods while the southern wall is a modern-day rip-rap construction style where the basalt has been cut to form a level surface and modern concrete has replaced original material (Figure 17 and Figure 18).

Figure 15. Kūlanihāko‘i Bridge, view northwest.

Figure 16. Kūlanihāko‘i Bridge, view northeast

Figure 17. Northern wing wall historic construction.

Figure 18. Southern wing wall modern construction.

## 4.2 Sub-Surface Testing Results

Through shovel testing and pipe coring we were able to construct a general stratigraphy of the project are to a depth of approximately 3 m (10 ft) below ground surface (bgs), shown in Figure 20 and described in Table 4. We were unable to extract the PCV pipe with the soils intact below this depth. The fieldwork effort is summarized below.

### 4.2.1 Shovel Test 1

Sub-surface testing began in the southeast portion of the project area (see Figure 19) with STP 1. The intention being to remove the modern fill, expose the natural sediment and then extract a column sample. Shovel Test 1, measuring 30 by 30 cm (12 by 12 in) and was terminated at approximately 70 cm (28 in) bgs. The stratigraphy consisted of approximately 7 cm (3 in) of a modern A horizon (Stratum Ia) above about 50 cm (20 in) of modern unconsolidated silt fill (Stratum Ib). Stratum Ic was tightly packed gravel fill separated from Stratum Ib by plastic mesh (Figure 20). The fill was likely associated with the native plant restoration project. Unable to break through the gravel fill with a shovel STP 2 was excavated farther north in an attempt to collect an adequate soil sample.

### 4.2.2 Shovel Test 2

Shovel Test 2, measuring 30 by 30 cm (12 by 12 in) was excavated to 95 cm (37 in) bgs. The stratigraphy was similar to the STP 1 (Figure 20). Below the consolidated gravel fill (Stratum Ic) the more recent natural sediment (Stratum II) was exposed. Stratum II was a dark yellowish brown sandy loam. Due to the depth of the fill and inability to extract an adequate sample, STP 2 was terminated. and STP 3 was excavated farther north down slope and closer to the streambed.

### 4.2.3 Shovel Test 3/Pipe Core 1

Shovel Test 3, measuring 30 by 30 cm (12 by 12 in) was excavated to a depth of 150 cm (60 in) bgs (Figure 20). At around 70 cm (28 in) bgs a dark, organic, anaerobic sediment indicative of stagnant water/marsh (Stratum IV) was observed (Figure 21). The STP was expanded with and benched above Stratum IV to extract a pipe core sample from between 50 and 210 cm (20 and 83 in) bgs (see Figure 8). Subsequently the intact stratigraphy was exposed back at the CSH Wailuku lab revealing another deposit of stagnant/marsh sediments(Strata VI) at between 170 and 180 cm (67 and 71 in) bgs (Figure 22 and Figure 23). In all, Strata III -VII were represented in Pipe Core 1. Samples of Strata IV and VI were sent to Paleoresearch for analysis. The results are discussed in Section 5

### 4.2.4 Pipe Core 2

Pipe Core 2 was taken from the surface in the streambed (Figure 24). The stratigraphy, although sandier, was similar to Pipe Core 1 (Figure 25 and Figure 26). Strata V-VII were represented (Figure 20).

Figure 19. Aerial showing the locations of the sub-surface excavation and SIHP 50-50-10-7606.

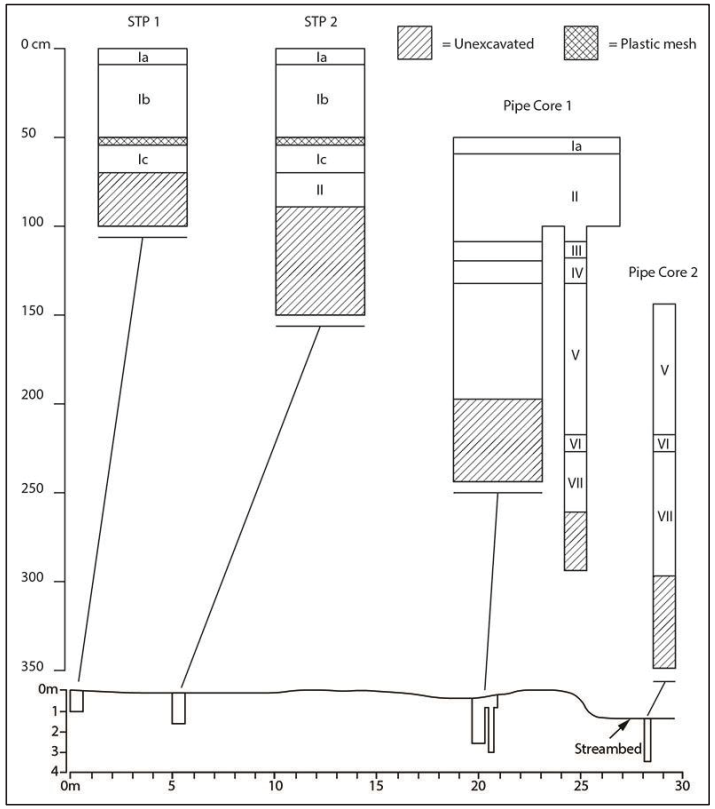



Figure 20. Profiles of the sub-surface excavations.





Table 4. Stratigraphic summary of the sub-surface investigations.

| | |
|---|---|
| Stratum Ia | Modern A horizon; 10YR 3/3, dark brown sand; single grain structure; very fine size; loose dry consistency; non-plastic; no cementation; mixed origin; abrupt lower boundary; smooth topography; many, medium roots. Akulikuli (*Sesuvium portulacastrum*) growing on the surface. No cultural material or features were observed. |
| Stratum Ib | Fill horizon; 10YR 3/6, dark yellowish brown silt; single grain structure; loose dry consistency; non-plastic; no cementation; terrigenous origin; very abrupt lower boundary; smooth topography; many, fine to medium roots. This modern fill is associated with the native plants restoration project. No cultural material or features were observed. |
| Stratum Ic | Consolidated gravel fill |
| Stratum II | C horizon; 10YR 3/6, dark yellowish brown to 5/2 grayish brown sandy loam to very fine sand; single grain structure; friable moist consistency; non-plastic; no cementation; mixed origin; very abrupt lower boundary; wavy topography; no roots. Alternating ocean incursions laying down very fine sand deposits alternating with silty loam and silty clay loam terrestrial deposits. No cultural material or features were observed. |
| Stratum III | C horizon; 10YR 2/2, very dark brown sandy loam; very fine size; single grain structure; loose moist consistency; non-plastic; no cementation; terrigenous origin; very abrupt lower boundary; wavy topography; no roots. High energy event, likely flooding. Five percent gravel and pebble inclusions. No cultural material or features were observed. |
| Stratum IV | C horizon; 10YR 2/1, black sandy clay loam; very fine size; massive structure; friable moist consistency; slightly plastic; no cementation; terrigenous origin; very abrupt lower boundary; smooth topography; no roots. Very finely bedded marsh/stagnant water soils. Highly organic and anaerobic. No cultural material or features were observed. |
| Stratum V | C horizon; 10YR 3/3, dark brown to 3/2 very dark grayish brown sandy loam to silty clay loam, fine to medium size; single grain structure; loose moist consistency; slightly plastic; no cementation; mixed origin; abrupt lower boundary; smooth topography; no roots. Fine alternating horizontally banded layers from ocean incursion and still water deposition, highly organic/anaerobic. No cultural material or features were observed. |
| Stratum VI | C horizon; 10YR 2/1, black sandy silt; very fine size; massive structure; non-sticky wet consistency; non- plastic; no cementation; mixed origin; abrupt lower boundary; smooth topography; no roots. No cultural material or features were observed. |
| Stratum VII | C horizon; 10YR 3/1, very dark gray sandy clay; fine to coarse size; massive structure; slightly-sticky wet consistency; slightly-plastic; no cementation; mixed origin; abrupt lower boundary; smooth topography; no roots. Coralline sand, no cultural material or features were observed. |

Figure 21. Profile of the sediment in STP 3/Pipe Core 1





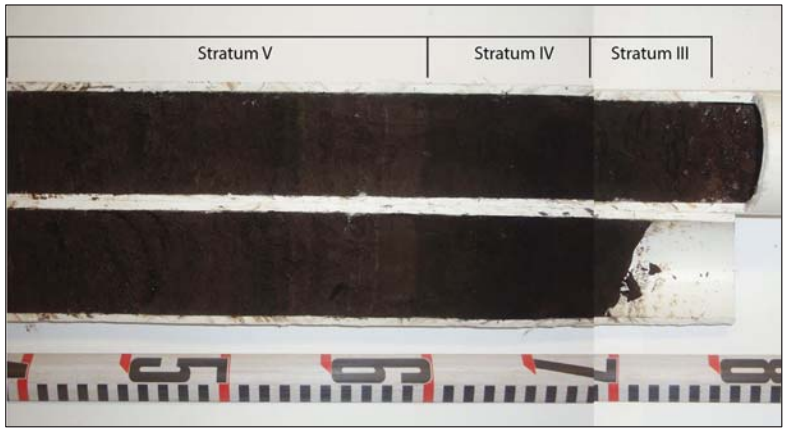



Figure 22. Pipe Core 1 showing Strata III-V.

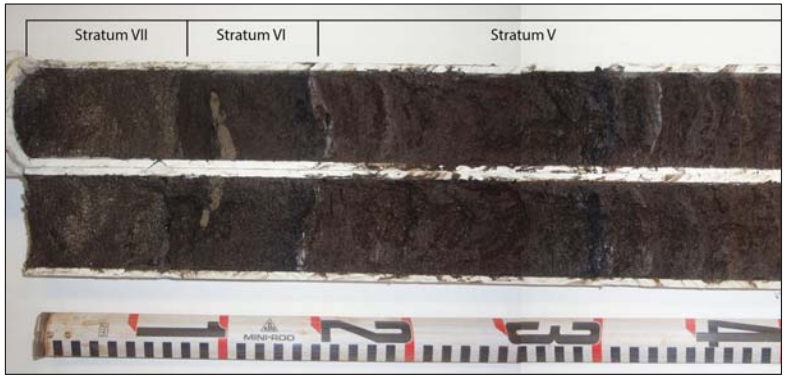



Figure 23. Pipe Core 1 showing Strata V-VII.

Figure 24. Pipe Core 2 being extracted from the streambed, view to the west.

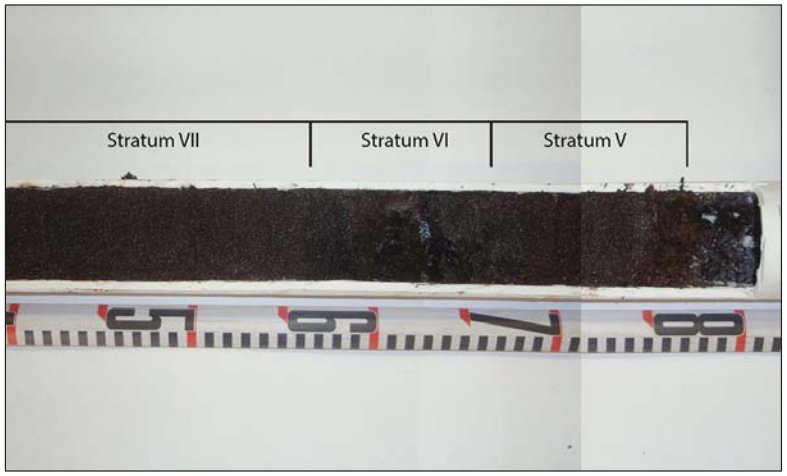



Figure 25. Pipe Core 2 showing Strata V-VII.





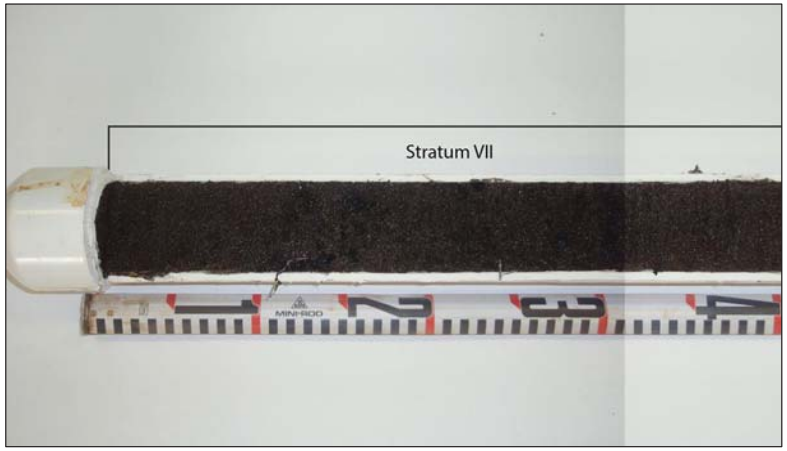



Figure 26. Pipe Core 2 showing Stratum VII.

# Section 5 Results of Laboratory Analysis

## 5.1 Soil Sample Analysis

Pollen analysis of two samples collected from Stratum IV and VI in Pipe Core 1 (Table 5) provide a record of earlier vegetation. Poaceae pollen (Figure 27 and Table 6) is the dominant in both samples, accompanied by moderate quantities of various types of Asteraceae pollen indicating that the area may, indeed, be best described as having been a grassland that also supported many plants in the sunflower family (Asteraceae). Recovery of two sizes of Poaceae pollen was noted. The larger Poaceae might reflect grasses such as *pili*, which produce larger pollen. In the lower sample Cheno-am pollen was moderately abundant, suggesting local growth of shrubby *aheahea*. *Prosopis* pollen was observed in both samples, indicating local growth of *kiawe* and relatively recent accumulation of sediment in this location. Sample 2, representing Stratum VI, is particularly rich in pollen taxa, as it contains small quantities of *Acacia*, *Acacia koa*, Myrtaceae, *Coprosma*, *Dodonaea*, Fabaceae, *Senna*-type, Ericaceae, *Ilex*-type, *Kadua*, *Hibiscus*, *Sida*, *Waltheria*, *Artemisia*, Brassicaceae, and *Euphorbia* representing acacia, members of the myrtle family, *'Aiakanene*, *A'ali'i*, members of the legume family such as *kolomona* or perhaps the introduced candle bush, members of the heath family, possibly holly, *au*, *aloalo*, *'ilima*, *'uhaloa*, *'ahinahina*, members of the mustard family, and *kaliko*. Recovery of Cyperaceae pollen indicates that sedges grew with the grasses. Stratum VI contains *Prosopis* as the primary pollen representing alien plants in the local vegetation community. Ferns, represented primarily by monolete and trilete spores, as well as spores typical of the Dicksoniaceae, also grew in the area (Cummings 2013:2).

Stratum VI, also contained a small quantity of *Zea mays* pollen, reflecting local cultivation of corn/maize. This pollen is large and heavy, usually traveling no farther than a few tens of meters from the plants. This pollen exhibits several characteristics making it distinct from that of sugarcane in that it is larger, has a different surface texture, and the annulus surrounding the pore is wider(Cummings 2013:2).

Stratum IV exhibits fewer pollen taxa suggesting that vegetation diversity decreased. *Pandanus*, *Rauvolfia*, and *Scaevola* pollen recovered in this sample, but not the from Stratum VI, indicate that beach vegetation included *hala*, *hao*, and *naupaka*. In addition, pollen representing aliens included *Casuarina*, *Erodium*, and *Leucaena*, representing Australian pine, filaree, and *koa haole* growing in the area by the time the sediments in Stratum IV accumulated. Finally, Stratum IV sample also contained a small quantity of *Sporormiella* dung fungal spores(Cummings 2013:2).

*Sporormiella* is an ascomycete fungus found only on the dung of herbivores. The genus is widespread in sub-boreal and temperate regions of the world. *Sporormiella* spores are borne in ascomata on the surface of drying dung and are spread passively to nearby vegetation, with which they are ingested (Davis and Shafer 2006) Many coprophilous fungi, such as *Sporormiella*, rely on a cyclic process involving herbivore ingestion of spores with foliage, germination of spores following passage through the gut, mycelial growth within, and eventual sporulation on dung (Wicklow et al. 1980). While grazing, herbivores also can inadvertently ingest ascomata, the fruiting bodies on dung that contain millions of individual spores, especially in areas where dense herbivore populations exist (Aptroop and Van Geel 2006). Depending on the context of the sample,





recovery of *Sporormiella* in archaeological samples can be an indicator for the presence and utilization of herbivores. Interpretations can range from the presence of dung on the landscape to burning dung for fuel to the utilization of intestinal material for cooking and subsistence(Cummings 2013:3).

*Sporormiella* often becomes more abundant in Historic Period sediments following the historic introduction of grazing animals. Its increasing presence in historic samples has been noted in numerous palynological studies (Davis 1987). *Sporormiella* fungal spores are not confined to the dung of introduced herbivores, since they also occur on dung from bison, moose, wild sheep, deer, elk, caribou, and rabbits. The increase of *Sporormiella* spores in historic sediments may relate to changing land use patterns and increase in the length of time that herds of animals occupy any given area (Cummings 2013:3).

Table 5. Provenience Data for Soil Samples Collected During Excavation (adapted from Cummings 2013:4)

| Sample No. | Depth (cmbs) | Stratum | Provenience/Description | Analysis |
|---|---|---|---|---|
| 001 | 79-80 | IV | Marsh/Stagnant sediment | Pollen |
| 002 | 175-176 | VI | Marsh/Stagnant sediment | Pollen |

Table 6. Pollen Types Observed in the Soil Samples (adapted from Cummings 2013:5-7).

| Scientific Name | Common Name | Nat | Pol | End | Ind |
|---|---|---|---|---|---|
| TREES: | | | | | |
| *Acacia* | *Koa, kolu, koai'a* | x | | x | |
| *Acacia koa* | *Koa ‘oh_, koai'a, koai'e, dwarf koa* | | | x | |
| Myrtaceae | Myrtle family | x | x | x | X |
| *Pandanus tectorius* | *Hala, p_ hala* | | | | x |
| *Rauvolfia sandwicensis* | *Hao* | | | x | |
| SHRUBS: | | | | | |
| *Coprosma* | *'Aiakanene, kukuaenene, leponene, nene, punene, coprosma* | | | x | |
| *Dodonaea viscosa* | *A'ali'i, ('a'ali'i k_ makani, 'a'ali'i k_ ma kua, k_makani*) | | | | x |
| Ericaceae | Heath family | | | x | |
| Fabaceae | Legume or pea family | x | x | x | x |
| *Senna*-type | Candle bush and others | x | | | |
| *Ilex aquifolium* and *Ilex paraguariensis* | English or European holly, yerbe mate, Paraguay tea | x | | | |
| *Kadua* | *Au, pilo, 'Awiwi, kio'ele,* etc. | x | | x | |
| *Labordia* | *Kamakahala* | | | x | |
| Malvaceae | Mallow family | x | | x | x |
| *Hibiscus* | *Aloalo, hau, koki'o ke 'oke'o,* (*hau hele, koki'o kea, pamakani*), *ma'o hau hele, kaiohala,* (*akiahala, hau hele wai*), *koki'o* (*m_k_*), large-leaved hau, cotton or confederate rose (*aloalo waik_huli, waik_huli*) | x | | x | x |
| *Sida* | *'Ilima,* Prickly sida | x | | | x |
| *Myrsine* | *K_lea, ‘_liko, K_lea lau nui, K_lea lau li'i* | | | x | |
| *Scaevola* | *Naupaka* | | | x | x |
| *Waltheria* | *'Uhaloa* (*'ala'ala p_ loa*) | | | | x? |





| Scientific Name | Common Name | Nat | Pol | End | Ind |
|---|---|---|---|---|---|
| HERBS AND GRASSES: | | | | | |
| Asteraceae | Sunflower family | x | | x | x |
| *Artemisia* | *‘_hinahina, hinahina, hina hina kuahiwi* | x | | x | |
| Low-spine Asteraceae | Sunflower family; Includes ragweed and others | x | | x | x |
| High-Spine Asteraceae | Sunflower family; Includes *Bidens* | x | | x | x |
| Liguliflorae | Sunflower family, chicory tribe | x | | | |
| Apiaceae (Umbelliferae) | | x | | x | |
| Caryophyllaceae | Pink family | x | | x | |
| Cheno-am | *Achyranthes, Chenopodium oahuense, Amaranthus, Charpentiera,* etc. | x | | x | |
| Cyperaceae | Sedge family | x | | x | x |
| *Euphorbia* | *Kaliko,* spurge, Mexican fireplant (wild poinsettia) | x | | x | |
| Poaceae | Grass family | x | | x | x |
| Poaceae large | Members of the Grass family with larger pollen such as *pili* grass | | | | x |
| *Typha domingensis/latifolia* | Cattail | x | | | |
| ALIENS: | | | | | |
| *Casuarina* | Australian pine (Ironwood, *Paina*) | x | | | |
| *Erodium* | Storksbill, heron-bill, filaree | x | | | |
| *Leucaena* | *Kao-haole* (*'ekoa, lilikoa*) | x | | | |
| Prosopis | Kiawe, mesquite | x | | | |
| Zea mays | Maize, corn | Agric | | | |
| SPORES: | | | | | |
| Dicksoniaceae | Tree fern family | | | x | x |

| Scientific Name | Common Name | Nat | Pol | End | Ind |
|---|---|---|---|---|---|
| Lycopodium cernuum | Club moss (Wawae’iole) | | | X | |

Plant names and information derived from (Wagner et al. 1990)

Fern (spore) names derived from (Selling 1946)

Nat = Naturalized

Pol = Polynesian introduction

End = Endemic

Ind = Indigenous

Pollen identifications to species were made based on the fact that only 1 species is reported by (Wagner et al. 1990). Species identification was not made based on morphologic characteristics observed under the microscope.





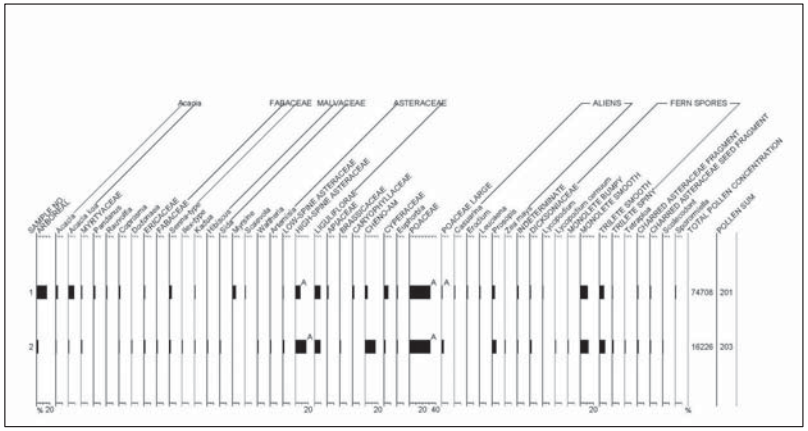



Figure 27. Pollen Diagram for samples 1 and 2 (adapted from Cummings 2013:8).

# Section 6 Summary and Interpretation

Between May 9 and 10, 2013 Cultural Surveys Hawai‘i, Inc. (CSH) completed an Archaeological Inventory Survey (AIS) for the proposed Kūlanihāko‘i Bridge Replacement Project. The fieldwork, accomplished by Hallett H. Hammatt, Ph.D., Todd D. McCurdy, M.A., and Jonas Madeus, B.A., took 3 person-days to complete.

The initial field inspection (Medeiros et al. 2012) identified one historic property within the current project area, Kūlanihāko‘i Bridge (SIHP 50-50-10-7606). As per the field visit with SHPD, the primary focus of the AIS was to address concerns of sub-surface fishpond deposits in the APE through sub-surface testing/coring. The current investigation consisted of shovel testing and pipe coring. While no new historic properties were discovered during the current investigation, two sediment samples were submitted for pollen analysis.

## 6.1 Summary of Historic Properties and Sub-Surface Investigations Within the Current Project Area

### 6.1.1 SIHP 50-50-10-7606

SIHP -7606 (Kūlanihāko‘i Bridge) was constructed in 1911 and consisted of four individual reinforced concrete box culverts. Each culvert cell measured 1.8 m (6 ft) wide by 1.2 m (4 ft) high by 11.6 m (38 ft) long. The total span of the four culverts is 8.5 m (27 ft. 9 in). The paving surface over the existing culvert was applied in the 1930’s. This included some shoring-up of the edge of the roadway using a historic construction style attributed to pre-1940’s plantation masons.

### 6.1.2 Sub-Surface Investigations

Due to the depth of the fill and inability to extract an adequate sample the coring/sub-surface testing was restricted to near the streambed. Nonetheless, the investigation yielded two soil samples from Strata IV and V, both of which were submitted to the PaleoResearch Institute in Golden, Colorado for pollen analysis. The resulting report (Cummings 2013) indicated that the sediments in Layers VI and IV accumulated during the historic era. Although *Prosopis* pollen was observed in both samples, pollen representing other alien plants including Australian pine, filaree, and *koa haole* was present only in the Stratum IV. The pollen record is one of vegetation typical in dry areas and may best described as mixed grassland. The presence of *Sporormiella* dung fungal spores in Stratum IV reflects use of some of the land on the leeward slopes of Haleakalā for grazing.

The Stratum VI sample contained *Zea mays* pollen, which is evidence in this core of the growth of corn in the Kula area of Maui. A Hawaiian Islands map from 1903 of Maui depicts areas across the leeward slope of Haleakala deemed good agricultural land for growing corn and potatoes (Figure 28). Duensing (2008:160) reports that corn was grown in the Hawaiian Islands as early as 1826 for personal consumption, although it was closer to the middle of the Nineteenth Century before it became a viable commercial crop. The Missionary Herald (Richards et al. 1829) documented it being available on Maui as early as 1828:

*Tour Around Maui*





*[An expedition by William Richards, Lorrin Andrews and Jonathan Green]*

*Commencement of the Tour*

*“Monday, August 18 [1828], we left Lahaina with the design of making the tour of Maui. The examination of the schools in the several districts of the Islands was our primary object. We wished to see also the length and breadth of the land. To ascend its lofty mountains, cross its fruitful plains, descend into its vallies [sic], to learn the state of the people; and, as we had opportunity, to afford them instruction. We set out in a double canoe, rowed by twelve able bodied men, and soon lost sight of Lahaina. We steered N.E., keeping the shores of Maui on our right.*

*Here we tarried over night, intending in the morning, to ascend the mountain [Haleakala], near which we were, and sleep on the highest land on Maui. We were told by the natives, that the way was long, but the ascent very easy. We suppose no English travellers (sic) had ever ascended this mountain. (pp 247)*

*Ascent of an Extinguished Volcano*

*August 21. We rose early, and prepared for our ascent. Having procured a guide, we set out; taking only a scanty supply of provisions. Half way up the mountain, we found plenty of good water, and at a convenient fountain, we filled our calabash for tea. By the sides of our path, we found plenty of ohelos, (a juicy berry, very palatable), and, occasionally, a cluster of strawberries. On the lower part of the mountain, there is considerable timber; but as we proceeded, it became scarce, and, as we approached the summit, almost the only thing, of the vegetable kind, which we saw, was a plant that grew to the height of six or eight feet, and produced a most beautiful flower [silversword]. It seems to be peculiar to this mountain, as our guide and servants made ornaments of it for their hats, to demonstrate to those below, that they had been to the top of the mountain. (pp 248)*

*It was nearly 5 o’clock, when we reached the summit; but we felt ourselves richly repaid for the toil of the day, by the grandeur and beauty of the scene, which at once opened to our view. The day was very fine. The clouds, which hung over the mountains on West Maui, and which were scattered promiscuously, between us and the sea, were far below us; so that we saw the upper side (italics theirs) of them, while the reflection of the sun painting their verge with varied tints, made them appear like enchantment. We gazed on them with admiration, and longed for the pencil of Raphael, to give perpetuity to a prospect, which awakened in our bosoms unutterable emotions. On the other side, we beheld the seat of Pele’s dreadful reign. We stood on the edge of a tremendous crater, down which, a single misstep would have precipitated us 1,000 or 1,500 feet. This was once filled with liquid fire, and in it, we counted sixteen extinguished craters. To complete the grandeur of the scene, Mouna Kea and Mouna Roa lifted their lofty summits, and convinced us, that, though far above the clouds, we were far below the feet of the traveller (sic) who ascends the mountains of Hawaii. By this time, the sun had nearly sunk in*

*the Pacific; and we looked around for a shelter during the night. Our guide and other attendants we had left far behind; and we reluctantly began our descent, keeping along on the edge of the crater. (pp 248)*

*After descending about a mile, we met the poor fellows, who were hobbling along on the sharp lava, as fast as their feet would suffer them. They were glad to stop for the night, though they complained of the cold. We kindled a fire, and preparations were made for tea and lodgings. The former we obtained with little trouble. We boiled part of a chicken, roasted a few potatoes, and, gathering round the fire, we made a comfortable meal; but the place of lodging, we obtained with some difficulty. At length, we spread our mats and blankets in a small yard, enclosed, probably, by natives, when passing from one side of the island to the other. We were within twenty feet of the precipice, and the wind whistled across the valley, forcibly reminding us of a November evening in New England. The thermometer had fallen from 77 to 43 (the next morning, the thermometer stood at 40), and we shivered with the cold. The night was long and comfortless.*

*22. Early in the morning, we arose, and reascended the mountain, to its summit and contemplated the beauties of the rising sun, and gazed a while longer, on the scenery before us. There seemed to be but one or two places, where the lava had found a passage to the sea, and through these channels [Koolau and Kaupo Gaps], it must have rushed with tremendous velocity. Not having an instrument, we were unable to acertain the height of the mountain. We presume it would not fall short of 10,000 feet. (This, I believe, is the height at which it has been generally estimated) The circumference of the great crater, we judged to be no less than fifteen miles. We were anxious to remain longer, that we might descend into the crater, to examine the appearance of things below, and ascend other eminences; but as we were nearly out of provisions, and our work but just commenced, we finished our chicken and tea, and began our descent." (pp 248)*

*Nothing remarkable occurred, on our way down. When we reached the cluster of houses nearest the mountain, the occupants, who had heard of our approach, kindly presented us with* ***roasted corn*** *and bananas. (pp 248).*

Corn was grown as a field crop for horses and cattle by about 1853 on Maui, particularly in the Kula district (Crawford 1937:101). Pests and mosaic disease, as well as the fact that corn was not well integrated into the local diet, eventually lead to the reduction in acres devoted to this crop after 1928.Corn grown at higher elevations and then transported down the Kūlanihāko‘i Gulch with the sediment is probably responsible for recovery of this pollen.





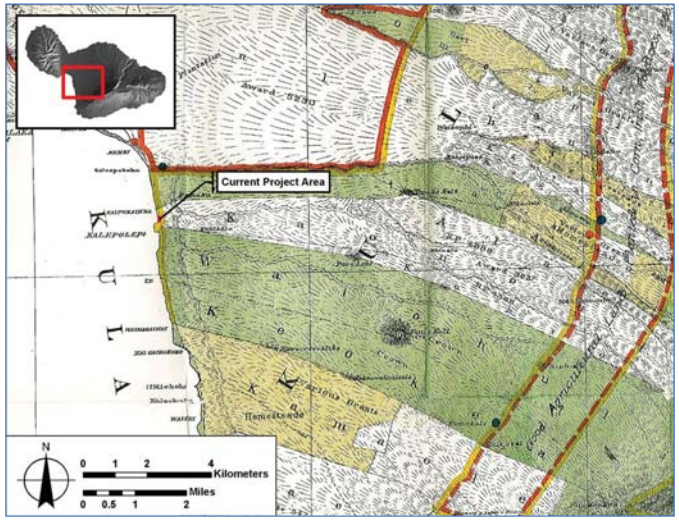



Figure 28. Portion of a 1885 Hawaiian Island Map (Revised 1903) showing the agricultural land mauka of the current project area (Donn 1903).

At the conclusion of the sub-surface investigation we were able to establish that at least the first 3 m (10 ft) of sediment can be attributed to historic alluvium from Kūlanihāko‘i Gulch. No pond sediments were observed to this depth. The stratigraphy observed was generally consistent with the information collected by GEOLABS Inc.,(Kwock 2012) from Bore Holes 3, 4, 6 and 7 that are within the current APE (Figure 29). They recorded a dark gray clay silt to a depth of 10 ft above a grayish tan coralline sand. The boreholes closest to our subsurface testing area 3 and 4 (Figure 30 to Figure 33). The logs for Bore Holes 6 and 7 are available in Appendix C. The coralline sand we observed at around 10 ft (3 m) in Stratum VII coincides with the findings of GEOLABS, Inc (Kwock 2012).





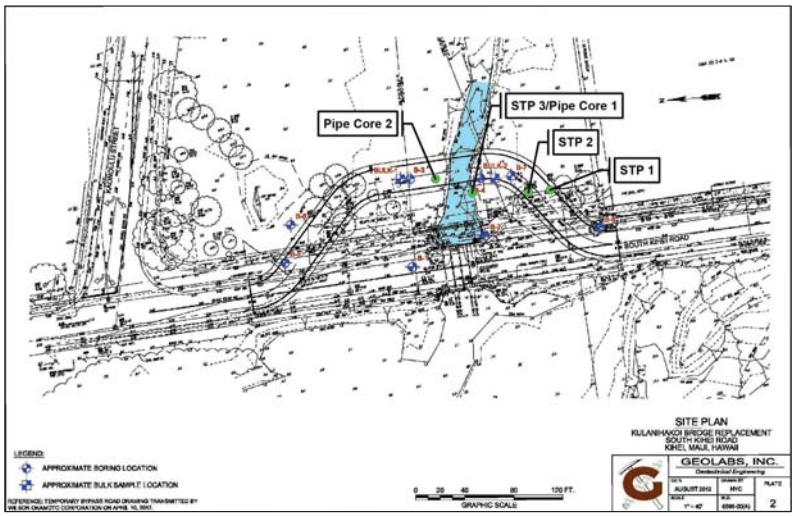



Figure 29. Site plan showing the location of STP's and pipe cores in relation to the boring and bulk samples taken by GEOLABS Inc. (adapted from Kwock 3013:35).

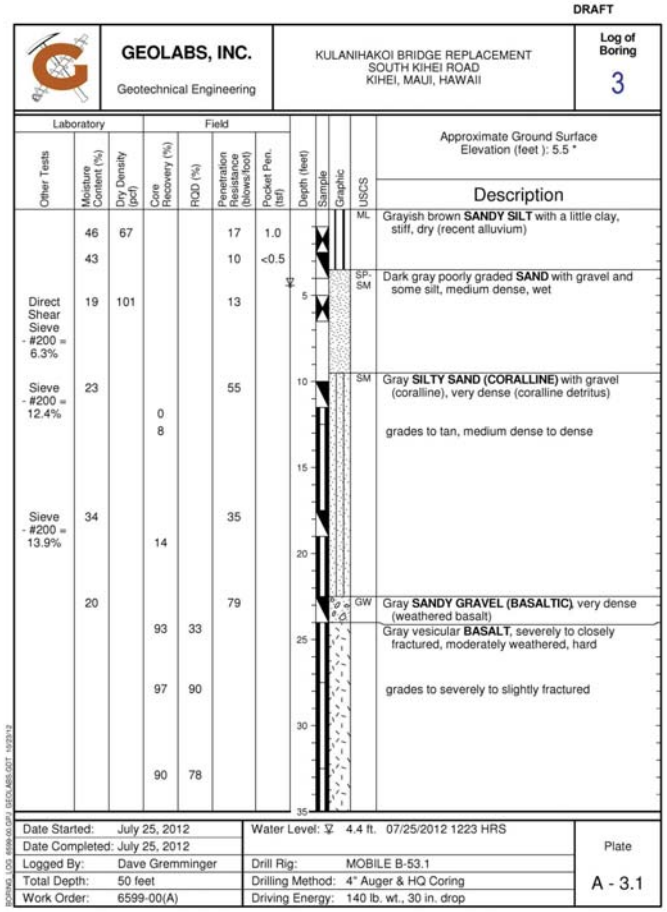



Figure 30. Log of Boring 3 (Kwock 3013:45).





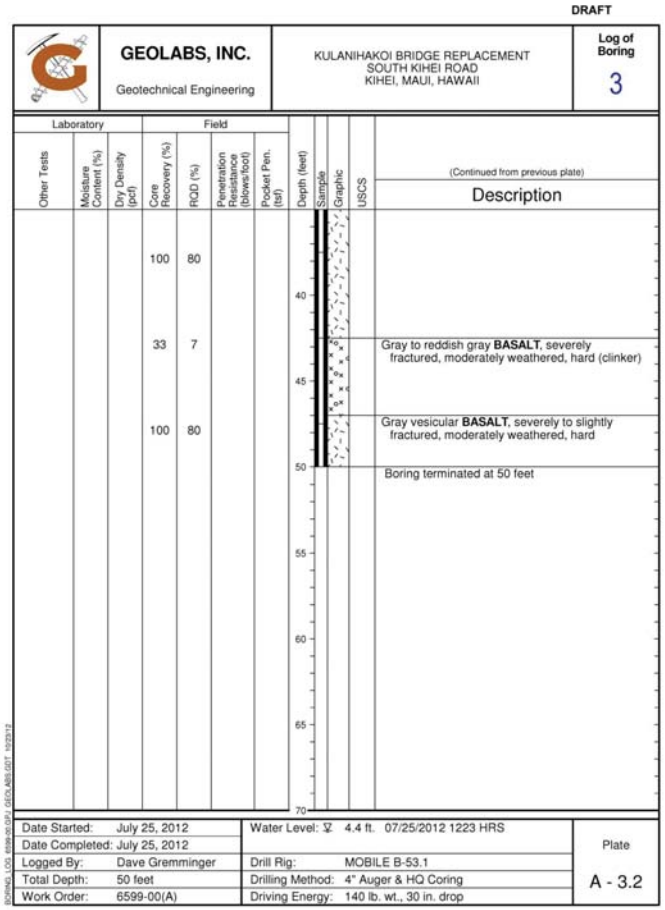



Figure 31. Log of Boring 3 (Kwock 3013:46).

DRAFT

**GEOLABS, INC.**
Geotechnical Engineering

KULANIHAKOI BRIDGE REPLACEMENT
SOUTH KIHEI ROAD
KIHEI, MAUI, HAWAII

Log of Boring
4

Approximate Ground Surface Elevation (feet ): 5 *

| Laboratory: Other Tests | Laboratory: Moisture Content (%) | Laboratory: Dry Density (pcf) | Field: Core Recovery (%) | Field: RQD (%) | Field: Penetration Resistance (blows/foot) | Field: Pocket Pen. (tsf) | Depth (feet) | USCS | Description |
|---|---|---|---|---|---|---|---|---|---|
| | 41 | 60 | | | 15 | 1.0 | | ML | Dark brown **SILT** with a little clay, stiff, dry (recent alluvium) |
| Sieve - #200 = 83.8% | 55 | | | | Wt. of Hammer | <0.5 | | ML | Dark gray **SANDY SILT**, very soft, wet |
| LL=NP PI=NP Consol. | 33 | 95 | | | 14 | | 5 | | grades to stiff |
| | | | | | | | 10 | | |
| Sieve - #200 = 10.5% | 28 | | 0 | | 40 | | 15 | SP-SM | Brownish tan poorly graded **SAND (CORALLINE)** with some gravel (coralline) and silt, dense (coralline detritus) |
| | 33 | | 36 | | 11 | | 20 | | grades with more gravel (coralline), medium dense<br>grades with some boulders (basaltic) |
| | 28 | | 64 | 0 | 69 | | 25 | MH | Reddish brown **CLAYEY SILT** with a little fine sand with traces of gravel, very hard (alluvium) |
| | | | 87 | 87 | | | 30 | | Gray vesicular **BASALT**, severely fractured, moderately weathered, hard<br>grades to closely to slightly fractured |
| | | | 78 | 37 | | | 35 | | grades to severely to closely fractured |

| | | | |
|---|---|---|---|
| Date Started: July 24, 2012 | Water Level: ▽ 4.3 ft. 07/24/2012 0000 HRS | | Plate |
| Date Completed: July 25, 2012 | | | |
| Logged By: Dave Gremminger | Drill Rig: MOBILE B-53.1 | | A - 4.1 |
| Total Depth: 50 feet | Drilling Method: 4" Auger & HQ Coring | | |
| Work Order: 6599-00(A) | Driving Energy: 140 lb. wt., 30 in. drop | | |

Figure 32. Log of Boring 4 (Kwock 3013:47).





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KULANIHAKOI BRIDGE REPLACEMENT
SOUTH KIHEI ROAD
KIHEI, MAUI, HAWAII

Log of Boring
4

(Continued from previous plate)

| Laboratory: Other Tests | Laboratory: Moisture Content (%) | Laboratory: Dry Density (pcf) | Field: Core Recovery (%) | Field: RQD (%) | Field: Penetration Resistance (blows/foot) | Field: Pocket Pen. (tsf) | Depth (feet) | USCS | Description |
|---|---|---|---|---|---|---|---|---|---|
| | | | 100 | 100 | | | 40 | | grades to severely to slightly fractured |
| | | | 100 | 47 | | | 45 | | grades to severely to moderately fractured |
| | | | 100 | 100 | | | 50 | | grades to closely to moderately fractured |
| | | | | | | | | | Boring terminated at 50 feet |
| | | | | | | | 55 | | |
| | | | | | | | 60 | | |
| | | | | | | | 65 | | |
| | | | | | | | 70 | | |

| | | | |
|---|---|---|---|
| Date Started: July 24, 2012 | Water Level: ▽ 4.3 ft. 07/24/2012 0000 HRS | | Plate |
| Date Completed: July 25, 2012 | | | |
| Logged By: Dave Gremminger | Drill Rig: MOBILE B-53.1 | | A - 4.2 |
| Total Depth: 50 feet | Drilling Method: 4" Auger & HQ Coring | | |
| Work Order: 6599-00(A) | Driving Energy: 140 lb. wt., 30 in. drop | | |

Figure 33. Log of Boring 4 (Kwock 3013:48).

# Section 7 Significance Assessments

Significance assessments have been made in accordance with the State Department of Land and Natural Resources (DLNR) Chapter 13-284, Hawai‘i Administrative Rules (HAR), entitled “Rules Governing Procedures for Historic Preservation Review to Comment on Section 6E-42, Hawai‘i Revised Statutes (HRS), Projects”; Chapter 13-284-6 entitled “Evaluation of Significance”, states:

a. Once a historic property is identified, then an assessment of significance shall occur. The agency shall make this initial assessment, or delegate this assessment, in writing, to the SHPD. This information shall be submitted concurrently with the survey report, if historic properties are found in the survey.

b. To be significant, a historic property shall possess integrity of location, design, setting, materials, workmanship, feeling, and association and shall meet one or more of the following criteria:

   *A. Sites that are associated with events that have made a significant contribution to broad patterns of our history; or*

   *B. Sites that are associated with the lives of persons significant in our past; or*

   *C. Sites that embody the distinctive characteristics of a type, period, or method of construction, or that represents the work of a master, or that possesses high artistic values, or that represents a significant or distinguishable entity, whose components may lack individual distinction; or*

   *D. Sites which have yielded, or may be likely to yield, information important in prehistory or history; or*

   *E. Sites which have an important value to the native Hawaiian people or to another ethnic group of the State due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events, or oral accounts- these associations being important to the groups’ history and cultural identity.*

## 7.1 SIHP 50-50-10-7606

### 7.1.1 Criterion of Significance D

This historic bridge has yielded information important to the understanding of the first generation of concrete bridges in the Hawaiian Islands. For this reasons SIHP -7606 is considered significant under Criterion D. Sufficient information concerning SIHP-7606 was collected during this investigation.

Based on the above significance evaluation of 50-50-10-7606, Cultural Surveys Hawai‘i, Inc. is recommending no further work.





# Section 8 Project Effect and Mitigation Recommendations

An architectural review of SIHP 50-50-10-7606 was conducted in December of 2012 by the Architectural Branch of SHPD (LOG: 2012.3734 DOC: 1212RS64) based on the initial Literature Review and Field Inspection (Medeiros et al. 2012). It was concluded that although the bridge does represent the first generation if concrete bridges in Hawai‘i, it has since lost any distinguishing architectural characteristics. A determination of no effect on historic property was recommended(Appendix B).

## 8.1 Mitigation Recommendations

While sub-surface testing was not completed by CSH beneath S. Kihei road, boring logs from the Geotechnical report completed by Geolabs Inc. (Kwock 2012), recorded the presence of coralline sand around 3.7 m (12 ft) below the surface of the road. The presence of this type of sediment deposit may present the potential for encountering sensitive cultural resources in a sub-surface context. In addition the subsurface testing for traditional fishpond deposits was limited to 3m (10 ft) below the ground surface. Therefore, any sub-surface excavation exceeding 3 m (10) feet or containing coralline sand and the culvert removal should be monitored by a qualified archaeologist.

## 8.2 Disposition of Material

All of the data gathered and generated during the course of this investigation are currently being curated and housed at the Maui Office of Cultural Surveys Hawai‘i Inc. (1860 Main Street, Wailuku, HI 96793), with copies on file at the main office of Cultural Surveys Hawai‘i, Inc. (41-1537 Kalanianaole HWY # 200, Waimanalo, HI 96795-1185).

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# Appendix A Pollen Analysis Report

# POLLEN ANALYSIS OF SAMPLES FROM AUGER 1 OF THE KAONOULU 7 PROJECT, MAUI

By

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With assistance from
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PaleoResearch Institute Technical Report 13-055

Prepared for

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Wailuku, Hawaii

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## INTRODUCTION

The Kūlanihāko'i Bridge Replacement Project, in the Ka'ono'ulu Ahupua'a, Kula District on Maui involved archaeological testing that included sampling marshy deposits. Kūlanihāko'i Stream and Gulch experiences flooding during the winter as a result of *naulu* (southern-exposure rains), which carry debris from the *mauka* or Kula reaches of the gulch. Two soil samples, collected from Auger 1 and representing Layers IV and VI, were examined for pollen to provide information concerning local vegetation and potential use of this area.

## METHODS

### Pollen

Due to the highly organic nature of these samples, our normal chemical extraction technique was modified. Approximately 1.25 cubic centimeters (cc) of organic-rich sediment was selected for each sample, which received a small amount of hydrochloric acid (10%) to remove any calcium carbonates present in the soil. Next the samples were screened through 250-micron mesh. The samples were allowed to settle for 2 hours, after which the supernatant was poured off and the samples were transferred to 50 ml tubes. The samples then received a 30 minute treatment in hot hydrofluoric (HF) acid to remove inorganic particles. The samples were acetylated for 5 minutes to remove extraneous, non-pollen organic matter.

A light microscope was used to count pollen at a magnification of 500x. Pollen preservation in these samples varied from good to poor. Comparative reference material collected at the Intermountain Herbarium at Utah State University, the University of Colorado Herbarium, and the Bishop Museum Herbarium was used to identify the pollen to the family, genus, and species level, where possible.

Pollen aggregates were recorded during identification of the pollen. Aggregates are clumps of a single type of pollen and may be interpreted to represent either pollen dispersal over short distances or the introduction of portions of the plant represented into an archaeological setting. The aggregates were included in the pollen counts as single grains, as is customary. The presence of aggregates is noted by an "A" next to the pollen frequency on the percentage pollen diagram. The percentage pollen diagram was produced using Tilia 2.0 and TGView 2.0.2. Total pollen concentrations were calculated in Tilia using the quantity of sample processed in cubic centimeters (cc), the quantity of exotics (spores) added to the sample, the quantity of exotics counted, and the total pollen counted and expressed as pollen per cc of sediment.

"Indeterminate" pollen includes pollen grains that are folded, mutilated, or otherwise distorted beyond recognition. These grains were included in the total pollen count since they are part of the pollen record.

## DISCUSSION

The Kūlanihāko'i Bridge Replacement Project is located on the leeward-facing slopes of Haleakalā adjacent to the Kīhei coastline at mean sea level. Annual rainfall averages between 15 and 19 inches annually, with winter receiving the heaviest rainfall. Lowland, dry shrubland and grassland are postulated as the native ecosystem (Pratt 1998 in McCurdy and Hammatt 2013). Currently local vegetation consists primarily of *Akulikuli* (*Sesuvium portulacastrum*).

Pollen analysis of two samples collected from Layers IV and VI in Auger 1 (Table 1) provide a record of earlier vegetation. Poaceae pollen (Figure 1, Table 2) is the dominant in both samples, accompanied by moderate quantities of various types of Asteraceae pollen indicating that the area may, indeed, be best described as having been a grassland that also supported many plants in the sunflower family (Asteraceae). Recovery of two sizes of Poaceae pollen was noted. The larger Poaceae might reflect grasses such as *pili*, which produce larger pollen. In the lower sample Cheno-am pollen was moderately abundant, suggesting local growth of shrubby *aheahea*. *Prosopis* pollen was observed in both samples, indicating local growth of *kiawe* and relatively recent accumulation of sediment in this location. Sample 2, representing Layer VI, is particularly rich in pollen taxa, as it contains small quantities of *Acacia*, *Acacia koa*, Myrtaceae, *Coprosma*, *Dodonaea*, Fabaceae, *Senna*-type, Ericaceae, *Ilex*-type, *Kadua*, *Hibiscus*, *Sida*, *Waltheria*, *Artemisia*, Brassicaceae, and *Euphorbia* representing acacia, members of the myrtle family, *'Aiakanene*, *A'ali'i*, members of the legume family such as *kolomona* or perhaps the introduced candle bush, members of the heath family, possibly holly, *au*, *aloalo*, *'ilima*, *'uhaloa*, *'ahinahina*, members of the mustard family, and *kaliko*. Recovery of Cyperaceae pollen indicates that sedges grew with the grasses. The lowest sample (2) contains *Prosopis* as the primary pollen representing alien plants in the local vegetation community. Ferns, represented primarily by monolete and trilete spores, as well as spores typical of the Dicksoniaceae, also grew in the area.

Sample 2, representing Layer VI, also contained a small quantity of *Zea mays* pollen, reflecting local cultivation of corn/maize. This pollen is large and heavy, usually traveling no farther than a few tens of meters from the plants. This pollen exhibits several characteristics making it distinct from that of sugarcane in that it is larger, has a different surface texture, and the annulus surrounding the pore is wider. Duensing (2008:160) reports that corn was grown in the Hawai'ian Islands as early as 1826 for personal consumption, although it was closer to the middle of the Nineteenth Century before it became a viable commercial crop. Corn was grown as a field crop for horses and cattle by about 1853 on Maui, particularly in the Kula district (Crawford 1937:101). Pests and mosaic disease, as well as the fact that corn was not well integrated into the local diet, eventually lead to the reduction in acres devoted to this crop after 1928.

Sample 1 exhibits fewer pollen taxa suggesting that vegetation diversity decreased. *Pandanus*, *Rauvolfia*, and *Scaevola* pollen recovered in this sample, but not the lower sample, indicate that beach vegetation included *hala*, *hao*, and *naupaka*. In addition, pollen representing aliens included *Casuarina*, *Erodium*, and *Leucaena*, representing Australian pine, filaree, and *koa haole* growing in the area by the time the sediments in Layer IV accumulated. Finally, this sample also contained a small quantity of *Sporormiella* dung fungal spores. In this author's experience *Sporormiella* dung fungal spores are rarely encountered in Hawaiian sediments.

2





*Sporormiella* is an ascomycete fungus found only on the dung of herbivores. The genus is widespread in sub-boreal and temperate regions of the world. *Sporormiella* spores are borne in ascomata on the surface of drying dung and are spread passively to nearby vegetation, with which they are ingested (Davis and Shafer 2006). Many coprophilous fungi, such as *Sporormiella*, rely on a cyclic process involving herbivore ingestion of spores with foliage, germination of spores following passage through the gut, mycelial growth within, and eventual sporulation on dung (Wicklow et al. 1980). While grazing, herbivores also can inadvertently ingest ascomata, the fruiting bodies on dung that contain millions of individual spores, especially in areas where dense herbivore populations exist (Aptroot and Geel 2006). Depending on the context of the sample, recovery of *Sporormiella* in archaeological samples can be an indicator for the presence and utilization of herbivores. Interpretations can range from the presence of dung on the landscape to burning dung for fuel to the utilization of intestinal material for cooking and subsistence.

*Sporormiella* often becomes more abundant in Historic Period sediments following the historic introduction of grazing animals. Its increasing presence in historic samples has been noted in numerous palynological studies (Davis 1987). *Sporormiella* fungal spores are not confined to the dung of introduced herbivores, since they also occur on dung from bison, moose, wild sheep, deer, elk, caribou, and rabbits. The increase of *Sporormiella* spores in historic sediments may relate to changing land use patterns and increase in the length of time that herds of animals occupy any given area.

## SUMMARY AND CONCLUSIONS

Pollen analysis of two samples from the Kūlanihāko'i Bridge Replacement Project in South Maui indicates that the sediments in Layers VI and IV accumulated during the historic era. Although *Prosopis* pollen was observed in both samples, pollen representing other alien plants including Australian pine, filaree, and *koa haole* was present only in the upper sample. The pollen record is one of vegetation typical in dry areas and may best described as mixed grassland. The lowest sample contained *Zea mays* pollen, which is evidence in this core of the growth of corn in the Kula area of Maui. A map from 1903 of Maui shows areas across the leeward slope of Haleakalā deemed good agricultural land for growing corn and potatoes (Duensing 2008:164). If corn was grown at higher elevations on Haleakalā, then sediment transport down the Kūlanihāko'i Stream and Gulch are probably responsible for recovery of this pollen. It is also possible that corn was grown much closer to the area sampled. Recovery of *Zea mays* pollen from this sample is an interesting, if unexpected, result of this study. The presence of *Sporormiella* dung fungal spores in the uppermost sample probably reflects use of some of the land on the leeward slopes of Haleakalā for grazing.

3

TABLE 1
PROVENIENCE DATA FOR SAMPLES FROM AUGER 1 OF THE KAONOULU7 PROJECT

| Sample No. | Level (Layer) | Depth (cmbs) | Sample Description/ Provenience | Analysis |
|---|---|---|---|---|
| 001 | IV | 79-80 | Marsh/Stagnant sediment | Pollen |
| 002 | VI | 154-155 | Marsh/Stagnant sediment | Pollen |

4





TABLE 2
POLLEN TYPES OBSERVED IN SAMPLES FROM

| Scientific Name | Common Name | Nat | Pol | End | Ind |
|---|---|---|---|---|---|
| TREES: | | | | | |
| *Acacia* | *Koa, kolu, koai'a* | x | | x | |
| *Acacia koa* | *Koa 'ohā, koai'a, koai'e, dwarf koa* | | | x | |
| Myrtaceae | Myrtle family | x | x | x | x |
| *Pandanus tectorius* | *Hala, pū hala* | | | | x |
| *Rauvolfia sandwicensis* | *Hao* | | | x | |
| SHRUBS: | | | | | |
| *Coprosma* | *'Aiakanene, kukuaenene, leponene, nene, punene, coprosma* | | | x | |
| *Dodonaea viscosa* | *A'ali'i, ('a'ali'i kū makani, 'a'ali'i kū ma kua, kūmakani)* | | | | x |
| Ericaceae | Heath family | | | x | |
| Fabaceae | Legume or pea family | x | x | x | x |
| *Senna*-type | Candle bush and others | x | | | |
| *Ilex aquifolium* and *Ilex paraguariensis* | English or European holly, yerbe mate, Paraguay tea | x | | | |
| *Kadua* | *Au, pilo, 'Awiwi, kio'ele*, etc. | x | | x | |
| *Labordia* | *Kamakahala* | | | x | |
| Malvaceae | Mallow family | x | | x | x |
| *Hibiscus* | *Aloalo, hau, koki'o ke 'oke'o, (hau hele, koki'o kea, pamakani), ma'o hau hele, kaiohala, (akiahala, hau hele wai), koki'o (mākū)*, large-leaved hau, cotton or confederate rose (*aloalo waikāhuli, waikāhuli*) | x | | x | x |
| *Sida* | *'Ilima*, Prickly sida | x | | | x |
| *Myrsine* | *Kōlea, 'Ōliko, Kōlea lau nui, Kōlea lau li'i* | | | x | |
| *Scaevola* | *Naupaka* | | | x | x |
| *Waltheria* | *'Uhaloa ('ala'ala pū loa)* | | | | x? |

5

TABLE 2 (Continued)

| Scientific Name | Common Name | Nat | Pol | End | Ind |
|---|---|---|---|---|---|
| HERBS AND GRASSES: | | | | | |
| Asteraceae | Sunflower family | x | | x | x |
| *Artemisia* | *Āhinahina, hinahina, hina hina kuahiwi* | x | | x | |
| Low-spine Asteraceae | Sunflower family; Includes ragweed and others | x | | x | x |
| High-Spine Asteraceae | Sunflower family; Includes *Bidens* | x | | x | x |
| Liguliflorae | Sunflower family, chicory tribe | x | | | |
| Apiaceae (Umbelliferae) | | x | | x | |
| Brassicaceae | Mustard family | | | | |
| Caryophyllaceae | Pink family | x | | x | |
| Cheno-am | *Achyranthes, Chenopodium oahuense, Amaranthus, Charpentiera,* etc. | x | | x | |
| Cyperaceae | Sedge family | x | | x | x |
| *Euphorbia* | *Kaliko*, spurge, Mexican fireplant (wild poinsettia) | x | | x | |
| Poaceae | Grass family | x | | x | x |
| Poaceae large | Members of the Grass family with larger pollen such as *pili* grass | | | | x |
| *Typha domingensis/latifolia* | Cattail | x | | | |
| ALIENS: | | | | | |
| *Casuarina* | Australian pine (Ironwood, *Paina*) | x | | | |
| *Erodium* | Storksbill, heron-bill, filaree | x | | | |
| *Leucaena* | *Kao-haole (‘ekoa, lilikoa)* | x | | | |
| *Prosopis* | *Kiawe*, mesquite | x | | | |
| *Zea mays* | Maize, corn | Agric | | | |
| Indeterminate | Too badly deteriorated to identify | | | | |
| SPORES: | | | | | |
| Dicksoniaceae | Tree fern family | | | x | x |

6





TABLE 2 (Continued)

| Scientific Name | Common Name | Nat | Pol | End | Ind |
|---|---|---|---|---|---|
| *Lycopodium Haleakala* or *L. serratum* | Club moss | | | | |
| *Lycopodium cernuum* | Club moss (*Wawae‘iole*) | | | x | |
| Monolete smooth | Fern | | | | |
| Monolete bumpy | Fern | | | | |
| Trilete smooth or spiny | Fern | | | | |
| *Tetraploa* | Fungal spore | | | | |
| OTHER: | | | | | |
| Charred Asteraceae fragment | Charred fragment from a member of the sunflower family | | | | |
| Charred Asteraceae seed fragment | Charred seed fragment from a member of the sunflower family | | | | |
| Scolecodont | Worm jaw | | | | |
| Sporormiella | Dung fungus | | | | |
| Total pollen concentration | Quantity of pollen per cubic centimeter (cc) of sediment | | | | |

Plant names and information derived from (Wagner et al. 1990)
Fern (spore) names derived from (Selling 1946)

Nat = Naturalized
Pol = Polynesian introduction
End = Endemic
Ind = Indigenous
Agric = Agricultural

Pollen identifications to species were made based on the fact that only 1 species is reported by (Wagner, et al. 1990). Species identification was not made based on morphologic characteristics observed under the microscope.

7

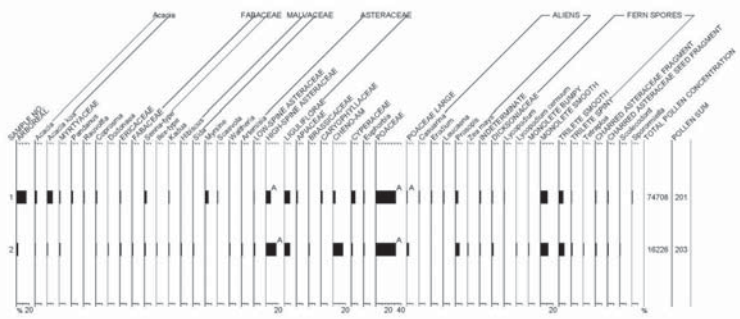


FIGURE 1. POLLEN DIAGRAM FOR AUGER 1, KAONOULU 7, MAUI.





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9

# Appendix B SHPD Architectural Branch Determination letter





NEIL ABERCROMBIE
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KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

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

HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD STE 555
KAPOLEI HI 96707

**DATE:** December 20, 2012

**LOG:** 2012.3734
**DOC:** 1212RS64
Architecture

**TO:** Colleen Medeiros
Cultural Surveys Hawaii, Inc.
1860 Main Street
Wailuku, HI 96793

**SUBJECT:** **Section 6E-8 Historic Preservation Review**
**Project:** Emergency replacement of Kulanihakoi Bridge
**Owner:** County of Maui
**Location:** South Kihei Road, Maui
**Tax Map Key:** (2) 3-9-001:015, :147, :162, :999

---

**Date Received by SHPD:** December 18, 2012

**Description of Project/Undertaking:** Emergency replacement/demolition of Kulanihakoi Bridge.

**Area of Potential Effect (APE):** South Kihei Road over Kulanihakoi Stream and immediate approaches

**Description of Historic Resource:** Built in 1911, the bridge is 101 years old. It consists of four reinforced box drain culverts that are six feet wide by four feet high by 38 feet long. The existing bridge has suffered such severe spalling and other deterioration so that it no longer has any structure above its deck surface.

**Eligibility:** While the bridge is unique due to age, representing the first generation of concrete bridges in the islands, it is literally falling apart and has lost any distinguishing architectural characteristics. On this basis it has lost integrity and is not eligible. A telephone call on December 18, 2012 to Stanley Solamillo, Maui County Planner, confirmed this assessment.

**Documentation Received:** *An Archaeological Literature Review and Field Inspection for Kulanihakoi Bridge Replacement Project, Kaonoulu Ahupuaa, Wailuku District, Maui Island.* Cultural Surveys Hawaii, Inc., for Wilson Okamoto Corporation, October 2012. Included are photographs of the bridge and area history.

**SHPD Determination:** SHPD determines that the proposed project will have *no effect on historic property.*

Any questions should be addressed to Ross Stephenson, SHPD Historian, at (808) 692-8028 or ross.w.stephenson@hawaii.gov

Mahalo for the opportunity to comment,

Ange Westfall
Architecture Branch Chief, Hawaii Historic Preservation Division

In the event that historic resources, including human skeletal remains, lava tubes, and lava blisters/bubbles are identified during construction activities, all work should cease in the immediate vicinity of the find, the find should be protected from additional disturbance, and the State Historic Preservation Division should be contacted immediately at (808) 692-8015.

# Appendix C Logs for Bore Holes 6 and 7





DRAFT

**GEOLABS, INC.**
Geotechnical Engineering

KULANIHAKOI BRIDGE REPLACEMENT
SOUTH KIHEI ROAD
KIHEI, MAUI, HAWAII

Log of Boring
6

Approximate Ground Surface Elevation (feet ): 6.5 *

| Other Tests | Moisture Content (%) | Dry Density (pcf) | Core Recovery (%) | RQD (%) | Penetration Resistance (blows/foot) | Pocket Pen. (tsf) | Depth (feet) | Sample | Graphic | USCS | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 26 | 68 | | | 25 | 1.5 | | | | ML | Grayish brown **SANDY SILT** with a little clay, very stiff, dry (recent alluvium) |
| | 31 | | | | 11 | | | | | SM | Dark gray **SILTY SAND** with some fine gravel, medium dense, wet |
| | 45 | 73 | | | 19 | | 5 | | | | |
| | 45 | | | | 40 | | 10 | | | SM | Grayish tan **SILTY SAND (CORALLINE)** with a little gravel (coralline), dense (coralline detritus) |
| | | | | | | | | | | | Boring terminated at 11.5 feet |
| | | | | | | | 15 | | | | |
| | | | | | | | 20 | | | | |
| | | | | | | | 25 | | | | |
| | | | | | | | 30 | | | | |
| | | | | | | | 35 | | | | |

| | | | |
|---|---|---|---|
| Date Started: | July 25, 2012 | Water Level: ▽ 4.6 ft. 07/26/2012 0946 HRS | Plate |
| Date Completed: | July 25, 2012 | | |
| Logged By: | Dave Gremminger | Drill Rig: MOBILE B-53.1 | A - 6 |
| Total Depth: | 11.5 feet | Drilling Method: 4" Auger | |
| Work Order: | 6599-00(A) | Driving Energy: 140 lb. wt., 30 in. drop | |

BORING LOG 6599-00.GPJ GEOLABS.GDT 10/29/12

DRAFT

**GEOLABS, INC.**
Geotechnical Engineering

KULANIHAKOI BRIDGE REPLACEMENT
SOUTH KIHEI ROAD
KIHEI, MAUI, HAWAII

Log of Boring 7

Approximate Ground Surface Elevation (feet ): 6 *

| Laboratory: Other Tests | Laboratory: Moisture Content (%) | Laboratory: Dry Density (pcf) | Field: Core Recovery (%) | Field: RQD (%) | Field: Penetration Resistance (blows/foot) | Field: Pocket Pen. (tsf) | Depth (feet) | Sample | Graphic | USCS | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 30 | 44 | | | 90 | | | | | ML | Grayish brown **SANDY SILT** with a little clay, very hard, dry (recent alluvium) |
| | 38 | | | | 14 | 1.0 | | | | | |
| | 39 | 93 | | | 21 | | 5 | | | MH | Dark gray **CLAYEY SILT** with some fine sand, stiff, wet |
| | 39 | | | | 21 | | 10 | | | SW | Grayish tan **GRAVELLY SAND (CORALLINE)** with a little silt, medium dense (coralline detritus) |
| | | | | | | | | | | | Boring terminated at 11.5 feet |
| | | | | | | | 15 | | | | |
| | | | | | | | 20 | | | | |
| | | | | | | | 25 | | | | |
| | | | | | | | 30 | | | | |
| | | | | | | | 35 | | | | |

| | | | |
|---|---|---|---|
| Date Started: | July 25, 2012 | Water Level: ▽ 4.3 ft. 07/25/2012 0955 HRS | Plate |
| Date Completed: | July 25, 2012 | | |
| Logged By: | Dave Gremminger | Drill Rig: MOBILE B-53.1 | |
| Total Depth: | 11.5 feet | Drilling Method: 4" Auger | A - 7 |
| Work Order: | 6599-00(A) | Driving Energy: 140 lb. wt., 30 in. drop | |

BORING_LOG_6599-00.GPJ GEOLABS.GDT 12/29/12



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HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

**HISTORIC PRESERVATION DIVISION**
**DEPARTMENT OF LAND AND NATURAL RESOURCES**

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

June 25, 2014

Dr. Hallett H. Hammatt
Cultural Surveys Hawai‘i, Inc.
1860 Main Street
Wailuku, Hawaii 96793

LOG NO: 2014.00115
DOC NO: 1406JP16
Archaeology

Aloha Dr. Hammatt:

SUBJECT: **Chapter 6E-8 and National Historic Preservation Act Section 106 Review - Revised Archaeological Inventory Survey for the Kūlanihako‘i Bridge Replacement Project Ka‘ono‘ulu Ahupua‘a, Wailuku District, Island of Maui TMK (2) 3-9-001: 143, 162, 999 (portions)**

Thank you for submitting the revised draft report entitled *An Archaeological Inventory Survey for the Kūlanihako‘i Bridge Replacement Project, Ka‘ono‘ulu Ahupua‘a, Wailuku District, Maui Island, TMK: (2) 3-9-001: 999, 162, 143 (pors)*, Todd D. McCurdy and Hallett Hammatt (2014). We received the revised submittal on January 9, 2014.

The revised draft report was prepared in support of compliance with state and federal historic preservation review regulations Chapter 6E-8 and Section 106 of the National Historic Preservation Act (NHPA). We previously reviewed the draft inventory survey report and recommended revisions (*Log 2013.4397, Doc 1309CG03*). Thank you for including the updated construction plans and maps depicting the approximate 0.9 acre area of potential effect, which consists of the detour bridge, the temporary support structure, and the replacement of the existing bridge. The 1911 Kulanihako‘i Bridge is listed in the State Inventory as 50-50-10-7606 based on Criterion D. The bridge has suffered severe deterioration so it no longer has any distinguishing architectural characteristics. Therefore, it has lost integrity and is not eligible for the National Register (*Log 2012.3734, Doc 1212RS64*). The historic bridge has yielded information important to the understanding of the first generation of concrete bridges in the Hawaiian Islands. Sufficient information was collected and no further work recommended for Site 7606. No additional historic properties were identified during the survey. An archaeological monitoring program is recommended, and we concur with that assessment.

Changes made according to our requested revisions are adequate; the archaeological inventory survey meets the requirements of Hawai‘i Administrative Rule § 13-276 and is accepted as final. Please send one hardcopy of the final document, clearly marked FINAL, along with a copy of this review letter and a text-searchable PDF version on CD to the Kapolei SHPD office, attention SHPD Library. We look forward to continued consultation regarding historic properties (36 CFR Part 800.4), and the assessment of adverse effects (36 CFR Part 800.5). Please contact Jenny Pickett at (808) 243-5169 or Jenny.L.Pickett@Hawaii.gov for any questions or concerns about this letter.

Mahalo,

Theresa K. Donham
Deputy Historic Preservation Officer

cc: County of Maui DSA Fax: (808) 270-7972
Department of Planning (planning@mauicounty.gov)
Annalise Kehler (annalise.kehler@mauicounty.gov)
Tanya Lee-Greig (LeeGreig@culturalsurveys.com)

# APPENDIX E

***Traffic Assessment Report for Kūlanihāko‘i Bridge Replacement***

***Wilson Okamoto Corporation***

***December 2012***

Traffic Assessment Report

# *Kulanihakoi Bridge Replacement*

Prepared for:
County of Maui
Department of Public Works

Prepared by:
Wilson Okamoto Corporation

December 2012

***TRAFFIC ASSESSMENT REPORT***

***FOR THE***

***KULANIHAKOI BRIDGE REPLACEMENT***

*Prepared for*:

County of Maui
Department of Public Works
200 South High Street
Wailuku, Maui, HI 96793

*Prepared by*:

Wilson Okamoto Corporation
1907 S. Beretania Street, Suite 400
Honolulu, Hawaii 96826
WOC Ref #8256-01

December 2012

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| APPENDIX C | Capacity Analysis Calculations<br>Existing Peak Hour Traffic Analysis |
| APPENDIX D | Capacity Analysis Calculations<br>Interim Peak Hour Traffic Analysis |
| APPENDIX E | Capacity Analysis Calculations<br>Year 2015 Peak Hour Traffic Analysis |

## I. INTRODUCTION

### A. Purpose of Study

The purpose of this study is to assess traffic operations along South Kihei Road with the proposed replacement of the Kulanihakoi Bridge in Kihei on the island of Maui. A temporary detour road and bridge will be provided during construction to accommodated traffic along that roadway.

### B. Scope of Study

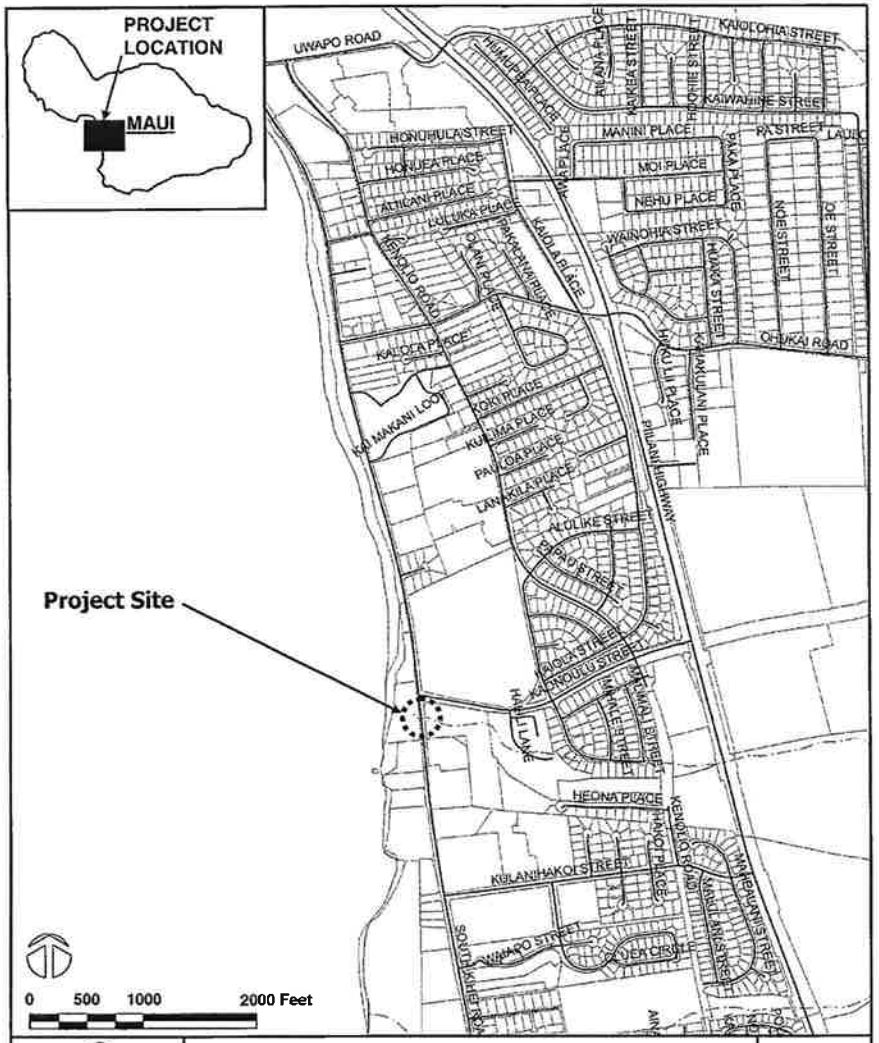
This report presents the findings and conclusions of the traffic study, the scope of which includes:

1. Description of the proposed project.
2. Evaluation of existing roadway and traffic operations in the vicinity.
3. The identification and analysis of traffic operations with the proposed project.
4. Recommendations of improvements, if appropriate, that would mitigate traffic conditions resulting from the proposed project.

## II. PROJECT DESCRIPTION

The existing Kulanihakoi Bridge is located along South Kihei Road between Kaonoulu Street and Kulanihakoi Street in Kihei on the island of Maui (see Figure 1). The proposed project entails the replacement of the existing 4-cell culvert system at the bridge with a six-cell culvert system with inlet and outlet head walls. Currently, the bridge accommodates two ~10' lanes of traffic along South Kihei Road (one lane in each direction) with ~4' shoulders. Prior to the removal of the existing bridge, a two-lane, two-way temporary detour road and steel panel bridge will be constructed east of the existing bridge that will accommodate two 12' lanes (one lane in each direction) without shoulders. After construction, the temporary road and bridge will be removed. The new Kulanihakoi Bridge is expected to be completed by the Year 2015 and will provide two 12' lanes (one lane in each direction) with 5' shoulders that should provide enhanced safety for pedestrians and bicyclists. Figures 2 and 3 show the plan views for the temporary or interim and replacement bridges.



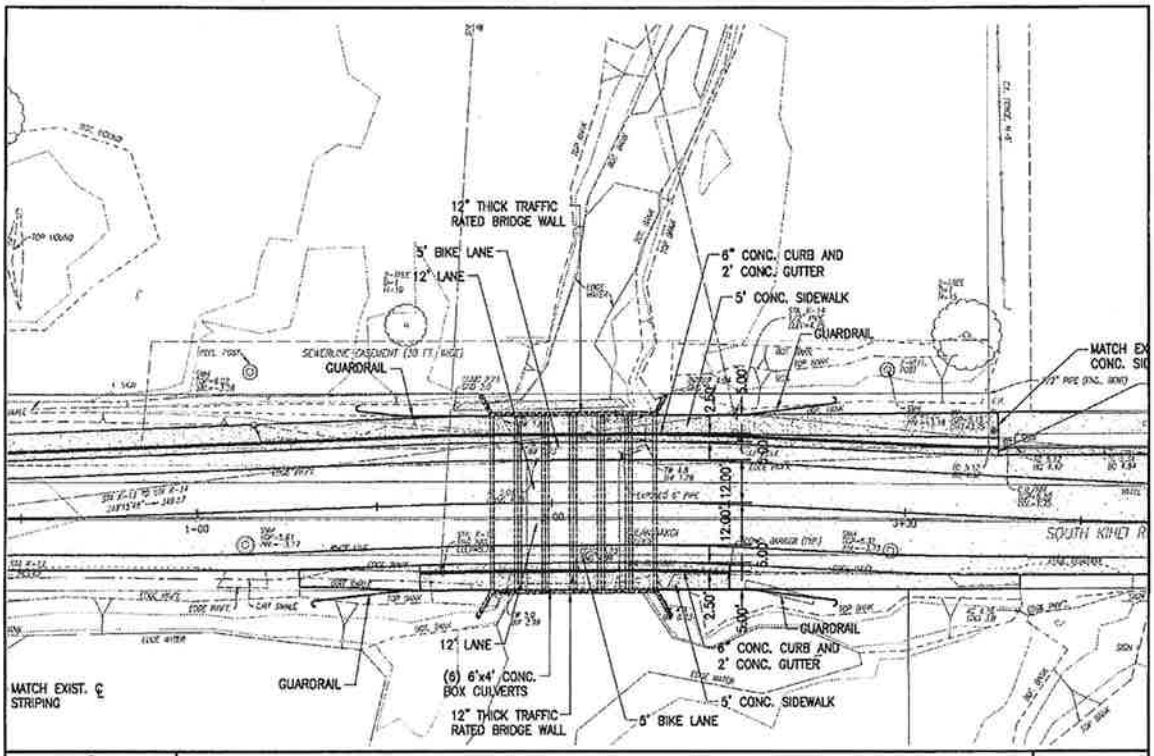



WILSON OKAMOTO CORPORATION ENGINEERS • PLANNERS

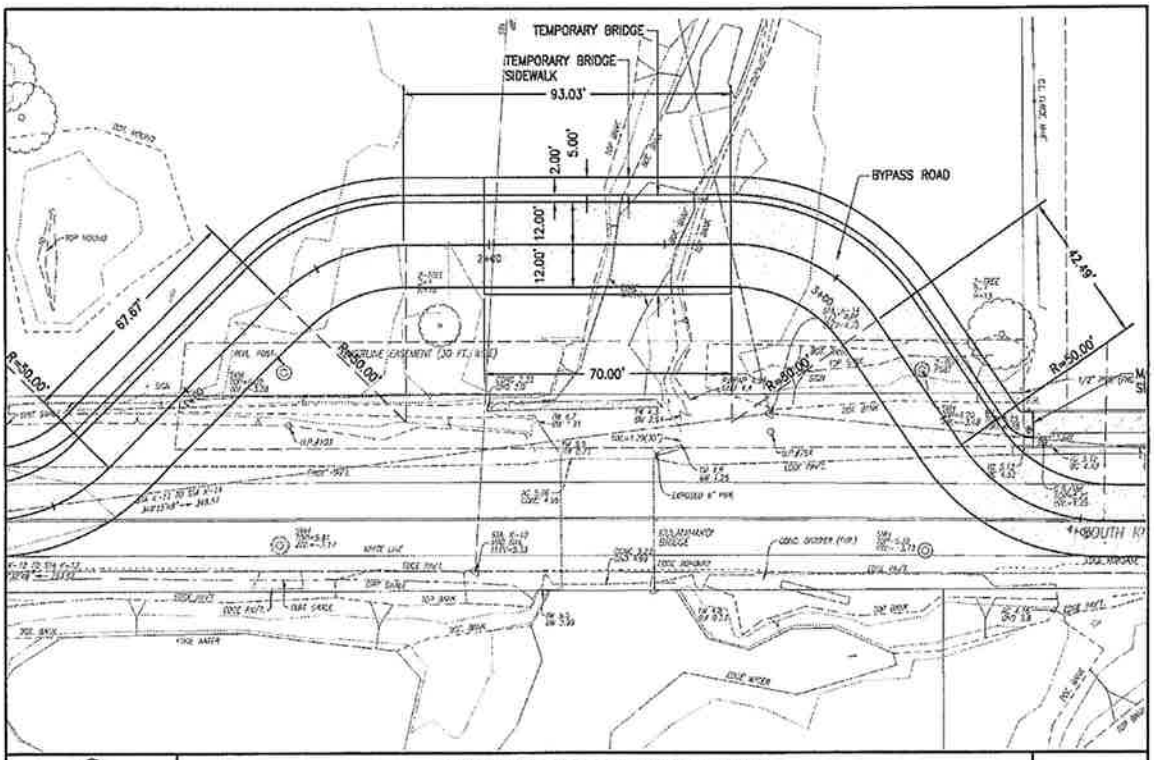
KULANIHAKOI BRIDGE REPLACEMENT

LOCATION MAP AND VICINITY MAP

FIGURE 1




| | | |
|---|---|---|
| WILSON OKAMOTO CORPORATION ENGINEERS - PLANNERS | KULANIHAKOI BRIDGE REPLACEMENT<br>REPLACEMENT BRIDGE – PLAN VIEW | FIGURE 3 |




| | | |
|---|---|---|
| WILSON OKAMOTO CORPORATION ENGINEERS - PLANNERS | KULANIHAKOI BRIDGE REPLACEMENT<br>TEMPORARY BRIDGE – PLAN VIEW | FIGURE 2 |

## III. EXISTING TRAFFIC CONDITIONS

### A. General

In the vicinity of the project site, South Kihei Road is a predominantly two-lane, two-way roadway generally oriented in the north-south direction that provides access through Kihei. Field investigations were conducted in October 2012 to survey the existing traffic volumes currently utilizing South Kihei Road between Kaonoulu Street and Kulanihakoi Street. The investigations consisted of 24-hour mechanical count surveys near the existing Kulanihakoi Bridge. Appendix A includes the existing traffic count data.

### B. Capacity Analysis Methodology

The highway capacity analysis performed in this study is based upon procedures presented in the "Highway Capacity Manual", Transportation Research Board, 2010, and the "HCS" software, developed by the Federal Highway Administration (FHWA). The analysis is based on the concept of Level of Service (LOS).

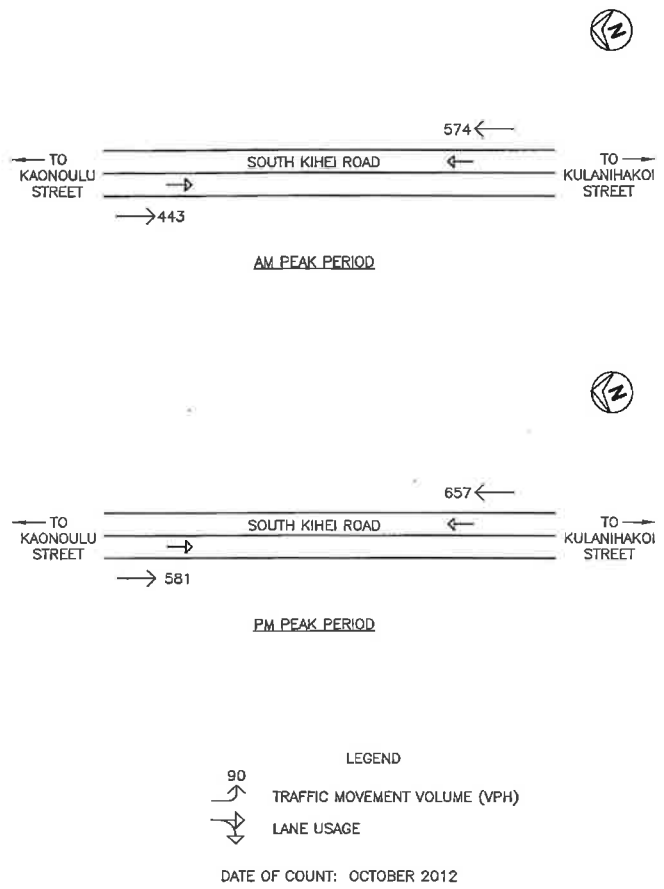
LOS is a quantitative and qualitative assessment of traffic operations. Levels of Service are defined by LOS "A" through "F"; LOS "A" representing ideal or free-flow traffic operating conditions and LOS "F" unacceptable or potentially congested traffic operating conditions.

"Volume-to-Capacity" (v/c) ratio is another measure indicating the relative traffic demand to the road carrying capacity. A v/c ratio of one (1.00) indicates that the roadway is operating at or near capacity. A v/c ratio of greater than 1.00 indicates that the traffic demand exceeds the road's carrying capacity. The LOS definitions are included in Appendix B.

### C. Existing Peak Hour Traffic

Figure 4 shows the existing AM and PM peak hour traffic volumes along South Kihei Road near the existing bridge. The AM peak hour of traffic generally occurs between the hours of 7:15 AM and 8:15 AM while the PM peak hour of traffic generally occurs between the hours of 4:30 PM and 5:30 PM. The analysis is based on these peak hour time periods. LOS calculations are included in Appendix C.






WILSON OKAMOTO CORPORATION
ENGINEERS · PLANNERS

KULANIHAKOI BRIDGE REPLACEMENT

EXISTING PEAK HOURS OF TRAFFIC

FIGURE 4

Near the existing Kulanihakoi Bridge, South Kihei Road carries 574 vehicles northbound and 443 vehicles southbound during the AM peak period. During the PM peak period, traffic volumes are higher with 657 vehicles traveling northbound and 581 vehicles traveling southbound. The northbound direction of traffic operates at LOS "D" during both peak periods with a v/c ratio of 0.37 and 0.40 during the AM and PM peak periods, respectively. The southbound direction of traffic operates at LOS "C" with a v/c ratio of 0.29 during the AM peak period and at LOS "D" with a v/c ratio of 0.35 during the PM peak period.

## IV. PROJECTED TRAFFIC CONDITIONS

### A. Through Traffic Forecasting Methodology

The travel forecast is based upon historical traffic count data obtained from the State Department of Transportation (SDOT), Highway Division survey stations in the vicinity of the project site. The historical data were analyzed by linear regression techniques to obtain an annual traffic growth rate of approximately 2.5%. Using 2012 as the base year, a growth rate factor of 1.075 was applied to the existing traffic demands South Kihei Road to achieve the projected Year 2015 traffic demands.

### B. Interim Total Traffic Volumes

Prior to the removal of the existing bridge, a two-lane, two-way temporary detour road and bridge will be constructed east of the existing bridge to accommodate traffic along South Kihei Road during construction. The temporary bridge is anticipated to have two 12' travel lanes (one lane in each direction) without shoulders. The peak hour traffic conditions during this interim construction period are summarized in Table 1. The existing levels of service are provided for comparison purposes. LOS calculations are included in Appendix D.

**Table 1: Existing and Interim LOS Traffic Operating Conditions**

| Direction of Travel | | AM | | PM | |
|---|---|---|---|---|---|
| | | Exist | Interim | Exist | Interim |
| Northbound | LOS | D | D | D | D |
| | v/c ratio | 0.37 | 0.37 | 0.40 | 0.40 |





**Table 1: Existing and Interim LOS Traffic Operating Conditions (Cont'd)**

| Direction of Travel | | AM | | PM | |
|---|---|---|---|---|---|
| | | Exist | Interim | Exist | Interim |
| Southbound | LOS | C | D | D | D |
| | v/c ratio | 0.29 | 0.29 | 0.35 | 0.35 |

Under interim conditions, traffic operations along South Kihei Road are generally expected to remain similar to existing conditions due to the maintenance of the existing number of travel lanes. The northbound direction of traffic is expected to continue operating at LOS "D" during both peak periods with v/c ratios similar to existing conditions. The southbound direction of traffic is expected to operate at a slightly lower LOS "D" during the AM peak period, but the v/c ratios for that direction are expected to remain similar to existing conditions during both peak periods.

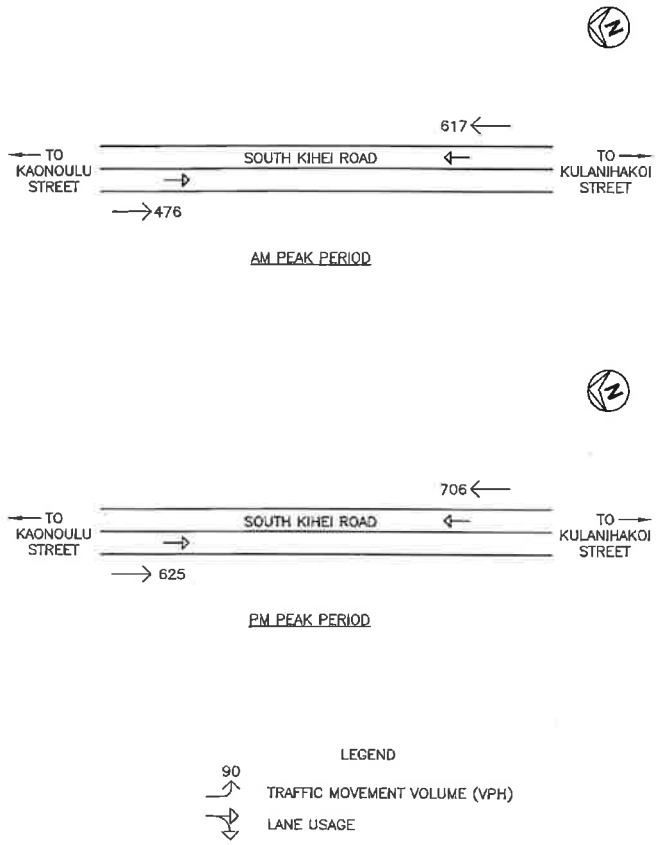
### C. Year 2015 Total Traffic Volumes

The replacement of the Kulanihakoi Bridge is expected to be completed by the Year 2015 and is anticipated to have two 12' travel lanes (one lane in each direction) with 5' shoulders. The Year 2015 peak hour traffic conditions with the new bridge are shown in Figure 5 and summarized in Table 2. The existing levels of service are provided for comparison purposes. LOS calculations are included in Appendix E.

**Table 2: Existing and Year 2015 LOS Traffic Operating Conditions**

| Direction of Travel | | AM | | PM | |
|---|---|---|---|---|---|
| | | Exist | Year 2015 | Exist | Year 2015 |
| Northbound | LOS | D | D | D | D |
| | v/c ratio | 0.37 | 0.40 | 0.40 | 0.43 |
| Southbound | LOS | C | D | D | D |
| | v/c ratio | 0.29 | 0.31 | 0.35 | 0.38 |

Under Year 2015 conditions, traffic operations along South Kihei Road are generally expected to remain similar to existing conditions despite the anticipated ambient growth in traffic due to the provision of wider travel lanes and shoulder areas




| | | |
|---|---|---|
| WILSON OKAMOTO CORPORATION ENGINEERS · PLANNERS | KULANIHAKOI BRIDGE REPLACEMENT<br>YEAR 2015 PEAK HOURS OF TRAFFIC | FIGURE 5 |



along this segment of South Kihei Road. The northbound direction of traffic is expected to continue operating at LOS "D" during both peak periods with v/c ratios of 0.40 and 0.43 during the AM and PM peak periods, respectively. The southbound direction of traffic is also expected to operate at LOS "D" during both peak periods with v/c ratios of 0.31 and 0.38 during the AM and PM peak periods, respectively.

## V. RECOMMENDATIONS

Based on the analysis of the traffic data, the following are the recommendations of this study to be implemented in conjunction with the proposed project:

1. Provide sufficient sight distances for motorists to safely navigate the proposed temporary detour road and bridge.

2. Provide sufficient turning radii along the temporary detour road and bridge to accommodate all anticipated vehicle types. If the provision of these radii is not technically feasible, consider restriction of larger vehicles along this segment of South Kihei Road and the provision of a detour utilizing Piilani Highway.

3. Prepare a Construction Traffic Management Plan to minimize the impact of construction activities on the surrounding roadways.

## VI. CONCLUSION

The existing Kulanihakoi Bridge is located along South Kihei Road between Kaonoulu Street and Kulanihakoi Street in Kihei on the island of Maui. The proposed project entails the replacement of the culvert system under the existing bridge with a newer higher-capacity system. During construction, a two-lane, two-way temporary detour road and steel panel bridge will be constructed east of the existing bridge to accommodate the existing traffic utilizing South Kihei Road in the project vicinity. Traffic operations during the interim construction period and once the project is complete in Year 2015 are anticipated to remain similar to existing conditions. However, recommendations have been provided to ensure that the temporary detour road and bridge can safely accommodate existing traffic during construction and minimize the impact of construction activities on the surrounding roadways.

**APPENDIX A**

**EXISTING TRAFFIC COUNT DATA**

***Wilson Okamoto Corporation***
1907 S. Beretania Street, Suite 400
Honolulu, Hawaii



Site Code:
Station ID:
S. Kihei Road

Latitude: 0' 0.000 Undefined

NB

| Start Time | Bikes | Cars & Trailers | 2 Axle Long | Buses | 2 Axle 6 Tire | 3 Axle Single | 4 Axle Single | <5 Axl Double | 5 Axle Double | >5 Axl Double | <6 Axl Multi | 6 Axle Multi | >6 Axl Multi | Not Classed | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10/29/12 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 00:15 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 00:30 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 00:45 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 01:00 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 01:15 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 01:30 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 01:45 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 02:00 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 02:15 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 02:30 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 02:45 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 03:00 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 03:15 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 03:30 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 03:45 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 04:00 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 04:15 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 04:30 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 04:45 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 05:00 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 05:15 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 05:30 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 05:45 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 06:00 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 06:15 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 06:30 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 06:45 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 07:00 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 07:15 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 07:30 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 07:45 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 08:00 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 08:15 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 08:30 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 08:45 | 3 | 72 | 24 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 113 |
| | 3 | 72 | 24 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 113 |
| 09:00 | 5 | 81 | 23 | 0 | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 6 | 120 |
| 09:15 | 2 | 70 | 23 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 106 |
| 09:30 | 5 | 79 | 26 | 1 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 120 |
| 09:45 | 6 | 76 | 30 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 127 |
| | 18 | 306 | 102 | 1 | 15 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 28 | 473 |
| 10:00 | 4 | 89 | 28 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 129 |
| 10:15 | 3 | 93 | 20 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 131 |
| 10:30 | 2 | 90 | 38 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 141 |
| 10:45 | 12 | 97 | 24 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 145 |
| | 21 | 369 | 110 | 1 | 8 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 35 | 546 |
| 11:00 | 0 | 85 | 36 | 0 | 5 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 10 | 140 |
| 11:15 | 3 | 96 | 29 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 140 |
| 11:30 | 8 | 85 | 28 | 0 | 6 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 9 | 137 |
| 11:45 | 5 | 91 | 33 | 0 | 3 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 8 | 144 |
| | 16 | 357 | 126 | 0 | 18 | 4 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 34 | 561 |
| Total | 58 | 1104 | 364 | 2 | 43 | 6 | 1 | 6 | 1 | 0 | 0 | 0 | 0 | 108 | 1693 |
| Percent | 3.4% | 65.2% | 21.5% | 0.1% | 2.5% | 0.4% | 0.1% | 0.4% | 0.1% | 0.0% | 0.0% | 0.0% | 0.0% | 6.4% | |

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1907 S. Beretania Street, Suite 400
Honolulu, Hawaii

Site Code:
Station ID:
S. Kihei Road

NB

Latitude: 0° 0.000 Undefined

| Start Time | Bikes | Cars & Trailers | 2 Axle Long | Buses | 2 Axle 6 Tire | 3 Axle Single | 4 Axle Single | <5 Axl Double | 5 Axle Double | >6 Axl Double | <6 Axl Multi | 6 Axle Multi | >6 Axl Multi | Not Classed | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 PM | 0 | 102 | 26 | 0 | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 14 | 147 |
| 12:15 | 4 | 87 | 22 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 126 |
| 12:30 | 5 | 86 | 25 | 1 | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 129 |
| 12:45 | 3 | 97 | 29 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 3 | 136 |
| | 12 | 372 | 102 | 4 | 14 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 30 | 538 |
| 13:00 | 5 | 96 | 19 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 133 |
| 13:15 | 4 | 74 | 32 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 126 |
| 13:30 | 4 | 96 | 31 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 139 |
| 13:45 | 9 | 90 | 28 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 140 |
| | 23 | 356 | 110 | 4 | 12 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 538 |
| 14:00 | 4 | 114 | 22 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 153 |
| 14:15 | 3 | 102 | 26 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 144 |
| 14:30 | 2 | 100 | 29 | 1 | 5 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 8 | 147 |
| 14:45 | 5 | 104 | 29 | 1 | 6 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 151 |
| | 14 | 420 | 106 | 4 | 14 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 34 | 595 |
| 15:00 | 4 | 105 | 25 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 145 |
| 15:15 | 5 | 82 | 33 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 129 |
| 15:30 | 3 | 85 | 32 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 132 |
| 15:45 | 6 | 120 | 31 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 172 |
| | 18 | 392 | 121 | 1 | 8 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 578 |
| 16:00 | 4 | 97 | 40 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 159 |
| 16:15 | 5 | 101 | 35 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 155 |
| 16:30 | 8 | 110 | 30 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 164 |
| 16:45 | 4 | 100 | 30 | 1 | 2 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 18 | 158 |
| | 21 | 408 | 135 | 1 | 13 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 54 | 636 |
| 17:00 | 5 | 103 | 33 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 157 |
| 17:15 | 5 | 96 | 24 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 138 |
| 17:30 | 5 | 91 | 35 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 142 |
| 17:45 | 6 | 114 | 27 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 164 |
| | 21 | 404 | 119 | 0 | 8 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 44 | 601 |
| 18:00 | 5 | 95 | 19 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 12 | 135 |
| 18:15 | 5 | 113 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 155 |
| 18:30 | 5 | 83 | 25 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 122 |
| 18:45 | 6 | 83 | 17 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 113 |
| | 21 | 374 | 88 | 2 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 33 | 525 |
| 19:00 | 5 | 79 | 13 | 0 | 1 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 5 | 106 |
| 19:15 | 2 | 78 | 17 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 4 | 103 |
| 19:30 | 2 | 73 | 17 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 104 |
| 19:45 | 7 | 67 | 8 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 87 |
| | 16 | 297 | 55 | 0 | 7 | 1 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 20 | 400 |
| 20:00 | 4 | 71 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 99 |
| 20:15 | 2 | 47 | 14 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 68 |
| 20:30 | 3 | 54 | 11 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 71 |
| 20:45 | 2 | 46 | 18 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 67 |
| | 11 | 218 | 62 | 1 | 2 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 8 | 305 |
| 21:00 | 3 | 48 | 8 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 62 |
| 21:15 | 5 | 46 | 13 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 66 |
| 21:30 | 1 | 29 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 44 |
| 21:45 | 3 | 38 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 48 |
| | 12 | 161 | 41 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 220 |
| 22:00 | 1 | 24 | 7 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 35 |
| 22:15 | 5 | 30 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 44 |
| 22:30 | 1 | 27 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 |
| 22:45 | 1 | 18 | 5 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 27 |
| | 8 | 99 | 26 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 140 |
| 23:00 | 1 | 27 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 37 |
| 23:15 | 0 | 22 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 |
| 23:30 | 1 | 11 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 16 |
| 23:45 | 3 | 12 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| | 5 | 72 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 96 |
| Total | 182 | 3573 | 983 | 17 | 85 | 24 | 0 | 12 | 1 | 0 | 0 | 1 | 0 | 294 | 5172 |
| Percent | 3.5% | 69.1% | 19.0% | 0.3% | 1.6% | 0.5% | 0.0% | 0.2% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 5.7% | |



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| Start Time | Bikes | Cars & Trailers | 2 Axle Long | Buses | 2 Axle 6 Tire | 3 Axle Single | 4 Axle Single | <5 Axl Double | 5 Axle Double | >6 Axl Double | <6 Axl Multi | 6 Axle Multi | >6 Axl Multi | Not Classed | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10/30/12 | 0 | 11 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 |
| 00:15 | 1 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| 00:30 | 2 | 9 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 15 |
| 00:45 | 1 | 7 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| | 4 | 31 | 8 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 46 |
| 01:00 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| 01:15 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 01:30 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 01:45 | 1 | 7 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| | 3 | 21 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 |
| 02:00 | 2 | 9 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 13 |
| 02:15 | 0 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| 02:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 02:45 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 2 | 13 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 22 |
| 03:00 | 0 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| 03:15 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 03:30 | 1 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| 03:45 | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| | 1 | 15 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 |
| 04:00 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 04:15 | 1 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 04:30 | 1 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 04:45 | 1 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 11 |
| | 3 | 15 | 11 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 31 |
| 05:00 | 0 | 7 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 05:15 | 1 | 11 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 |
| 05:30 | 0 | 11 | 6 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 |
| 05:45 | 2 | 21 | 8 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 34 |
| | 3 | 50 | 27 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 87 |
| 06:00 | 2 | 29 | 12 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 47 |
| 06:15 | 0 | 44 | 22 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 74 |
| 06:30 | 5 | 58 | 13 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 81 |
| 06:45 | 2 | 70 | 12 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 93 |
| | 9 | 201 | 59 | 3 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 295 |
| 07:00 | 3 | 59 | 17 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 88 |
| 07:15 | 3 | 64 | 36 | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 132 |
| 07:30 | 5 | 87 | 33 | 0 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 137 |
| 07:45 | 4 | 113 | 42 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 168 |
| | 15 | 343 | 128 | 2 | 13 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 525 |
| 08:00 | 3 | 91 | 30 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 137 |
| 08:15 | 6 | 72 | 33 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 118 |
| 08:30 | 2 | 79 | 27 | 0 | 1 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 13 | 125 |
| 08:45 | 4 | 68 | 26 | 1 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 10 | 113 |
| | 15 | 310 | 116 | 1 | 8 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 38 | 493 |
| 09:00 | 2 | 83 | 29 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 7 | 123 |
| 09:15 | 7 | 81 | 18 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 116 |
| 09:30 | 5 | 91 | 28 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 135 |
| 09:45 | 6 | 87 | 18 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 128 |
| | 20 | 342 | 93 | 0 | 10 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 33 | 502 |
| 10:00 | 3 | 106 | 24 | 0 | 4 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 143 |
| 10:15 | 3 | 107 | 24 | 0 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 146 |
| 10:30 | 5 | 80 | 29 | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 124 |
| 10:45 | 6 | 97 | 23 | 1 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 137 |
| | 17 | 390 | 100 | 1 | 20 | 6 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 15 | 550 |
| 11:00 | 7 | 91 | 19 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 125 |
| 11:15 | 5 | 86 | 21 | 0 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 3 | 120 |
| 11:30 | 6 | 77 | 31 | 0 | 5 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 126 |
| 11:45 | 4 | 84 | 34 | 1 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 138 |
| | 22 | 338 | 105 | 1 | 13 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 22 | 509 |
| Total | 114 | 2069 | 664 | 8 | 80 | 22 | 0 | 8 | 2 | 0 | 0 | 0 | 0 | 144 | 3111 |
| Percent | 3.7% | 66.5% | 21.3% | 0.3% | 2.6% | 0.7% | 0.0% | 0.3% | 0.1% | 0.0% | 0.0% | 0.0% | 0.0% | 4.6% | |

## Wilson Okamoto Corporation

1907 S. Beretania Street, Suite 400
Honolulu, Hawaii

Site Code:
Station ID:
S. Kihei Road

Latitude: 0' 0.000 Undefined

NB

| Start Time | Bikes | Cars & Trailers | 2 Axle Long | Buses | 2 Axle 6 Tire | 3 Axle Single | 4 Axle Single | <5 Axl Double | 5 Axle Double | >5 Axl Double | <6 Axl Multi | 6 Axle Multi | >6 Axl Multi | Not Classed | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 PM | 5 | 92 | 24 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 127 |
| 12:15 | 9 | 94 | 22 | 1 | 2 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 15 | 146 |
| 12:30 | 4 | 128 | 31 | 0 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 179 |
| 12:45 | 4 | 85 | 30 | 1 | 5 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 6 | 133 |
| | 22 | 399 | 107 | 2 | 16 | 4 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 33 | 585 |
| 13:00 | 5 | 84 | 30 | 0 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 9 | 133 |
| 13:15 | 3 | 98 | 33 | 0 | 5 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 5 | 147 |
| 13:30 | 5 | 90 | 25 | 0 | 6 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 7 | 134 |
| 13:45 | 5 | 106 | 25 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 4 | 144 |
| | 18 | 378 | 113 | 1 | 15 | 4 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 25 | 558 |
| 14:00 | 9 | 103 | 19 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 8 | 143 |
| 14:15 | 7 | 74 | 24 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 122 |
| 14:30 | 8 | 90 | 27 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 147 |
| 14:45 | 4 | 107 | 33 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 154 |
| | 28 | 374 | 103 | 5 | 11 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 41 | 566 |
| 15:00 | 6 | 102 | 27 | 1 | 5 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 10 | 153 |
| 15:15 | 3 | 115 | 27 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 163 |
| 15:30 | 4 | 107 | 35 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 156 |
| 15:45 | 6 | 112 | 35 | 1 | 3 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 10 | 171 |
| | 19 | 436 | 124 | 2 | 13 | 5 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 42 | 643 |
| 16:00 | 2 | 100 | 41 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 160 |
| 16:15 | 5 | 91 | 33 | 0 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 152 |
| 16:30 | 4 | 115 | 34 | 1 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 9 | 168 |
| 16:45 | 7 | 99 | 30 | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 154 |
| | 18 | 405 | 138 | 1 | 15 | 6 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 50 | 634 |
| 17:00 | 3 | 112 | 30 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 166 |
| 17:15 | 6 | 114 | 31 | 0 | 2 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 11 | 169 |
| 17:30 | 8 | 99 | 26 | 0 | 6 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 20 | 160 |
| 17:45 | 3 | 107 | 34 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 159 |
| | 22 | 432 | 121 | 1 | 10 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 62 | 654 |
| 18:00 | 4 | 117 | 32 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 165 |
| 18:15 | 6 | 94 | 20 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 127 |
| 18:30 | 5 | 95 | 19 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 137 |
| 18:45 | 2 | 94 | 15 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 12 | 124 |
| | 17 | 400 | 86 | 0 | 7 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 40 | 553 |
| 19:00 | 6 | 83 | 20 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 118 |
| 19:15 | 3 | 74 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 95 |
| 19:30 | 2 | 69 | 22 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 98 |
| 19:45 | 1 | 63 | 18 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 86 |
| | 12 | 289 | 75 | 1 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 397 |
| 20:00 | 0 | 72 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 86 |
| 20:15 | 2 | 60 | 14 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 80 |
| 20:30 | 2 | 64 | 13 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 81 |
| 20:45 | 2 | 43 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 54 |
| | 6 | 239 | 47 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 301 |
| 21:00 | 3 | 58 | 18 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 82 |
| 21:15 | 1 | 41 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 53 |
| 21:30 | 1 | 35 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 48 |
| 21:45 | 4 | 43 | 9 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 58 |
| | 9 | 177 | 48 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 241 |
| 22:00 | 4 | 45 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 53 |
| 22:15 | 5 | 34 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 |
| 22:30 | 1 | 20 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 |
| 22:45 | 2 | 27 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 41 |
| | 12 | 126 | 29 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 170 |
| 23:00 | 2 | 22 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 |
| 23:15 | 0 | 28 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 |
| 23:30 | 2 | 15 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 22 |
| 23:45 | 3 | 7 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 |
| | 7 | 72 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 98 |
| Total | 190 | 3727 | 1008 | 14 | 103 | 28 | 0 | 11 | 3 | 0 | 0 | 0 | 0 | 316 | 5400 |
| Percent | 3.5% | 69.0% | 18.7% | 0.3% | 1.9% | 0.5% | 0.0% | 0.2% | 0.1% | 0.0% | 0.0% | 0.0% | 0.0% | 5.9% | |



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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10/31/12 | 5 | 17 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 27 |
| 00:15 | 1 | 10 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 00:30 | 0 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 00:45 | 1 | 13 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 16 |
| | 7 | 51 | 8 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 69 |
| 01:00 | 0 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| 01:15 | 1 | 6 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 01:30 | 1 | 8 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| 01:45 | 2 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| | 4 | 33 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43 |
| 02:00 | 1 | 7 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 02:15 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 02:30 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 02:45 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| | 1 | 15 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 |
| 03:00 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| 03:15 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 03:30 | 1 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| 03:45 | 0 | 6 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| | 1 | 20 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 |
| 04:00 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 04:15 | 0 | 8 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| 04:30 | 0 | 6 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| 04:45 | 0 | 9 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| | 0 | 25 | 8 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 |
| 05:00 | 0 | 7 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 11 |
| 05:15 | 1 | 7 | 11 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 22 |
| 05:30 | 1 | 19 | 6 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 |
| 05:45 | 0 | 22 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 |
| | 2 | 55 | 28 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 90 |
| 06:00 | 1 | 33 | 5 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 42 |
| 06:15 | 0 | 36 | 19 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 58 |
| 06:30 | 3 | 59 | 20 | 1 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 92 |
| 06:45 | 2 | 58 | 22 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 90 |
| | 6 | 186 | 66 | 2 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 282 |
| 07:00 | 4 | 72 | 24 | 1 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 110 |
| 07:15 | 0 | 69 | 32 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 117 |
| 07:30 | 5 | 78 | 28 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 123 |
| 07:45 | 6 | 100 | 30 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 149 |
| | 15 | 319 | 114 | 1 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 38 | 499 |
| 08:00 | 7 | 93 | 24 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 7 | 134 |
| 08:15 | 0 | 91 | 25 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 122 |
| 08:30 | 12 | 60 | 31 | 0 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 118 |
| 08:45 | 4 | 92 | 20 | 1 | 5 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 128 |
| | 23 | 336 | 100 | 1 | 13 | 4 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 23 | 502 |
| 09:00 | 5 | 78 | 23 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 118 |
| 09:15 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 09:30 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 09:45 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:00 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 10:15 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 10:30 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 10:45 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:00 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 11:15 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 11:30 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 11:45 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 64 | 1116 | 367 | 4 | 43 | 8 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 82 | 1687 |
| Percent | 3.8% | 66.2% | 21.8% | 0.2% | 2.5% | 0.5% | 0.1% | 0.1% | 0.1% | 0.0% | 0.0% | 0.0% | 0.0% | 4.9% | |
| Grand Total | 608 | 11589 | 3386 | 45 | 354 | 88 | 2 | 38 | 8 | 0 | 0 | 1 | 0 | 944 | 17063 |
| Percent | 3.6% | 67.9% | 19.8% | 0.3% | 2.1% | 0.5% | 0.0% | 0.2% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 5.5% | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10/29/12 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 00:15 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 00:30 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 00:45 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 01:00 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 01:15 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 01:30 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 01:45 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 02:00 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 02:15 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 02:30 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 02:45 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 03:00 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 03:15 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 03:30 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 03:45 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 04:00 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 04:15 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 04:30 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 04:45 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 05:00 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 05:15 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 05:30 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 05:45 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 06:00 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 06:15 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 06:30 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 06:45 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 07:00 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 07:15 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 07:30 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 07:45 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 08:00 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 08:15 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 08:30 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 08:45 | 5 | 67 | 26 | 0 | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 3 | 106 |
| | 5 | 67 | 26 | 0 | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 3 | 106 |
| 09:00 | 2 | 59 | 24 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 7 | 96 |
| 09:15 | 2 | 49 | 8 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 69 |
| 09:30 | 2 | 65 | 21 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 89 |
| 09:45 | 5 | 65 | 27 | 1 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 8 | 110 |
| | 11 | 238 | 80 | 2 | 11 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 19 | 364 |
| 10:00 | 0 | 60 | 21 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 89 |
| 10:15 | 7 | 55 | 20 | 1 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 97 |
| 10:30 | 3 | 69 | 14 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 99 |
| 10:45 | 1 | 68 | 23 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 125 |
| | 16 | 272 | 78 | 2 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 410 |
| 11:00 | 5 | 64 | 19 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 98 |
| 11:15 | 1 | 53 | 27 | 1 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 105 |
| 11:30 | 3 | 62 | 31 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 110 |
| 11:45 | 6 | 60 | 25 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 120 |
| | 15 | 269 | 102 | 2 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 433 |
| Total | 47 | 846 | 286 | 6 | 33 | 5 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 85 | 1313 |
| Percent | 3.6% | 64.4% | 21.8% | 0.5% | 2.5% | 0.4% | 0.0% | 0.3% | 0.1% | 0.0% | 0.0% | 0.0% | 0.0% | 6.5% | |



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SB

Latitude: 0' 0.000 Undefined

| Start Time | Bikes | Cars & Trailers | 2 Axle Long | Buses | 2 Axle 6 Tire | 3 Axle Single | 4 Axle Single | <5 Axl Double | 5 Axle Double | >6 Axl Double | <6 Axl Multi | 6 Axle Multi | >6 Axl Multi | Not Classed | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 PM | 4 | 64 | 22 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 11 | 102 |
| 12:15 | 1 | 81 | 22 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 118 |
| 12:30 | 2 | 65 | 30 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 108 |
| 12:45 | 4 | 83 | 20 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 10 | 120 |
| | 11 | 293 | 94 | 1 | 6 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 38 | 448 |
| 13:00 | 1 | 93 | 23 | 0 | 3 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 9 | 131 |
| 13:15 | 2 | 81 | 20 | 1 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 119 |
| 13:30 | 3 | 76 | 19 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 109 |
| 13:45 | 3 | 78 | 24 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 118 |
| | 9 | 328 | 86 | 2 | 10 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 38 | 477 |
| 14:00 | 6 | 91 | 19 | 0 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 13 | 134 |
| 14:15 | 7 | 90 | 23 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 131 |
| 14:30 | 5 | 96 | 23 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 134 |
| 14:45 | 3 | 83 | 15 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 109 |
| | 21 | 360 | 80 | 1 | 12 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 30 | 508 |
| 15:00 | 6 | 83 | 23 | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 15 | 131 |
| 15:15 | 5 | 89 | 33 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 133 |
| 15:30 | 2 | 96 | 18 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 14 | 133 |
| 15:45 | 9 | 95 | 26 | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 150 |
| | 22 | 363 | 100 | 0 | 9 | 2 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 47 | 547 |
| 16:00 | 7 | 91 | 25 | 1 | 4 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 7 | 137 |
| 16:15 | 4 | 88 | 34 | 0 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 148 |
| 16:30 | 3 | 91 | 24 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 135 |
| 16:45 | 7 | 86 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 141 |
| | 21 | 356 | 112 | 1 | 11 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 56 | 561 |
| 17:00 | 4 | 93 | 21 | 0 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 17 | 140 |
| 17:15 | 1 | 97 | 23 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 130 |
| 17:30 | 6 | 89 | 15 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 9 | 122 |
| 17:45 | 3 | 70 | 23 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 114 |
| | 14 | 349 | 82 | 0 | 9 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 47 | 506 |
| 18:00 | 7 | 95 | 23 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 11 | 139 |
| 18:15 | 4 | 75 | 28 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 116 |
| 18:30 | 5 | 50 | 13 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 80 |
| 18:45 | 6 | 90 | 17 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 118 |
| | 22 | 310 | 81 | 2 | 2 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 33 | 453 |
| 19:00 | 2 | 56 | 15 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 80 |
| 19:15 | 3 | 48 | 6 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 59 |
| 19:30 | 2 | 43 | 10 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 63 |
| 19:45 | 6 | 39 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 |
| | 13 | 186 | 36 | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 252 |
| 20:00 | 5 | 44 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 59 |
| 20:15 | 2 | 33 | 8 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 48 |
| 20:30 | 0 | 29 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 47 |
| 20:45 | 1 | 57 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 74 |
| | 8 | 163 | 40 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 228 |
| 21:00 | 1 | 49 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 62 |
| 21:15 | 4 | 32 | 11 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 51 |
| 21:30 | 5 | 24 | 7 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 39 |
| 21:45 | 0 | 19 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 23 |
| | 10 | 124 | 32 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 175 |
| 22:00 | 1 | 27 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 32 |
| 22:15 | 0 | 21 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 |
| 22:30 | 2 | 19 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 |
| 22:45 | 1 | 17 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 |
| | 4 | 84 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 108 |
| 23:00 | 1 | 14 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 |
| 23:15 | 2 | 10 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 |
| 23:30 | 0 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 |
| 23:45 | 0 | 12 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 15 |
| | 3 | 42 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 58 |
| Total | 159 | 2958 | 772 | 9 | 66 | 21 | 0 | 11 | 1 | 0 | 0 | 0 | 0 | 324 | 4321 |
| Percent | 3.7% | 68.5% | 17.9% | 0.2% | 1.5% | 0.5% | 0.0% | 0.3% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 7.5% | |

## Wilson Okamoto Corporation

1907 S. Beretania Street, Suite 400
Honolulu, Hawaii

Site Code:
Station ID:
S. Kihei Road

SB

Latitude: 0° 0.000 Undefined

| Start Time | Bikes | Cars & Trailers | 2 Axle Long | Buses | 2 Axle 6 Tire | 3 Axle Single | 4 Axle Single | <5 Axl Double | 5 Axle Double | >6 Axl Double | <6 Axl Multi | 6 Axle Multi | >6 Axl Multi | Not Classed | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10/30/12 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 00:15 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 00:30 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 00:45 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 2 | 14 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 |
| 01:00 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 01:15 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 01:30 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 01:45 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| | 0 | 8 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 02:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 02:15 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 02:30 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 02:45 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 03:00 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 03:15 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 03:30 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 03:45 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| | 0 | 8 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 04:00 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 04:15 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 04:30 | 2 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 04:45 | 0 | 8 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| | 2 | 20 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 |
| 05:00 | 0 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 05:15 | 0 | 9 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 |
| 05:30 | 1 | 15 | 8 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 27 |
| 05:45 | 2 | 12 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 22 |
| | 3 | 38 | 28 | 2 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 75 |
| 06:00 | 2 | 15 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 |
| 06:15 | 3 | 30 | 10 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 50 |
| 06:30 | 4 | 18 | 12 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 40 |
| 06:45 | 2 | 43 | 24 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 76 |
| | 11 | 106 | 49 | 1 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 187 |
| 07:00 | 1 | 53 | 24 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 87 |
| 07:15 | 3 | 54 | 25 | 0 | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 6 | 93 |
| 07:30 | 5 | 86 | 30 | 0 | 4 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 13 | 140 |
| 07:45 | 3 | 56 | 23 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 91 |
| | 12 | 249 | 102 | 1 | 11 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 32 | 411 |
| 08:00 | 6 | 65 | 29 | 0 | 3 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 13 | 119 |
| 08:15 | 2 | 64 | 24 | 0 | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 6 | 101 |
| 08:30 | 3 | 56 | 23 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 94 |
| 08:45 | 4 | 70 | 32 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 115 |
| | 15 | 255 | 108 | 1 | 8 | 4 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 34 | 429 |
| 09:00 | 6 | 58 | 29 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 100 |
| 09:15 | 4 | 62 | 26 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 101 |
| 09:30 | 3 | 72 | 13 | 0 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 99 |
| 09:45 | 2 | 60 | 18 | 2 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 98 |
| | 15 | 252 | 86 | 2 | 13 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 398 |
| 10:00 | 4 | 54 | 16 | 0 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 88 |
| 10:15 | 1 | 80 | 20 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 112 |
| 10:30 | 5 | 66 | 30 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 8 | 111 |
| 10:45 | 5 | 82 | 23 | 1 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 117 |
| | 15 | 282 | 89 | 1 | 10 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 27 | 428 |
| 11:00 | 4 | 82 | 22 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 114 |
| 11:15 | 3 | 72 | 26 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 113 |
| 11:30 | 5 | 78 | 33 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 122 |
| 11:45 | 5 | 74 | 22 | 1 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 116 |
| | 17 | 306 | 105 | 1 | 8 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 465 |
| Total | 92 | 1539 | 587 | 9 | 61 | 15 | 0 | 8 | 2 | 0 | 0 | 0 | 0 | 157 | 2470 |
| Percent | 3.7% | 62.3% | 23.8% | 0.4% | 2.5% | 0.6% | 0.0% | 0.3% | 0.1% | 0.0% | 0.0% | 0.0% | 0.0% | 6.4% | |



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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 PM | 2 | 81 | 24 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 113 |
| 12:15 | 6 | 71 | 23 | 0 | 4 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 9 | 115 |
| 12:30 | 0 | 76 | 22 | 0 | 4 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 11 | 115 |
| 12:45 | 4 | 74 | 18 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 105 |
| | 12 | 302 | 87 | 1 | 13 | 1 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 28 | 448 |
| 13:00 | 5 | 67 | 9 | 0 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 7 | 92 |
| 13:15 | 6 | 76 | 21 | 0 | 2 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 110 |
| 13:30 | 1 | 75 | 30 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 113 |
| 13:45 | 2 | 68 | 27 | 1 | 3 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 5 | 129 |
| | 14 | 306 | 87 | 2 | 10 | 1 | 0 | 5 | 1 | 1 | 0 | 0 | 0 | 17 | 444 |
| 14:00 | 6 | 71 | 16 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 102 |
| 14:15 | 5 | 97 | 25 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 14 | 144 |
| 14:30 | 3 | 60 | 25 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 107 |
| 14:45 | 5 | 87 | 20 | 2 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 13 | 132 |
| | 21 | 315 | 86 | 2 | 6 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 50 | 465 |
| 15:00 | 6 | 103 | 25 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 153 |
| 15:15 | 6 | 93 | 25 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 136 |
| 15:30 | 3 | 103 | 19 | 0 | 3 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 136 |
| 15:45 | 3 | 85 | 25 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 129 |
| | 18 | 384 | 94 | 0 | 12 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 43 | 554 |
| 16:00 | 6 | 80 | 32 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 131 |
| 16:15 | 3 | 100 | 27 | 0 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 16 | 151 |
| 16:30 | 5 | 90 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 139 |
| 16:45 | 5 | 95 | 31 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 147 |
| | 19 | 365 | 117 | 1 | 7 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 56 | 568 |
| 17:00 | 8 | 102 | 19 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 12 | 145 |
| 17:15 | 6 | 107 | 25 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 8 | 150 |
| 17:30 | 7 | 93 | 28 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 13 | 145 |
| 17:45 | 3 | 92 | 23 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 134 |
| | 24 | 394 | 95 | 1 | 7 | 5 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 45 | 574 |
| 18:00 | 2 | 78 | 20 | 1 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 114 |
| 18:15 | 7 | 104 | 20 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 8 | 142 |
| 18:30 | 4 | 89 | 30 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 11 | 135 |
| 18:45 | 4 | 61 | 12 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 92 |
| | 17 | 332 | 82 | 1 | 8 | 2 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 38 | 463 |
| 19:00 | 3 | 63 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 83 |
| 19:15 | 0 | 46 | 14 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 67 |
| 19:30 | 1 | 50 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 67 |
| 19:45 | 1 | 38 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 53 |
| | 5 | 199 | 50 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 270 |
| 20:00 | 0 | 35 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 45 |
| 20:15 | 3 | 42 | 9 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 57 |
| 20:30 | 1 | 34 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 45 |
| 20:45 | 1 | 48 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 64 |
| | 5 | 159 | 34 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 211 |
| 21:00 | 2 | 30 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 46 |
| 21:15 | 1 | 26 | 8 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 39 |
| 21:30 | 3 | 26 | 7 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 37 |
| 21:45 | 2 | 32 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 41 |
| | 8 | 116 | 33 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 163 |
| 22:00 | 3 | 29 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 |
| 22:15 | 2 | 23 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 |
| 22:30 | 0 | 18 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 |
| 22:45 | 2 | 17 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 23 |
| | 7 | 87 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 112 |
| 23:00 | 0 | 15 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 |
| 23:15 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 11 |
| 23:30 | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 23:45 | 1 | 8 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| | 1 | 36 | 11 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 51 |
| Total | 151 | 2995 | 792 | 10 | 68 | 15 | 0 | 17 | 3 | 2 | 0 | 0 | 0 | 310 | 4363 |
| Percent | 3.5% | 68.6% | 18.2% | 0.2% | 1.6% | 0.3% | 0.0% | 0.4% | 0.1% | 0.0% | 0.0% | 0.0% | 0.0% | 7.1% | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10/31/12 | 2 | 9 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 14 |
| 00:15 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 00:30 | 0 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| 00:45 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| | 2 | 22 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 28 |
| 01:00 | 0 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| 01:15 | 1 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 01:30 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 |
| 01:45 | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| | 3 | 14 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 23 |
| 02:00 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 02:15 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 02:30 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 02:45 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| | 0 | 10 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 03:00 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 |
| 03:15 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 03:30 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 03:45 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| | 0 | 10 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 14 |
| 04:00 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 04:15 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 04:30 | 1 | 7 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 04:45 | 0 | 9 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| | 1 | 19 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 |
| 05:00 | 0 | 5 | 5 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| 05:15 | 0 | 7 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 14 |
| 05:30 | 1 | 13 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| 05:45 | 0 | 12 | 10 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 24 |
| | 1 | 37 | 21 | 1 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 65 |
| 06:00 | 0 | 18 | 9 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 30 |
| 06:15 | 1 | 27 | 9 | 1 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 42 |
| 06:30 | 3 | 33 | 17 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 59 |
| 06:45 | 2 | 47 | 19 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 74 |
| | 6 | 125 | 54 | 1 | 8 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 9 | 205 |
| 07:00 | 1 | 55 | 23 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 84 |
| 07:15 | 3 | 63 | 25 | 0 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 100 |
| 07:30 | 5 | 66 | 28 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 109 |
| 07:45 | 7 | 65 | 14 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 95 |
| | 16 | 249 | 90 | 0 | 8 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 21 | 388 |
| 08:00 | 9 | 72 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 112 |
| 08:15 | 1 | 48 | 24 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 83 |
| 08:30 | 4 | 73 | 22 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 116 |
| 08:45 | 2 | 81 | 19 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 7 | 112 |
| | 16 | 274 | 89 | 0 | 5 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 36 | 423 |
| 09:00 | 4 | 44 | 15 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 75 |
| 09:15 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 09:30 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 09:45 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:00 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 10:15 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 10:30 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 10:45 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:00 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 11:15 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 11:30 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 11:45 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 49 | 804 | 290 | 3 | 28 | 7 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 79 | 1264 |
| Percent | 3.9% | 63.6% | 22.9% | 0.2% | 2.2% | 0.6% | 0.0% | 0.2% | 0.1% | 0.0% | 0.0% | 0.0% | 0.0% | 6.3% | |
| Grand Total | 498 | 9142 | 2727 | 37 | 256 | 63 | 0 | 43 | 8 | 2 | 0 | 0 | 0 | 955 | 13731 |
| Percent | 3.6% | 66.6% | 19.9% | 0.3% | 1.9% | 0.5% | 0.0% | 0.3% | 0.1% | 0.0% | 0.0% | 0.0% | 0.0% | 7.0% | |

# APPENDIX B

# LEVEL OF SERVICE DEFINITIONS

## LEVEL OF SERVICE DEFINITIONS

### LEVEL-OF-SERVICE CRITERIA FOR A TWO-LANE HIGHWAY

The primary measures of service quality for two-lane highways are average travel speed (ATS), percent time-spent-following (PTSF) and percent of free-flow speed (PFFS). For Class I two-lane highways, LOS is defined in terms of ATS and PTSF while service quality for Class II two-lane highways is based only on PTSF. For Class II two-lane highways, LOS is defined in terms of PFFFS. LOS criteria are shown and described below.

| Level of Service | Class I ATS (mi/h) | Class I PTSF (%) | Class II PTSF (%) | Class III PFFS (%) |
|---|---|---|---|---|
| A | >55 | ≤35 | ≤40 | >91.7 |
| B | <50-55 | >35-50 | >40-55 | <83.3-91.7 |
| C | >45-50 | >50-65 | >55-70 | >75.0-83.3 |
| D | >40-45 | >65-80 | >70-85 | >66.7-75.0 |
| E | ≤40 | >80 | >85 | ≤66.7 |

At **Level of Service A**, motorists experience high operating speeds on Class I highways and little difficulty in passing. Platoons of three or more vehicles are rare. On Class II highways, speed would be controlled primarily by roadway conditions. A small amount of platooning would be expected. On Class III highways, drivers should be able to maintain operating speeds close or equal to the free-flow speed (FFS) of the facility.

At **Level of Service B**, passing demand and passing capacity are balanced. On both Class I and Class II highways, the degree of platooning becomes noticeable. Some speed reductions are present on Class I highways. On Class III highways, it becomes difficult to maintain FFS operation, but the speed reduction is still relatively small.

At **Level of Service C**, most vehicles are traveling in platoons. Speeds are noticeably curtailed on all three classes of highway.

At **Level of Service D**, platooning increases significantly. Passing demand is high on both Class I and II facilities, but passing capacity approaches zero. A high percentage vehicles are now traveling in platoons, and PTSF is quite noticeable. On Class III highways, the fall-off from FFS is now significant.

At **Level of Service E**, demand is approaching capacity. Passing on Class I and II highways is virtually impossible, and PTSF is more than 80%. Speeds are seriously curtailed. On Class III highways, speed is less than two-thirds the FFS.

**Level of Service F** exists whenever demand flow in one or both directions exceeds the capacity of the segment. Operating conditions are unstable, and heavy congestion exists on all classes of two-lane highway.

"Highway Capacity Manual," Transportation Research Board, 2010.

## APPENDIX C

### CAPACITY ANALYSIS CALCULATIONS
### EXISTING PEAK HOUR TRAFFIC ANALYSIS

HCS 2010: Two-Lane Highways Release 6.3

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | CL |
| Agency/Co. | |
| Date Performed | 12/5/2012 |
| Analysis Time Period | AM Peak |
| Highway | South Kihei Road |
| From/To | North of Kulanihakoi (NB) |
| Jurisdiction | |
| Analysis Year | Existing |
| Description | |

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 3 | | Peak hour factor, PHF | 0.92 | |
| Shoulder width | 4.0 | ft | % Trucks and buses | 3 | % |
| Lane width | 10.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.3 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Level | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 0 | % |
| Up/down | - | % | Access point density | 25 | /mi |

Analysis direction volume, Vd 574 veh/h
Opposing direction volume, Vo 443 veh/h

## Average Travel Speed

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.1 | | 1.2 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adj. factor, (note-5) fHV | 0.997 | | 0.994 | |
| Grade adj. factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 626 | pc/h | 484 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed, (note-3) S FM | - | mi/h |
| Observed total demand, (note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed, (note-3) BFFS | 45.0 | mi/h |
| Adj. for lane and shoulder width, (note-3) fLS | 2.4 | mi/h |
| Adj. for access point density, (note-3) fA | 6.3 | mi/h |
| Free-flow speed, FFSd | 36.3 | mi/h |
| Adjustment for no-passing zones, fnp | 0.7 | mi/h |
| Average travel speed, ATSd | 27.0 | mi/h |

Percent Free Flow Speed, PFFS 74.4 %

## Percent Time-Spent-Following

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.0 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 1.000 | | 1.000 | |
| Grade adjustment factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 624 | pc/h | 482 | pc/h |
| Base percent time-spent-following, (note-4) BPTSFd | 59.0 | % | | |
| Adjustment for no-passing zones, fnp | 13.2 | | | |
| Percent time-spent-following, PTSFd | 66.4 | % | | |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | D | |
| Volume to capacity ratio, v/c | 0.37 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 47 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 172 | veh-mi |
| Peak 15-min total travel time, TT15 | 1.7 | veh-h |
| Capacity from ATS, CdATS | 1690 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1690 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.3 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 27.0 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 66.4 | |
| Level of service, LOSd (from above) | D | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following | | |

including passing lane, PTSFpl - %

Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 623.9 |
| Effective width of outside lane, We | 14.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 4.77 |
| Bicycle LOS | E |

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.



Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | CL |
| Agency/Co. | |
| Date Performed | 12/5/2012 |
| Analysis Time Period | AM Peak |
| Highway | South Kihei Road |
| From/To | North of Kulanihakoi (SB) |
| Jurisdiction | |
| Analysis Year | Existing |
| Description | |

Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 3 | | Peak hour factor, PHF | 0.92 | |
| Shoulder width | 4.0 | ft | % Trucks and buses | 3 | % |
| Lane width | 10.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.3 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Level | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 0 | % |
| Up/down | - | % | Access point density | 25 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 443 | veh/h |
| Opposing direction volume, Vo | 574 | veh/h |

Average Travel Speed

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.2 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adj. factor, (note-5) fHV | 0.994 | | 0.997 | |
| Grade adj. factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 484 | pc/h | 626 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed, (note-3) S FM | - | mi/h |
| Observed total demand, (note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed, (note-3) BFFS | 45.0 | mi/h |
| Adj. for lane and shoulder width, (note-3) fLS | 2.4 | mi/h |
| Adj. for access point density, (note-3) fA | 6.3 | mi/h |
| Free-flow speed, FFSd | 36.3 | mi/h |
| Adjustment for no-passing zones, fnp | 0.4 | mi/h |
| Average travel speed, ATSd | 27.3 | mi/h |

Percent Free Flow Speed, PFFS 75.2 %

## Percent Time-Spent-Following

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.0 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 1.000 | | 1.000 | |
| Grade adjustment factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 482 | pc/h | 624 | pc/h |
| Base percent time-spent-following, (note-4) BPTSFd | 51.1 | % | | |
| Adjustment for no-passing zones, fnp | 13.2 | | | |
| Percent time-spent-following, PTSFd | 56.9 | % | | |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | C | |
| Volume to capacity ratio, v/c | 0.29 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 42 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 155 | veh-mi |
| Peak 15-min total travel time, TT15 | 1.5 | veh-h |
| Capacity from ATS, CdATS | 1695 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1695 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.3 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 27.3 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 56.9 | |
| Level of service, LOSd (from above) | C | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 481.5 |
| Effective width of outside lane, We | 14.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 4.64 |
| Bicycle LOS | E |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS 2010: Two-Lane Highways Release 6.3

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | CL |
| Agency/Co. | |
| Date Performed | 12/5/2012 |
| Analysis Time Period | PM Peak |
| Highway | South Kihei Road |
| From/To | North of Kulanihakoi (NB) |
| Jurisdiction | |
| Analysis Year | Existing |
| Description | |

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class Class 3 | | | Peak hour factor, PHF | 0.97 | |
| Shoulder width | 4.0 | ft | % Trucks and buses | 3 | % |
| Lane width | 10.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.3 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Level | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 0 | % |
| Up/down | - | % | Access point density | 25 | /mi |

Analysis direction volume, Vd 657 veh/h
Opposing direction volume, Vo 581 veh/h

## Average Travel Speed

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.1 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adj. factor, (note-5) fHV | 0.997 | | 0.997 | |
| Grade adj. factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 679 | pc/h | 601 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed, (note-3) S FM | - | mi/h |
| Observed total demand, (note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed, (note-3) BFFS | 45.0 | mi/h |
| Adj. for lane and shoulder width, (note-3) fLS | 2.4 | mi/h |
| Adj. for access point density, (note-3) fA | 6.3 | mi/h |
| Free-flow speed, FFSd | 36.3 | mi/h |
| Adjustment for no-passing zones, fnp | 0.4 | mi/h |
| Average travel speed, ATSd | 26.0 | mi/h |

Percent Free Flow Speed, PFFS 71.6 %

## Percent Time-Spent-Following

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.0 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 1.000 | | 1.000 | |
| Grade adjustment factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 677 | pc/h | 599 | pc/h |
| Base percent time-spent-following, (note-4) BPTSFd | 61.6 | % | | |
| Adjustment for no-passing zones, fnp | 13.0 | | | |
| Percent time-spent-following, PTSFd | 68.5 | % | | |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | D | |
| Volume to capacity ratio, v/c | 0.40 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 59 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 230 | veh-mi |
| Peak 15-min total travel time, TT15 | 2.3 | veh-h |
| Capacity from ATS, CdATS | 1695 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1695 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.3 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 26.0 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 68.5 | |
| Level of service, LOSd (from above) | D | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following | | |

including passing lane, PTSFpl - %

Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 677.3 |
| Effective width of outside lane, We | 14.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 4.81 |
| Bicycle LOS | E |

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.



Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | CL |
| Agency/Co. | |
| Date Performed | 12/5/2012 |
| Analysis Time Period | PM Peak |
| Highway | South Kihei Road |
| From/To | North of Kulanihakoi (SB) |
| Jurisdiction | |
| Analysis Year | Existing |
| Description | |

Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 3 | | Peak hour factor, PHF | 0.97 | |
| Shoulder width | 4.0 | ft | % Trucks and buses | 3 | % |
| Lane width | 10.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.3 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Level | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 0 | % |
| Up/down | - | % | Access point density | 25 | /mi |

Analysis direction volume, Vd 581 veh/h
Opposing direction volume, Vo 657 veh/h

Average Travel Speed

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.1 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adj. factor, (note-5) fHV | 0.997 | | 0.997 | |
| Grade adj. factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 601 | pc/h | 679 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed, (note-3) S FM | - | mi/h |
| Observed total demand, (note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed, (note-3) BFFS | 45.0 | mi/h |
| Adj. for lane and shoulder width, (note-3) fLS | 2.4 | mi/h |
| Adj. for access point density, (note-3) fA | 6.3 | mi/h |
| Free-flow speed, FFSd | 36.3 | mi/h |
| Adjustment for no-passing zones, fnp | 0.4 | mi/h |
| Average travel speed, ATSd | 26.1 | mi/h |

Percent Free Flow Speed, PFFS 71.7 %

## Percent Time-Spent-Following

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.0 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 1.000 | | 1.000 | |
| Grade adjustment factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 599 | pc/h | 677 | pc/h |
| Base percent time-spent-following, (note-4) BPTSFd | 59.6 | % | | |
| Adjustment for no-passing zones, fnp | 13.0 | | | |
| Percent time-spent-following, PTSFd | 65.7 | % | | |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | D | |
| Volume to capacity ratio, v/c | 0.35 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 52 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 203 | veh-mi |
| Peak 15-min total travel time, TT15 | 2.0 | veh-h |
| Capacity from ATS, CdATS | 1695 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1695 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.3 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 26.1 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 65.7 | |
| Level of service, LOSd (from above) | D | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 599.0 |
| Effective width of outside lane, We | 14.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 4.75 |
| Bicycle LOS | E |

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

## APPENDIX D

## CAPACITY ANALYSIS CALCULATIONS
## INTERIM PEAK HOUR TRAFFIC ANALYSIS



Phone: Fax:
E-Mail:

### Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | CL |
| Agency/Co. | |
| Date Performed | 12/5/2012 |
| Analysis Time Period | AM Peak |
| Highway | South Kihei Road |
| From/To | North of Kulanihakoi (NB) |
| Jurisdiction | |
| Analysis Year | Interim |
| Description | |

### Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class Class 3 | | | Peak hour factor, PHF | 0.92 | |
| Shoulder width | 0.0 | ft | % Trucks and buses | 3 | % |
| Lane width | 12.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.3 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Level | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 0 | % |
| Up/down | - | % | Access point density | 25 | /mi |

Analysis direction volume, Vd 574 veh/h
Opposing direction volume, Vo 443 veh/h

### Average Travel Speed

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.1 | | 1.2 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adj. factor, (note-5) fHV | 0.997 | | 0.994 | |
| Grade adj. factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 626 | pc/h | 484 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed, (note-3) S FM | - | mi/h |
| Observed total demand, (note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed, (note-3) BFFS | 45.0 | mi/h |
| Adj. for lane and shoulder width, (note-3) fLS | 4.2 | mi/h |
| Adj. for access point density, (note-3) fA | 6.3 | mi/h |
| Free-flow speed, FFSd | 34.5 | mi/h |
| Adjustment for no-passing zones, fnp | 0.7 | mi/h |
| Average travel speed, ATSd | 25.2 | mi/h |

Percent Free Flow Speed, PFFS 73.1 %

## Percent Time-Spent-Following

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.0 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 1.000 | | 1.000 | |
| Grade adjustment factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 624 | pc/h | 482 | pc/h |
| Base percent time-spent-following, (note-4) BPTSFd | 59.0 | % | | |
| Adjustment for no-passing zones, fnp | 13.2 | | | |
| Percent time-spent-following, PTSFd | 66.4 | % | | |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | D | |
| Volume to capacity ratio, v/c | 0.37 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 47 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 172 | veh-mi |
| Peak 15-min total travel time, TT15 | 1.9 | veh-h |
| Capacity from ATS, CdATS | 1690 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1690 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.3 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 25.2 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 66.4 | |
| Level of service, LOSd (from above) | D | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 623.9 |
| Effective width of outside lane, We | 12.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 5.03 |
| Bicycle LOS | E |

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | CL |
| Agency/Co. | |
| Date Performed | 12/5/2012 |
| Analysis Time Period | AM Peak |
| Highway | South Kihei Road |
| From/To | North of Kulanihakoi (SB) |
| Jurisdiction | |
| Analysis Year | Interim |
| Description | |

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 3 | | Peak hour factor, PHF | 0.92 | |
| Shoulder width | 0.0 | ft | % Trucks and buses | 3 | % |
| Lane width | 12.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.3 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Level | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 0 | % |
| Up/down | - | % | Access point density | 25 | /mi |

Analysis direction volume, Vd 443 veh/h
Opposing direction volume, Vo 574 veh/h

## Average Travel Speed

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.2 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adj. factor, (note-5) fHV | 0.994 | | 0.997 | |
| Grade adj. factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 484 | pc/h | 626 | pc/h |

Free-Flow Speed from Field Measurement:

| | | |
|---|---|---|
| Field measured speed, (note-3) S FM | - | mi/h |
| Observed total demand, (note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed, (note-3) BFFS | 45.0 | mi/h |
| Adj. for lane and shoulder width, (note-3) fLS | 4.2 | mi/h |
| Adj. for access point density, (note-3) fA | 6.3 | mi/h |
| Free-flow speed, FFSd | 34.5 | mi/h |
| Adjustment for no-passing zones, fnp | 0.4 | mi/h |
| Average travel speed, ATSd | 25.5 | mi/h |
| Percent Free Flow Speed, PFFS | 73.9 | % |

## Percent Time-Spent-Following

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.0 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 1.000 | | 1.000 | |
| Grade adjustment factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 482 | pc/h | 624 | pc/h |
| Base percent time-spent-following, (note-4) BPTSFd | 51.1 | % | | |
| Adjustment for no-passing zones, fnp | 13.2 | | | |
| Percent time-spent-following, PTSFd | 56.9 | % | | |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | D | |
| Volume to capacity ratio, v/c | 0.29 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 36 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 133 | veh-mi |
| Peak 15-min total travel time, TT15 | 1.4 | veh-h |
| Capacity from ATS, CdATS | 1695 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1695 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.3 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 25.5 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 56.9 | |
| Level of service, LOSd (from above) | D | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following | | |

including passing lane, PTSFpl - %

Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 481.5 |
| Effective width of outside lane, We | 12.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 4.90 |
| Bicycle LOS | E |

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.



Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | CL |
| Agency/Co. | |
| Date Performed | 12/5/2012 |
| Analysis Time Period | PM Peak |
| Highway | South Kihei Road |
| From/To | North of Kulanihakoi (NB) |
| Jurisdiction | |
| Analysis Year | Interim |
| Description | |

Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 3 | | Peak hour factor, PHF | 0.97 | |
| Shoulder width | 0.0 | ft | % Trucks and buses | 3 | % |
| Lane width | 12.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.3 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Level | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 0 | % |
| Up/down | - | % | Access point density | 25 | /mi |

Analysis direction volume, Vd 657 veh/h
Opposing direction volume, Vo 581 veh/h

Average Travel Speed

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.1 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adj. factor, (note-5) fHV | 0.997 | | 0.997 | |
| Grade adj. factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 679 | pc/h | 601 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed, (note-3) S FM | - | mi/h |
| Observed total demand, (note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed, (note-3) BFFS | 45.0 | mi/h |
| Adj. for lane and shoulder width, (note-3) fLS | 4.2 | mi/h |
| Adj. for access point density, (note-3) fA | 6.3 | mi/h |
| Free-flow speed, FFSd | 34.5 | mi/h |
| Adjustment for no-passing zones, fnp | 0.4 | mi/h |
| Average travel speed, ATSd | 24.2 | mi/h |

Percent Free Flow Speed, PFFS 70.1 %

## Percent Time-Spent-Following

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.0 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 1.000 | | 1.000 | |
| Grade adjustment factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 677 | pc/h | 599 | pc/h |
| Base percent time-spent-following, (note-4) BPTSFd | 61.6 | % | | |
| Adjustment for no-passing zones, fnp | 13.0 | | | |
| Percent time-spent-following, PTSFd | 68.5 | % | | |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | D | |
| Volume to capacity ratio, v/c | 0.40 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 51 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 197 | veh-mi |
| Peak 15-min total travel time, TT15 | 2.1 | veh-h |
| Capacity from ATS, CdATS | 1695 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1695 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.3 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 24.2 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 68.5 | |
| Level of service, LOSd (from above) | D | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 677.3 |
| Effective width of outside lane, We | 12.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 5.07 |
| Bicycle LOS | E |

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | CL |
| Agency/Co. | |
| Date Performed | 12/5/2012 |
| Analysis Time Period | PM Peak |
| Highway | South Kihei Road |
| From/To | North of Kulanihakoi (SB) |
| Jurisdiction | |
| Analysis Year | Interim |
| Description | |

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 3 | | Peak hour factor, PHF | 0.97 | |
| Shoulder width | 0.0 | ft | % Trucks and buses | 3 | % |
| Lane width | 12.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.3 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Level | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 0 | % |
| Up/down | - | % | Access point density | 25 | /mi |

Analysis direction volume, Vd 581 veh/h
Opposing direction volume, Vo 657 veh/h

## Average Travel Speed

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.1 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adj. factor, (note-5) fHV | 0.997 | | 0.997 | |
| Grade adj. factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 601 | pc/h | 679 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed, (note-3) S FM | - | mi/h |
| Observed total demand, (note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed, (note-3) BFFS | 45.0 | mi/h |
| Adj. for lane and shoulder width, (note-3) fLS | 4.2 | mi/h |
| Adj. for access point density, (note-3) fA | 6.3 | mi/h |
| Free-flow speed, FFSd | 34.5 | mi/h |
| Adjustment for no-passing zones, fnp | 0.4 | mi/h |
| Average travel speed, ATSd | 24.3 | mi/h |

Percent Free Flow Speed, PFFS 70.2 %

## Percent Time-Spent-Following

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.0 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 1.000 | | 1.000 | |
| Grade adjustment factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 599 | pc/h | 677 | pc/h |
| Base percent time-spent-following, (note-4) BPTSFd | 59.6 | % | | |
| Adjustment for no-passing zones, fnp | 13.0 | | | |
| Percent time-spent-following, PTSFd | 65.7 | % | | |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | D | |
| Volume to capacity ratio, v/c | 0.35 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 45 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 174 | veh-mi |
| Peak 15-min total travel time, TT15 | 1.9 | veh-h |
| Capacity from ATS, CdATS | 1695 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1695 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.3 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 24.3 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 65.7 | |
| Level of service, LOSd (from above) | D | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following | | |

including passing lane, PTSFpl - %

Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 599.0 |
| Effective width of outside lane, We | 12.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 5.01 |
| Bicycle LOS | E |

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

# APPENDIX E

## CAPACITY ANALYSIS CALCULATIONS
## PROJECTED YEAR 2015 PEAK HOUR TRAFFIC ANALYSIS

HCS 2010: Two-Lane Highways Release 6.3

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | CL |
| Agency/Co. | |
| Date Performed | 12/5/2012 |
| Analysis Time Period | AM Peak |
| Highway | South Kihei Road |
| From/To | North of Kulanihakoi (NB) |
| Jurisdiction | |
| Analysis Year | Projected |
| Description | |

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 3 | | Peak hour factor, PHF | 0.92 | |
| Shoulder width | 5.0 | ft | % Trucks and buses | 3 | % |
| Lane width | 12.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.3 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Level | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 0 | % |
| Up/down | - | % | Access point density | 25 | /mi |

Analysis direction volume, Vd 617 veh/h
Opposing direction volume, Vo 476 veh/h

## Average Travel Speed

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.1 | | 1.2 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adj. factor, (note-5) fHV | 0.997 | | 0.994 | |
| Grade adj. factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 673 | pc/h | 521 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed, (note-3) S FM | - | mi/h |
| Observed total demand, (note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed, (note-3) BFFS | 45.0 | mi/h |
| Adj. for lane and shoulder width, (note-3) fLS | 1.3 | mi/h |
| Adj. for access point density, (note-3) fA | 6.3 | mi/h |
| Free-flow speed, FFSd | 37.5 | mi/h |
| Adjustment for no-passing zones, fnp | 0.6 | mi/h |
| Average travel speed, ATSd | 27.6 | mi/h |

Percent Free Flow Speed, PFFS 73.7 %

## Percent Time-Spent-Following

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.0 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 1.000 | | 1.000 | |
| Grade adjustment factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 671 | pc/h | 517 | pc/h |
| Base percent time-spent-following, (note-4) BPTSFd | 60.6 | % | | |
| Adjustment for no-passing zones, fnp | 12.9 | | | |
| Percent time-spent-following, PTSFd | 67.9 | % | | |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | D | |
| Volume to capacity ratio, v/c | 0.40 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 50 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 185 | veh-mi |
| Peak 15-min total travel time, TT15 | 1.8 | veh-h |
| Capacity from ATS, CdATS | 1690 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1690 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.3 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 27.6 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 67.9 | |
| Level of service, LOSd (from above) | D | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following | | |

including passing lane, PTSFpl - %

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl E
Peak 15-min total travel time, TT15 - veh-h

Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 670.7 |
| Effective width of outside lane, We | 22.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 3.37 |
| Bicycle LOS | C |

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.



Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | CL |
| Agency/Co. | |
| Date Performed | 12/5/2012 |
| Analysis Time Period | AM Peak |
| Highway | South Kihei Road |
| From/To | North of Kulanihakoi (SB) |
| Jurisdiction | |
| Analysis Year | Projected |
| Description | |

Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 3 | | Peak hour factor, PHF | 0.92 | |
| Shoulder width | 5.0 | ft | % Trucks and buses | 3 | % |
| Lane width | 12.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.3 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Level | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 0 | % |
| Up/down | - | % | Access point density | 25 | /mi |

Analysis direction volume, Vd 476 veh/h
Opposing direction volume, Vo 617 veh/h

Average Travel Speed

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.2 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adj. factor, (note-5) fHV | 0.994 | | 0.997 | |
| Grade adj. factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 521 | pc/h | 673 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed, (note-3) S FM | - | mi/h |
| Observed total demand, (note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed, (note-3) BFFS | 45.0 | mi/h |
| Adj. for lane and shoulder width, (note-3) fLS | 1.3 | mi/h |
| Adj. for access point density, (note-3) fA | 6.3 | mi/h |
| Free-flow speed, FFSd | 37.5 | mi/h |
| Adjustment for no-passing zones, fnp | 0.4 | mi/h |
| Average travel speed, ATSd | 27.8 | mi/h |

Percent Free Flow Speed, PFFS 74.3 %

## Percent Time-Spent-Following

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.0 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 1.000 | | 1.000 | |
| Grade adjustment factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 517 | pc/h | 671 | pc/h |
| Base percent time-spent-following, (note-4) BPTSFd | 54.3 | % | | |
| Adjustment for no-passing zones, fnp | 12.9 | | | |
| Percent time-spent-following, PTSFd | 59.9 | % | | |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | D | |
| Volume to capacity ratio, v/c | 0.31 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 39 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 143 | veh-mi |
| Peak 15-min total travel time, TT15 | 1.4 | veh-h |
| Capacity from ATS, CdATS | 1695 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1695 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.3 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 27.8 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 59.9 | |
| Level of service, LOSd (from above) | D | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 517.4 |
| Effective width of outside lane, We | 22.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 3.24 |
| Bicycle LOS | C |

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS 2010: Two-Lane Highways Release 6.3

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | CL |
| Agency/Co. | |
| Date Performed | 12/5/2012 |
| Analysis Time Period | PM Peak |
| Highway | South Kihei Road |
| From/To | North of Kulanihakoi (NB) |
| Jurisdiction | |
| Analysis Year | Projected |
| Description | |

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 3 | | Peak hour factor, PHF | 0.97 | |
| Shoulder width | 5.0 | ft | % Trucks and buses | 3 | % |
| Lane width | 12.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.3 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Level | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 0 | % |
| Up/down | - | % | Access point density | 25 | /mi |

Analysis direction volume, Vd 706 veh/h
Opposing direction volume, Vo 625 veh/h

## Average Travel Speed

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.1 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adj. factor, (note-5) fHV | 0.997 | | 0.997 | |
| Grade adj. factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 730 | pc/h | 646 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed, (note-3) S FM | - | mi/h |
| Observed total demand, (note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed, (note-3) BFFS | 45.0 | mi/h |
| Adj. for lane and shoulder width, (note-3) fLS | 1.3 | mi/h |
| Adj. for access point density, (note-3) fA | 6.3 | mi/h |
| Free-flow speed, FFSd | 37.5 | mi/h |
| Adjustment for no-passing zones, fnp | 0.4 | mi/h |
| Average travel speed, ATSd | 26.4 | mi/h |

Percent Free Flow Speed, PFFS 70.5 %

## Percent Time-Spent-Following

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.0 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 1.000 | | 1.000 | |
| Grade adjustment factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 728 | pc/h | 644 | pc/h |
| Base percent time-spent-following, (note-4) BPTSFd | 65.2 | % | | |
| Adjustment for no-passing zones, fnp | 12.6 | | | |
| Percent time-spent-following, PTSFd | 71.9 | % | | |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | D | |
| Volume to capacity ratio, v/c | 0.43 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 55 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 212 | veh-mi |
| Peak 15-min total travel time, TT15 | 2.1 | veh-h |
| Capacity from ATS, CdATS | 1695 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1695 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.3 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 26.4 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 71.9 | |
| Level of service, LOSd (from above) | D | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following | | |

including passing lane, PTSFpl - %

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 727.8 |
| Effective width of outside lane, We | 22.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 3.41 |
| Bicycle LOS | C |

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.



Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | CL |
| Agency/Co. | |
| Date Performed | 12/5/2012 |
| Analysis Time Period | PM Peak |
| Highway | South Kihei Road |
| From/To | North of Kulanihakoi (SB) |
| Jurisdiction | |
| Analysis Year | Projected |
| Description | |

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 3 | | Peak hour factor, PHF | 0.97 | |
| Shoulder width | 5.0 | ft | % Trucks and buses | 3 | % |
| Lane width | 12.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.3 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Level | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 0 | % |
| Up/down | - | % | Access point density | 25 | /mi |

Analysis direction volume, Vd 625 veh/h
Opposing direction volume, Vo 706 veh/h

## Average Travel Speed

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.1 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adj. factor, (note-5) fHV | 0.997 | | 0.997 | |
| Grade adj. factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 646 | pc/h | 730 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed, (note-3) S FM | - | mi/h |
| Observed total demand, (note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed, (note-3) BFFS | 45.0 | mi/h |
| Adj. for lane and shoulder width, (note-3) fLS | 1.3 | mi/h |
| Adj. for access point density, (note-3) fA | 6.3 | mi/h |
| Free-flow speed, FFSd | 37.5 | mi/h |
| Adjustment for no-passing zones, fnp | 0.3 | mi/h |
| Average travel speed, ATSd | 26.4 | mi/h |

Percent Free Flow Speed, PFFS 70.6 %

## Percent Time-Spent-Following

| Direction | Analysis (d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.0 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 1.000 | | 1.000 | |
| Grade adjustment factor, (note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate, (note-2) vi | 644 | pc/h | 728 | pc/h |
| Base percent time-spent-following, (note-4) BPTSFd | 62.3 | % | | |
| Adjustment for no-passing zones, fnp | 12.6 | | | |
| Percent time-spent-following, PTSFd | 68.2 | % | | |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | D | |
| Volume to capacity ratio, v/c | 0.38 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 48 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 188 | veh-mi |
| Peak 15-min total travel time, TT15 | 1.8 | veh-h |
| Capacity from ATS, CdATS | 1695 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1695 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.3 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 26.4 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 68.2 | |
| Level of service, LOSd (from above) | D | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 644.3 |
| Effective width of outside lane, We | 22.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 3.35 |
| Bicycle LOS | C |

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

# APPENDIX F

***Drainage Report for Kūlanihāko‘i Bridge Replacement***

***Wilson Okamoto Corporation***

***March 2013***

# DRAINAGE REPORT

*For*

# KULANIHAKOI BRIDGE REPLACEMENT

South Kihei Road
Kihei, Maui, Hawaii

Lic. Exp. 04-30-14

*This work was prepared by me or under my supervision and construction of this project will be under my observation. (Observation of construction as defined in Chapter 16-115 Subchapter 1 Definitions of the Hawaii Administrative Rules "Professional Engineers, Architects, Surveyors, and Landscape Architects.")*

*Prepared for:*

**County of Maui Department of Public Works**
200 South High St.
Kalana O Maui Bldg. 4th Flr
Wailuku, Hawaii 96793

*Prepared by:*

**Wilson Okamoto Corporation**
1907 South Beretania Street, Suite 400
Honolulu, HI 96826

March 2013

WILSON OKAMOTO CORPORATION
ENGINEERS | PLANNERS | CONSULTANTS

Civil Engineering Department
1907 South Beretania Street, Suite 400
Honolulu, Hawaii 96826



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# I. INTRODUCTION

## A. General

The County of Maui Department of Public Works proposes to replace and upgrade the Kulanihakoi Bridge crossing at South Kihei Road. The existing bridge consists of four 6' x 4' high reinforced concrete box culverts with temporary concrete barriers located on either side of the roadway. The bridge is in deteriorated condition with exposed reinforcement and crumbling concrete and is not capable of handling heavy storm events, causing storm water runoff to overtop South Kihei Road. The purpose of this report is to analyze the impact of the proposed development on the existing drainage conditions of the area, and to recommend any drainage improvements as required.

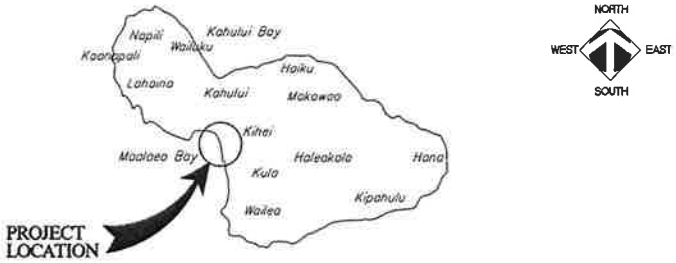
## B. Site Location & Project Description

The project site is located on South Kihei Road approximately 200 feet south of Kaonoulu Street intersection in the Kihei area on the island of Maui, Hawaii (see Exhibit 1). The proposed project will involve demolishing the four 6' x 4' high existing reinforced concrete box culverts and replacing them with new six 6' x 4' high reinforced concrete box culverts. Proposed improvements also include road widening, installation of concrete curb and gutter, concrete sidewalk, bike lanes, headwalls and guardrails. Other improvements include a new 24" drainline and relocating the outlet of an existing 30" drainline. A temporary bypass road and detour bridge will be located on the adjacent property (TMK (2) 3-9-01: 162) east of South Kihei Road prior to the construction of the new culverts and road improvements. See Exhibit 2 for site layout of bridge replacement and temporary by-pass road.

# II. EXISTING CONDITIONS

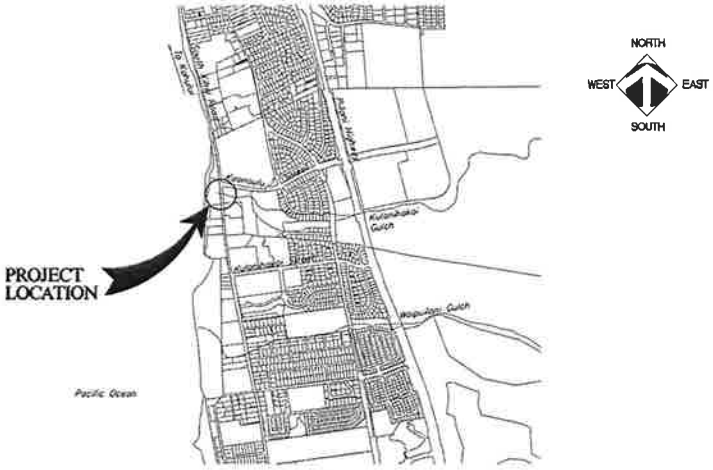
## A. Topography

The existing topography of the project site consists of a two-way asphalt concrete. paved roadway. Existing pavement grades around the stream crossing range approximately between 5.2 feet and 5.7 feet mean sea level (msl). The area around the location of the bypass road and detour bridge consists of sparsely to moderately covered grass and some trees. The existing stream channel is approximately 30 feet wide near the location of the detour bridge. The area is also flat with ground elevations ranging from approximately 4.5 feet to 6.5 feet mean sea level (msl).




ISLAND OF MAUI

VICINITY MAP
NOT TO SCALE




LOCATION MAP
NOT TO SCALE

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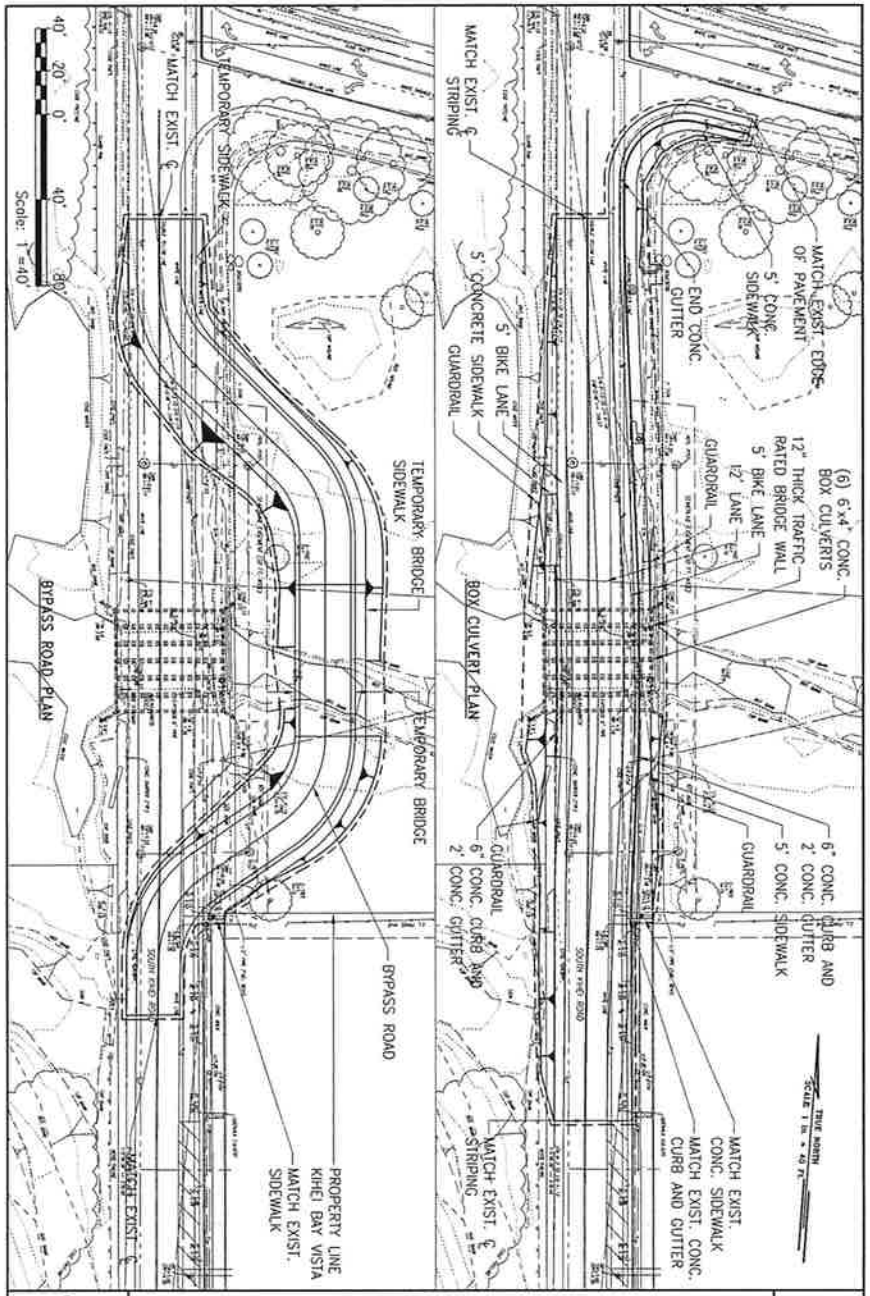
KULANIHAKOI BRIDGE REPLACEMENT
KIHEI, MAUI, HAWAII

VICINITY AND LOCATION MAPS

EXHIBIT 1

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KULANIHAKOI BRIDGE REPLACEMENT
KIHEI, MAUI, HAWAII

SITE LAYOUT PLAN

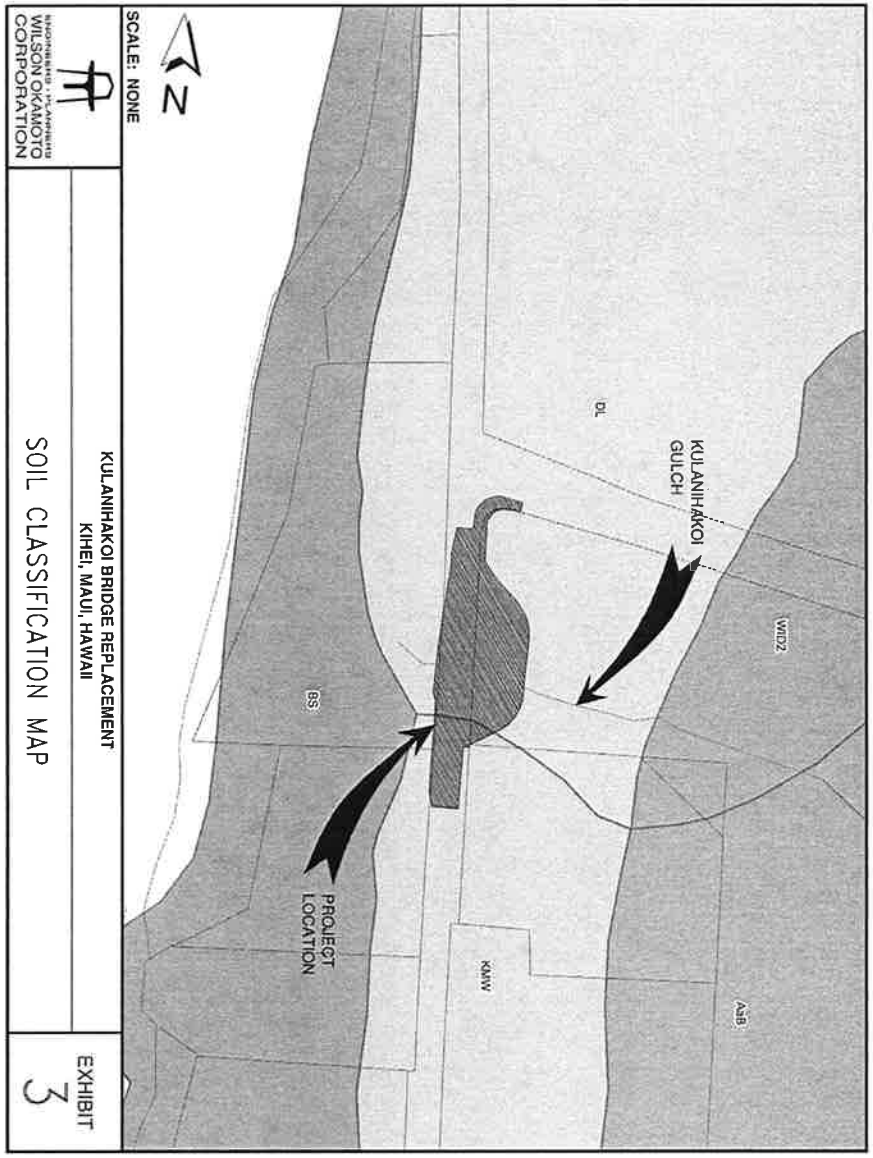
EXHIBIT 2

**B. Soil Conditions**

From Geolabs, Inc. draft report, "Geotechnical Engineering Exploration: Kulanihakoi Bridge Replacement, South Kihei Road, Kihei, Maui, Hawaii," October 26, 2012, the soil around the box culverts consists of very hard clayey silts and dense silty gravel over basaltic boulders extending to a depth of approximately 5 to 6 feet below the existing pavement surface. Medium dense sands were encountered approximately 28 feet below the existing surface, which is underlain by moderately weathered, medium hard to hard basalt rock formation extending to a depth of approximately 40 feet below the existing pavement surface. The area east of South Kihei Road consists of medium dense sands and stiff sandy silts approximately 10 to 12 feet below ground surface. Approximately 25 feet below the existing ground surface, medium dense to dense silty sands were encountered, which is underlain by moderately weathered, hard basalt rock formation extending to the maximum depth explored of approximately 50 feet below the existing ground surface. Groundwater was encountered about 4.1 to 4.8 feet below ground surface (0.7 to 1.9 feet mean sea level).

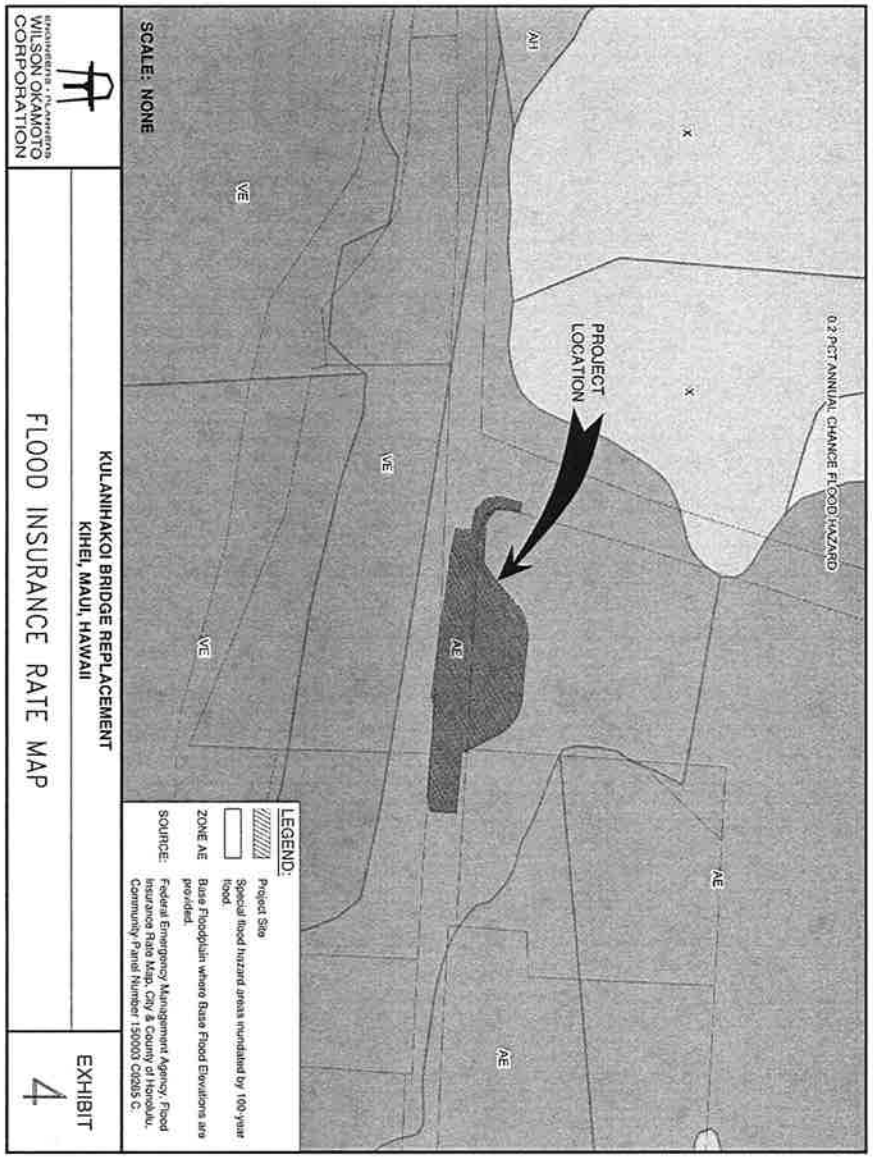
From the U.S. Department of Agriculture Soil Conservation Service's "Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii," August 1972, majority of the soil within and around the project site are classified as Dune Land soil (DL). Dune Land soil consists of hills and ridges of sand size particles drifted and piled by winds. Hills and ridges are actively shifting or are so recently fixed or stabilized that no soil horizons have developed. The sand is dominantly coral and seashells with elevations ranging from sea level to 150 feet and an annual rainfall of 15 to 90 inches. The soil west of South Kihei Road is classified as Beach soil (BS) which consists of sandy, gravelly, or cobbly areas. Soils are washed and rewashed by ocean waves and are mainly light-colored sands derived from coral and seashells. The soil south of the bridge is classified as Kealia Silt Loam (KMW) which consists of poorly drained soil and has a high content of salt. Ponding occurs in low areas after heavy rain and when the soil dries, salt crystals form on the surface. Slope of the soil varies between 0 to 1 percent. Permeability is moderately rapid. Hazard of water erosion is slight, but can be severe when dry and windy.

See Exhibit 3 for Soil Classification Map.



**C. Flood Hazard**

According to Panel Number 15003 C0265 C of the revised (September 6, 1989) U.S. Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map, the entire project site is situated in Flood Zone *AE*. *AE* zones represent the base floodplain where base flood elevations are provided (See Exhibit 4).



**D. Existing Drainage Conditions**

According to the County of Maui's Draft Report, "Kihei Drainage Master Plan Waiakoa Gulch to Kilohana Drive Existing Conditions," dated April 2009, there are eight different flood districts in the Kihei Region. The Kulanihakoi Bridge at South Kihei Road is located in the Kulanihakoi district, which is the largest district in the region that ranges near the summit of Haleakala down to the ocean. Runoffs from a 100-yr storm event are contributed by six drainage areas; Piilani Basins 5, 6, 7, 8 and Makai Basins Kula2_1 and Kula2_2 (see Exhibit 5). The Kihei Drainage Master Plan follows Maui County Drainage Standards which states that for drainage areas greater than 100 acres and for all streams, the Natural Resources Conservative Service (NRCS) method is required with recurrence interval equal to 100 year based on the 24-hour storm. The Hydrologic Engineering Center-Hydrologic Modeling System (HEC-MIS) was used to determine the flow rates and runoff volumes which incorporate the NRCS method. Some of the areas in the Kulanihakoi District are not greater than 100 acres, but for consistency, the HEC-MIS model and NRCS method was used for all drainage areas. Culvert analyses were used to determine the existing culvert capacities with the use of CulvertMaster program and nomographs.

*Piilani Basins 5 and 6*

Basin 5 is located east of Piilani Highway that consists of 13 acres of residential properties that generate 59 cfs of storm runoff that discharges through a roadside ditch and underground pipes into basin 6. Basin 6 is also east of Piilani Highway and produces approximately 208 cfs of runoff from 62 acres of residential and agricultural lands. The combined flows from both basins cross Piilani Highway through a 54" culvert that connects to Kaonoulu Estates Phase I drainage system and eventually is routed to Kulanihakoi Gulch at the makai side of Kaonoulu Estates Phase III.

*Piilani Basin 7*

Basin 7 is located east of Piilani Highway that produces 1,038 cfs from 526 acres of agricultural land. The runoff flows through two 102" culverts under the highway into a shallow earth channel and enters a 16'x6'-6" box culvert. The outlet from the culvert flows to a crossing at Kulanihakoi Gulch where it combines with runoffs from basin 8 and Kula2_1.

*Piilani Basin 8*

Basin 8 is located east of Piilani Highway and is mostly agricultural land. This is the largest drainage area of 9,576 acres which creates 13,373 cfs of runoff. The





flow crosses under Piilani Highway through Kulanihakoi Gulch. It continues down through a natural earth channel and enters a trapezoidal channel with boulder-lined side slopes and geotextile bottom. Basin 8 flow combines with basin 7 and Kula2_1 near Kaonoulu Estates Phase IV area at the Kulanihakoi Gulch.

*Kula2_1*

This drainage basin consists mostly of agricultural land in its 18 acres and produces 61 cfs of runoff that combines with basins 7 and 8 at the Kulanihakoi Gulch near Kaonoulu Estates Phase IV with a total flow of 14,022 cfs.

*Kula2_2*

This drainage basin is approximately 129 acres of mostly residential and some agricultural areas and contributes 356 cfs of runoff into Kaonoulu Estates Subdivision Phase III drainage system and discharges into Kulanihakoi Gulch. The combined flows from all the areas at this point are approximately 14,016 cfs.

The runoff continues flowing through the gulch which flattens out as it approaches South Kihei Road. It then flows to the existing four 6' x 4' concrete box culverts underneath South Kihei Road with a total approximate flow of 14,148 cfs for a 100-yr storm event. Sand dunes accumulate at the downstream end of Kulanihakoi Gulch, west of South Kihei Road, which causes flooding problems and backwater effects during heavy storm events. Water surface elevations at the existing culverts along South Kihei Road were analyzed using the Hydrologic Engineering Centers River Analysis System (HEC-RAS) under existing conditions (see Appendix B). HEC-RAS models the water flow through the natural open channels and computes water surface profiles. It also analyzes bridge and culvert designs which will help compute the different proposed culverts and bridges in this report. Roadway overtopping calculations were also conducted to determine how much runoff will flow over South Kihei Road during large storm events (see Appendix A).

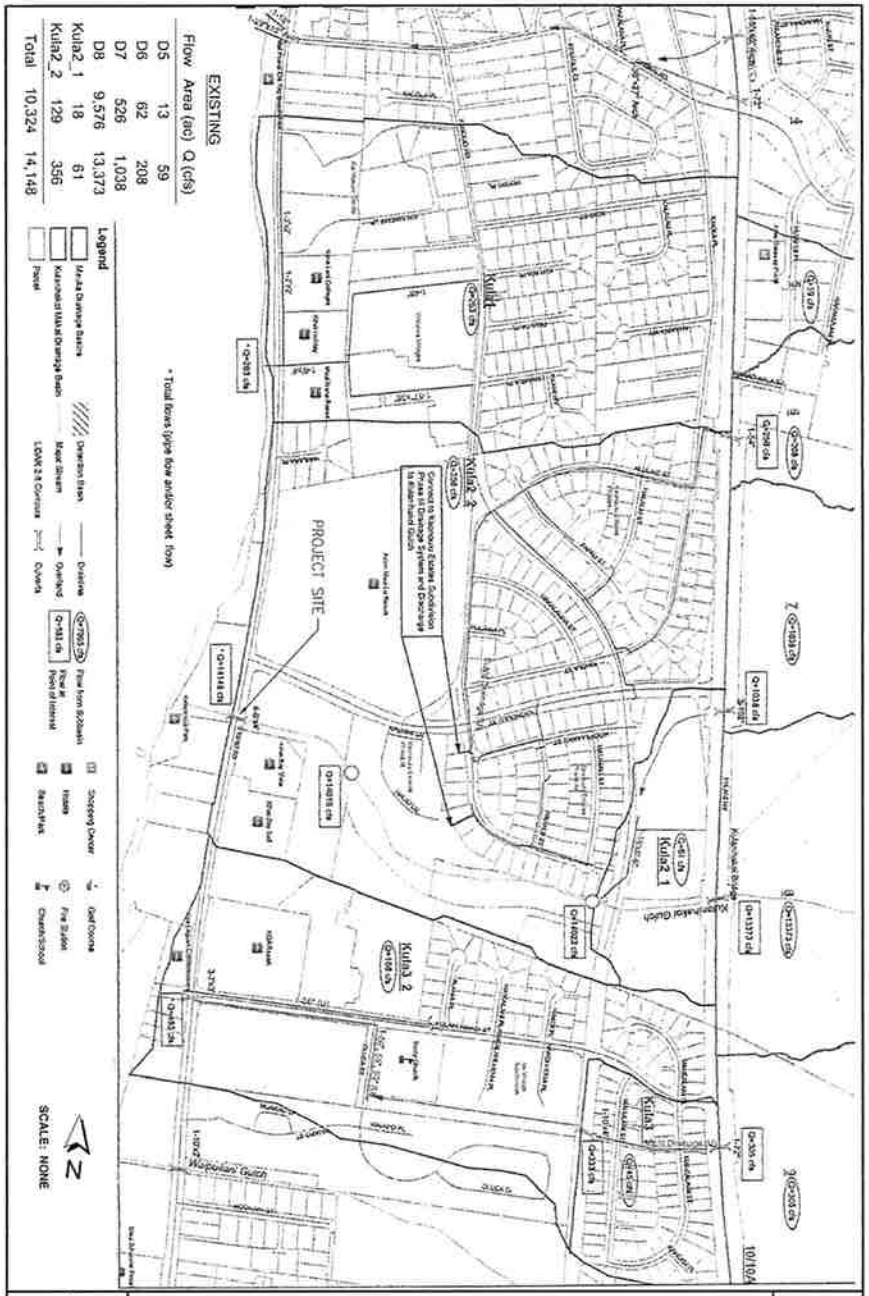
**1. 100-year Storm Event**

Calculations show that the downstream elevations of the culvert were slightly higher than the upstream elevations, which may be caused by the accumulating sand dunes which prevent runoff from flowing out to the ocean and causing backwater effects that flood neighboring properties. Results also show that the existing culverts are not capable of handling large amounts of runoff which leads to runoff overtopping the roadway.

**2. Existing Flood Occurrence**

We also determined the water surface elevations at the existing culvert from past flood events in the area from the Western Regional Climate Center website. Data from their site provides information on the amount of precipitation recorded daily from 1949 to 2012. Using the highest precipitation value recorded, we determined the actual flow that occurred around our project site using the NRCS Peak Flow Method (see Appendix A), and used HEC-RAS to analyze the water surface elevations at the existing culverts (see Appendix B). The calculations show that the past rainfall event produced much less flow to that of the 100-year storm event, however, this estimated peak flow was merely a conservative estimate since determining an actual values take extensive research and data of the existing drainage areas of the Kulanihakoi District that is beyond our scope of work. Although the existing flood event produced less flow from the upstream drainage areas, the existing culverts are still not able to handle that amount of flow, which results in flooding over South Kihei Road. This flooding is also caused by the blocked off outlet preventing the storm runoff from flowing out into the ocean.





## III. TEMPORARY DRAINAGE CONDITIONS

### A. General

Before construction of the proposed roadway and culvert, a temporary bypass road and bridge will need to be constructed. The temporary bypass route will be constructed and remain for approximately one year. It will be located east of South Kihei Road on the adjacent property (TMK (2) 3-9-01: 162). The runoff from the temporary road and bridge is intended to flow into the existing stream.

### B. Temporary Drainage Conditions

The finished grade of the temporary bridge is approximately three feet above the top bank of the existing stream. The capacity of flow between the bridge and existing stream was calculated so we could determine the largest storm event the bridge is capable of handling (see Appendix A). HEC-RAS was used to determine how the existing stream conditions during a 100-year storm event will affect the temporary bypass bridge (see Appendix B).

#### 1. Temporary Bridge

Results show that the clearance between the bridge and stream allows approximately 705 cfs of flow. Using this runoff value, we determined that the largest storm event the temporary bridge can handle is a 1-year, 24-hour storm event. The location and elevation of the temporary bridge is constrained due to the physical location of the project area, making it difficult to raise the bridge over the stream and providing more flow to pass beneath.

#### 2. 100-year Storm Event

For a 100-year storm event, HEC-RAS shows that the bridge will likely be flooded due to large amounts of runoff flowing from upstream. To compensate for this occurrence, the temporary bridge will need to be raised, but due to physical constraints of the project site, raising the bridge will increase the bypass road slope and may become too steep for vehicles to travel on.





## IV. PROPOSED DRAINAGE CONDITION

### A. General

Upon completion of this project, the runoff from Kulanihakoi Gulch will flow through six 6' x 4' reinforced box culverts. The runoff from the re-graded road is intended to flow into the existing 30" drain line, or into the proposed 24" drainline, and eventually into the stream.

### B. Proposed Drainage Conditions

A total flow of 14,148 cfs during a 100-year storm event from the existing drainage areas upstream will flow to the proposed six 6' x 4' reinforced concrete box culverts. The size of the box culverts and water surface elevations were analyzed through HEC-RAS (see Appendix B) to determine if they can handle the large amounts of runoff flowing through the existing drainage areas during heavy storm events as well as how much runoff will overtop South Kihei Road (see Appendix A).

#### 1. Proposed Six 6' x 4' Reinforced Concrete Box Culverts during 100-year Storm Event

The proposed six box culverts were analyzed assuming the downstream end of the stream was blocked off from the existing accumulated sand dunes. The results from HEC-RAS show that the six 6' x 4' box culverts have more capacity and can handle more flow than the existing four culverts. Additional calculations also show that the depth of flow over South Kihei Road is slightly reduced compared to the existing box culverts. Although there is an increase in drainage capacity and depth of flow over the roadway is slightly decreased, the proposed bridge replacement ultimately does not resolve the existing flooding that occurs near and around the project site during heavy storm events. This is due to the accumulating sand dunes blocking off the downstream path causing runoff to back up and flood the roadway.

The six box culverts were also analyzed assuming that the outlet is not blocked. The results from the model and calculations show that the depth overtopping the roadway is reduced significantly by about three feet.

**2. Proposed Eight 6' x 4' Reinforced Concrete Box Culverts during 100-year Storm Event**

The proposed eight box culverts were analyzed assuming the downstream end of the stream is not blocked off. Results from the calculations show that adding more box culverts can handle more flow, but does not significantly reduce the amount of runoff overtopping South Kihei Road. This is mostly due to the sand dunes blocking the natural flow path at the outlet of the stream causing the runoff to back up and flood the roadway. Adding more culverts will not reduce the existing flooding in the area.

**3. Proposed Bridge over South Kihei Road during 100-year Storm Event**

An option to relieve some of the flooding over South Kihei Road is to provide a bridge of the existing culvert/stream. The bridge will sit approximately 3 feet above the existing road to help reduce and/or eliminate the amount of runoff overtopping the roadway during heavy storm events. We modeled this proposed option in HEC-RAS (see Appendix B), assuming the outlet is not blocked off and determined that the storm runoff from the 100-year storm event will still overtop the bridge, but not as severe as the proposed six box culverts. To compensate for this occurrence, the bridge would be raised higher. However, due to the physical constraints of the project site, which includes the Kaonoulu Street intersection north of the stream and the Kihei Bay Vista property south of the stream, constructing a bridge will require extensive improvements which may require reconstruction of Kaonoulu intersection and the existing drainage system along South Kihei Road to prevent flooding of the Kihei Bay Vista complex from the proposed bridge.





## V. SUMMARY & CONCLUSION

After extensive calculations and research, the proposed six 6' x 4' reinforced box culverts will replace the existing deteriorated four 6' x 4' reinforced box culverts. However, the proposed culverts are not intended to alleviate the existing flooding conditions over South Kihei Road. Adding more than six culverts is not very cost effective because they do not significantly decrease the flooding over the roadway. Also, the option to place a bridge over the existing stream may be ideal, but it will require more site and roadway improvements and will eventually cost more.

From past rainfall data and the Kihei Master Drainage Plan, South Kihei Road and the adjacent properties are prone to flooding during large storm events. This is partially due to the enormous drainage areas upstream that contribute large amounts of runoff to Kulanihakoi Gulch. It is also due to the accumulating sand dunes at the end of the gulch that obstruct the natural flow path at the outlet of the stream and causes runoff to back up and flood onto South Kihei Road and the neighboring properties. Overall, a more in-depth approach to handling the significant amount of runoff during large rainfall events is needed in order to reduce flooding over South Kihei Road, which is beyond the scope of work for this project.

## REFERENCES

1. Draft Report for the "Kihei Drainage Master Plan: Waiakoa Gulch to Kilohana Drive Existing Conditions," by R.M. Towill Corporation, April 2009.

2. Draft Report, "Geotechnical Engineering Exploration: Kulanihakoi Bridge Replacement, South Kihei Road, Kihei, Maui, Hawaii," by Geolabs, Inc., October 26, 2012.

3. "Flood Insurance Rate Map, City and County of Honolulu, Hawaii, Community-Panel Number 150003 C0265 C," Federal Emergency Management Agency, Federal Insurance Administration, September 6, 1989.

4. "Kihei 311, Hawaii: Period of Record Daily Climate Summary." Western Regional Climate Center, http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?hi4489.

5. "Rules for the Design of Storm Drainage Facilities in the County of Maui." Department of Public Works and Waste Management, County of Maui, July 1995.

6. "Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii," U.S. Department of Agriculture, Soil Conservation Service, August 1972.





# APPENDIX A

## Appendix A – Roadway Overtopping Sample Calculations

The purpose of this calculation is to determine the height of runoff flowing over South Kihei Road and at what velocity. The following calculation solves for the height and velocity of runoff for the proposed six 6' x 4' reinforce concrete box culvert. The attached tabulated results show heights and velocities for the existing four box culverts, the proposed six culverts, and a proposed eight culverts.

100-yr storm event: $Q_{tot}$ = 14,148 cfs where $Q_{tot}$ is the total flow in cubic feet per second

Assuming inlet and outlet of 6'x4' culvert is submerged (outlet control), the following equation was used:

$$Q_p = C_d A_p \sqrt{2g\left(\frac{h_1 - h_4}{1 + \frac{29C_d^2 n^2 L}{R^{4/3}}}\right)}$$

| | | |
|---|---|---|
| $Q_p$ = | flow in culvert [cfs] | |
| $C_d$ = | coefficient of discharge = | 0.62 (for squared-edge opening) |
| $A_p$ = | area of culvert [ft$^2$] = | 24 |
| g = | acceleration due to gravity [ft/s$^2$] = | 32.2 |
| n = | Manning's roughness coefficient = | 0.012 (for concrete) |
| $L_p$ = | length of culvert [ft] = | 49 |
| $h_1$* = | height of water at inlet [ft] = | 9.0 |
| $h_4$* = | height of water at outlet [ft] = | 8.8 |
| P = | wetted perimeter [ft] = | (6) + 2(4) = 14 |
| R = | hydraulic radius [ft] = | $A_p$ / P = 24/14 = 1.714 |

*Values were determined through HEC-RAS. If the height of water at the outlet ($h_4$) of the culvert is higher than the height of water at the inlet ($h_1$) of the culvert, than the above equation does not apply. This is caused by the blocked off outlet of the stream which allows runoff to back up and flood the roadway.

$$Q_p = (0.62)(24)\sqrt{2(32.2)\left(\frac{(9.0)-(8.8)}{1+\frac{29(0.62)^2(0.012)^2(49)}{(1.714)^{4/3}}}\right)} = 51$$

We are proposing to install six 6'x4' culverts in place of the existing four 6'x4' culverts, total flow through the entire culvert:

$$N^*Q_p = (6)^*(51) = \mathbf{306\ cfs}$$

**Appendix A**
**Roadway Overtopping Tabulated Results**
Kulanihakoi Bridge Replacement
#8256-01
11/9/2012

100-yr storm event
$Q_{tot}$ = 14,148 cfs

Culvert Size
base = 6 ft
height = 4 ft

| | CULVERT | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | $C_d$ | $A_p$ ft$^2$ | g ft/s$^2$ | n | $L_p$ ft | $h_1$ ft | $h_4$ ft | P ft | R ft | $Q_p$ cfs | $N^*Q_p$ cfs |
| **(4) 6' x 4'** | 4 | 0.62 | 24 | 32.2 | 0.012 | 37 | 12.75 | 12.99 | 14 | 1.714 | N/A | N/A |
| **(6) 6' x 4'** | 6 | 0.62 | 24 | 32.2 | 0.012 | 49 | 12.73 | 12.99 | 14 | 1.714 | N/A | N/A |
| **(6) 6' x 4' *** | 6 | 0.62 | 24 | 32.2 | 0.012 | 49 | 9.00 | 8.81 | 14 | 1.714 | 51 | 306 |
| **(8) 6' x 4' *** | 8 | 0.62 | 24 | 32.2 | 0.012 | 49 | 9.00 | 8.81 | 14 | 1.714 | 51 | 409 |

| | ROADWAY | | | | | |
|---|---|---|---|---|---|---|
| | $Q_r$ cfs | C | $L_r$ ft | H ft | $A_r$ ft$^2$ | $V_r$ ft/s |
| **(4) 6' x 4'** | N/A | 2.63 | 300 | N/A | N/A | N/A |
| **(6) 6' x 4'** | N/A | 2.63 | 300 | N/A | N/A | N/A |
| **(6) 6' x 4' *** | 13,842 | 2.63 | 300 | 6.75 | 2025 | 6.83 |
| **(8) 6' x 4' *** | 13,739 | 2.63 | 300 | 6.72 | 2015 | 6.82 |

***Note:** Assumed outlet is not blocked. See HEC-RAS profile.

The remaining total flow that does not flow through the culvert is assumed to flow over the road. The total flow over the road was determined as follows:

$Q_r = Q_{tot} - Q_p$ where $Q_r$ is the total flow over the roadway

$Q_r = (14{,}148) - (306) =$ **13,842 cfs**

To determine how high the water will flow above the roadway, the following equation was used:

$$Q_r = CLH^{3/2}$$

| | | |
|---|---|---|
| $Q_r$ = | flow over the road [cfs] = | 13,842 |
| C = | coefficient = | 2.63 |
| $L_r$ = | length of road span [ft] = | 300 |
| H = | height of water from roadway to top of water surface [ft] | |

$$(13{,}842) = (2.63)*(300)*H^{3/2}$$

**H = 6.75 ft****

**If $h_4$ is greater than $h_1$, than the equation above does not apply. If this occurs, the amount of runoff overtopping the roadway can be determined from the HEC-RAS result.

The velocity of the water over the roadway was determined as follows:

$$V_r = Q_r / A_r$$

| | | |
|---|---|---|
| $V_r$ = | velocity over the road [ft/s] | |
| $Q_r$ = | flow over the road [cfs] = | 13,842 |
| $A_r$ = | Area of road span [$ft^2$] = | $L_r*H = (300)*(6.75) = 2025$ |

$$V_r = (13{,}842) / (2025)$$

**$V_r$ = 6.84 ft/s**

The flow velocity over the roadway is approximately 7 ft/s. The finished roadway should be paved with a material that is capable of handling this flow velocity. The County of Maui's "Rules for the Design of Storm Drainage Facilities" shows different lining material and the maximum flow velocity for each lining. Concrete is an ideal pavement choice with no limits on a maximum velocity. Concrete would be a great material for long term use and increases strength protection over the culverts, however can be very costly. City and County of Honolulu's "Rules Relating to Storm Drainage Standards" also shows concrete to have no limitation for maximum velocity, but also show that A.C.





pavement is capable of 20 ft/s of flow over it. This is more than enough to handle the flow velocity we determined and is cheaper than concrete.

**Appendix A – Peak Flow from Actual Storm Event Sample Calculations**

The purpose of this calculation is to determine the total peak flow that occurred from past flood events around our project site. We used the SCS (NRCS) Peak Flow Method to find the peak flow since the total drainage area is approximately 10,324 acres which is greater than 100 acres. For the State of Hawaii, it is assumed that the SCS rainfall distribution is a 24-hour, Type I Rainfall Distribution. Tabulated results are attached.

From the Western Regional Climate Center website, we determined the largest daily rainfall amount that occurred around the project area between 1949 and 2012. The largest rainfall amount that occurred was six inches (January 10, 1980).

First, we need to determine the composite Curve Number from all the existing drainage areas (see tabulated results). The equation we use is:

$$CN = \frac{\sum CN_X A_X}{A_X}$$

| | |
|---|---|
| CN = | curve number |
| $CN_X$ = | curve number for each drainage basin |
| $A_X$ = | area of each drainage basin [ac] |

From the tabulated results, we calculated a composite curve number of 74.

Next, we calculate the retention value, $S_R$ [in] which we use the equation:

$$S_R = 1.0\left(\frac{1000}{CN} - 10\right) = 1.0\left(\frac{1000}{(74)} - 10\right) = 3.5in$$

The following equation was used to calculate the depth of direct runoff:

$$Q_D = \frac{(P - 0.2S_R)^2}{P + 0.8S_R}$$

| | | |
|---|---|---|
| $Q_D$ = | depth of direct runoff [in] | |
| P = | depth of 24-hr precipitation [in] | 6 |
| $S_R$ = | retention [in] | 3.5 |

Inserting the values from the table into the equation results in a depth of $Q_D$ = 3.2 in.

Next, we solve for the initial abstraction, $I_a$ using:





$$I_a = 0.2S_R = 0.2(3.5) = 0.70 \text{ in.}$$

From there, we can solve for $I_a/P$:

$$I_a/P = (0.70) / (6) = 0.12$$

We now solve for the unit peak flow by using the equation below:

$$q_u = (K_u)\left(10^{C_0 + C_1 \log t_c + C_2 (\log t_c)^2}\right)$$

| | | |
|---|---|---|
| $q_u$ = | unit peak flow [$ft^3/s/mi^2/in$] | |
| $K_u$ = | coefficient = | 1.0 (English Units) |
| $C_0$ = | coefficient = | 2.294512 |
| $C_1$ = | coefficient = | -0.512657 |
| $C_2$ = | coefficient = | -0.11308 |
| $t_c$ = | time of concentration [hr] = | 4.87* |

*Note: The time of concentration value should be between 0.1 and 10. Since determining this value requires a more in depth calculation of all the existing drainage areas and is beyond our scope of work, we conservatively estimated this value.

The $C_0$, $C_1$, and $C_2$ coefficients were determined from the Coefficients of SCS Peak Discharge Method table based on the type of rainfall distribution and $I_a/P$ value. Inputting the values from the table above resulted in a unit peak flow of approximately 77 $ft^3/s/mi^2/in$.

Finally, we can calculate the peak or total flow using the equation below:

$$q_P = (q_u)\ (A_k)\ (Q_D)$$

| | | |
|---|---|---|
| $q_p$ = | peak flow [$ft^3/s$] | |
| $q_u$ = | unit peak flow [$ft^3/s/mi^2/in$] = | 77 |
| $A_k$ = | basin area [$mi^2$] = | 16.13 |
| $Q_D$ = | depth of direct runoff [in] = | 3.2 |

The total peak flow we calculated is approximately:

$$q_P = (77)\ (16.13)\ (3.2)$$

$$\mathbf{q_P = 4{,}004\ cfs}$$

The total peak flow from an actual storm flood event around our project area is approximately 4,004 cfs, which is significantly less than the 100-yr storm event of 14,148 cfs. We can use the total peak flow value we calculated and use HEC-RAS to determine the water surface elevations at the existing culverts at Kulanihakoi Bridge under South Kihei Road (see Appendix B).

**Appendix A**
**Existing Flood Occurrence Tabulated Results**
**SCS (NRCS) Peak Flow Method**
Kulanihakoi Bridge Replacement
#8256-01
1/14/2013

Largest Rainfall Event
P= 6 in
$A_{tot}$= 16.13 $mi^2$
Type I Rainfall
$t_c$= 4.87 hr

| Drainage Basin | Area (ac) | Area ($mi^2$) | Curve Number (CN) |
|---|---|---|---|
| **Piilani Basin 5** | 13 | 0.02 | 83 |
| **Piilani Basin 6** | 62 | 0.10 | 78 |
| **Piilani Basin 7** | 526 | 0.82 | 74 |
| **Piilani Basin 8** | 9576 | 14.96 | 74 |
| **Kula 2_1** | 18 | 0.03 | 76 |
| **Kula 2_2** | 129 | 0.20 | 90 |
| **Total** | 10324 | 16.13 | 74 |

$S_R$ = 3.5 in
$Q_D$ = 3.2 in
$I_a$ = 0.69 in
$I_a/P$ = 0.12

$C_0$ = 2.294512
$C_1$ = -0.512657
$C_2$ = -0.11308

$q_u$ = 77 $cfs/mi^2/in$
**$q_P$ = 4,004 cfs**

**Appendix A**
**Temporary Bypass Road and Bridge Tabulated Results**
**SCS (NRCS) Peak Flow Method**
Kulanihakoi Bridge Replacement
#8256-01
1/14/2013

$q_p$= 705 cfs
$S_R$ = 3.5 in
$A_{tot}$= 16.13 $mi^2$
Type I Rainfall
$t_c$= 4.87 hr

| Drainage Basin | Area (ac) | Area ($mi^2$) | Curve Number (CN) |
|---|---|---|---|
| **Piilani Basin 5** | 13 | 0.02 | 83 |
| **Piilani Basin 6** | 62 | 0.10 | 78 |
| **Piilani Basin 7** | 526 | 0.82 | 74 |
| **Piilani Basin 8** | 9576 | 14.96 | 74 |
| **Kula 2_1** | 18 | 0.03 | 76 |
| **Kula 2_2** | 129 | 0.20 | 90 |
| **Total** | 10324 | 16.13 | 74 |

**P= 2.581 in**
$I_a$= 0.69 in
$I_a/P$ = 0.27
$C_0$ = 2.18219
$C_1$ = (0.48488)
$C_2$ = (0.06589)

$q_u$= 66 $cfs/mi^2/in$
$A_k$= 16.1 $mi^2$
$Q_D$= 0.66 in
$q_p$= 705 cfs

**Appendix A – Temporary Bypass Road and Bridge Calculations**

The purpose of this calculation is to determine how much flow can travel through in the area under the temporary bridge as well as the largest storm event the temporary bridge can handle. Tabulated results are attached.

To determine flow under the temporary bridge, we used Manning's equation:

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

| | | |
|---|---|---|
| Q = | flow under temp. bridge [cfs] | |
| n = | Manning's roughness coefficient = | 0.043 |
| A = | area under temp. bridge [$ft^2$] = | 100.6 |
| P = | wetted perimeter [ft] = | 58.9 |
| R = | hydraulic radius [ft] = | A / P = 100.6/58.9 = 1.71 |
| S = | slope of stream [ft/ft] = | .02 |

$$Q = \frac{1.49}{(0.043)}(100.6)(1.71)^{2/3}(.02)^{1/2} = 705$$

To determine the rainfall intensity, I, from the flow above, the SCS (NRCS) Peak Flow Method was used. By rearranging the steps of this method, we are able to calculate the depth of 24-hr precipitation, P [in] and assume the intensity is the same as the depth, I [in/hr]. The following values were given:

| | | |
|---|---|---|
| $q_p$ = | total peak flow [cfs] = | 705 |
| CN = | composite curve number = | 74 |
| $S_R$ = | retention [in] = | 1.0(1000/CN-10) = 3.5 |
| $A_k$ = | area [$mi^2$] = | 16.13 |
| $t_c$ = | time of concentration [hr] = | 4.87* |
| $I_a$ = | initial abstraction [in] = | $0.2S_R$ = 0.70 |
| $K_u$ = | coefficient = | 1.0 (English Units) |

*Note: The time of concentration value should be between 0.1 and 10. Since determining this value requires a more in depth calculation of all the existing drainage areas and is beyond our scope of work, we conservatively estimated this value.



The following equations are needed to solve for the total peak flow:

$$Q_D = \frac{(P - 0.2S_R)^2}{P + 0.8S_R}$$

$$I_a / P$$

$$q_u = (K_u)\left(10^{C_0 + C_1 \log t_c + C_2 (\log t_c)^2}\right)$$

$$q_P = (q_u)(A_k)(Q_D)$$

| | |
|---|---|
| $Q_D$ = | depth of direct runoff [in] |
| P = | depth of 24-hr precipitation [in] |
| $q_u$ = | unit peak flow [$ft^3/s/mi^2/in$] |
| $C_0$ = | coefficient |
| $C_1$ = | coefficient |
| $C_2$ = | coefficient |

The $C_0$, $C_1$, and $C_2$ coefficients were determined from the Coefficients of SCS Peak Discharge Method table based on the type of rainfall distribution and $I_a/P$ value. Since these four equations depend on depth P, and we are trying to solve for depth P, an iterative process was conducted with the help of Excel. After several calculations, we determined the depth P is approximately 2.6 inches, therefore we used a rainfall intensity of 2.6 in/hr.

With this rainfall intensity at the temporary bridge, we can determine the largest storm event that can occur. From the U.S. Department of Commerce Weather Bureau, "Rainfall-Frequency Atlas of the Hawaiian Islands," a 1-year, 24-hour storm is the largest storm event that can occur to that will allow flow to pass beneath the temporary bridge.

Existing Drainage Conditions during 100-year Storm Event

HEC-RAS Plan: Plan 30 River: Konoulu Stream Reach: Site 1 Profile: 100-YR

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Site 1 | 635.35 | 100-YR | 14148.00 | 2.93 | 13.19 | 13.19 | 17.14 | 0.006922 | 23.68 | 1360.64 | 164.05 | 1.32 |
| Site 1 | 510.35 | 100-YR | 14148.00 | 2.51 | 13.04 | 13.04 | 16.52 | 0.005814 | 20.91 | 1453.66 | 193.96 | 1.19 |
| Site 1 | 585.35 | 100-YR | 14148.00 | 2.99 | 12.73 | 12.73 | 16.18 | 0.006018 | 21.14 | 1474.49 | 205.06 | 1.22 |
| Site 1 | 560.35 | 100-YR | 14148.00 | 2.73 | 12.81 | 12.81 | 15.66 | 0.005483 | 20.16 | 1692.90 | 257.68 | 1.15 |
| Site 1 | 535.37 | 100-YR | 14148.00 | 2.34 | 12.13 | 11.90 | 14.70 | 0.005062 | 18.64 | 1739.36 | 266.49 | 1.10 |
| Site 1 | 510.35 | 100-YR | 14148.00 | 2.31 | 12.33 | 11.67 | 14.44 | 0.004271 | 17.33 | 1906.41 | 284.30 | 1.01 |
| Site 1 | 485.35 | 100-YR | 14148.00 | 2.10 | 12.37 | 11.55 | 14.28 | 0.003795 | 16.62 | 2034.93 | 302.68 | 0.95 |
| Site 1 | 460.35 | 100-YR | 14148.00 | 1.72 | 12.24 | 11.50 | 14.17 | 0.003918 | 16.69 | 2020.66 | 305.25 | 0.96 |
| Site 1 | 435.35 | 100-YR | 14148.00 | 0.27 | 12.87 | | 13.80 | 0.002116 | 12.61 | 2786.90 | 387.74 | 0.69 |
| Site 1 | 410.36 | 100-YR | 14148.00 | 1.51 | 12.70 | | 13.74 | 0.002226 | 13.52 | 2755.02 | 394.45 | 0.74 |
| Site 1 | 385.37 | 100-YR | 14148.00 | 1.63 | 12.47 | | 13.66 | 0.002784 | 14.78 | 2609.85 | 401.91 | 0.81 |
| Site 1 | 360.35 | 100-YR | 14148.00 | 1.25 | 12.42 | | 13.58 | 0.002912 | 14.55 | 2583.96 | 403.85 | 0.81 |
| Site 1 | 323.18 | 100-YR | 14148.00 | 1.12 | 12.50 | | 13.43 | 0.001864 | 11.97 | 2942.45 | 437.61 | 0.67 |
| Site 1 | 313.03 | 100-YR | 14148.00 | 0.68 | 12.75 | 9.18 | 13.30 | 0.000865 | 8.94 | 3718.09 | 444.99 | 0.47 |
| Site 1 | 288.5 | | Culvert | | | | | | | | | |
| Site 1 | 264.01 | 100-YR | 14148.00 | -0.13 | 12.99 | | 13.16 | 0.000369 | 5.14 | 6184.58 | 805.82 | 0.29 |
| Site 1 | 255.13 | 100-YR | 14148.00 | 0.18 | 12.84 | | 13.14 | 0.000422 | 5.99 | 4880.30 | 558.82 | 0.33 |
| Site 1 | 228.53 | 100-YR | 14148.00 | 1.28 | 12.88 | | 13.11 | 0.000283 | 5.12 | 5603.36 | 658.70 | 0.27 |
| Site 1 | 201.86 | 100-YR | 14148.00 | 0.88 | 12.70 | | 13.08 | 0.000408 | 6.04 | 3996.63 | 453.84 | 0.33 |
| Site 1 | 134.82 | 100-YR | 14148.00 | 3.22 | 10.86 | 9.87 | 12.87 | 0.002682 | 11.64 | 1439.32 | 270.40 | 0.78 |
| Site 1 | 109.84 | 100-YR | 14148.00 | 3.46 | 10.09 | 10.09 | 12.72 | 0.004330 | 13.22 | 1214.03 | 274.58 | 0.96 |
| Site 1 | 84.95 | 100-YR | 14148.00 | 3.72 | 9.24 | 9.24 | 11.43 | 0.005075 | 12.82 | 1483.76 | 350.89 | 1.01 |
| Site 1 | 59.95 | 100-YR | 14148.00 | 3.99 | 8.74 | 8.74 | 10.94 | 0.006106 | 13.06 | 1435.33 | 331.40 | 1.09 |
| Site 1 | 34.95 | 100-YR | 14148.00 | 3.93 | 8.31 | 8.31 | 10.47 | 0.007536 | 13.22 | 1417.12 | 340.68 | 1.19 |
| Site 1 | 5.58 | 100-YR | 14148.00 | 1.04 | 6.30 | 6.30 | 8.65 | 0.005811 | 12.88 | 1286.31 | 281.29 | 1.07 |



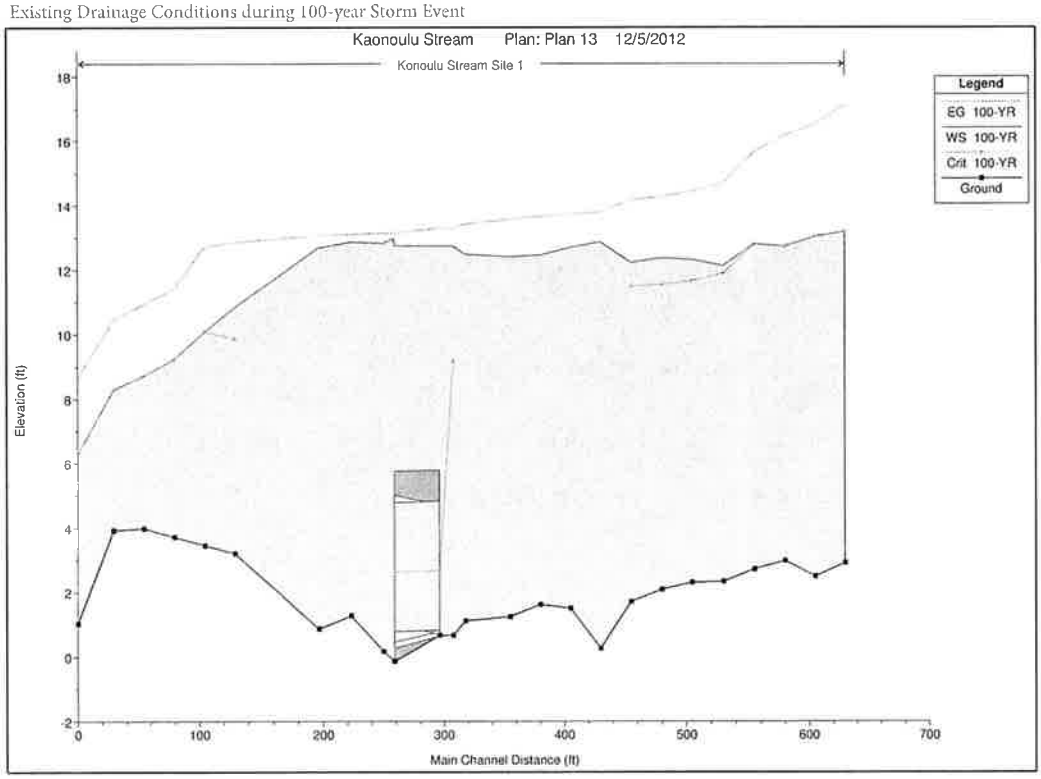
# APPENDIX B

Existing Flood Occurrence

HEC-RAS Plan: 88 River: Konoulu Stream Reach: Site 1 Profile: 100-YR

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Site 1 | 635.35 | 100-YR | 4004.00 | 2.93 | 9.53 | | 10.64 | 0.003302 | 12.06 | 759.93 | 164.05 | 0.85 |
| Site 1 | 610.35 | 100-YR | 4004.00 | 2.51 | 9.50 | | 10.54 | 0.002873 | 10.85 | 782.44 | 184.20 | 0.77 |
| Site 1 | 585.35 | 100-YR | 4004.00 | 2.99 | 9.49 | | 10.45 | 0.002646 | 10.56 | 827.04 | 195.03 | 0.75 |
| Site 1 | 560.35 | 100-YR | 4004.00 | 2.73 | 8.81 | 8.78 | 10.31 | 0.004799 | 13.10 | 702.05 | 213.52 | 0.98 |
| Site 1 | 535.37 | 100-YR | 4004.00 | 2.34 | 9.22 | | 10.02 | 0.002298 | 9.85 | 963.48 | 266.49 | 0.69 |
| Site 1 | 510.35 | 100-YR | 4004.00 | 2.31 | 9.22 | | 9.94 | 0.002140 | 9.31 | 1024.26 | 284.30 | 0.67 |
| Site 1 | 485.35 | 100-YR | 4004.00 | 2.10 | 9.19 | | 9.88 | 0.001977 | 9.13 | 1073.04 | 302.68 | 0.64 |
| Site 1 | 460.35 | 100-YR | 4004.00 | 1.72 | 9.14 | | 9.83 | 0.001974 | 9.09 | 1074.50 | 305.25 | 0.64 |
| Site 1 | 435.35 | 100-YR | 4004.00 | 0.27 | 9.31 | | 9.70 | 0.001313 | 7.48 | 1403.68 | 387.74 | 0.51 |
| Site 1 | 410.36 | 100-YR | 4004.00 | 1.51 | 9.19 | | 9.66 | 0.001393 | 8.14 | 1369.52 | 394.45 | 0.54 |
| Site 1 | 385.37 | 100-YR | 4004.00 | 1.63 | 8.42 | 8.42 | 9.55 | 0.003435 | 11.80 | 984.57 | 391.20 | 0.83 |
| Site 1 | 360.35 | 100-YR | 4004.00 | 1.25 | 8.34 | 8.34 | 9.43 | 0.003761 | 11.67 | 960.48 | 383.20 | 0.84 |
| Site 1 | 323.16 | 100-YR | 4004.00 | 1.12 | 7.98 | 7.98 | 9.04 | 0.003194 | 10.46 | 968.46 | 433.21 | 0.79 |
| Site 1 | 313.03 | 100-YR | 4004.00 | 0.68 | 8.03 | 6.47 | 8.34 | 0.000796 | 6.01 | 1617.47 | 444.99 | 0.41 |
| Site 1 | 288.5 | | Culvert | | | | | | | | | |
| Site 1 | 264.01 | 100-YR | 4004.00 | -0.13 | 8.14 | | 8.27 | 0.000615 | 4.16 | 2276.49 | 805.82 | 0.34 |
| Site 1 | 255.13 | 100-YR | 4004.00 | 0.18 | 8.13 | | 8.27 | 0.000387 | 3.83 | 2120.97 | 568.82 | 0.28 |
| Site 1 | 228.53 | 100-YR | 4004.00 | 1.28 | 8.16 | | 8.25 | 0.000205 | 2.99 | 2604.41 | 580.47 | 0.21 |
| Site 1 | 201.86 | 100-YR | 4004.00 | 0.88 | 8.13 | | 8.24 | 0.000226 | 3.09 | 2037.03 | 392.62 | 0.22 |
| Site 1 | 134.82 | 100-YR | 4004.00 | 3.22 | 7.49 | | 8.15 | 0.002106 | 6.60 | 653.44 | 202.04 | 0.62 |
| Site 1 | 109.84 | 100-YR | 4004.00 | 3.46 | 6.75 | 6.75 | 8.00 | 0.006209 | 9.00 | 452.59 | 191.46 | 1.00 |
| Site 1 | 84.95 | 100-YR | 4004.00 | 3.72 | 6.58 | 6.58 | 7.59 | 0.006175 | 8.45 | 586.46 | 301.41 | 0.98 |
| Site 1 | 59.95 | 100-YR | 4004.00 | 3.99 | 6.26 | 6.26 | 7.21 | 0.007701 | 8.51 | 615.17 | 331.40 | 1.07 |
| Site 1 | 34.95 | 100-YR | 4004.00 | 3.93 | 5.84 | 5.84 | 6.78 | 0.013410 | 8.94 | 576.68 | 340.68 | 1.34 |
| Site 1 | 5.58 | 100-YR | 4004.00 | 1.04 | 3.69 | 3.69 | 4.69 | 0.008082 | 8.50 | 549.73 | 281.29 | 1.09 |

Existing Drainage Conditions during 100-year Storm Event

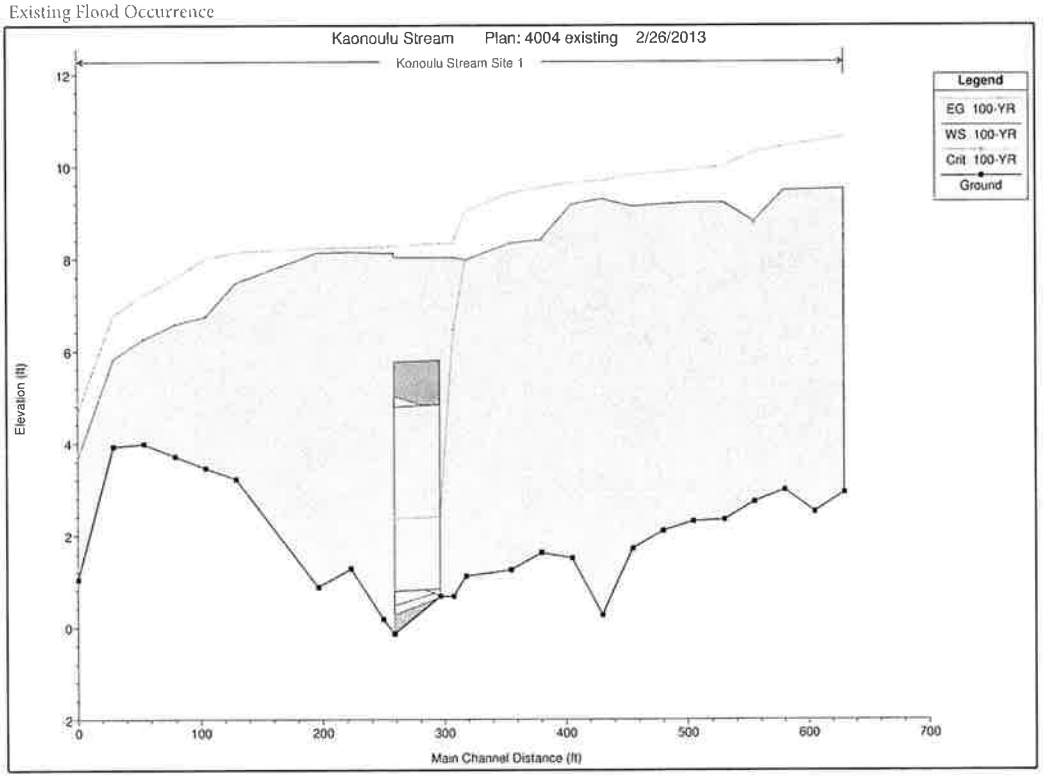


Temporary Drainage Condition during 100-year Storm Event

HEC-RAS Plan: Temp Bridge River: Kaonoulu Stream Reach: Alignment - Cent Profile: PF 1

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Alignment - Cent | 635.35 | PF 1 | 14148.00 | 2.93 | 13.19 | 13.19 | 17.14 | 0.006922 | 23.68 | 1360.64 | 164.05 | 1.32 |
| Alignment - Cent | 610.35 | PF 1 | 14148.00 | 2.51 | 13.04 | 13.04 | 18.52 | 0.005814 | 20.91 | 1453.66 | 193.96 | 1.19 |
| Alignment - Cent | 585.35 | PF 1 | 14148.00 | 2.99 | 12.73 | 12.73 | 16.18 | 0.006018 | 21.14 | 1474.49 | 205.06 | 1.22 |
| Alignment - Cent | 560.35 | PF 1 | 14148.00 | 2.73 | 12.81 | 12.81 | 15.66 | 0.005483 | 20.16 | 1692.90 | 257.68 | 1.15 |
| Alignment - Cent | 535.37 | PF 1 | 14148.00 | 2.34 | 12.70 | 11.90 | 14.83 | 0.003926 | 17.11 | 1890.80 | 266.49 | 0.98 |
| Alignment - Cent | 510.35 | PF 1 | 14148.00 | 2.31 | 12.84 | | 14.63 | 0.003399 | 16.04 | 2054.12 | 284.30 | 0.91 |
| Alignment - Cent | 485.35 | PF 1 | 14148.00 | 2.10 | 12.89 | | 14.50 | 0.003024 | 15.37 | 2192.51 | 302.68 | 0.88 |
| Alignment - Cent | 460.35 | PF 1 | 14148.00 | 1.72 | 12.83 | | 14.42 | 0.003028 | 15.27 | 2199.52 | 305.25 | 0.85 |
| Alignment - Cent | 435.35 | PF 1 | 14148.00 | 0.27 | 13.32 | | 14.12 | 0.001758 | 11.82 | 2958.97 | 387.74 | 0.64 |
| Alignment - Cent | 410.36 | PF 1 | 14148.00 | 1.51 | 13.19 | | 14.07 | 0.001808 | 12.55 | 2949.01 | 394.45 | 0.67 |
| Alignment - Cent | 385.37 | PF 1 | 14148.00 | 1.63 | 13.05 | 11.21 | 14.02 | 0.002140 | 13.45 | 2844.42 | 401.91 | 0.72 |
| Alignment - Cent | 383.08 | | Bridge | | | | | | | | | |
| Alignment - Cent | 360.35 | PF 1 | 14148.00 | 1.25 | 12.73 | 11.15 | 13.76 | 0.002522 | 13.81 | 2708.28 | 403.85 | 0.75 |
| Alignment - Cent | 357.33 | | Bridge | | | | | | | | | |
| Alignment - Cent | 323.16 | PF 1 | 14148.00 | 1.12 | 12.50 | | 13.43 | 0.001863 | 11.97 | 2943.08 | 437.61 | 0.67 |
| Alignment - Cent | 313.03 | PF 1 | 14148.00 | 0.68 | 12.76 | | 13.30 | 0.000865 | 8.94 | 3718.66 | 444.99 | 0.47 |
| Alignment - Cent | 264.01 | PF 1 | 14148.00 | -0.13 | 12.99 | | 13.16 | 0.000369 | 5.14 | 6184.61 | 805.82 | 0.29 |
| Alignment - Cent | 255.13 | PF 1 | 14148.00 | 0.18 | 12.84 | | 13.14 | 0.000422 | 5.99 | 4800.32 | 568.82 | 0.33 |
| Alignment - Cent | 228.53 | PF 1 | 14148.00 | 1.28 | 12.88 | | 13.11 | 0.000283 | 5.12 | 5604.45 | 658.80 | 0.27 |
| Alignment - Cent | 201.86 | PF 1 | 14148.00 | 0.88 | 12.70 | | 13.08 | 0.000408 | 6.04 | 3996.63 | 453.84 | 0.33 |
| Alignment - Cent | 134.82 | PF 1 | 14148.00 | 3.22 | 10.86 | 9.87 | 12.87 | 0.002682 | 11.64 | 1439.32 | 270.40 | 0.78 |
| Alignment - Cent | 109.84 | PF 1 | 14148.00 | 3.46 | 10.09 | 10.09 | 12.72 | 0.004330 | 13.22 | 1214.03 | 274.58 | 0.96 |
| Alignment - Cent | 84.95 | PF 1 | 14148.00 | 3.72 | 9.24 | 9.24 | 11.43 | 0.005075 | 12.82 | 1483.76 | 350.89 | 1.01 |
| Alignment - Cent | 59.95 | PF 1 | 14148.00 | 3.99 | 8.74 | 8.74 | 10.94 | 0.006104 | 13.06 | 1435.52 | 331.40 | 1.09 |
| Alignment - Cent | 34.95 | PF 1 | 14148.00 | 3.93 | 8.29 | 8.29 | 10.47 | 0.007635 | 13.27 | 1411.73 | 340.68 | 1.19 |
| Alignment - Cent | 5.58 | PF 1 | 14148.00 | 1.04 | 5.26 | 5.26 | 7.17 | 0.008217 | 12.84 | 1553.03 | 418.95 | 1.22 |

Existing Flood Occurrence

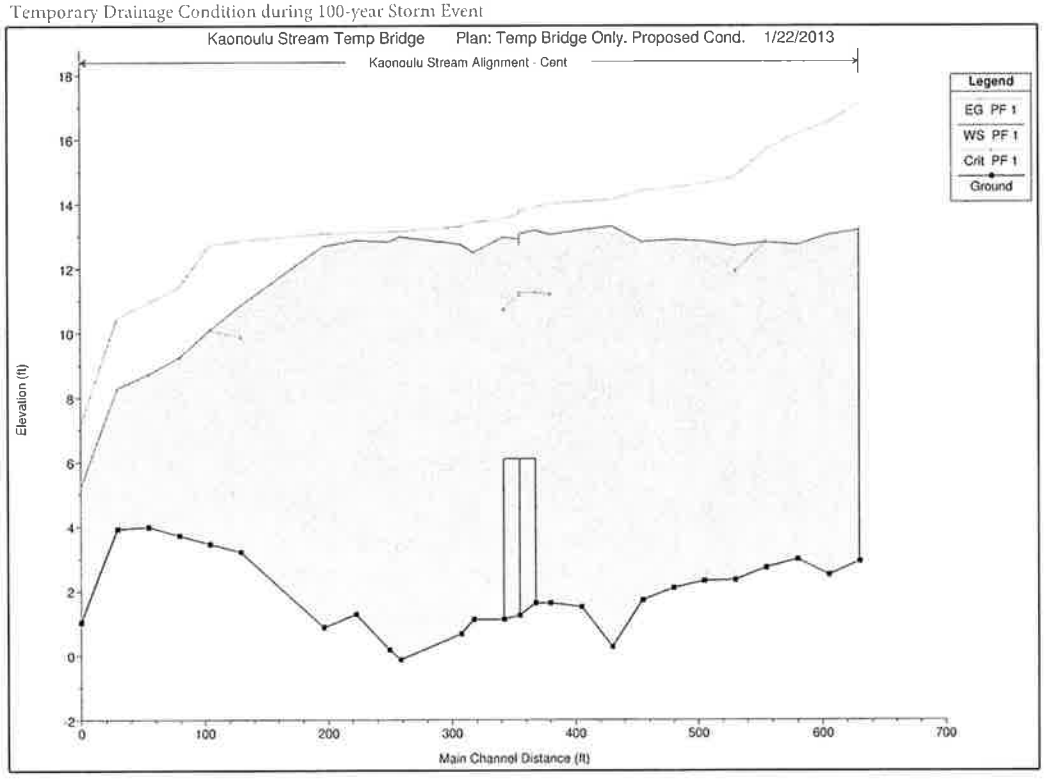


Proposed Six 6' x 4' Box Culverts during 100-year Storm Event with Blocked Outlet

HEC-RAS Plan: 99 River: Konoulu Stream Reach: Site 1 Profile: 100-YR

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Site 1 | 635.35 | 100-YR | 14148.00 | 2.93 | 13.19 | 13.19 | 17.14 | 0.006922 | 23.68 | 1360.64 | 164.05 | 1.32 |
| Site 1 | 610.35 | 100-YR | 14148.00 | 2.51 | 13.04 | 13.04 | 16.52 | 0.005814 | 20.91 | 1453.66 | 193.96 | 1.19 |
| Site 1 | 585.35 | 100-YR | 14148.00 | 2.99 | 12.73 | 12.73 | 16.18 | 0.006018 | 21.14 | 1474.49 | 205.06 | 1.22 |
| Site 1 | 560.35 | 100-YR | 14148.00 | 2.73 | 12.81 | 12.81 | 15.66 | 0.005483 | 20.16 | 1692.90 | 257.68 | 1.15 |
| Site 1 | 535.37 | 100-YR | 14148.00 | 2.34 | 12.11 | 11.90 | 14.70 | 0.005112 | 18.71 | 1733.71 | 266.49 | 1.11 |
| Site 1 | 510.35 | 100-YR | 14148.00 | 2.31 | 12.31 | 11.67 | 14.44 | 0.004307 | 17.38 | 1901.10 | 284.30 | 1.01 |
| Site 1 | 485.35 | 100-YR | 14148.00 | 2.10 | 12.35 | 11.55 | 14.27 | 0.003828 | 16.66 | 2029.23 | 302.68 | 0.96 |
| Site 1 | 460.35 | 100-YR | 14148.00 | 1.72 | 12.22 | 11.50 | 14.16 | 0.003962 | 16.75 | 2013.27 | 305.25 | 0.96 |
| Site 1 | 435.35 | 100-YR | 14148.00 | 0.27 | 12.86 | | 13.79 | 0.002131 | 12.64 | 2780.30 | 387.74 | 0.69 |
| Site 1 | 410.36 | 100-YR | 14148.00 | 1.51 | 12.68 | | 13.73 | 0.002245 | 13.56 | 2747.35 | 394.45 | 0.74 |
| Site 1 | 385.37 | 100-YR | 14148.00 | 1.63 | 12.44 | | 13.65 | 0.002817 | 14.85 | 2599.79 | 401.91 | 0.81 |
| Site 1 | 360.35 | 100-YR | 14148.00 | 1.25 | 12.39 | | 13.57 | 0.002949 | 14.81 | 2573.37 | 403.85 | 0.81 |
| Site 1 | 323.16 | 100-YR | 14148.00 | 1.12 | 12.47 | | 13.41 | 0.001885 | 12.02 | 2931.65 | 437.61 | 0.67 |
| Site 1 | 313.03 | 100-YR | 14148.00 | 0.68 | 12.73 | 9.18 | 13.28 | 0.000872 | 8.97 | 3708.57 | 444.99 | 0.47 |
| Site 1 | 288.5 | | Culvert | | | | | | | | | |
| Site 1 | 264.01 | 100-YR | 14148.00 | -0.13 | 12.99 | | 13.16 | 0.000369 | 5.14 | 6184.58 | 805.82 | 0.29 |
| Site 1 | 255.13 | 100-YR | 14148.00 | 0.18 | 12.84 | | 13.14 | 0.000422 | 5.99 | 4800.30 | 568.82 | 0.33 |
| Site 1 | 228.53 | 100-YR | 14148.00 | 1.28 | 12.88 | | 13.11 | 0.000283 | 5.12 | 5603.36 | 658.70 | 0.27 |
| Site 1 | 201.86 | 100-YR | 14148.00 | 0.88 | 12.70 | | 13.08 | 0.000408 | 6.04 | 3996.63 | 453.84 | 0.33 |
| Site 1 | 134.82 | 100-YR | 14148.00 | 3.22 | 10.88 | 9.87 | 12.87 | 0.002682 | 11.64 | 1439.32 | 270.40 | 0.78 |
| Site 1 | 109.84 | 100-YR | 14148.00 | 3.46 | 10.09 | 10.09 | 12.72 | 0.004330 | 13.22 | 1214.03 | 274.58 | 0.96 |
| Site 1 | 84.95 | 100-YR | 14148.00 | 3.72 | 9.24 | 9.24 | 11.43 | 0.005075 | 12.82 | 1483.76 | 350.89 | 1.01 |
| Site 1 | 59.95 | 100-YR | 14148.00 | 3.99 | 8.74 | 8.74 | 10.94 | 0.006106 | 13.06 | 1435.33 | 331.40 | 1.09 |
| Site 1 | 34.95 | 100-YR | 14148.00 | 3.93 | 8.31 | 8.31 | 10.47 | 0.007536 | 13.22 | 1417.12 | 340.68 | 1.19 |
| Site 1 | 5.58 | 100-YR | 14148.00 | 1.04 | 6.30 | 6.30 | 8.65 | 0.005811 | 12.88 | 1286.31 | 281.29 | 1.07 |

Temporary Drainage Condition during 100-year Storm Event

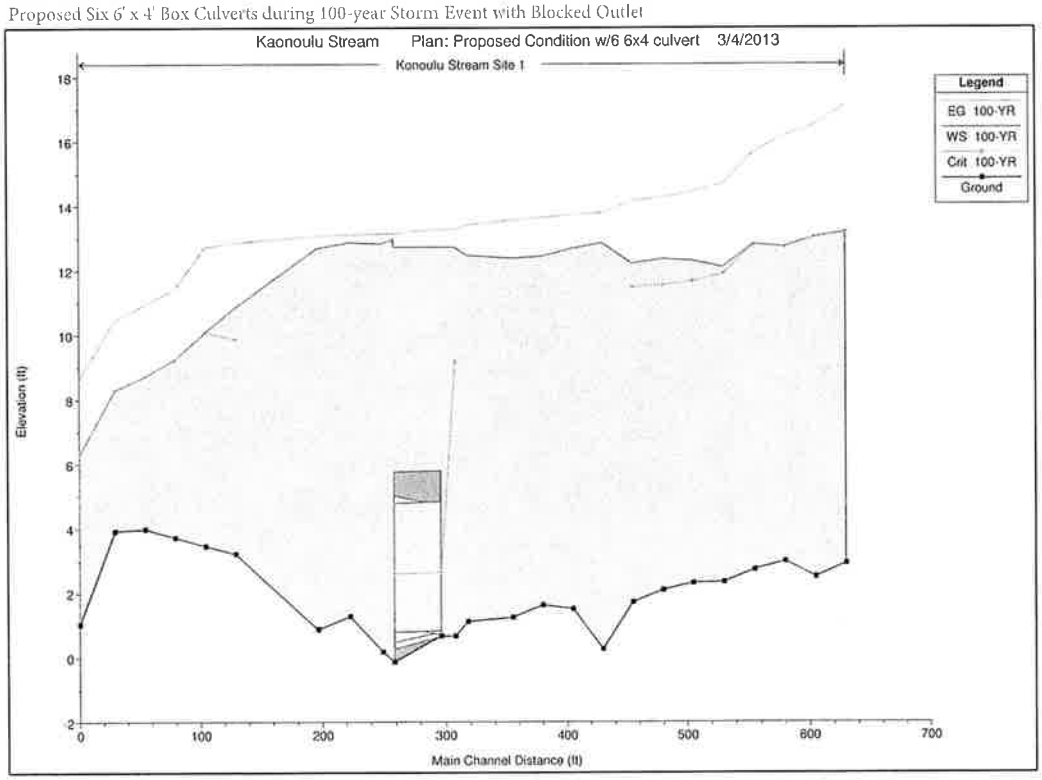


Proposed Six 6' x 4' Box Culverts during 100-year Storm Event without Blocked Outlet

HEC-RAS Plan: Plan 30 River: Konoulu Stream Reach: Site 1 Profile: 100-YR

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Site 1 | 635.35 | 100-YR | 14148.00 | 2.93 | 13.19 | 13.19 | 17.14 | 0.006922 | 23.68 | 1360.64 | 164.05 | 1.32 |
| Site 1 | 610.35 | 100-YR | 14148.00 | 2.51 | 13.04 | 13.04 | 16.52 | 0.005814 | 20.91 | 1453.66 | 193.98 | 1.19 |
| Site 1 | 585.35 | 100-YR | 14148.00 | 2.99 | 12.73 | 12.73 | 16.18 | 0.006018 | 21.14 | 1474.49 | 205.06 | 1.22 |
| Site 1 | 560.35 | 100-YR | 14148.00 | 2.73 | 12.81 | 12.81 | 15.66 | 0.005483 | 20.16 | 1692.90 | 257.68 | 1.15 |
| Site 1 | 535.37 | 100-YR | 14148.00 | 2.34 | 11.90 | 11.90 | 14.69 | 0.005643 | 19.34 | 1678.12 | 266.49 | 1.16 |
| Site 1 | 510.35 | 100-YR | 14148.00 | 2.31 | 12.07 | 11.87 | 14.38 | 0.004815 | 18.05 | 1832.74 | 284.30 | 1.07 |
| Site 1 | 485.35 | 100-YR | 14148.00 | 2.10 | 12.11 | 11.55 | 14.20 | 0.004281 | 17.32 | 1955.67 | 302.68 | 1.01 |
| Site 1 | 460.35 | 100-YR | 14148.00 | 1.72 | 11.57 | 11.50 | 14.04 | 0.005428 | 18.69 | 1813.35 | 305.25 | 1.11 |
| Site 1 | 435.35 | 100-YR | 14148.00 | 0.27 | 12.46 | | 13.53 | 0.002541 | 13.44 | 2626.31 | 387.74 | 0.75 |
| Site 1 | 410.36 | 100-YR | 14148.00 | 1.51 | 12.20 | | 13.44 | 0.002788 | 14.65 | 2559.07 | 394.45 | 0.82 |
| Site 1 | 385.37 | 100-YR | 14148.00 | 1.63 | 11.65 | 11.21 | 13.32 | 0.004196 | 17.17 | 2278.90 | 401.91 | 0.98 |
| Site 1 | 360.35 | 100-YR | 14148.00 | 1.25 | 11.15 | 11.15 | 13.17 | 0.005685 | 18.56 | 2070.71 | 403.85 | 1.11 |
| Site 1 | 323.16 | 100-YR | 14148.00 | 1.12 | 10.66 | 10.66 | 12.66 | 0.004820 | 16.80 | 2139.72 | 437.61 | 1.04 |
| Site 1 | 313.03 | 100-YR | 14148.00 | 0.00 | 9.00 | 9.00 | 11.12 | 0.003472 | 15.78 | 2213.73 | 444.99 | 0.93 |
| Site 1 | 288.5 | | Culvert | | | | | | | | | |
| Site 1 | 264.01 | 100-YR | 14148.00 | 0.00 | 8.81 | | 9.99 | 0.002500 | 11.41 | 2990.77 | 805.82 | 0.75 |
| Site 1 | 255.13 | 100-YR | 14148.00 | -0.04 | 8.80 | | 9.96 | 0.001673 | 10.36 | 2730.96 | 568.82 | 0.63 |
| Site 1 | 228.53 | 100-YR | 14148.00 | -0.18 | 9.16 | | 9.76 | 0.000766 | 7.59 | 3676.78 | 626.21 | 0.44 |
| Site 1 | 201.86 | 100-YR | 14148.00 | -0.31 | 9.27 | | 9.69 | 0.000531 | 6.43 | 3760.79 | 436.01 | 0.37 |
| Site 1 | 134.82 | 100-YR | 14148.00 | -0.65 | 8.20 | | 9.55 | 0.001306 | 9.41 | 1622.26 | 207.85 | 0.56 |
| Site 1 | 109.84 | 100-YR | 14148.00 | -0.77 | 6.39 | 6.39 | 9.33 | 0.004665 | 13.76 | 1033.62 | 183.42 | 1.00 |
| Site 1 | 84.95 | 100-YR | 14148.00 | -0.90 | 4.87 | | 6.05 | 0.002447 | 9.84 | 2021.57 | 350.89 | 0.72 |
| Site 1 | 59.95 | 100-YR | 14148.00 | -1.02 | 4.71 | | 5.98 | 0.002520 | 9.95 | 1899.62 | 331.40 | 0.73 |
| Site 1 | 34.95 | 100-YR | 14148.00 | -1.15 | 4.76 | | 5.88 | 0.002117 | 9.31 | 2011.22 | 340.68 | 0.67 |
| Site 1 | 5.58 | 100-YR | 14148.00 | -1.25 | 3.33 | 3.33 | 5.66 | 0.005613 | 12.79 | 1288.25 | 281.29 | 1.05 |

Proposed Six 6' x 4' Box Culverts during 100-year Storm Event with Blocked Outlet

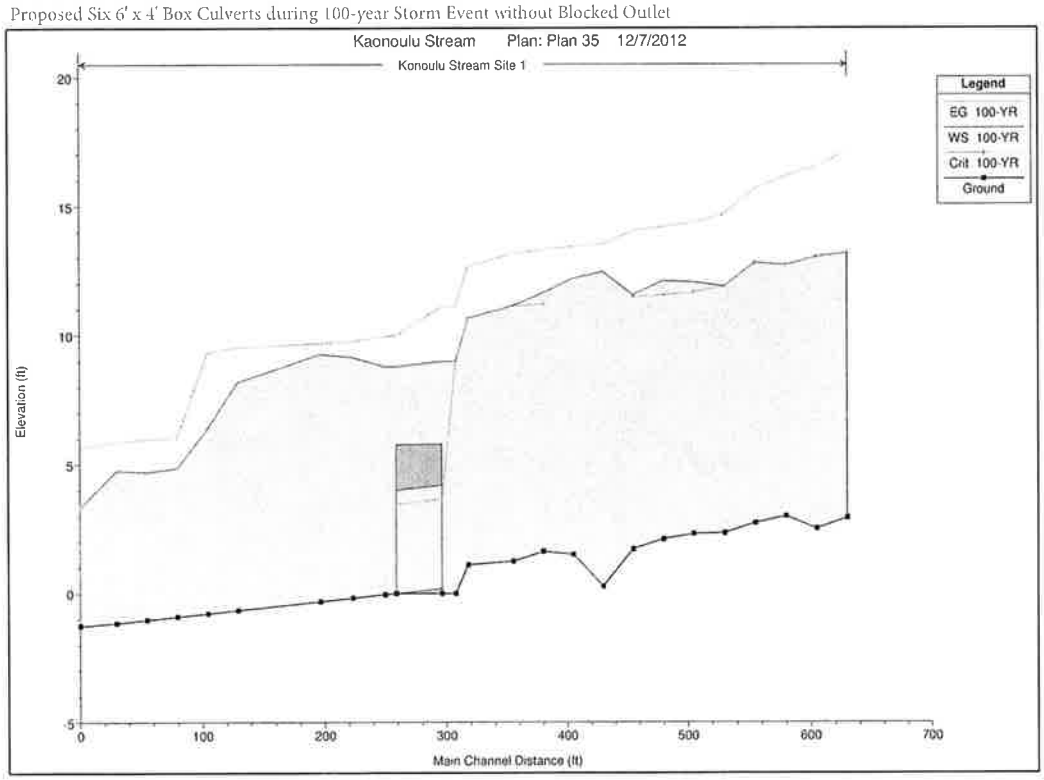


Proposed Eight 6' x 4' Box Culverts during 100-year Storm Event without Blocked Outlet

HEC-RAS Plan: Plan 30 River: Konoulu Stream Reach: Site 1 Profile: 100-YR

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Site 1 | 635.35 | 100-YR | 14148.00 | 2.93 | 13.19 | 13.19 | 17.14 | 0.006922 | 23.68 | 1360.64 | 164.05 | 1.32 |
| Site 1 | 610.35 | 100-YR | 14148.00 | 2.51 | 13.04 | 13.04 | 16.52 | 0.005814 | 20.91 | 1453.56 | 193.96 | 1.19 |
| Site 1 | 585.35 | 100-YR | 14148.00 | 2.99 | 12.73 | 12.73 | 16.18 | 0.006018 | 21.14 | 1474.49 | 205.06 | 1.22 |
| Site 1 | 560.35 | 100-YR | 14148.00 | 2.73 | 12.81 | 12.81 | 15.66 | 0.005483 | 20.16 | 1692.90 | 257.68 | 1.15 |
| Site 1 | 535.37 | 100-YR | 14148.00 | 2.34 | 11.90 | 11.90 | 14.69 | 0.005643 | 19.34 | 1678.12 | 266.49 | 1.16 |
| Site 1 | 510.35 | 100-YR | 14148.00 | 2.31 | 12.07 | 11.67 | 14.38 | 0.004815 | 18.05 | 1832.74 | 284.30 | 1.07 |
| Site 1 | 485.35 | 100-YR | 14148.00 | 2.10 | 12.11 | 11.55 | 14.20 | 0.004281 | 17.32 | 1955.67 | 302.68 | 1.01 |
| Site 1 | 460.35 | 100-YR | 14148.00 | 1.72 | 11.57 | 11.50 | 14.04 | 0.005428 | 18.69 | 1813.35 | 305.25 | 1.11 |
| Site 1 | 435.35 | 100-YR | 14148.00 | 0.27 | 12.46 | | 13.53 | 0.002541 | 13.44 | 2626.31 | 387.74 | 0.75 |
| Site 1 | 410.36 | 100-YR | 14148.00 | 1.51 | 12.20 | | 13.44 | 0.002788 | 14.65 | 2559.07 | 394.45 | 0.82 |
| Site 1 | 385.37 | 100-YR | 14148.00 | 1.63 | 11.65 | 11.21 | 13.32 | 0.004196 | 17.17 | 2278.90 | 401.91 | 0.98 |
| Site 1 | 360.35 | 100-YR | 14148.00 | 1.25 | 11.15 | 11.15 | 13.17 | 0.005685 | 18.56 | 2070.71 | 403.85 | 1.11 |
| Site 1 | 323.16 | 100-YR | 14148.00 | 1.12 | 10.66 | 10.66 | 12.66 | 0.004820 | 16.80 | 2139.72 | 437.61 | 1.04 |
| Site 1 | 313.03 | 100-YR | 14148.00 | 0.00 | 9.00 | 9.00 | 11.12 | 0.003472 | 15.78 | 2213.73 | 444.99 | 0.93 |
| Site 1 | 288.5 | | Culvert | | | | | | | | | |
| Site 1 | 264.01 | 100-YR | 14148.00 | 0.00 | 8.81 | | 9.99 | 0.002500 | 11.41 | 2990.77 | 805.82 | 0.75 |
| Site 1 | 255.13 | 100-YR | 14148.00 | -0.04 | 8.80 | | 9.96 | 0.001673 | 10.36 | 2730.96 | 568.82 | 0.63 |
| Site 1 | 228.53 | 100-YR | 14148.00 | -0.18 | 9.16 | | 9.76 | 0.000766 | 7.59 | 3676.78 | 626.21 | 0.44 |
| Site 1 | 201.86 | 100-YR | 14148.00 | -0.31 | 9.27 | | 9.69 | 0.000531 | 6.43 | 3760.79 | 436.01 | 0.37 |
| Site 1 | 134.82 | 100-YR | 14148.00 | -0.65 | 8.20 | | 9.55 | 0.001306 | 9.41 | 1622.26 | 207.85 | 0.56 |
| Site 1 | 109.84 | 100-YR | 14148.00 | -0.77 | 6.39 | 6.39 | 9.33 | 0.004665 | 13.76 | 1033.62 | 183.42 | 1.00 |
| Site 1 | 84.95 | 100-YR | 14148.00 | -0.90 | 4.87 | | 6.05 | 0.002447 | 9.84 | 2021.59 | 350.89 | 0.72 |
| Site 1 | 59.95 | 100-YR | 14148.00 | -1.02 | 4.71 | | 5.98 | 0.002519 | 9.95 | 1899.65 | 331.40 | 0.73 |
| Site 1 | 34.95 | 100-YR | 14148.00 | -1.15 | 4.76 | | 5.88 | 0.002117 | 9.30 | 2011.40 | 340.68 | 0.67 |
| Site 1 | 5.58 | 100-YR | 14148.00 | -1.25 | 3.33 | 3.33 | 5.66 | 0.005613 | 12.79 | 1288.25 | 281.29 | 1.05 |

Proposed Six 6' x 4' Box Culverts during 100-year Storm Event without Blocked Outlet

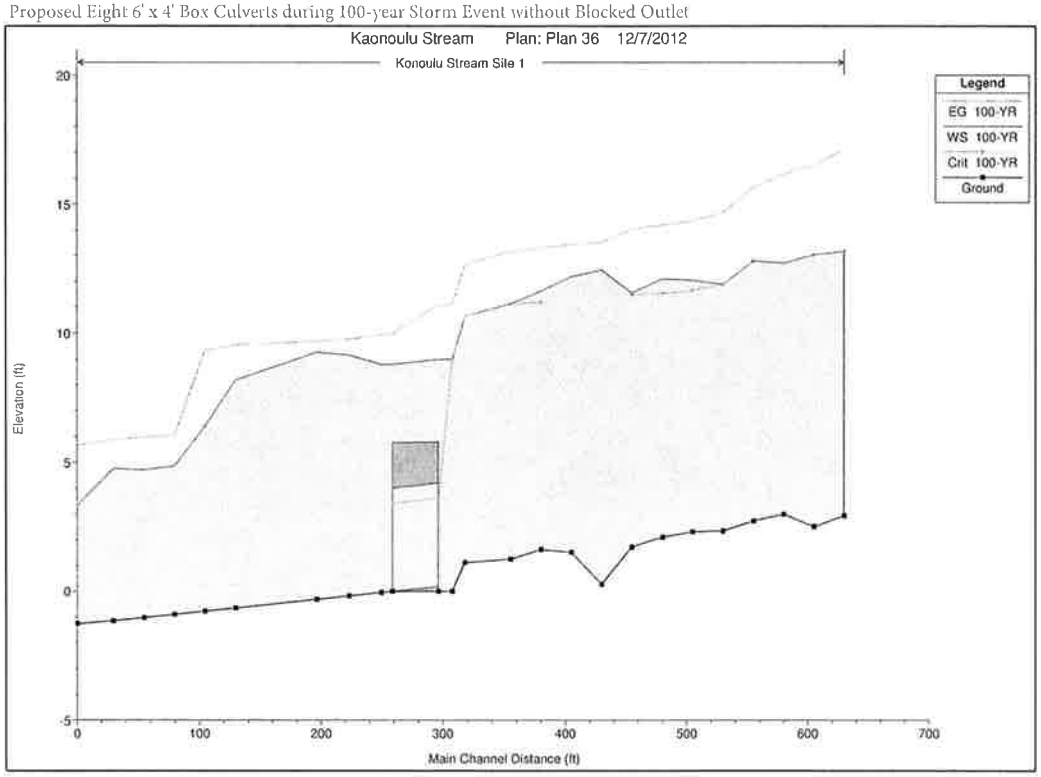


Proposed Bridge during 100-year Storm Event without Blocked Outlet

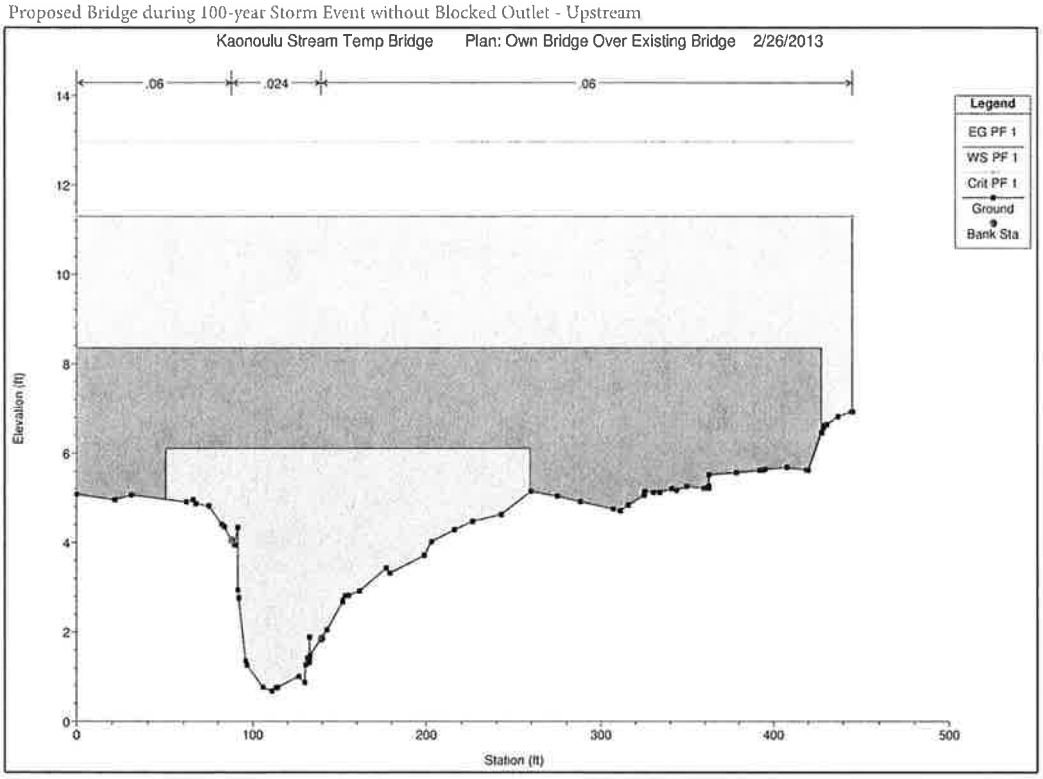
HEC-RAS Plan: 99 River: Kaonoulu Stream Reach: Alignment - Cont Profile: PF 1

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Alignment - Cont | 635.35 | PF 1 | 14148.00 | 2.93 | 13.19 | 13.19 | 17.14 | 0.006922 | 23.68 | 1360.64 | 164.05 | 1.32 |
| Alignment - Cont | 610.35 | PF 1 | 14148.00 | 2.51 | 13.04 | 13.04 | 16.52 | 0.005814 | 20.91 | 1453.66 | 193.96 | 1.19 |
| Alignment - Cont | 585.35 | PF 1 | 14148.00 | 2.99 | 12.73 | 12.73 | 16.18 | 0.006018 | 21.14 | 1474.49 | 205.06 | 1.22 |
| Alignment - Cont | 560.35 | PF 1 | 14148.00 | 2.73 | 12.81 | 12.81 | 15.66 | 0.005483 | 20.16 | 1692.90 | 257.68 | 1.15 |
| Alignment - Cont | 535.37 | PF 1 | 14148.00 | 2.34 | 11.92 | 11.90 | 14.69 | 0.005608 | 19.30 | 1681.50 | 266.49 | 1.15 |
| Alignment - Cont | 510.35 | PF 1 | 14148.00 | 2.31 | 12.15 | 11.67 | 14.40 | 0.004623 | 17.80 | 1857.45 | 284.30 | 1.05 |
| Alignment - Cont | 485.35 | PF 1 | 14148.00 | 2.10 | 12.20 | 11.55 | 14.22 | 0.004109 | 17.08 | 1982.33 | 302.68 | 0.99 |
| Alignment - Cont | 460.35 | PF 1 | 14148.00 | 1.72 | 12.00 | 11.50 | 14.10 | 0.004398 | 17.37 | 1944.94 | 305.25 | 1.01 |
| Alignment - Cont | 435.35 | PF 1 | 14148.00 | 0.27 | 12.71 | | 13.69 | 0.002276 | 12.93 | 2721.95 | 387.74 | 0.72 |
| Alignment - Cont | 410.36 | PF 1 | 14148.00 | 1.51 | 12.50 | | 13.62 | 0.002427 | 13.94 | 2678.40 | 394.45 | 0.77 |
| Alignment - Cont | 385.37 | PF 1 | 14148.00 | 1.63 | 12.20 | | 13.53 | 0.003159 | 15.48 | 2503.71 | 401.91 | 0.86 |
| Alignment - Cont | 360.35 | PF 1 | 14148.00 | 1.25 | 12.14 | | 13.44 | 0.003337 | 15.28 | 2471.04 | 403.85 | 0.86 |
| Alignment - Cont | 323.16 | PF 1 | 14148.00 | 1.12 | 12.24 | | 13.26 | 0.002101 | 12.49 | 2828.46 | 437.61 | 0.71 |
| Alignment - Cont | 313.03 | PF 1 | 14148.00 | 0.68 | 12.54 | 9.18 | 13.11 | 0.000939 | 9.19 | 3620.47 | 444.99 | 0.48 |
| Alignment - Cont | 288.5 | | Bridge | | | | | | | | | |
| Alignment - Cont | 264.01 | PF 1 | 14148.00 | 0.00 | 8.80 | | 9.99 | 0.002506 | 11.42 | 2988.05 | 805.82 | 0.75 |
| Alignment - Cont | 255.13 | PF 1 | 14148.00 | -0.04 | 8.80 | | 9.96 | 0.001672 | 10.36 | 2731.05 | 568.82 | 0.63 |
| Alignment - Cont | 228.53 | PF 1 | 14148.00 | -0.18 | 9.16 | | 9.76 | 0.000766 | 7.59 | 3677.29 | 626.35 | 0.44 |
| Alignment - Cont | 201.86 | PF 1 | 14148.00 | -0.31 | 9.27 | | 9.69 | 0.000531 | 6.43 | 3760.81 | 436.01 | 0.37 |
| Alignment - Cont | 134.82 | PF 1 | 14148.00 | -0.65 | 8.20 | | 9.55 | 0.001306 | 9.41 | 1622.27 | 207.85 | 0.58 |
| Alignment - Cont | 109.84 | PF 1 | 14148.00 | -0.77 | 6.39 | 6.39 | 9.33 | 0.004665 | 13.76 | 1033.54 | 183.41 | 1.00 |
| Alignment - Cont | 84.95 | PF 1 | 14148.00 | -0.90 | 4.19 | 3.35 | 5.70 | 0.003695 | 11.13 | 1785.18 | 350.89 | 0.87 |
| Alignment - Cont | 59.95 | PF 1 | 14148.00 | -1.02 | 3.31 | 3.31 | 5.52 | 0.006389 | 13.15 | 1434.80 | 331.40 | 1.11 |
| Alignment - Cont | 34.95 | PF 1 | 14148.00 | -1.15 | 3.09 | 3.09 | 5.25 | 0.006348 | 12.92 | 1444.29 | 340.68 | 1.11 |
| Alignment - Cont | 5.58 | PF 1 | 14148.00 | -1.25 | 2.53 | 2.53 | 4.45 | 0.007068 | 12.62 | 1581.92 | 418.95 | 1.14 |

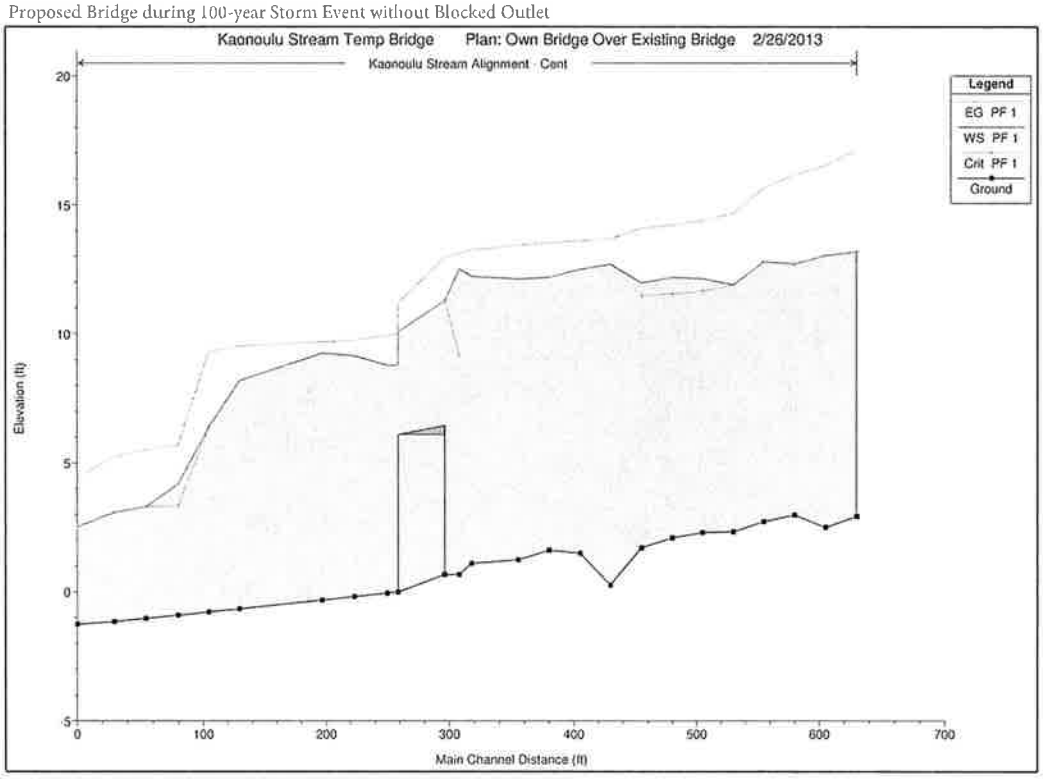
Proposed Eight 6' x 4' Box Culverts during 100-year Storm Event without Blocked Outlet



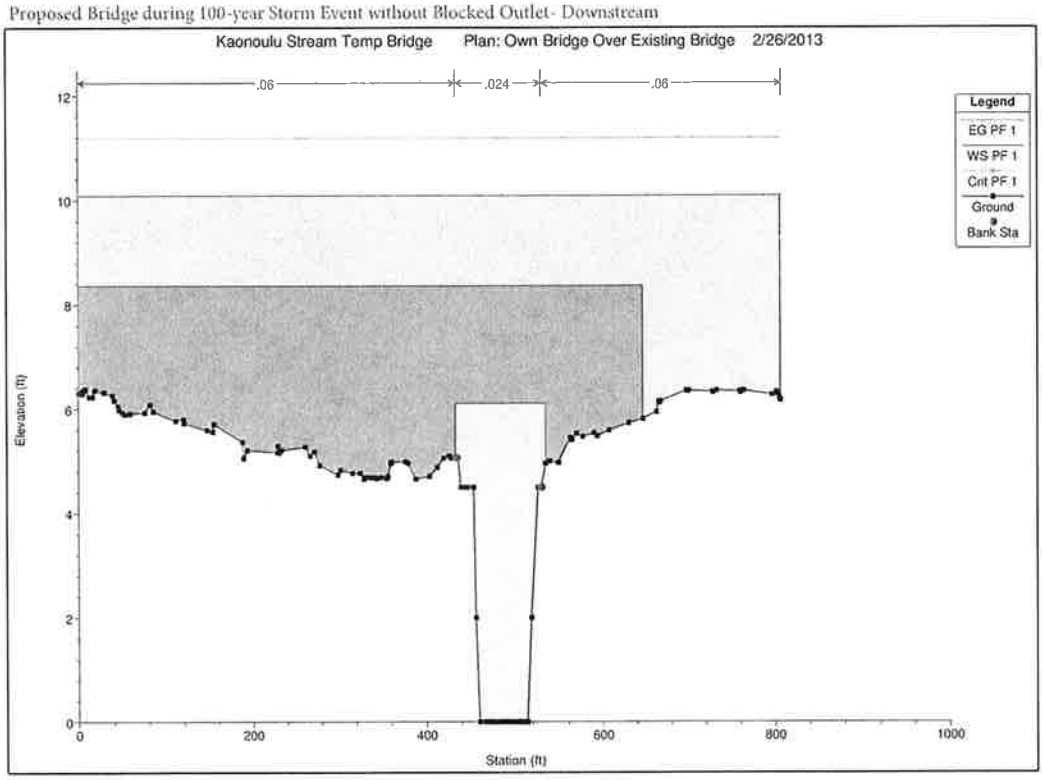
Proposed Bridge during 100-year Storm Event without Blocked Outlet - Upstream




Proposed Bridge during 100-year Storm Event without Blocked Outlet



Proposed Bridge during 100-year Storm Event without Blocked Outlet- Downstream



# APPENDIX G

## *Pre-Assessment Consultation Comment and Response Letters*

EW

**DEPARTMENT OF THE ARMY**
**U.S. ARMY CORPS OF ENGINEERS, HONOLULU DISTRICT**
**FORT SHAFTER, HAWAII 96858-5440**

REPLY TO ATTENTION OF:

January 10, 2013

Regulatory Branch

**POH-2013-00014**

Wilson Okamoto Corporation
Attn: Earl Matsukawa, AICP
1907 S. Beretania St
Artesian Plaza, Suite 400
Honolulu, HI 96826

**PERMIT REQUIRED**

Dear Mr. Matsukawa:

This is in response to your November 30, 2012 letter requesting the Department of the Army review and provide comments for the preparation of a Draft Environmental Assessment for proposed Bridge Replacement in Kulanihako'i Gulch located at the Kulanihako'i Stream Bridge Crossing at S. Kihei Road, near Kihei, County of Maui, Island of Maui, Hawai'i. We have determined the potential project site contains waters under the regulatory jurisdiction of the Corps of Engineers.

Your proposed project was reviewed pursuant to Section 10 of the Rivers and Harbors Act of 1899 (Section 10) and Section 404 of the Clean Water Act (Section 404). Section 10 requires that a DA permit be obtained for certain structures or work in or affecting navigable waters of the United States (U.S.), prior to conducting the work (33 U.S.C. 403). Navigable waters of the U.S. are those waters subject to the ebb and flow of the tide shoreward to the mean high water mark, and/or other waters identified as navigable by the Honolulu District. In addition, a Section 10 permit is required for structures or work outside this limit if they affect the course, capacity, or condition of the waterbody. Some typical examples of structures or work requiring Section 10 permits within this jurisdictional area include beach nourishment, boat ramps, breakwaters, bulkheads, dredging, filling or discharging material such as sand, gravel or stones, and placement of riprap for wave protection or streambank stabilization.

Section 404 requires that a DA permit be obtained for the placement or discharge of dredged and/or fill material into waters of the U.S., including wetlands, prior to conducting the work (33 U.S.C. 1344). For regulatory purposes, the U.S. Army Corps of Engineers (Corps) defines wetlands as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. The area of Corps jurisdiction under Section 404 extends to the Mean Higher High Tide Line (MHHTL) or to the Ordinary



High Water Mark (OHWM) for navigable waters other than the Pacific Ocean, and to the upland boundary of any adjacent wetlands. Fill material is any material that replaces a jurisdictional aquatic area with dry land or changes the bottom elevation of a waterbody. Fill may be temporary or permanent and often includes, but is not limited to, rock, sand, concrete, sandbags, etc. Projects involving discharges typically include placement of fill material for homes and landscaping, impoundments , road fills, dams and dikes, culverts, riprap, groins, and beach nourishment. Section 404 also regulates discharges of dredged material incidental to certain activities such as grading, mechanized landclearing, ditching or other excavation activity, and the installation of certain pile-supported structures.

The **Kulanihako'i Gulch** is considered a navigable water of the U.S. and therefore a Section 10 and Section 404 **permit is required** for certain structures or work in, over, or under navigable waters of the U.S., as well as any activities that would involve either **the temporary or permanent placement of fill and/ or dredged material** into waters of the U.S. Documents submitted to this office indicated temporary concrete barriers on either side of the current bridge, a temporary detour road and steel panel bridge, and replacement of existing culverts with six new culverts with inlet and outlet head walls. Our assertion of jurisdiction is based on our documentation that the proposed work would occur waterward of the line on the shore reached by the MHW of the Pacific Ocean and that discharges would occur waterward of the MHHW mark, requiring both a Section 10 and Section 404 authorization from the Corps. Also note that a Section 401 water quality certification from the State of Hawaii Department of Health will also be required. Please contact DOH directly to discuss their permit application requirements.

Thank you for giving us the opportunity to review this proposal and for your cooperation with our regulatory program. Please be advised you can provide comments on your experience with the Honolulu District Regulatory Branch by accessing our web-based customer survey form at http://per2.nwp.usace.army.mil/survey.html.

Should you have any questions, please contact Kaitlyn Seberger of this office at the above address or telephone 808-835-4303 (FAX: 808-835-4301) or by E-Mail at Kaitlyn.R.Seberger@usace.army.mil. Please refer to File Number **POH-13-00014** in all future communications with this office regarding this or other projects at this location.

Sincerely,

George P. Young, P.E.
Chief, Regulatory Branch

WILSON OKAMOTO
CORPORATION
ENGINEERS | PLANNERS | CONSULTANTS

1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8256-01
June 6, 2013

Mr. George P. Young, P.E.
Chief, Regulatory Branch
Department of the Army
U.S. Army Corps of Engineers
Honolulu District
Fort Shafter, Hawai'i 96858-5440

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA)
Kūlanihāko'i Bridge Replacement
Kīhei, Island of Maui, Hawai'i

Dear Mr. Young:

Thank you for your letter dated January 10, 2013 (POH-2013-00014) regarding the subject project. We offer the following responses to your letter.

We appreciate the information provided on the applicability of Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. We intend to work cooperatively with your office in providing the requisite permit application submittals. We also acknowledge that coordination with the State of Hawai'i Department of Health regarding the Section 401 water quality certification will also be required.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Milton Arakawa, AICP
Project Manager

MA/ly

cc: Wendy Kobashigawa, DPW

NEIL ABERCROMBIE
GOVERNOR

Dean H. Seki
Comptroller

Maria E. Zielinski
Deputy Comptroller

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

DEC 10 2012

(P)1285.2

EM

Mr. Earl Matsukawa, AICP
Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, Hawaii 96826

RECEIVED
DEC 11 2012
WILSON OKAMOTO CORPORATION

Dear Mr. Matsukawa:

Subject: Kulanihakoi Bridge Replacement
Environmental Assessment
Kihei, Maui, Hawaii

Thank you for the opportunity to provide comments for the subject project. This project does not impact any of the Department of Accounting and General Services' projects or existing facilities in the general area, and we have no comments to offer at this time.

If you have any questions, please call me at 586-0400 or have your staff call Mr. Alva Nakamura of the Public Works Division at 586-0488.

Sincerely,

DEAN H. SEKI
Comptroller

c: Mr. David Victor, DAGS-Maui District Office

---

WILSON OKAMOTO CORPORATION
ENGINEERS · PLANNERS · CONSULTANTS

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8256-01
June 6, 2013

Mr. Dean Seki, Comptroller
State of Hawai'i
Department of Accounting and General Services
P.O. Box 119
Honolulu, Hawai'i 96810-0119

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA)
Kūlanihāko'i Bridge Replacement
Kīhei, Island of Maui, Hawai'i

Dear Mr. Seki:

Thank you for your letter dated December 10, 2012 regarding the subject project. We offer the following responses to your letter.

We appreciate the information that the proposed project does not impact any of the Department of Accounting and General Services projects or existing facilities in the general area.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Milton Arakawa, AICP
Project Manager

MA/ly

cc: Wendy Kobashigawa, DPW

File: 8251-01 EM

NEIL ABERCROMBIE
GOVERNOR
RICHARD C. LIM
DIRECTOR
MARY ALICE EVANS
DEPUTY DIRECTOR
JESSE K. SOUKI
DIRECTOR
OFFICE OF PLANNING

**DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM**

**OFFICE OF PLANNING**
235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Telephone: (808) 587-2846
Fax: (808) 587-2824

Ref. No. P-13813

December 18, 2012

RECEIVED
DEC 20 2012
WILSON OKAMOTO CORPORATION

Mr. Earl Matsukawa, AICP
Wilson Okamoto Corporation
1907 S. Beretania Street, Suite 400
Honolulu, Hawaii 96826

Dear Mr. Matsukawa:

Subject: Pre-Assessment Consultation
Kulanihakoi Bridge Replacement
Kihei, Maui, Hawai'i

Thank you for the opportunity to review and comment on the above referenced early consultation in preparation of an Environmental Assessment (EA). The Office of Planning (OP) has reviewed the initial project information and has the following comments:

1. The entire State is defined to be within the Coastal Zone Management Area (Hawaii Revised Statutes (HRS) §205A-1 – definition of "coastal zone management area"). The Draft EA should include a discussion of the proposed project's consistency with the objectives and policies set forth in HRS §205A-2.

2. We invite the applicant to review the *Hawaii Watershed Guidance*, specifically the sections on management measures for Urban Areas – Bridges; Operation and Maintenance, Roads and Highways; and Runoff Systems for Roads, Highways and Bridges, beginning on p. 130 of the Guidance. The Guidance provides a summary and links to management measures that may be implemented to minimize coastal non-point pollution impact. The *Hawaii Watershed Guidance* document can be found on-line at: http://hawaii.gov/dbedt/czm/initiative/nonpoint.

3. Coastal Zone Management Act (CZMA) federal consistency review will be required for the application for federal funding from the Federal Highway Administration and for the Department of the Army Permit from the U.S. Army Corps of Engineers, if applicable. Pre-application consultation for the Coastal Zone Management (CZM) review is encouraged. Contact John Nakagawa of our CZM Program at 587-2878, for further information.



If you have any questions, please contact Leo Asuncion of our CZM Program at 587-2875.

Sincerely,

Jesse K. Souki
Director

WILSON OKAMOTO
CORPORATION
ENGINEERS | PLANNERS | CONSULTANTS

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8256-01
June 6, 2013

Mr. Jesse K. Souki, Director
State of Hawai'i
Department of Business, Economic Development & Tourism
Office of Planning
235 South Beretania Street, 6th Floor
Honolulu, Hawai'i 96804

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA)
Kūlanihāko'i Bridge Replacement
Kīhei, Island of Maui, Hawai'i

Dear Mr. Souki:

Thank you for your letter dated December 18, 2012 (Ref. No. P-13813) regarding the subject project. We offer the following responses to your letter.

We acknowledge that the entire State is defined to be within the Coastal Zone Management Area. The Draft EA will include a discussion of the proposed project's consistency with the objectives and policies set forth in Section 205A-2, HRS.

We appreciate your suggestion to review *Hawai'i Watershed Guidance*, specifically sections on management measures for Urban Area – Bridges; Operation and Maintenance, Roads and Highways; and Runoff Systems for Roads, Highways and Bridges.

Since use of Federal funding for the project is anticipated, we acknowledge that Coastal Zone Management Act federal consistency review will be required. We will coordinate with applicable staff on this matter.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Milton Arakawa, AICP
Project Manager

MA/ly

cc: Wendy Kobashigawa, DPW

EM
MA

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

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

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

In reply, please refer to:
EMD/CWB

03017PST.13

March 6, 2013

Mr. Earl Matsukawa, AICP
Project Manager
Wilson Okamoto Corporation
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii 96826

RECEIVED
MAR 08 2013
WILSON OKAMOTO CORPORATION

Dear Mr. Matsukawa:

**SUBJECT: Comments on the Draft Environmental Assessment for the Kulanihakoi Bridge Replacement Project Kihei, Island of Maui, Hawaii**

The Department of Health (DOH), Clean Water Branch (CWB), acknowledges receipt of your letter, dated November 30, 2012, requesting comments on your project. The DOH-CWB has reviewed the subject document and offers these comments. Please note that our review is based solely on the information provided in the subject document and its compliance with the Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. You may be responsible for fulfilling additional requirements related to our program. We recommend that you also read our standard comments on our website at: http://www.hawaii.gov/health/environmental/env-planning/landuse/CWB-standardcomment.pdf.

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

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

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

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

2. You may be required to obtain a National Pollutant Discharge Elimination System (NPDES) permit for discharges of wastewater, including storm water runoff, into State surface waters (HAR, Chapter 11-55). An application for an NPDES individual permit must be submitted at least 180 calendar days before the commencement of the discharge. To request NPDES permit coverage, you must submit the CWB



Individual NPDES Form through the e-Permitting Portal and the hard copy certification statement with $1,000 filing fee. Please open the e-Permitting Portal website at: https://eha-cloud.doh.hawaii.gov/epermit/View/home.aspx. You will be asked to do a one-time registration to obtain your login and password. After you register, click on the Application Finder tool and locate the "CWB Individual NPDES Form." Follow the instructions to complete and submit this form.

3. If your project involves work in, over, or under waters of the United States, it is highly recommend that you contact the Army Corp of Engineers, Regulatory Branch (Tel: 438-9258) regarding their permitting requirements.

   Pursuant to Federal Water Pollution Control Act [commonly known as the "Clean Water Act" (CWA)], Paragraph 401(a)(1), a Section 401 Water Quality Certification (WQC) is required for "[a]ny applicant for Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may **result** in any discharge into the navigable waters..." (emphasis added). The term "discharge" is defined in CWA, Subsections 502(16), 502(12), and 502(6); Title 40 of the Code of Federal Regulations, Section 122.2; and Hawaii Administrative Rules (HAR), Chapter 11-54.

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

If you have any questions, please visit our website at: http://www.hawaii.gov/health/environmental/water/cleanwater/index.html, or contact the Engineering Section, CWB, at (808) 586-4309.

Sincerely,

ALEC WONG, P.E., CHIEF
Clean Water Branch

ST:jst

c: DOH-EPO [via email only]

WILSON OKAMOTO
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8256-01
June 6, 2013

Mr. Alec Wong, P.E.
Chief, Clean Water Branch
Department of Health
P.O. Box 3378
Honolulu, Hawai'i 96801-3378

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA)
Kūlanihāko'i Bridge Replacement
Kīhei, Island of Maui, Hawai'i

Dear Mr. Wong:

Thank you for your letter dated March 6, 2013 (03017PST.13) regarding the subject project. We offer the following responses to your letter.

We appreciate the information provided on the applicability of Chapter 11-54 and 11-55, Hawai'i Administrative Rules, National Pollutant Discharge Elimination System, and Section 401 water quality certification provisions. We intend to work cooperatively with your office in providing the requisite permit application submittals. We also acknowledge that coordination with the U.S Army Corps of Engineers regarding work in, over, or under waters of the United States will also be required.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Milton Arakawa, AICP
Project Manager

MA/ly

cc: Wendy Kobashigawa, DPW

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

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

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

In reply, please refer to:
File:
12-224
Kulanihakoi Bridge

December 12 2012

RECEIVED
DEC 17 2012
WILSON OKAMOTO CORPORATION

EM

Mr. Earl Matsukawa, AICP
Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, Hawaii 96826

Dear Mr. Matsukawa:

**SUBJECT: Environmental Assessment for Kulanihako`i Bridge Replacement Kihei, Maui, Hawaii**

The Department of Health (DOH), Environmental Planning Office (EPO), acknowledges receipt of your letter, dated November 30, 2012. Thank you for allowing us to review and comment on the subject document. The document was routed to the various branches of the Environmental Health Administration. We have no comments at this time, but reserve the right to future comments. We strongly recommend that you review all of the Standard Comments on our website: www.hawaii.gov/health/environmental/env-planning/landuse/landuse.html. Any comments specifically applicable to this application should be adhered to.

The United States Environmental Protection Agency (EPA) provides a wealth of information on their website including strategies to help protect our natural environment and build sustainable communities at: http://water.epa.gov/infrastructure/sustain/ . The DOH encourages State and county planning departments, developers, planners, engineers and other interested parties to apply these strategies and environment principles whenever they plan or review new developments or redevelopments projects. We also ask you to share this information with others to increase community awareness on healthy, sustainable community design. If there are any questions about these comments please contact me.

Sincerely,

Laura Leialoha Phillips McIntyre, AICP
Environmental Planning Office Manager
Environmental Health Administration
Department of Heath
919 Ala Moana Blvd., Ste. 312
Honolulu, Hawaii 96814
Phone: 586-4337
laura.mcintyre@doh.hawaii.gov

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8256-01
June 6, 2013

Ms. Laura Leialoha Phillips McIntyre, AICP
Environmental Planning Office Manager
Environmental Health Administration
Department of Health
919 Ala Moana Boulevard, Suite 312
Honolulu, Hawai'i 96814

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA)
Kūlanihāko'i Bridge Replacement
Kīhei, Island of Maui, Hawai'i

Dear Ms. McIntyre:

Thank you for your letter dated December 12, 2012 regarding the subject project. The following responds to your letter.

We appreciate your sharing information on Standard Comments from the Department of Health website as well as information from the U.S. Environmental Protection Agency website. This information will be taken into consideration as we move forward on the planning and design of the project.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Milton Arakawa, AICP
Project Manager

EM/ma

cc: Wendy Kobashigawa

EM

NEIL ABERCROMBIE
GOVERNOR

GARY L. GILL
ACTING DIRECTOR

STATE OF HAWAI'I
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
Department of Health
235 South Beretania Street, Suite 702
Honolulu, Hawai'i 96813
Telephone (808) 586-4185
Facsimile (808) 586-4186
Email: oeqc@doh.hawaii.gov

In reply, please refer to:
File:

December 7, 2012

RECEIVED
DEC 10 2012
WILSON OKAMOTO CORPORATION

Mr. Earl Matsukawa, AICP
Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, Hawai'i 96826

Subject: Kūlanihāko'i Bridge Replacement
Environmental Assessment
Kihei, Maui, Hawai'i

Dear Mr. Matsukawa,

This is in response to your November 30, 2012, pre-assessment consultation about the subject proposed environmental assessment (EA). The Office of Environmental Quality Control offers these comments:

1. We recommend inclusion of an analysis of the temporary detour bridge site; please identify impacts, mitigation, and disposition of the temporary bridge upon project completion.

2. We recommend a discussion of the construction staging area(s), a discussion on traffic management and level of service during the construction period, and impacts and mitigation.

3. Please check with the Clean Water Branch, Department of Health, for requirements regarding water quality issues.

Thank you for the opportunity to provide comments to the proposed project. Feel free to contact Herman Tuiolosega at (808) 586-4185, if you have any questions.

Sincerely,

GARY GILL,
Acting Director

WILSON OKAMOTO CORPORATION
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Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8256-01
June 6, 2013

Mr. Gary Gill, Acting Director
State of Hawai'i
Office of Environmental Quality Control
Department of Health
235 South Beretania Street, Suite 702
Honolulu, Hawai'i 96813

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA)
Kūlanihāko'i Bridge Replacement
Kīhei, Island of Maui, Hawai'i

Dear Mr. Gill:

Thank you for your letter dated December 7, 2012 regarding the subject project. We offer the following responses to your letter.

Impacts and mitigation relating to the temporary bridge located mauka of South Kīhei Road will be discussed in the Draft EA. After completion of the replacement culverts, the temporary bridge is intended to be removed. If it is still in good operating condition, the temporary bridge can be stored and reused.

Discussion of traffic management and level of service during the construction period, and impacts and mitigation will be discussed in the Draft EA. Construction staging will be provided at an off-site location.

We acknowledge that close coordination with the Clean Water Branch, Department of Health, will need to be undertaken regarding water quality issues.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Milton Arakawa, AICP
Project Manager

MA/ly

cc: Wendy Kobashigawa, DPW

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

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

EM

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

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

December 27, 2012

Wilson Okamoto Corporation
Attention: Mr. Earl Matsukawa, AICP
1907 South Beretania Street, Suite 400
Honolulu, Hawaii 96826

RECEIVED
DEC 28 2012
WILSON OKAMOTO CORPORATION

Dear Mr. Matsukawa:

SUBJECT: Kulanihako'i Bridge Replacement

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 the (a) Office of Conservation and Coastal Lands and (b) Engineering Division on the subject matter. Should you have any questions, please feel free to call Lydia Morikawa at 587-0410. Thank you.

Sincerely,

Russell Y. Tsuji
Land Administrator

Enclosure(s)
cc:

---

MA-13-57

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

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

RECEIVED
LAND DIVISION
2012 DEC 13 A 11:28

RECEIVED
OFFICE OF CONSERVATION & COASTAL LANDS
2012 DEC 10 A 7:01

**STATE OF HAWAII**
**DEPARTMENT OF LAND AND NATURAL RESOURCES**
**LAND DIVISION**
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

DEP. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

December 6, 2012

**MEMORANDUM**

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

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Kulanihako'I Bridge Replacement
LOCATION: Kihei, Island of Maui; in the vicinity of TMK: (2) 3-9-001:015, 147 & 162
APPLICANT: Wilson Okamoto Corporation for the County of Maui Department of Public Works

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by December 27, 2012.

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 Lydia Morikawa at 587-0410. Thank you.

Attachments

SEE MEMO

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

Signed:
Print Name: ALEX ROY
Date: 12-13-2012

cc: Central Files

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

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

ESTHER KIA'AINA
FIRST DEPUTY

WILLIAM M. TAM
DEPUTY DIRECTOR - WATER

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

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

OFFICE OF CONSERVATION AND COASTAL LANDS
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

REF: OCCL: AJR

COR: MA-13-57

DEC 1 3 2012

**MEMORANDUM**

**TO:** Russell Y. Tsuji, Administrator
*Land Division*

**FROM:** Samuel J. Lemmo, Administrator
*Office of Conservation and Coastal Lands*

**SUBJECT:** **Request for Comments on the Proposed Kulanihako'i Bridge Replacement Project**
*TMK(s): (2) 3-9-001:015, 147 & 162*
Wailuku District, Kihei, County of Maui

The Department of Land and Natural Resources, Office of Conservation and Coastal Lands (OCCL) is in receipt of your memo regarding the proposed Kulanihako'i Bridge Replacement project which crosses the Kulanihako'i Gulch in Kihei, Maui. For your information all lands located *makai* of the shoreline are considered to be within the State Land Use Conservation District Resource Subzone.

The County of Maui, Department of Public Works (DPW) is proposing to replace the existing 4-cell concrete box culvert system under South Kihei Road with a new 6-cell concrete box culvert system. The project will also include the construction of new intake and outlet headwalls to assist in channeling water flowing from the Kulanihako'i Gulch. The OCCL is requesting additional information regarding the construction of the intake and outlet headwalls and the type and location of shoreline or sand-moving activities in order to determine potential permitting or approval requirements.

Additionally there are a number of existing coastal management projects located near the proposed project site that may need to be integrated into the design and/or function of the new bridge repair and outlet. North of the Kulanihako'i Bridge, the Maui Lu Resort is currently working to mitigate the construction of revetments with multiple beach nourishment activities. Similarly, Maui County has an on-going Dune Management project south of the project site in Kalepolepo Park. The OCCL is requesting that the various agencies and consultants integrate the proposed project design principles with the existing projects to promote a coordinated approach to Coastal Zone Management.

This office looks forward to reviewing the full proposal and completing a review of the Environmental Assessment (EA) report. Pease make sure to address the effect of the other projects in the vicinity of your proposal.

Should you have any questions, please feel free to contact Alex J. Roy of the Office of Conservation and Coastal Lands at 808-587-0316 or via email at alex.j.roy@hawaii.gov

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

'12 DEC-11 PM 3:06 ENGINEERING DIVISION

2012 DEC 19 A 6:07

DEPT. OF LAND & NATURAL RESOURCES STATE OF HAWAII

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

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

December 6, 2012

**MEMORANDUM**

TO: Fr:

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

FROM: To: Russell Y. Tsuji, Land Administrator
SUBJECT: Kulanihako'I Bridge Replacement
LOCATION: Kihei, Island of Maui; in the vicinity of TMK: (2) 3-9-001:015, 147 & 162
APPLICANT: Wilson Okamoto Corporation for the County of Maui Department of Public Works

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by December 27, 2012.

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 Lydia Morikawa at 587-0410. Thank you.

Attachments

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

Signed:
Print Name: Carty S. Chang, Chief Engineer
Date: 12/19/12

cc: Central Files

**DEPARTMENT OF LAND AND NATURAL RESOURCES**
**ENGINEERING DIVISION**

**LD/LydiaMorikawa**
**Ref.:KulanihakoBridgeReplacement**
**Maui.590**

**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 project site, according to the Flood Insurance Rate Map (FIRM), is located in Zones AE and VE. The National Flood Insurance Program regulates developments within Zones AE and VE as indicated in bold letters below.**

( ) Please note that the correct Flood Zone Designation for the project site according to the Flood Insurance Rate Map (FIRM) is ___.

**(X) 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 or Ms. Ardis Shaw-Kim 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.

**(X) Mr. Francis Cerizo at (808) 270-7771 of the County of Maui, Department of Planning.**

( ) Ms. Wynne Ushigome at (808) 241-4890 of the County of Kauai, Department of Public Works.

( ) The applicant should include water demands and infrastructure required to meet project needs. Please note that projects within State lands requiring water service from the Honolulu Board of Water Supply system will be required to pay a resource development charge, in addition to Water Facilities Charges for transmission and daily storage.

( ) 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 Ms. Suzie S. Agraan of the Planning Branch at 587-0258.

Signed: _____
CARTY S. CHANG, CHIEF ENGINEER

Date: 12/18/12

WILSON OKAMOTO CORPORATION
ENGINEERS | PLANNERS | CONSULTANTS
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8256-01
June 6, 2013

Mr. Russell Tsuji, Land Administrator
State of Hawai'i
Department of Land and Natural Resources
Land Division
P.O. Box 621
Honolulu, Hawai'i 96809

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA)
Kūlanihāko'i Bridge Replacement
Kīhei, Island of Maui, Hawai'i

Dear Mr. Tsuji:

Thank you for your letter dated December 27, 2012 regarding the subject project. The following responds to your letter.

Regarding comments from the Office of Conservation and Coastal Lands, additional construction details such as the construction of new intake and outlet headwalls and potential activities relating to shoreline or sand-moving activities will be provided in the Draft EA. Other shoreline related projects in the vicinity will also be discussed in the Draft EA.

Regarding comments from the Engineering Division, we acknowledge that the project site is located within Flood Zones AE and VE, and that compliance with applicable National Flood Insurance Program rules and regulations are required.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Milton Arakawa, AICP
Project Manager

MA/ly

cc: Wendy Kobashigawa

NEIL ABERCROMBIE
GOVERNOR

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
JADE T. BUTAY
FORD N. FUCHIGAMI
RANDY GRUNE
JADINE URASAKI

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

IN REPLY REFER TO:
STP 8.1073

EM

December 28, 2012

Mr. Earl Matsukawa, AICP
Wilson Okamoto Corporation
1907 South Beretania, Suite 400
Honolulu, Hawaii 96826

RECEIVED
JAN 09 2013
WILSON OKAMOTO CORPORATION

Dear Mr. Matsukawa:

Subject: Kulanihakoi Bridge
Pre-Assessment Consultation
Draft Environmental Assessment
TMK: (2) 3-9-001:999

Thank you for requesting the State Department of Transportation's (DOT) review of the subject project. DOT understands the Maui County, Department of Public Works proposes to replace the existing deteriorated bridge with a new bridge.

Given the location and the nature of the project, DOT does not anticipate any significant adverse impacts to the State transportation facilities.

DOT appreciates the opportunity to provide comments. If there are any other questions, please contact Mr. Garrett Smith of the DOT Statewide Transportation Planning Office at telephone number (808) 831-7976.

Very truly yours,

GLENN M. OKIMOTO, Ph.D.
Director of Transportation

---

WILSON OKAMOTO CORPORATION
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Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
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FAX: 808-946-2253
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8256-01
June 6, 2013

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

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA)
Kūlanihāko'i Bridge Replacement
Kīhei, Island of Maui, Hawai'i

Dear Dr. Okimoto:

Thank you for your letter dated December 28, 2012 (STP 8.1073) regarding the subject project. We offer the following response to your letter.

We appreciate the information that DOT does not anticipate any significant adverse impacts to State transportation facilities.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Milton Arakawa, AICP
Project Manager

MA/ly

cc: Wendy Kobashigawa, DPW

ALAN M. ARAKAWA
Mayor

KYLE K. GINOZA, P.E.
Director

MICHAEL M. MIYAMOTO
Deputy Director

TRACY TAKAMINE, P.E.
Solid Waste Division

ERIC NAKAGAWA, P.E.
Wastewater Reclamation Division

EM

**COUNTY OF MAUI**
**DEPARTMENT OF**
**ENVIRONMENTAL MANAGEMENT**
2200 MAIN STREET, SUITE 100
WAILUKU, MAUI, HAWAII 96793

December 28, 2012

Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, HI 96826
Attention Earl Matsukawa, AICP

RECEIVED
JAN 09 2013
WILSON OKAMOTO CORPORATION

Dear Mr. Matsukawa,

**SUBJECT: KULANIHAKOI BRIDGE REPLACEMENT**
**ENVIRONMENTAL ASSESSMENT**
**KIHEI, MAUI, HAWAII**

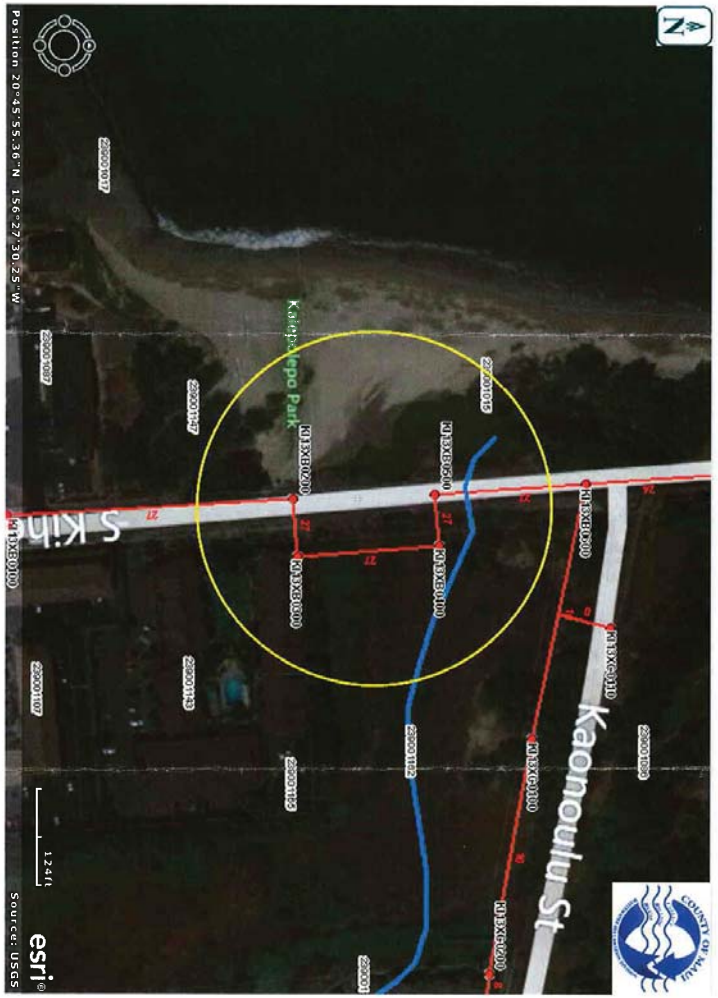
The Wastewater Reclamation Division has reviewed your project as requested in your November 30, 2012 letter. Be advised that there is a major sewer line in the vicinity of your proposed working area. You will be required to work with our division in order to eliminate any possibility of breaking or harming the line during construction of the bridge or other temporary traffic structures. Any wastewater spills must be avoided. The County is still under a Consent Decree that requires substantial fees for any spills, especially those that reach waterways and the ocean.

Attached is a schematic of the sewer location for your use. As Built plans are available upon request. Should you have any questions please contact Mr. Arnold Abe ((808) 270-7428) or our Wastewater Reclamation Division.

Sincerely,

Kyle K. Ginoza, Director
Department of Environmental Management

KG:sr(Kulanihakoi Bridge Replacement.doc)



WILSON OKAMOTO
CORPORATION
ENGINEERS / PLANNERS / CONSULTANTS

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www.wilsonokamoto.com

8256-01
June 6, 2013

Mr. Kyle Ginoza, Director
County of Maui
Department of Environmental Management
2200 Main Street, Suite 100
P.O. Box 621
Wailuku, Hawai'i 96793

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA)
Kūlanihāko'i Bridge Replacement
Kīhei, Island of Maui, Hawai'i

Dear Mr. Ginoza:

Thank you for your letter dated December 28, 2012 regarding the subject project. We offer the following response to your letter.

We acknowledge the existence of the County sewerline in the vicinity of the project mauka of South Kīhei Road and intend to work with your department in order to eliminate any damage to the sewer line or wastewater spills.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Milton Arakawa, AICP
Project Manager

MA/ly

cc: Wendy Kobashigawa, DPW

ALAN M. ARAKAWA
Mayor

GLENN T. CORREA
Director

PATRICK T. MATSUI
Deputy Director

(808) 270-7230
FAX (808) 270-7934

**DEPARTMENT OF PARKS & RECREATION**
700 Hali'a Nakoa Street, Unit 2, Wailuku, Hawaii 96793

EM

December 11, 2012

RECEIVED
DEC 17 2012
WILSON OKAMOTO CORPORATION

Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, Hawaii 96826
Attention: Earl Matsukawa, AICP

Dear Mr. Matsukawa:

**SUBJECT: KULANIHAKOI BRIDGE REPLACEMENT
ENVIRONMENTAL ASSESSMENT
KIHEI, MAUI, HAWAII**

Thank you for the opportunity to review and comment on the project summary for the Kulanihakoi Bridge Replacement. As the project is adjacent to Kalepolepo Park, our Department would like to review the design as it develops.

Please feel free to contact me or Robert Halvorson, Chief of Planning and Development, at 270-7931, should you have any questions.

Sincerely,

GLENN T. CORREA
Director of Parks and Recreation

c: Robert Halvorson, Chief of Planning and Development
Project File

GTC:RH:kp

WILSON OKAMOTO CORPORATION
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FAX: 808-946-2253
www.wilsonokamoto.com

8256-01
June 6, 2013

Mr. Glenn T. Correa, Director
County of Maui
Department of Parks and Recreation
700 Hali'a Nakoa Street, Unit 2
Honolulu, Hawai'i 96793

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA)
Kūlanihāko'i Bridge Replacement
Kīhei, Island of Maui, Hawai'i

Dear Mr. Correa:

Thank you for your letter dated December 11, 2012 regarding the subject project. The following responds to your letter.

We acknowledge that the nearby Kalepolepo Park is under the jurisdiction of the Department of Parks and Recreation. Additional design details of the project will be available in the Draft EA. We intend to coordinate with your department on this matter.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Milton Arakawa, AICP
Project Manager

MA/ly

cc: Wendy Kobashigawa, DPW

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

RALPH M. NAGAMINE, L.S., P.E.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS
**DEVELOPMENT SERVICES ADMINISTRATION**
250 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

EM

December 26, 2012

Earl Matsukawa, AICP
WILSON OKAMOTO CORPORATION
1907 South Beretania Street, Suite 400
Honolulu, Hawaii 96826

RECEIVED
JAN 02 2013
WILSON OKAMOTO CORPORATION

Subject: KULANIHAKO'I BRIDGE REPLACEMENT
ENVIRONMENTAL ASSESSMENT

Dear Mr. Matsukawa:

We reviewed the subject application and have no comments at this time.

Please call Rowena M. Dagdag-Andaya at 270-7845 if you have any questions regarding this letter.

Sincerely,

for David C. Goode
Director of Public Works

ls S:\LUCA\CZM\kulanihakoi_bridge_replacement_ls.wpd
xc: Highways Division
Engineering Division

WILSON OKAMOTO CORPORATION
ENGINEERS | PLANNERS | CONSULTANTS
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8256-01
June 6, 2013

Mr. David Goode, Director
County of Maui
Department of Public Works
Development Services Administration
250 South High Street
Wailuku, Hawai'i 96793

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA)
Kūlanihāko'i Bridge Replacement
Kīhei, Island of Maui, Hawai'i

Dear Mr. Goode:

Thank you for your letter from the Development Services Administration dated December 26, 2012 regarding the subject project.

We acknowledge that there are no comments at this time.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Milton Arakawa, AICP
Project Manager

MA/ly

cc: Wendy Kobashigawa, DPW

ALAN M. ARAKAWA
MAYOR

JEFFREY A. MURRAY
CHIEF

ROBERT M. SHIMADA
DEPUTY CHIEF

COUNTY OF MAUI
DEPARTMENT OF FIRE AND PUBLIC SAFETY
FIRE PREVENTION BUREAU

313 MANEA PLACE • WAILUKU, HAWAII 96793
(808) 244-9161 • FAX (808) 244-1363

**December 29, 2012**

**To** : Wilson Okamoto Corporation
Attn: Earl Matsukawa, AICP
1997 South Beretania Street, Suite 400
Honolulu, HI 96826

**Re** : **Kulanihako'i Bridge Replacement**
**Kihei, Maui, HI**

RECEIVED
JAN 02 2013
WILSON OKAMOTO CORPORATION

Dear Earl:

Thank for the allowing the Department of Fire and Public Safety the opportunity to comment on the proposed project. At this time, our office provides the following comments:

- Our office requests that the minimum clear width of the bridge after repair be at least 20 feet (the minimum width for fire apparatus access) to allow for fire apparatus access.
- The project must be able to support the weight of the heaviest fire apparatus in district; which would be the ladder truck at the Wailea Station with a GVW of 70,000 #.

These specifics should apply to the temporary detour road in place while the project is being completed.

If there are any questions or comments, please feel free to contact me at 244-9161 ext. 23.

Sincerely,

Paul Haake
Captain, Fire Prevention Bureau
Department of Fire and Public Safety, Maui County

WILSON OKAMOTO CORPORATION
ENGINEERS | PLANNERS | CONSULTANTS

1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
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FAX: 808-946-2253
www.wilsonokamoto.com

8256-01
June 6, 2013

Mr. Paul Haake, Captain
County of Maui
Department of Fire and Public Safety
Fire Prevention Bureau
313 Manea Place
Wailuku, Hawai'i 96793

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA)
Kūlanihāko'i Bridge Replacement
Kīhei, Island of Maui, Hawai'i

Dear Captain Haake:

Thank you for your letter dated December 29, 2012 regarding the subject project. We offer the following responses to your letter.

The Department of Fire and Public Safety's request for a minimum clear width of at least 20 feet of the bridge and the ability to support the heaviest fire apparatus at the Wailea Station which has a gross vehicle weight of 70,000 pounds will be considered as we proceed through the design phase. It is noted that these comments will be taken into consideration for the permanent improvements as well as the temporary detour road.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Milton Arakawa, AICP
Project Manager

MA/ly

cc: Wendy Kobashigawa, DPW

KCA

Kihei Community Association

EM

Wilson Okamoto Corporation
1907 S. Beretania Street, Suite 400
Honolulu HI 96286
Attn: Earl Matsukawa, AICP
January 4, 2013

RECEIVED
JAN 07 2013
WILSON OKAMOTO CORPORATION

RE: Kulanihako'i Bridge Replacement

Dear Mr. Matsukawa;

Thank you for your request for our comments regarding the proposed Kulanihako'i Bridge replacement. The Kihei Community Association provides broad based dissemination information to the community and provides feedback to decision makers. We are pleased to provide comments for the generation of the Environmental Assessment (EA) on the Kulanihako'i Bridge Replacement project that is being undertaken by the County of Maui Department of Public Works.

The EA needs to pay special attention to the very sensitive environment in this area as it contains a major floodway into the ocean with a highly active dune system. The roadway in itself posses a continual problem by its location immediately adjacent to the shoreline. Careful attention needs to be paid to the impact on the environment due to the permanently placed structures. The new flood elevation as a result of this project will have to be mitigated and should be done so within the immediate flood area. The Kulanihako'i stream at this location has been the depository point of massive amounts of silt and mud contaminating the ocean more that one half of a mile from shore and multiple miles along the coast.

The project plans to replace the existing damaged bridge with a new bridge with six culverts 6 feet wide by 4 feet deep. This will increase the storm flow under the bridge by 50%. Unfortunately, the 100 yr flood event at this location is 14,144 cfs (Draft Drainage Study South Kihei 2009 by R. M Towill Corporation for Maui Department of Public Works) and it appears that the new bridge still has insufficient capacity to handle this flow. We expect that the EA will quantify the effect of the project on the 100 yr flood flow, including new flood maps. Special attention needs to be made to identify design approaches that mitigate the impact to the structure from over topping in a severe flood. Headwalls and end walls should be designed so that when the storm flows stop, that the structure will remain serviceable.

The design should also minimize the flood flow onto South Kihei Road and onto properties upstream of the bridge. Floods in this area have damaged the nearby Kalepolepo Park, NOAA Hawaiian Island Humpback Whale facility and the Historic Fishpond. Alternative designs or other upstream improvements that could further mitigate the impact of the 100 yr flood should be identified. Such alternatives should include an elevated bridge above the base flood elevation, which would allow a freer flow of storm water, the natural migration of sand dune process, and help prevent potential debris build up caught within the proposed culverts or pilings. Retention and /or drainage basins in the near mauka area could be constructed to help prevent debris build up and storm silt and mud from entering the ocean. Any new design should be intended to be a long-term benefit 50-100 years from now and not a shorter-term fix. Consideration should be made to the overall esthetic nature of the bridge in how it relates to and accentuates the natural environment it is located in and help bring a sense of quality suitable to its park and natural drainage area.



KCA

Kihei Community Association

The traffic on S. Kihei Rd at Ka'ono'ulu Street will be impacted by the future connection of Ka'ono'ulu to the Upcountry connector road. The EA needs to evaluate the future traffic flow at that intersection and ensure that the bridge has sufficient capacity to handle that volume as this is a very sensitive issue to the Kihei community, which aspires for a pedestrian friendly, walkable community de-emphasizing the automobile and providing easy pedestrian access to our beaches and shorelines. The width of the new bridge will need to be consistent with the potential future improvements on S. Kihei Rd. The bridge structure should utilize the minimum amount of pavement to accommodate 2 travel lanes 2 sidewalks, and 2 bike lanes. Additionally, consideration should be made for the structure to potentially accommodate a turning lane if necessary at its North end in conjunction with the design of any future intersection at Ka'ono'ulu Street.

We are concerned about the impact on local traffic during the construction period. In order to reduce construction time disruption, consideration should be given to precast box culverts in 12, 24, or 48 foot lengths. Casting of the culverts adjacent to the work site could be accomplished prior to construction of the bridge detour thus saving casting and cure time of the boxes while the detour was in effect. Construction should be started after the rainy season to prevent silt damage to reefs. Storm water silt fences should be installed to prevent silt damage during construction. Work should be restricted to 8:00 AM to 4:00 PM Monday to Fridays due to peak traffic times and distance to residential units. The use of driven piles should be avoided if possible due to construction noise. Dust during construction should be minimized by use of dust fences and water where practical.

Traffic flow and Flood control are two major issues in Kihei. This project has the potential to help solve both of them if done with adequate foresight. The KCA would be pleased to assist in this effort by reviewing any work scopes or preliminary documents, and can support meetings on Maui. The Association is also able to provide public review and feedback. Please contact us at any time to participate in this important improvement.

Sincerely,

Mike Moran President
Kihei Community Association (KCA)

P.O. Box 662, Kihei, HI 96753 (508) 499 9996 www.GoKihei.org

WILSON OKAMOTO
CORPORATION
ENGINEERS | PLANNERS | CONSULTANTS

1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8256-01
June 6, 2013

Mr. Mike Moran, President
Kīhei Community Association
P.O. Box 662
Kīhei, Hawai'i 96753

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA)
Kūlanihāko'i Bridge Replacement
Kīhei, Island of Maui, Hawai'i

Dear Mr. Moran:

Thank you for your letter which we received on January 7, 2013 regarding the subject project. We offer the following responses to your letter.

We understand the regional concerns regarding drainage. Flooding has been a major issue in a number of South Maui watersheds which extend through the Kīhei region. Traffic on South Kīhei Road and consideration for pedestrian friendly, walkable communities are noted as concerns of the Association. Your concerns will be taken into consideration as design of the project proceeds.

Your letter, along with this response, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Milton Arakawa, AICP
Project Manager

MA/ly

cc: Wendy Kobashigawa, DPW

# APPENDIX H

## *Draft EA Comment and Response Letters*

DEPARTMENT OF THE ARMY
HONOLULU DISTRICT, U.S. ARMY CORPS OF ENGINEERS
FORT SHAFTER, HAWAII 96858-5440

REPLY TO ATTENTION OF:

August 29, 2013

Regulatory Branch

File Number POH-2013-00014

County of Maui
Department of Public Works
Attention: Wendy Kobashigawa
200 South High Street, 4th Floor
Wailuku, Hawaii 96793

Dear Mr. Okimoto:

This is in response to your letter dated July 3, 2013 requesting Department of the Army (DA) review and comment on the Draft Environmental Assessment (EA) for the proposed Kulanihakoi Bridge Replacement Project along South Kihei Road at the Kulanihakoi Gulch outlet, Wailuku, Island of Maui, Hawaii. We completed our review of the submitted documents pursuant to Section 10 of the Rivers and Harbors Act of 1899 (Section 10) and Section 404 of the Clean Water Act (Section 404).

As previously conveyed to you by letter dated January 10, 2013, Section 10 requires that a DA permit be obtained from the Corps prior to undertaking any construction, dredging, or other activity occurring **in, over, or under or affecting navigable waters of the U.S.** For tidal waters, the shoreward limit of the **Corps' jurisdiction extends to the Mean High Water Mark**. Section 404 requires that a DA permit be obtained for the **discharge (placement) of dredged and/or fill material into waters of the U.S.**, including wetlands. For tidally influenced waters, in the absence of adjacent wetlands, the shoreward limit of the **Corps' jurisdiction extends to the High Tide Line**, which in Hawai'i may be approximated by reference to the Mean Higher High Water Mark.

Please consider the following comments as you prepare your Final EA and DA Permit Application:

- The proposed project design involves replacement of the existing bridge culverts with six new culverts. The Corps has determined the proposed culvert replacement will result in a discharge of fill material into a water of the U.S., as regulated under Section 404. In accordance with Section 404, specifically the Section 404(b)(1) guidelines, the Corps must analyze project design alternatives to determine the least environmentally-damaging practicable alternative (LEDPA), taking into account all impacts the proposed fill will have on the aquatic environment. The Corps is



required to authorize the LEDPA. If there exists a design alternative that does not require the discharge of fill material or discharge of a lesser amount of fill material and that still achieves the project purpose, then the Corps will authorize the lesser impactful alternative. For example, replacement of the existing four culverts with a clear-span bridge that does not require a discharge of fill material will still provide for the project need and is less impactful than the proposed culvert replacement.

- As the Kulanihakoi Gulch is tidal at its intersection with South Kihei Road, all project drawings should clearly demarcate the Mean High Water Mark (limit of Section 10 jurisdiction) and the Mean Higher High Water Mark (limit of Section 404 jurisdiction) elevations at the project location.

- The site plan should clearly demarcate the limits of work (including staging, access and stockpiling areas) mauka, makai and adjacent to the bridge and temporary bridge so the Corps can clearly identify what portions of the project constitute 'work' under Section 10 and 'fill' under Section 404. Staging and access areas must be clearly demarcated on your site plan and sited outside of waters of the U.S., to the greatest extent practical. If staging and/or access requirements result in the discharge of fill material into a water of the U.S., you will require prior authorization from this office in accordance with Section 404. As described above, the 404(b)(1) guidelines will also apply to staging and access-related fills.

- The shoreline fronting and abutting the Kulanihakoi Bridge is currently reinforced with what appears to be a combination of dumped and grouted riprap. Please include in your project description any modifications to these shoreline structures throughout the project.

- You will be required to identify all regulated discharges of fill material, including type of fill, waterward of the High Tide Line (Mean Higher High Water Mark) elevation at the Kulanihakoi Gulch or other waters of the U.S. within the project area. In addition, you must provide area and volume specifications of regulated fills. The Corps has identified the following proposed project components that likely will result in a discharge of permanent and/or temporary fill material into a water of the U.S. including, but not limited to, bridge replacement/widening with culverts, permanent and temporary bridge foundation supports including backfill, backfill of subsurface waterlines, temporary dewatering structures and structural approach and stabilization structures.

- The draft EA did not include Best Management Practices (BMP) the County of Maui has proposed to avoid and/or minimize direct, indirect or cumulative impacts to the aquatic resource, endangered species, historic and cultural resources, and essential fish habitat within the project area.

These impacts should be identified and avoidance and minimization measures designed into the proposed action. Be advised that the Corps considers certain temporary BMP structures e.g., sandbags, earthen berms, etc. fill material and is likewise subject to regulation under Section 404.

- The project scope did not propose any dewatering activities associated with the bridge replacement although, it is apparent it may be required given the site conditions. Please be sure to provide in your permit application a construction sequence beginning with site preparation and temporary bridge installation to temporary bridge demolition and site restoration. The Corps will need a description of means and methods for each construction activity so we can adequately assess all project-related impacts on the aquatic resource.

The DA permit application can be found at: http://www.poh.usace.army.mil/Portals/10/docs/ENG%20Form%204345.OCT2010.pdf. An optional supplementary questionnaire is available here: http://www.poh.usace.army.mil/Portals/10/docs/Questionnaire.revFEB2012.pdf to aid in assuring you provide sufficient information to supplement the Corps' evaluation of your permit application. You may

Thank you for contacting us regarding this project and providing us with the opportunity to comment. Should you have any questions or if you would like to schedule a pre-application consultation meeting, please contact Ms. Jessie Pa'ahana at *808.835.4107* or via email at *Jessie.K.Paahana@usace.army.mil*. You are encouraged to provide comments on your experience with the Honolulu District Regulatory Branch by accessing our web-based customer survey form at *http://www.per2.nwp.usace.army.mil/survey.html*.

Sincerely,

George P. Young, P.E.
Chief, Regulatory Branch

Copy furnished:
Wilson Okamoto Corporation, Attn: Milton Arakawa, [sent via email]

**DEPARTMENT OF THE ARMY**
**HONOLULU DISTRICT, U.S. ARMY CORPS OF ENGINEERS**
**FORT SHAFTER, HAWAII 96858-5440**

March 11, 2015

SUBJECT: Preliminary Jurisdictional Determination and Request for Additional Information for Kulanihakoi Bridge Replacement in Kihei, Island of Maui, Hawaii, Department of the Army File No. POH-2013-00014.

County of Maui
Department of Public Works, Engineering Division
Attention: David C. Goode
200 South High Street
Wailuku, Hawaii 96793

Dear, Mr. Goode:

The Honolulu District, U.S. Army Corps of Engineers (Corps), is in receipt of your pre-construction notification (PCN) dated February 5, 2015 requesting authorization under the Nationwide Permit Program (NWP) for the proposed Bridge Replacement over Kulanihakoi Gulch at its intersection with South Kihei Road located at TMK (2) 3-9-001:999, :015, :147 and :162 in Kihei, Island of Maui, Hawaii.

We have reviewed your submittal pursuant to Section 404 of the Clean Water Act (Section 404) and Section 10 of the Rivers and Harbors Act of 1899 (Section 10). Section 404 requires authorization prior to the discharge and/or placement of dredged or fill material into waters of the U.S., including adjacent wetlands. Section 10 requires authorization prior to installing structures in or conducting work in, over, under, and affecting navigable waters.

We have determined the estuarine portion of the Kulanihakoi Gulch is a tidal reach of the Pacific Ocean and is a navigable water of the U.S. under the regulatory jurisdiction of the Corps. In addition, we have preliminarily determined that the wetlands adjacent to the gulch and mauka of South Kihei Road may be waters of the U.S. under the regulatory jurisdiction of the Corps; the limits of which extend to the boundaries identified as, "approximate historic edge of akulikuli" on Figure 17 of your submittal dated February 5, 2015 (See Enclosure 1). In accordance with both Section 10 and Section 404, a Department of the Army (DA) permit will be required for the proposed bridge replacement work in, over and affecting the Kulanihakoi Gulch and adjacent wetlands.

Based on our review of your submittal, it appears the proposed project may qualify for authorization under NWP 14. However, we have determined the information submitted in your preconstruction notification (PCN) is incomplete. The following information is required to complete your PCN:

1. Identify any Federally-listed species or designated critical habitat that might be affected or is in the vicinity of the project. Federal applicants must provide documentation demonstrating compliance with the Endangered Species Act (ESA);

2. A statement about the knowledge of the presence or absence of Historic Properties. Historic Properties includes a historic property listed on, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places. Federal applicants must provide documentation demonstrating compliance with Section 106 of the National Historic Preservation Act (NHPA).

Before authorizing work under our statutory authorities, the Corps must ensure a project complies with other applicable Federal laws and regulations including the ESA, Magnuson-Stevens Act (MSA), NHPA and Coastal Zone Management Act (CZM). Your PCN identifies this project as Federal-Aid Project No. BF-3100(015), however it does not identify the lead federal agency. The federal agency providing funding for this project will be considered the lead federal agency responsible for providing documentation to our office demonstrating that the project is in compliance with ESA, MSA, NHPA and CZM.

Section 40I(a)(I) of the Clean Water Act requires that you obtain a Water Quality Certification or waiver from the State of Hawaii, Department of Health, Clean Water Branch. For additional information, please contact the Clean Water Branch at (808) 586-4309 or CleanWaterBranch@doh.hawaii.gov. A final DA permit will not be issued until this office has received a copy of the approved 401 WQC.

This letter contains a preliminary jurisdictional determination (JD), which is a written indication that wetlands within your project area may be waters of the U.S. (Enclosure 1). Such waters will be treated as jurisdictional waters of the U.S. for purposes of computation of impacts and compensatory mitigation requirements. If you concur with the findings of the preliminary JD, please sign it and return it to the following address within two weeks. If you believe the preliminary JD is inaccurate, you may request an approved JD, which is an official determination regarding the presence or absence of waters of the United States.

U.S. Army Corps of Engineers
Honolulu District
Regulatory Office, CEPOH-RO
Fort Shafter, Hawaii 96858-5440

Your letter inquired about the applicability of NWP #23, Categorical Exclusions to this project. At this time, we cannot determine whether the proposed work complies with the terms of NWP #23 as the federal agency providing funding for this project has



not been identified to this office. For your information, to date, the Corps has only approved categorical exclusions for a specified list of projects to the following three federal agencies: the Federal Highways Administration, the United States Coast Guard and the Bureau of Reclamation.

This office will not continue to evaluate your project until we receive the information requested above. Providing a response to this letter in a timely manner will ensure efficient processing of your permit. If you fail to respond to this office within thirty (30) days of the date of this letter providing either the requested information or a request for additional time to gather the information, your application will be withdrawn. Upon receipt of the requested information, this office will resume evaluation of your project.

Thank you for your cooperation with the Honolulu District Regulatory Program. Should you have any questions related to this determination, please contact Ms. Jessie Paahana at 808-835-4107 or via e-mail at jessie.k.paahana@usace.army.miol. You are encouraged to provide comments on your experience with the Honolulu District Regulatory Office by accessing our web-based customer survey form at http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0. Please reference DA file no. **POH-2014-00013** in all future correspondence concerning this project.

Sincerely,

PAAHANAJESSIE.AK.1367868755
Digitally signed by PAAHANAJESSIE.A.K.1367868755
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=PAAHANAJESSIE.A.K.1367868755
Date: 2015.03.11 12:06:11 -10'00'

Jessie K. Paahana
Biologist, Regulatory Office

Enclosure

cc:
State of Hawaii DBEDT Office of Planning
State of Hawaii DOH-CWB
United States Coast Guard
State of Hawaii Historic Preservation Division

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

MA

April 9, 2015

Ms. Jessie K. Paahana
Biologist, Regulatory Office
Department of the Army
Honolulu District, U.S. Army Corps of Engineers
Fort Shafter, Hawai'i 96858-5440

RECEIVED
APR 13 2015
WILSON OKAMOTO CORPORATION

Subject: Preliminary Jurisdictional Determination and Request for Additional Information
Kūlanihāko'i Bridge Replacement
Kīhei, Maui, Hawai'i
Federal-Aid Project No. BR-3100(015)
Department of the Army File No. POH-2014-00013

Dear Ms. Paahana:

Thank you for your letter of March 11, 2015 in response to our pre-construction notification (PCN) dated February 5, 2015 requesting authorization under the Nationwide Permit Program (NWP) for the proposed Bridge Replacement over Kūlanihāko'i Gulch at its intersection with South Kīhei Road located at TMK (2) 3-9-001:999, 015, 147 and 162 in Kīhei, Island of Maui, Hawai'i.

We acknowledge the Corps' preliminary determination that the wetlands adjacent to the gulch and mauka of South Kīhei Road may be waters of the U.S., as identified in Figure 17 in our submittal as the "approximate historic edge of 'ākulikuli". We also understand that a Department of the Army (DA) Permit will be required for the proposed bridge replacement work.

We further acknowledge that the PCN is considered incomplete at this juncture since we must complete processes under Section 7 of the Endangered Species Act and Section 106 of the National Historic Preservation Act. We will be working on complying with applicable provisions of these processes in addition to other Federal statutory authorities which may apply including the Magnuson-Stevens Act and Coastal Zone Management. We are aware that we must be in compliance with applicable Section 401(a)(1) provisions before a DA permit is issued.



In reference to your statement regarding the Federal agency providing funding for this project, we note that Federal funding is being provided by the Federal Highway Administration.

Attached to this letter is the signed preliminary jurisdictional determination indicating jurisdictional waters of the U.S. for purposes of computation of impacts and compensatory mitigation requirements. Your letter asked for a response within 30 days with the requested information or a request for additional time to gather the information. Unfortunately, we are unable to comply with all the applicable Federal permit processes within 30 days of your letter. Please be informed, however, that we intend to work diligently to comply with all Federal provisions applicable to the project and will provide requisite information to your office at the appropriate time. Upon receipt of all the requested information, we will then request that your office resume evaluation of the project.

If there are any questions or concerns, please call Wendy Kobashigawa at (808) 270-7745. Thank you for your clarification and assistance. We look forward to working with you.

Sincerely,

DAVID C. GOODE
Director of Public Works

Attachment

xc: Milton Arakawa

DG/ma (ED15-389)
S:\ENG\DESIGN\FAP\BR-3100(015) Kulanihakoi Bridge Replacement\B Correspondence\Letters\Word files\ED15-389 Acknw Prelim Juris Determination.doc

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COUNTY OF MAUI
2013 AUG -7 AM 9:54
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DEPARTMENT OF PUBLIC WORKS

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COUNTY OF MAUI
PUBLIC WORKS

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850

RUSH

DEPT. OF PUBLIC WORKS

| | INFO | ACTION | SEE ME | COMMENTS | COPY | FILE |
|---|---|---|---|---|---|---|
| DIRECTOR | ✓ | | | | ✓ | |
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Return to_____ Due_____
By:_____ Date:_____

AUG 0 2 2013

In Reply Refer To:
2013-TA-0348

Mr. David Goode
Director
County of Maui
Department of Public Works
200 South High Street
Wailuku, Hawaii 96793

Subject: Draft Environmental Assessment for the Proposed Kulanihakoi Bridge Replacement Project, Maui

Dear Mr. Goode:

The U.S. Fish and Wildlife Service (Service) received your letter on July 5, 2013, requesting comment on a Draft Environmental Assessment (Draft EA) for the proposed replacement of the Kulanihakoi Bridge in Kihei, Maui.

*Project Description*
The proposed action involves replacing the existing bridge due to advanced deterioration and serious structural deficiencies. The existing bridge will be completely dismantled and demolished, and a replacement bridge which meets current standards for safety and pedestrian access will be constructed to accommodate traffic flow along the South Kihei Road corridor. However, during construction of the replacement bridge, that portion of South Kihei Road will not be usable. Therefore, prior to the removal of the existing structure and the construction of the replacement bridge, a temporary bridge and bypass road will need to be installed on the mauka side of the existing bridge to facilitate traffic along South Kihei Road during construction.

*Species Affected*
Based on information you provided and pertinent information in our files, including data compiled by the Hawaii Biodiversity and Mapping Program, six species protected by the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*), may occur within, or transit through, the proposed action area and could be impacted by the proposed action: the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), Blackburn's sphinx moth (*Manduca blackburni*), Hawaiian goose (*Branta sandvicensis*), Hawaiian stilt (*Himantopus*

TAKE PRIDE IN AMERICA



*mexicanus knudesenl*), Hawaiian petrel (*Pterodroma sandwichensis*), and the threatened Newell's shearwater (*Puffinus auricularis newelli*). Additionally, one species protected by the Migratory Bird Treaty Act (MBTA) (16 U.S.C. §§ 703–712), the wedge-tailed shearwater (*Puffinus pacificus*) may traverse the project area when flying between the ocean and nesting sites along the coastline during its breeding season.

To help you minimize potential impacts to listed species, the Service is providing you the flowing avoidance and minimization measures. Please note that implementation of these measures does not ensure that impacts to listed species can be avoided, and further coordination with the Service on compliance with the ESA may be required.

- The Hawaiian hoary bat is known to occur throughout the island of Maui. This bat roosts in both exotic and native woody vegetation and, while foraging, leaves young unattended in "nursery" trees and shrubs. If trees or shrubs suitable for bat roosting are cleared during the hoary bat breeding season (June 1 to September 15), there is a risk that young bats could inadvertently be harmed or killed. As a result, the Service recommends that woody plants greater than 15 feet tall should not be removed or trimmed during the Hawaiian hoary bat breeding and pupping season.

- The Blackburn's sphinx moth may presently breed and feed within the proposed action area. Adult moths feed on nectar from native plants, including beach morning glory (*Ipomoea pes-caprae*), iliee (*Plumbago zeylanica*), and maiapilo (*Capparis sandwichiana*); larvae feed upon non-native tree tobacco (*Nicotiana glauca*) and native aiea (*Nothocestrum latifolium*). Blackburn's sphinx moth pupae may occupy the soil within 35 feet of larval host plants for up to a year. The Service recommends that a survey of the project area and areas adjacent to the project footprint be conducted by an entomologist to ascertain the presence of native and non-native Blackburn's sphinx moth host plants. We also recommend that these surveys be conducted during the wettest portion of the year (usually November-April) and approximately four to eight weeks following a significant rainfall event. Surveys should include looking for eggs, larvae, and signs of larval feeding (chewed stems, frass, or leaf damage). If presence of the Blackburn's sphinx moth is confirmed, the Service should be contacted for further guidance.

- Because of its range and foraging behavior, the Hawaiian goose may be present in the vicinity of the proposed action at any time of the year. This species may be attracted to grassy areas along the road shoulder after the construction phase has been completed, thus increasing their vulnerability to collision with moving vehicles. The Service recommends that you contact our office for additional information about how to minimize and avoid potential impacts to the Hawaiian goose from this threat. Additionally, a biologist familiar with the nesting behavior of the Hawaiian goose should survey the area around proposed construction areas prior to the initiation of any work during the Hawaiian goose breeding season (October through April), or after any subsequent delay of work of three or more days (during which the birds may attempt to nest). If a nest is discovered within a radius of 150 feet of proposed construction activity, or a previously undiscovered nest is found within said radius after work begins, all work should cease immediately and the Service contacted for further guidance. If a Hawaiian

goose appears within 100 feet of ongoing work at any time during the construction phase of the proposed project, all activity should be temporarily suspended until the bird moves off to a safe distance of its own volition.

- Hawaiian stilts forage in areas with shallow, ponded water, and nest in nearby mud flats. This behavior may increase their vulnerability to disturbance and from nearby construction activities as well as collision with moving vehicles. The Service recommends that a biologist familiar with the nesting behavior of the Hawaiian stilt survey the area around proposed construction areas prior to the initiation of any work during the Hawaiian stilt breeding season (March through August), or after any subsequent delay of work of three or more days (during which the birds may attempt to nest). If a nest is discovered within a radius of 100 feet of proposed construction activity, or a previously undiscovered nest is found within said radius after work begins, all work should cease immediately and the Service contacted for further guidance. If a Hawaiian stilt appears within 100 feet of ongoing work at any time during the construction phase of the proposed project, all activity should be temporarily suspended until the bird moves off to a safe distance of its own volition.

- The Hawaiian petrel, Newell's shearwater and wedge-tailed shearwater, collectively referred to as seabirds, may transit through the proposed action area while flying between the ocean and nesting sites in the mountains and along the coastline during their breeding season (March through December). Seabird fatalities resulting from collisions with artificial structures that extend above the surrounding vegetation have been documented in Hawaii where high densities of transiting seabirds occur. Additionally, artificial lighting, such as flood lighting for construction work and site security, can adversely impact seabirds by causing disorientation which may result in collision with utility lines, buildings, fences, and vehicles. Fledging seabirds are especially affected by artificial lighting and have a tendency to exhaust themselves while circling the light sources and become grounded. Too weak to fly, these birds become vulnerable to depredation by feral predators such as dogs, cats, and mongoose. Therefore, the Service recommends that project-related lighting should be minimized. All project-related lights should be shielded so the bulb is not visible at or above bulb-height. According to guidelines in the Draft EA, all construction activities will take place during daytime hours. Should night-time construction work become necessary, lighting will be appropriately down-shielded, and the project will limit night work during the seabird fledging season (approximately September 15 through December 15).

The Service also recommends that a biosecurity assessment be conducted to address the potential impacts of invasive species introduction and transport due to the advent of construction-related materials and heavy vehicles into the action area during the construction phase of the proposed project. Accordingly, the Service can provide guidelines for invasive species containment and mitigation through Best Management Practices upon request. The biosecurity assessment should also include future and cumulative impacts related to both listed species and invasive species associated with the proposed action.



*Aquatic Resources*

It is understood that the project is in the early planning phase and that additional State and Federal permits will also be sought to authorize work impacting the stream and adjacent wetlands. The project design will include best management practices to avoid and minimize impacts to freshwater and marine aquatic resources during construction of the project. The Service recommends designing the project to enable continued passage of native stream fauna during flood conditions, and to capture and appropriately treat additional storm water run-off caused by the increase in impervious surface.

If you have any questions concerning the recommendations or comments provided in this letter, please contact Ian Bordenave, Fish and Wildlife Biologist, at (808) 792-9400.

Sincerely,

Jess Newton for

Loyal Mehrhoff
Field Supervisor

cc: Lasha Salbosa, Division of Forestry and Wildlife

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

November 9, 2015

Mr. Douglas Krofta, Acting Field Supervisor
United States Department of the Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawai'i 96850

Subject: Draft Environmental Assessment
for Kūlanihāko'i Bridge Replacement
Kīhei, Maui, Hawai'i
TMK: (2) 3-9-001:015 (por.), 147 (por.), 162 (por.)
and South Kīhei Road Right-of-Way (por.)

Dear Mr. Krofta:

Thank you for your letter dated August 2, 2013 regarding the subject Draft EA. We would like to take this opportunity to provide a response.

We appreciate the information on possible endangered species of concern which may occur within, or transit through the proposed project area. The information on avoidance and minimization measures on listed species is also appreciated. As the project moves forward, applicable avoidance and minimization measures will be coordinated with the Fish and Wildlife Service.

Your letter, along with this response, will be reproduced and included in the forthcoming Final EA. We appreciate your participation in the Draft EA review process.

Sincerely,

DAVID C. GOODE
Director of Public Works

DG/WYK (ED15-1166)
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cc. Mr. Will Spence, Department of Planning
Mr. Milton Arakawa, Wilson Okamoto Corporation

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ENGINEERING DIVISION
DEPARTMENT OF PUBLIC WORKS

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Pacific Islands Water Science Center
677 Ala Moana Blvd., Suite 415
Honolulu, Hawaii 96813
Phone: (808) 587-2400/Fax: (808) 587-2401

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July 18, 2013

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Return to_____ Due_____
By:_____ Date:_____

Mr. David Goode, Director
Department of Public Works
County of Maui
Attn: Ms. Wendy Kobashigawa
200 South High Street, 4th Floor
Wailuku, Hawaii 96793

Mr. William Spence, Director
Department of Planning
County of Maui
Attn: Ms. Anna Benesovska
250 South High Street
Wailuku, Hawaii 96793

Dear Mr. Goode and Mr. Spence:

Subject: Joint Review for Draft Environmental Assessment (EA), Application for Special Management Area (SMA) Use Permit (Major) and Shoreline Setback Variance (SSV) Permit, Kulanihakoi Bridge Replacement, Wailuku, Island of Maui, Hawaii

Thank you for forwarding the subject Draft EA for review and comment by the staff of the U.S. Geological Survey Pacific Islands Water Science Center. We regret however, that due to prior commitments and lack of available staff time, we are unable to review this document.

We appreciate the opportunity to participate in the review process.

Sincerely,

Stephen S. Anthony
Center Director

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

November 9, 2015

Mr. Stephen S. Anthony
Center Director
U.S. Department of the Interior
U.S. Geological Survey
Pacific Islands Water Science Center
677 Ala Moana Boulevard, Suite 415
Honolulu, Hawai'i 96813

Subject: Draft Environmental Assessment
for Kūlanihāko'i Bridge Replacement
Kīhei, Maui, Hawai'i
TMK: (2) 3-9-001:015 (por.), 147 (por.), 162 (por.)
and South Kīhei Road Right-of-Way (por.)

Dear Mr. Anthony:

Thank you for your letter dated July 18, 2013 regarding the subject Draft EA. We would like to note that your letter, along with this response, will be reproduced and included in the forthcoming Final EA. We appreciate your participation in the Draft EA review process.

Sincerely,

DAVID C. GOODE
Director of Public Works

DG/WYK (ED15-1167)
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cc. Mr. Will Spence, Department of Planning
Mr. Milton Arakawa, Wilson Okamoto Corporation

184

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

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COUNTY OF MAUI
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ENGINEERING DIVISION
DEPARTMENT OF PUBLIC WORKS

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

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

In reply, please refer to:
EMD/CWB

08014PGH.13

August 5, 2013

Mr. David Goode
Director
Department of Public Works
County of Maui
200 South High Street, 4th Floor
Wailuku, Hawaii 96793

Attention: Ms. Wendy Kobashigawa

Mr. William Spence
Director
Department of Planning
County of Maui
One Main Plaza
2200 Main Street, Suite 619
Wailuku, Hawaii 96793

Dear Messrs. Goode and Spence:

**SUBJECT: Comments on the Draft Environmental Assessment (EA) Application for Special Management Area (SMA) Use Permit (Major) and Shoreline Setback Variance (SSV) Permit Kulanihakoi Bridge Replacement Wailuku, Island of Maui, Hawaii**

The Department of Health (DOH), Clean Water Branch (CWB), acknowledges receipt of your letters, dated July 3 and 18, 2013, requesting comments on your project. The DOH-CWB has reviewed the subject document and offers these comments. Please note that our review is based solely on the information provided in the subject document and its compliance with the Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. You may be responsible for fulfilling additional requirements related to our program. We recommend that you also read our standard comments on our website at: http://health.hawaii.gov/epo/files/2013/05/CWB-standardcomment.pdf.

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

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

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

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

2. You may be required to obtain a National Pollutant Discharge Elimination System (NPDES) permit for discharges of wastewater, including storm water runoff, into State surface waters (HAR, Chapter 11-55). An application for an NPDES individual permit must be submitted at least 180 calendar days before the commencement of the discharge. To request NPDES permit coverage, you must submit the CWB Individual NPDES Form through the e-Permitting Portal and the hard copy certification statement with $1,000 filing fee. Please open the e-Permitting Portal website at: https://eha-cloud.doh.hawaii.gov/epermit/View/home.aspx. You will be asked to do a one-time registration to obtain your login and password. After you register, click on the Application Finder tool and locate the "CWB Individual NPDES Form." Follow the instructions to complete and submit this form.

3. If your project involves work in, over, or under waters of the United States, it is highly recommend that you contact the Army Corp of Engineers, Regulatory Branch (Tel: 438-9258) regarding their permitting requirements.

   Pursuant to Federal Water Pollution Control Act [commonly known as the "Clean Water Act" (CWA)], Paragraph 401(a)(1), a Section 401 Water Quality Certification (WQC) is required for "[a]ny applicant for Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may **result** in any discharge into the navigable waters..." (emphasis added). The term "discharge" is defined in CWA, Subsections 502(16), 502(12), and 502(6); Title 40 of the Code of Federal Regulations, Section 122.2; and HAR, Chapter 11-54.

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



If you have any questions, please visit our website at: http://health.hawaii.gov/cwb/, or contact the Engineering Section, CWB, at (808) 586-4309.

Sincerely,

Alec Wong

ALEC WONG, P.E., CHIEF
Clean Water Branch

GH:np

c: Ms. Wendy Kobashigawa, Department of Public Works, County of Maui
Mr. William Spence, Department of Planning, County of Maui

246

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

RECEIVED
2013 SEP 27 PM 3:03
COUNTY OF MAUI
PUBLIC WORKS

RECEIVED
COUNTY OF MAUI
2013 OCT 1 AM 10:20

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

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

In reply, please refer to:
EMD/CWB

☐ RUSH

DEPT. OF PUBLIC WORKS

| | INFO | ACTION | SEE ME | COMMENTS | COPY | FILE |
|---|---|---|---|---|---|---|
| DIRECTOR | | | | | | |
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Return to_____ Due_____
By:_____ Date:_____

09077PJF.13

September 25, 2013

Mr. David Goode
Director
Department of Public Works
County of Maui
200 S. High Street
Wailuku, Hawaii 96793

Attention: Ms. Wendy Kobashigawa

Dear Mr. Goode:

**SUBJECT: Comments on Joint Review for Draft Environmental Assessment (DEA), Application for Special Management Area (SMA) Use Permit (Major) and Shoreline Setback Variance (SSV) Permit Kulanihakoi Bridge Replacement Wailuku, Island of Maui, Hawaii**

The Department of Health (DOH), Clean Water Branch (CWB), acknowledges receipt of your letter, dated July 3, 2013, requesting comments on your project. The DOH-CWB has reviewed the subject document and offers these comments. Please note that our review is based solely on the information provided in the subject document and its compliance with the Hawaii Administrative Rules (HAR), Chapters 11-54, and 11-55. You may be responsible for fulfilling additional requirements related to our program. We recommend that you also read our standard comments on our website at: http://health.hawaii.gov/cwb/env-planning/landuse/CWB-standardcomment.pdf.

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

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

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

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



2. You may be required to obtain a National Pollutant Discharge Elimination System (NPDES) permit for discharges of wastewater, including storm water runoff, into State surface waters (HAR, Chapter 11-55). An application for an NPDES individual permit must be submitted at least 180 calendar days before the commencement of the discharge. To request NPDES permit coverage, you must submit the CWB Individual NPDES Form through the e-Permitting Portal and the hard copy certification statement with $1,000 filing fee. Please open the e-Permitting Portal website at: https://eha-cloud.doh.hawaii.gov/epermit/View/home.aspx. You will be asked to do a one-time registration to obtain your login and password. After you register, click on the Application Finder tool and locate the "CWB Individual NPDES Form." Follow the instructions to complete and submit this form.

3. If your project involves work in, over, or under waters of the United States, it is highly recommended that you contact the Army Corp of Engineers, Regulatory Branch (Tel: 438-9258) regarding their permitting requirements.

   Pursuant to Federal Water Pollution Control Act [commonly known as the "Clean Water Act" (CWA)], Paragraph 401(a)(1), a Section 401 Water Quality Certification (WQC) is required for "[a]ny applicant for Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may **result** in any discharge into the navigable waters..." (emphasis added). The term "discharge" is defined in CWA, Subsections 502(16), 502(12), and 502(6); Title 40 of the Code of Federal Regulations, Section 122.2; and HAR, Chapter 11-54.

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

If you have any questions, please visit our website at: http://health.hawaii.gov/cwb/index.html, or contact the Engineering Section, CWB, at (808) 586-4309.

Sincerely,

ALEC WONG, P.E., CHIEF
Clean Water Branch

JF:rh

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

November 9, 2015

Mr. Alec Wong, P.E., Chief
Clean Water Branch
State of Hawai'i
Department of Health
P.O. Box 3378
Honolulu, Hawai'i 96801-3378

Subject: Draft Environmental Assessment
for Kūlanihāko'i Bridge Replacement
Kīhei, Maui, Hawai'i
TMK: (2) 3-9-001:015 (por.), 147 (por.), 162 (por.)
and South Kīhei Road Right-of-Way (por.)

Dear Mr. Wong:

Thank you for your letters dated August 5, 2013 and September 25, 2013 regarding the subject Draft EA. We would like to take this opportunity to provide a response.

We appreciate the information provided on the applicability of Chapters 11-54 and 11-55, Hawai'i Administrative Rules, National Pollutant Discharge Elimination System, and Section 401 Water Quality Certification provisions. We intend to work cooperatively with your office in providing the requisite application submittals. We have also been in discussion with the Army Corps of Engineers and intend to work with them toward adequately fulfilling applicable regulatory requirements.

Your letter, along with this response, will be reproduced and included in the forthcoming Final EA. We appreciate your participation in the Draft EA review process.

Sincerely,

DAVID C. GOODE
Director of Public Works

DG/WYK (ED15-1162)
S:\ENG\PROJECTS\01 FAP\BR\BR-3100(015) Kulanihakoi Bridge Replacement\C Environmental\EA\FINAL EA\ED15-1162 Response to SoH DOH CWB.docx

cc. Mr. Will Spence, Department of Planning
Mr. Milton Arakawa, Wilson Okamoto Corporation

---

☐ RUSH

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Return to _____ Due _____
By: _____ Date: _____

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

LORETTA J. FUDDY
DIRECTOR OF HEALTH

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COUNTY OF MAUI
2013 JUL 25 AM 10: 16
In reply, please refer to:
File:
ENGINEERING DIVISION
DEPARTMENT OF PUBLIC WORKS

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2013 JUL 23 PM 2: 51
COUNTY OF MAUI
PUBLIC WORKS

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

July 19, 2013

TO: David Goode, Director
Department of Public Works

FROM: Laura McIntyre, Manager
Department of Health, Environmental Planning Office

SUBJECT: **Joint Review for Draft Environmental Assessment, Application for Special Management Area Use Permit, and Shoreline Setback Variance Permit, Kulanihakoi Bridge Replacement, Wailuku, Island of Maui, Hawaii**

The Department of Health (DOH), Environmental Planning Office (EPO), acknowledges receipt of your letter dated July 3, 2013. Thank you for allowing us to review and comment on the subject letter. The letter was routed to the Department of Health's Clean Water and Indoor & Radiological Health Branches, as well the Maui District Health Office. They will provide specific comments to you if necessary. EPO recommends that you review the Standard Comments found on our website: http://health.hawaii.gov/epo/home/landuse-planning-review-program/. You are required to adhere to all Standard Comments specifically applicable to this application.

EPO suggests that you examine the many sources available on strategies to support the sustainable design of communities, including the following:

- U.S. Environmental Protection Agency's report, "Creating Equitable, Health and Sustainable Communities: Strategies for Advancing Smart Grants, Environmental Justice, and Equitable Development" (Feb. 2013), http://www.epa.gov/smartgrowth/pdf/equitable-dev/equitable-development-report-508-011713b.pdf;
- U.S. Environmental Protection Agency's sustainability programs: www.epa.gov/sustainability;
- U.S. Green Building Council's LEED program: www.new.usgbc.org/leed; and World Health Organization, www.who.int/hia

The DOH encourages everyone to apply these sustainability strategies and principles early in the planning and review of projects. We also request that for future projects you consider conducting a Health Impact Assessment (HIA). More information is available at: www.cdc.gov/healthyplaces/hia.htm. We request you share all of this information with others to increase community awareness on sustainable, innovative, inspirational, and healthy community design.

We request a written response confirming receipt of this letter and any other letters you receive from DOH in regards to this submission. You may mail your response to 919 Ala Moana Blvd., Ste. 312, Honolulu, Hawaii 96814. However, we would prefer an email submission to: epo@doh.hawaii.gov. We anticipate that our letter(s) and your response(s) will be included in the final document. If you have any questions, please contact me at (808) 586-4337.

c: Mr. William Spence, Director, Department of Planning, County of Maui

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

November 9, 2015

Ms. Laura McIntyre, Manager
Environmental Planning Office
State of Hawai'i
Department of Health
P.O. Box 3378
Honolulu, Hawai'i 96801-3378

Subject: Draft Environmental Assessment
for Kūlanihāko'i Bridge Replacement
Kīhei, Maui, Hawai'i
TMK: (2) 3-9-001:015 (por.), 147 (por.), 162 (por.)
and South Kīhei Road Right-of-Way (por.)

Dear Ms. McIntyre:

Thank you for your letter dated July 19, 2013 regarding the subject Draft EA. We would like to take this opportunity to provide a response.

We appreciate your recommendation to review the DOH's Standard Comments on your website. We intend to adhere to all applicable comments. Thank you also for the references on sustainable design of communities as well as the information regarding the health impact assessment. We will review this information for possible applicability to the project.

Your letter, along with this response, will be reproduced and included in the forthcoming Final EA. We appreciate your participation in the Draft EA review process.

Sincerely,

DAVID C. GOODE
Director of Public Works

DG/WYK (ED15-1163)
S:\ENG\PROJECTS\01 FAP\BR\BR-3100(015) Kulanihakoi Bridge Replacement\C Environmental\EA\FINAL EA\ED15-1163 Response to SoH DOH Env Plng.docx

cc. Mr. Will Spence, Department of Planning
Mr. Milton Arakawa, Wilson Okamoto Corporation

---

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

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

LORRIN W. PANG, M.D., M.P.H.
DISTRICT HEALTH OFFICER

**STATE OF HAWAII**
**DEPARTMENT OF HEALTH**
**MAUI DISTRICT HEALTH OFFICE**
54 HIGH STREET
WAILUKU, HAWAII 96793

RECEIVED
COUNTY OF MAUI
2013 AUG -8 PM 1:55
ENGINEERING DIVISION
DEPARTMENT OF PUBLIC WORKS

August 7, 2013

Mr. David Goode
Director
Department of Public Works
County of Maui
200 South High Street, 4th Floor
Wailuku, Hawai'i 96793

Attention: Ms. Wendy Kobashigawa

Mr. William R. Spence
Director
Department of Planning
County of Maui
2200 Main Street, Suite 619
Wailuku, Hawaii 96793

Attention: Ms. Anna Benesovska

Dear Mr. Goode and Mr. Spence:

**Subject:** **Joint Review for Draft Environmental Assessment, Application for Special Management Area (SMA) Use Permit (Major), and Shoreline Setback Variance (SSV) Permit for Kulanihakoi Bridge Replacement, Maui, Hawaii**
**Applicant:** **County of Maui, Department of Public Works and Department of Planning**
**Project Description:** **Kulanihakoi Bridge Replacement**

Thank you for the opportunity to review the complete Draft Environmental Assessment, as well as the PDF of the SMA Use Permit (Major) and SSV Permit application. We have the following comments to add to our letter dated July 31, 2013:

The project may need to obtain a Section 401 Water Quality Certification (WQC) from the Clean Water Branch. Please contact the Clean Water Branch at 808 586-4309.

Mr. David Goode
Mr. William R. Spence
August 7, 2013
Page2

It is strongly recommended that the Standard Comments found at the Department's website: http://health.hawaii.gov/epo/home/landuse-planning-review-program/ be reviewed, and any comments specifically applicable to this project should be adhered to.

Should you have any questions, please call me at 808 984-8230 or E-mail me at patricia.kitkowski@doh.hawaii.gov.

Sincerely,

Patti Kitkowski

Patti Kitkowski
District Environmental Health Program Chief

c EPO


ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division


November 9, 2015

Ms. Patti Kitkowski
District Environmental Health Program Chief
State of Hawai'i
Department of Health
Maui District Health Office
54 South High Street
Wailuku, Hawai'i 96793

Subject: Draft Environmental Assessment
for Kūlanihāko'i Bridge Replacement
Kīhei, Maui, Hawai'i
TMK: (2) 3-9-001:015 (por.), 147 (por.), 162 (por.)
and South Kīhei Road Right-of-Way (por.)

Dear Ms. Kitkowski:

Thank you for your letter dated August 7, 2013 regarding the subject Draft EA. We would like to take this opportunity to provide a response.

We appreciate your recommendation to contact the Clean Water Branch regarding possible applicability of Section 401 Water Quality Certification provisions. We intend to work cooperatively with the Clean Water Branch in providing the requisite application submittals. We appreciate the recommendation to review DOH's Standard Comments and intend to comply with applicable comments.

Your letter, along with this response, will be reproduced and included in the forthcoming Final EA. We appreciate your participation in the Draft EA review process.

Sincerely,

DAVID C. GOODE
Director of Public Works

DG/WYK (ED15-1164)
S:\ENG\PROJECTS\01 FAP\BR\BR-3100(015) Kulanihakoi Bridge Replacement\C Environmental\EA\FINAL EA\ED15-1164 Response to SoH DOH Maui.docx

cc. Mr. Will Spence, Department of Planning
Mr. Milton Arakawa, Wilson Okamoto Corporation

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

August 13, 2013

County of Maui
Department of Public Works
Attention: Ms. Wendy Kobashigawa via email: wendy.kobashigawa@co.maui.hi.us
200 S. High Street, 4th Floor
Wailuku, Hawaii 96793

County of Maui
Department of Planning
Attention: Ms. Anna Benesovsks via email: anna.benesovsks@co.maui.hi.us
250 South High Street
Wailuku, Hawaii 96793

Dear Ms. Kobashigawa and Ms. Benesovsks:

*SUBJECT:* Joint Review for Draft Environmental Assessment (EA), Application for Special Management Area (SMA) Use Permit (Major) and Shoreline Setback Variance (SSV) Permit – Kulanihako'i Bridge Replacement

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 the Engineering Division on the subject matter. Should you have any questions, please feel free to call Lydia Morikawa at 587-0410. Thank you.

Sincerely,

Russell Y. Tsuji
Land Administrator

Enclosure(s)
cc: Central Files

---

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

July 11, 2013

RECEIVED
LAND DIVISION
2013 JUL 25 PM 2:26
DEPT. OF LAND & NATURAL RESOURCES STATE OF HAWAII

**MEMORANDUM**

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

TO: FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Joint Review for Draft Environmental Assessment (EA), Application for Special Management Area (SMA) Use Permit (Major) and Shoreline Setback Variance (SSV) Permit – Kulanihako'i Bridge Replacement
LOCATION: Wailuku, Island of Maui; TMK: (2) 3-9-001:015, 147 & 162
APPLICANT: County of Maui, Department of Public Works

'13 JUL 12 AM 09:47 ENGINEERING

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by August 5, 2013.

*Only one (1) copy of the CD is available for your review in Land Division office, Room 220.*

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 Lydia Morikawa at 587-0410. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(✓) Comments are attached.

Signed:
Print Name: Carty S. Chong, Chief Engineer
Date: 7/23/13

cc: Central Files

**DEPARTMENT OF LAND AND NATURAL RESOURCES**
**ENGINEERING DIVISION**

**LD/LMorikawa**
**Ref.: KulanihakoiBrReplacementDEA**
**Maui:608**

**COMMENTS**

**( X)** **We confirm that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Zones AE and VE. The National Flood Insurance Program regulates developments within Zones AE and VE as indicated in bold letters below.**

( ) Please take note that the project site, according to the Flood Insurance Rate Map (FIRM), is also located in Zone ____.

( ) Please note that the correct Flood Zone Designation for the project site according to the Flood Insurance Rate Map (FIRM) is ___.

**(X)** **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 or Ms. Ardis Shaw-Kim art (808) 768-8296 of the City and County of Honolulu, Department of Planning and Permitting.

**(X)** **Mr. Carolyn Cortez at (808) 270-7813 of the County of Maui, Department of Planning.**

( ) Ms. Maile Aiu at (808) 241-4884 of the County of Kauai, Department of Public Works.

( ) The applicant should include water demands and infrastructure required to meet project needs. Please note that projects within State lands requiring water service from the Honolulu Board of Water Supply system will be required to pay a resource development charge, in addition to Water Facilities Charges for transmission and daily storage.

( ) 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.

**(X)** **Other: For the proposed Kulanihakoi Bridge replacement and miscellaneous improvements, we offer the following suggestions:**

1. **If utilities (sewer, gas, water, etc.) are to be suspended along the bridge structure, they should be located and constructed to minimize flood damage, leakage and prevent snagging of debris.**

2. **The proposed bridge replacements and realignment should not impede the storm water carrying capacity of the body of water it crosses.**

3. **A scour analysis should be conducted to ensure that the design of the structure will minimize erosion of the foundation. If the channel opening at the structure is widened, evaluate downstream reaches to provide for adequate capacity and erosion.**

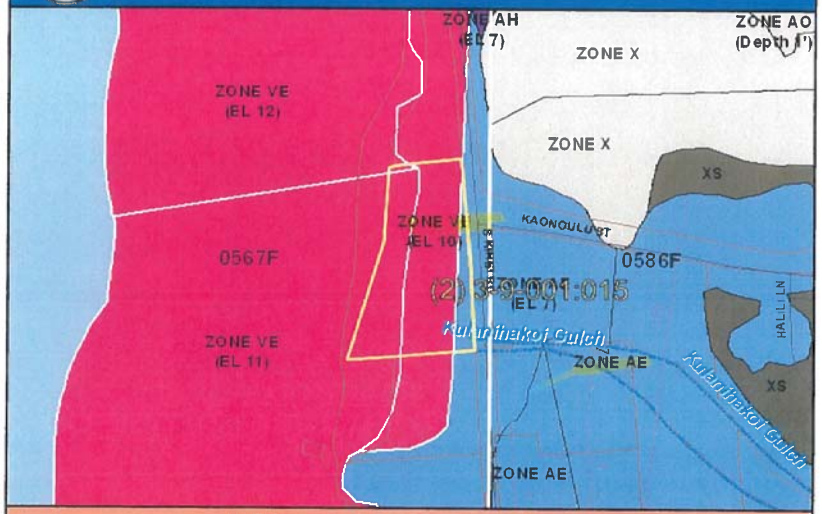
Should you have any questions, please call Ms. Suzie S. Agraan of the Planning Branch at 587-0258.

Signed: _____
CARTY CHANG, CHIEF ENGINEER

Date: _____

State of Hawaii

# FLOOD HAZARD ASSESSMENT REPORT




## NATIONAL FLOOD INSURANCE PROGRAM

### 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: | MAUI |
| TMK NO: | (2) 3-9-001-015 |
| PARCEL ADDRESS: | 640 S KIHEI RD<br>KIHEI, HI 96753 |
| FIRM INDEX DATE: | SEPTEMBER 19, 2012 |
| LETTER OF MAP CHANGE(S): | NONE |
| FEMA FIRM PANEL(S): | 1500030567F |
| PANEL EFFECTIVE DATE: | SEPTEMBER 19, 2012 |

| | |
|---|---|
| PARCEL DATA FROM: | MAY 2012 |
| IMAGERY DATA FROM: | MAY 2005 |

### IMPORTANT PHONE NUMBERS

| | |
|---|---|
| County NFIP Coordinator | |
| County of Maui | |
| Carolyn Cortez | (808) 270-7253 |
| 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.*

---


ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division


November 9, 2015

Russell Y. Tsuji, Esq.
Land Administrator
State of Hawai'i
Department of Land and Natural Resources
Land Division
P.O. Box 621
Honolulu, Hawai'i 96809

Subject: Draft Environmental Assessment
for Kūlanihāko'i Bridge Replacement
Kīhei, Maui, Hawai'i
TMK: (2) 3-9-001:015 (por.), 147 (por.), 162 (por.)
and South Kīhei Road Right-of-Way (por.)

Dear Mr. Tsuji:

Thank you for your letter dated August 13, 2013 regarding the subject Draft EA. We would like to take this opportunity to provide a response.

We appreciate the information provided by the Engineering Division. We acknowledge that we must comply with applicable provisions of the National Flood Insurance Program. We will be coordinating the design with the Engineering Division and the County Flood Coordinator.

We appreciate your suggestion on utilities being suspended along the bridge structure. There are existing water and wastewater lines located mauka of the existing bridge. Construction plans will be reviewed by the applicable responsible County agency prior to implementation. At the present time, there are no plans to suspend these lines from the bridge structure. It is noted that the storm water carrying capacity of the culverts will be increased slightly. We will review the issue of whether a scour analysis is needed for this particular project. However, we would note that the project involves culvert replacement where the culverts have a concrete bottom. Moreover, the project is located in a relatively dry area of the island as part of a gulch with intermittent flows. Abutting areas of the gulch are typically in standing water as part of a *muliwai*. Thus, scour analysis may not be warranted.

Your letter, along with this response, will be reproduced and included in the forthcoming Final EA. We appreciate your participation in the Draft EA review process.

Sincerely,

DAVID C. GOODE
Director of Public Works

DG/WYK(ED15-1161)
S:\ENG\PROJECTS\01 FAP\BR\BR-3100(015) Kulanihakoi Bridge Replacement\C Environmental\EA\FINAL EA\ED15-1161 Response to DLNR.docx

cc. Will Spence, Department of Planning
Milton Arakawa, Wilson Okamoto Corporation

---

NEIL ABERCROMBIE
GOVERNOR

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
JADE T. BUTAY
FORD N. FUCHIGAMI
RANDY GRUNE
JADINE URASAKI

IN REPLY REFER TO:
DIR 0966
STP 8.1255

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

July 12, 2013

RECEIVED
COUNTY OF MAUI
2013 JUL 18 PM 2:30
ENGINEERING DIVISION
DEPARTMENT OF PUBLIC WORKS

Mr. David Goode
Director
County of Maui
Department of Public Works
200 South High Street
Wailuku, Hawaii 96793

and

Mr. William Spence
Director
County of Maui
Department of Planning
250 South High Street
Wailuku, HI 96793

Dear Messrs. Goode and Spence:

Subject: Kulanihakoi Bridge Replacement
Draft Environmental Assessment (DEA),
Special Management Area (SMA) Use Permit (Major),
and Shoreline Setback Variance (SSV) Permit Applications
TMK: (2) 2-3-9001:999

Thank you for requesting the State Department of Transportation's (DOT) review of the subject project.

DOT understands the Maui County Department of Public Works (DPW) proposes to replace the existing deteriorated bridge with a new bridge.

Given the project location and the nature of the project it is not expected to significantly impact the State highway facility. However, the DPW is required to obtain a permit from DOT Highways Division, Maui District Office for the transport of oversized and /or overweight materials and equipment on State highway facilities.

DOT appreciates the opportunity to provide comments. If there are any other questions, please contact Mr. Garrett Smith of the DOT Statewide Transportation Planning Office at telephone number (808) 831-7976.

Very truly yours,

GLENN M. OKIMOTO, Ph.D.
Director of Transportation

ET:an

c: Ms. Anna Benesovska, County of Maui, Planning Department
Ms. Wendy Kobashigawa, County of Maui, Department of Public Works

bc: HWY-M (w/incoming), HWY-P (w/incoming), STP-M (13-DEA-069)

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

November 9, 2015

Mr. Ford Fuchigami, Director
State of Hawai'i
Department of Transportation
869 Punchbowl Street
Honolulu, Hawai'i 96813-5097

Subject: Draft Environmental Assessment
for Kūlanihāko'i Bridge Replacement
Kīhei, Maui, Hawai'i
TMK: (2) 3-9-001:015 (por.), 147 (por.), 162 (por.)
and South Kīhei Road Right-of-Way (por.)

Dear Mr. Fuchigami:

Thank you for your letter dated July 12, 2013 regarding the subject Draft EA. We would like to take this opportunity to provide a response.

We appreciate the information that the proposed project is not expected to significantly impact the State highway facility. It is acknowledged that a permit from the DOT Highways Division, Maui District Office is needed for the transport of oversized and/or overweight materials and equipment on State highway facilities.

Your letter, along with this response, will be reproduced and included in the forthcoming Final EA. We appreciate your participation in the Draft EA review process.

Sincerely,

DAVID C. GOODE
Director of Public Works

DG/WYK (ED15-1165)
S:\ENG\PROJECTS\01 FAP\BR\BR-3100(015) Kulanihakoi Bridge Replacement\C Environmental\EA\FINAL EA\ED15-1165 Response to SoH DOT.docx

cc. Mr. Will Spence, Department of Planning
Mr. Milton Arakawa, Wilson Okamoto Corporation

ALAN M. ARAKAWA
MAYOR

JEFFREY A. MURRAY
CHIEF

ROBERT M. SHIMADA
DEPUTY CHIEF

RECEIVED
COUNTY OF MAUI RECEIVED
2013 JUL 24 AM 9:05 8 JUL 18 PM 1:45
ENGINEERING DIVISION COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS PUBLIC WORKS

**COUNTY OF MAUI**
DEPARTMENT OF FIRE AND PUBLIC SAFETY
FIRE PREVENTION BUREAU

313 MANEA PLACE • WAILUKU, HAWAII 96793
(808) 244-9161 • FAX (808) 244-1363

832 ☐ RUSH

DEPT. OF PUBLIC WORKS

| | INFO | ACTION | SEE ME | COMMENTS | COPY | FILE |
|---|---|---|---|---|---|---|
| DIRECTOR | ✓ | | | | | |
| DEPUTY DIR. | | | | | | |
| PERS. | | | | | | |
| DSA | ✓ | | | | | |
| ENGR. | | | | | | |
| HWY. | | | | | | |
| SECTY. | | | | | | |

Return to_____ Due_____
By:_____ Date:_____

July 11, 2013

David Goode
Director
Department of Public Works
County of Maui

Subject: Kulanihakoi Bridge Replacement
South Kihei Road

Dear Mr. Goode

Thank you for the opportunity to review and comment on the subject application. At this time the Fire Prevention Bureau request that advance notification be provided to Kihei, Wailuku, Kahului and Wailea Fire Station on the road closer during the construction phase of this project.

If you have any questions, please call me at 244-9161 ext. 24

Sincerely,

Scott English
Fire Plans Examiner

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

November 3, 2015

Mr. Scott English
Fire Plans Examiner
County of Maui
Department of Fire and Public Safety
Fire Prevention Bureau
313 Manea Place
Wailuku, Hawai'i 96793

Subject: Draft Environmental Assessment
for Kūlanihāko'i Bridge Replacement
Kīhei, Maui, Hawai'i
TMK: (2) 3-9-001:015 (por.), 147 (por.), 162 (por.)
and South Kīhei Road Right-of-Way (por.)

Dear Mr. English:

Thank you for your letter dated July 11, 2013 regarding the subject Draft EA. We would like to take this opportunity to provide a response.

We note that we will notify the Kīhei, Wailuku, Kahului and Wailea Fire Stations of the construction schedule for the new bridge and temporary detour road and bridge as it gets closer to the actual construction date.

Your letter, along with this response, will be reproduced and included in the forthcoming Final EA. We appreciate your participation in the Draft EA review process.

Sincerely,

DAVID C. GOODE
Director of Public Works

DG/WYK(ED15-1156)
S:\ENG\PROJECTS\01 FAP\BR\BR-3100(015) Kulanihakoi Bridge Replacement\C Environmental\EA\FINAL EA\ED15-1156 Response to CoM Fire (English).docx

cc. Mr. Will Spence, Department of Planning
Mr. Milton Arakawa, Wilson Okamoto Corporation

**Alan M. Arakawa**
**Mayor**

**JEFFREY A. MURRAY**
**FIRE CHIEF**

**ROBERT M. SHIMADA**
**DEPUTY FIRE CHIEF**

**County of Maui**
**Department of Fire and Public Safety**
**Fire Prevention Bureau**
**313 Manea Place - Wailuku, Hawaii 96793**
**(808) 244-9161 - Fax (808) 244-1363**

**August 13, 2013**

**To :** Mr. David Goode
Director, Public Works
Attn: Wendy Kobashigawa

Mr. Will Spence
Director, Department of Planning

**Re : Kulanihako'i Bridge Replacement**
**Kihei, Maui, HI**

Dear Sirs:

Thank for the allowing the Department of Fire and Public Safety the opportunity to comment on the proposed project. At this time, our office restates the following comments that were provided to Wilson Okamoto Corporation in December 2012:

- Our office requests that the minimum clear width of the bridge after repair be at least 20 feet (the minimum width for fire apparatus access) to allow for fire apparatus access.
- The project must be able to support the weight of the heaviest fire apparatus in district; which would be the ladder truck at the Wailea Station with a GVW of 70,000 #.

These specifics should apply to the temporary detour road in place while the project is being completed.

If there are any questions or comments, please feel free to contact me at 244-9161 ext. 23.

Sincerely,

Paul Haake
Captain, Fire Prevention Bureau

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

November 2, 2015

Mr. Paul Haake
Captain, Fire Prevention Bureau
County of Maui
Department of Fire and Public Safety
Fire Prevention Bureau
313 Manea Place
Wailuku, Hawai'i 96793

Subject: Draft Environmental Assessment
for Kūlanihāko'i Bridge Replacement
Kīhei, Maui, Hawai'i
TMK: (2) 3-9-001:015 (por.), 147 (por.), 162 (por.)
and South Kīhei Road Right-of-Way (por.)

Dear Mr. Haake:

Thank you for your letter dated August 13, 2013 regarding the subject Draft EA. We would like to take this opportunity to provide a response.

The proposed permanent bridge as well as the temporary detour bridge is designed to have a minimum clear width of at least 20 feet and will be able to support the heaviest fire apparatus at the Wailea Station which has a gross vehicle weight of 70,000 pounds.

Your letter, along with this response, will be reproduced and included in the forthcoming Final EA. We appreciate your participation in the Draft EA review process.

Sincerely,

DAVID C. GOODE
Director of Public Works

DG/WYK(ED15-1157)
S:\ENG\PROJECTS\01 FAP\BR\BR-3100(015) Kulanihakoi Bridge Replacement\C Environmental\EA\FINAL EA\ED15-1157 Response to CoM Fire (Haake).docx

cc. Mr. Will Spence, Department of Planning
Mr. Milton Arakawa, Wilson Okamoto Corporation

192

ALAN M. ARAKAWA
Mayor

GLENN T. CORREA
Director

BRIANNE SAVAGE
Deputy Director

(808) 270-7230
FAX (808) 270-7934

**DEPARTMENT OF PARKS & RECREATION**
700 Hali'a Nakoa Street, Unit 2, Wailuku, Hawaii 96793

August 2, 2013

RECEIVED
COUNTY OF MAUI
2013 AUG -9 AM 9:06
ENGINEERING DIVISION
DEPARTMENT OF PUBLIC WORKS

Mr. David Goode, Director
Department of Public Works
County of Maui
200 South High Street, 4th Floor
Wailuku, Hawaii, 96793

Mr. William Spence, Director
Department of Planning
2200 Main Street, Suite 619
Wailuku, Hawaii 96793

Dear Mr. Goode and Mr. Spence:

**SUBJECT: JOINT REVIEW FOR COMPLETE DRAFT ENVIRONMENTAL ASSESSMENT (EA), SPECIAL MANAGEMENT AREA (SMA) USE PERMIT (MAJOR) AND SHORELINE SETBACK VARIANCE (SSV) PERMIT**
**KULANIHAKOI BRIDGE REPLACEMENT**
**KIHEI, ISLAND OF MAUI, HAWAII**

Thank you for the opportunity to review and comment on the complete Draft Environmental Assessment (EA), Special Management Area (SMA) Use Permit (Major) and Shoreline Setback Variance (SSV) Permit Applications for the Kulanihakoi Bridge Replacement. As the proposed construction will impact the Kalepolepo Park, our Department would like to be kept informed of the construction schedule and any anticipated closures in the area.

Please feel free to contact me or Robert Halvorson, Chief of Planning and Development, at 270-7931, should you have any questions.

Sincerely,

Brianne Savage
FOR
GLENN T. CORREA
Director of Parks and Recreation

c: Brianne Savage, Deputy Director
Robert Halvorson, Chief of Planning and Development
Wendy Kobashigawa, Department of Public Works

GTC:RH:kp

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

November 2, 2015

Mr. Kaala Buenconsejo, Director
County of Maui
Department of Parks and Recreation
700 Hali'a Nakoa Street, Unit 2
Wailuku, Hawai'i 96793

Subject: Draft Environmental Assessment
for Kūlanihāko'i Bridge Replacement
Kīhei, Maui, Hawai'i
TMK: (2) 3-9-001:015 (por.), 147 (por.), 162 (por.)
and South Kīhei Road Right-of-Way (por.)

Dear Mr. Buenconsejo:

Thank you for the Department's letter dated August 2, 2013 regarding the subject Draft EA. We would like to take this opportunity to provide a response.

We note that we will notify your Department of the construction schedule for the new bridge and temporary detour road and bridge as it gets closer to the actual construction date.

Your letter, along with this response, will be reproduced and included in the forthcoming Final EA. We appreciate your participation in the Draft EA review process.

Sincerely,

DAVID C. GOODE
Director

DG/WYK(ED15-1154)
S:\ENG\PROJECTS\01 FAP\BR\BR-3100(015) Kulanihakoi Bridge Replacement\C Environmental\EA\FINAL EA\ED15-1154 Response to CoM DPR.docx

cc. Mr. Will Spence, Department of Planning
Mr. Milton Arakawa, Wilson Okamoto Corporation

ALAN M. ARAKAWA
Mayor

WILLIAM R. SPENCE
Director

MICHELE CHOUTEAU McLEAN
Deputy Director

COUNTY OF MAUI

**DEPARTMENT OF PLANNING**

August 14, 2013

Mr. David Goode, Director
Department of Public Works
200 South High Street, Fourth Floor
Wailuku, Hawaii 96793

RECEIVED
AUG 15 2013
WILSON OKAMOTO CORPORATION

Attn: Ms. Wendy Kobashigawa

Dear Mr. Goode:

**SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT (EA), APPLICATION FOR SPECIAL MANAGEMENT AREA (SMA) USE PERMIT (MAJOR) AND APPLICATION FOR SHORELINE SETBACK VARIANCE (SSV) FOR THE PROPOSED KULANIHAKOI BRIDGE REPLACEMENT PROJECT LOCATED AT SOUTH KIHEI ROAD, KIHEI, ISLAND OF MAUI, HAWAII; TMK(S): (2) 3-9-001:015 (POR.) AND (2) 3-9-001:147 (POR.) AND (2) 3-9-001:162 (POR.) (SM1 2013/0006) (SSV 2013/0002) (EAC 2013/0012) (RFC 2012/0195)**

The Department of Planning (Department) is in receipt of the subject transmittal dated July 18, 2013. At this time, the Department has the following comments to offer:

1. Please provide a notarized letter from the owner of parcel **Tax Map Key (2) 3-9-001:162** authorizing the Department of Public Works to apply for the subject SMA Major and Shoreline Setback Variance Applications;

2. Please provide a State of Hawaii, Board of Land and Natural Resources (BLNR) Certified Shoreline Survey as soon as available so that the Shoreline Setback boundaries can be confirmed;

3. Please coordinate any potential adjustment or potential removal of the existing sand fencing deployed makai of the proposed project area with the Department of Planning (Department);

4. Please submit a separate document capturing all best management practices (BMPs) to be implemented for the proposed project; and

5. Please also note that a Flood Development Permit is required prior to the commencement of any construction work and can be obtained from the Department's Zoning Administration and Enforcement Division (ZAED).





If additional clarification is required, please contact Staff Planner Anna Benesovska at anna.benesovska@mauicounty.gov or at (808) 463-3867.

Sincerely,

CLAYTON I. YOSHIDA, AICP
Planning Program Administrator

*for* WILLIAM SPENCE
Planning Director

xc: Anna Benesovska, Staff Planner (PDF)
Milton Arakawa, Wilson Okamoto Corporation
Project File
General File

WRS:CIY:AB:nt
K:\WP_DOCS\PLANNING\SM1\2013\0006_KulanihakoiBridge\comment.doc

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

November 9, 2015

Mr. William Spence, Director
County of Maui
Department of Planning
One Main Plaza Building
2200 Main Street, Suite 315
Wailuku, Hawai'i 96793

Subject: Draft Environmental Assessment
for Kūlanihāko'i Bridge Replacement
Kīhei, Maui, Hawai'i
TMK: (2) 3-9-001:015 (por.), 147 (por.), 162 (por.)
and South Kīhei Road Right-of-Way (por.)

Dear Mr. Spence:

Thank you for the Department's letter dated August 14, 2013 regarding the subject Draft EA. We would like to take this opportunity to provide a response.

Regarding a notarized letter from the owner of TMK: (2) 3-9-001:162, we note that the ownership changed since the submittal of the SMA application. The current owner is Valley Isle Ventures, LLC and their letter of authorization is enclosed.

The previous shoreline map was certified on September 3, 2013 but has expired. The shoreline map has been re-certified on September 18, 2015. A copy of the current shoreline map with the shoreline setback boundaries is enclosed.

Regarding the existing sand fencing makai of the project area, this is being done by a community group independent of the Department of Public Works. They are aware that areas makai of the project area are part of a major drainageway. Sand fencing has been located away from central portions of the drainageway. However, it is noted that after major rains, the sand plug occurs naturally at the shoreline which forms a muliwai.



With regard to best management practices (BMP), we note that the project will be required to comply with provisions of a Department of the Army (DOA) Nationwide Permit, pursuant to Section 404 of the Clean Water Act and a Water Quality Certification issued by the Department of Health pursuant to Section 401 of the Clean Water Act. In conjunction with the Section 401 and 404 permits, a BMP plan will be prepared for construction activities within the project site. Erosion- and sediment-control measures will be instituted in accordance with specific assessments, incorporating appropriate structural and/or non-structural BMPs such as minimizing time of exposure between construction and landscaping, and implementing erosion-control measures such as silt fences and filter berms. It is also noted that excavation and grading activities associated with construction of the proposed improvements will be regulated by the County's grading ordinance.

We also acknowledge that we will work with the Zoning Administration and Enforcement Division to comply with applicable Flood Development provisions.

Your letter, along with this response, will be reproduced and included in the forthcoming Final EA. We appreciate your participation in the Draft EA review process.

Sincerely,

DAVID C. GOODE
Director of Public Works

DG/WYK (ED15-1158)

Enclosures

S:\ENG\PROJECTS\01 FAP\BR\BR-3100(015) Kulanihakoi Bridge Replacement\C Environmental\EA\FINAL EA\ED15-1158Response to CoM Planning.docx

cc. Milton Arakawa, Wilson Okamoto Corporation

RECEIVED
COUNTY OF MAUI

2015 APR 21 AM 11:56

ENGINEERING DIVISION
DEPARTMENT OF PUBLIC WORKS

April 12, 2015

Mr. William Spence
Director
Department of Planning
County of Maui
One Main Plaza
2200 Main Street, Suite 315
Wailuku, HI 96793

SUBJECT: Kūlanihāko'i Bridge Replacement
Federal-Aid Project No. BR-3100(015)
Kihei, Maui, Hawaii
Letter of Authorization for TMK: (2) 3-9-001:162 (por.)
(SM1 2013/0006) (SSV 2013/0002) (EAC 2013/0012) (RFC 2012/0195)

Dear Mr. Spence:

We hereby authorize the County of Maui Department of Public Works to file and process a Special Management Area Use Permit and Shoreline Setback Variance affecting portions of property designated as TMK: (2) 3-9-001:162, as part of the Kūlanihāko'i Bridge Replacement Project.

Please note that we reserve the right to provide comments on the application as additional details of the development are formulated.

Sincerely,

DOUGLAS R. PALIN, JR.
Manager, Valley Isle Ventures, LLC

STATE OF WASHINGTON )
) SS.
COUNTY OF CLARK )

On this 13TH day of APRIL, 2015, before me personally appeared DOUG PALIN, JR, to me known (or proven to me on the basis of satisfactory evidence) to be the person described in and who executed the foregoing document: Letter of Authorization for TMK: (2) 3-9-001:162 (por.) above, who being duly sworn, did acknowledge that he/she executed the same as his/her free act and deed as said MANAGER of Valley Isle Ventures, LLC, having been duly authorized to execute such instrument in such capacity.

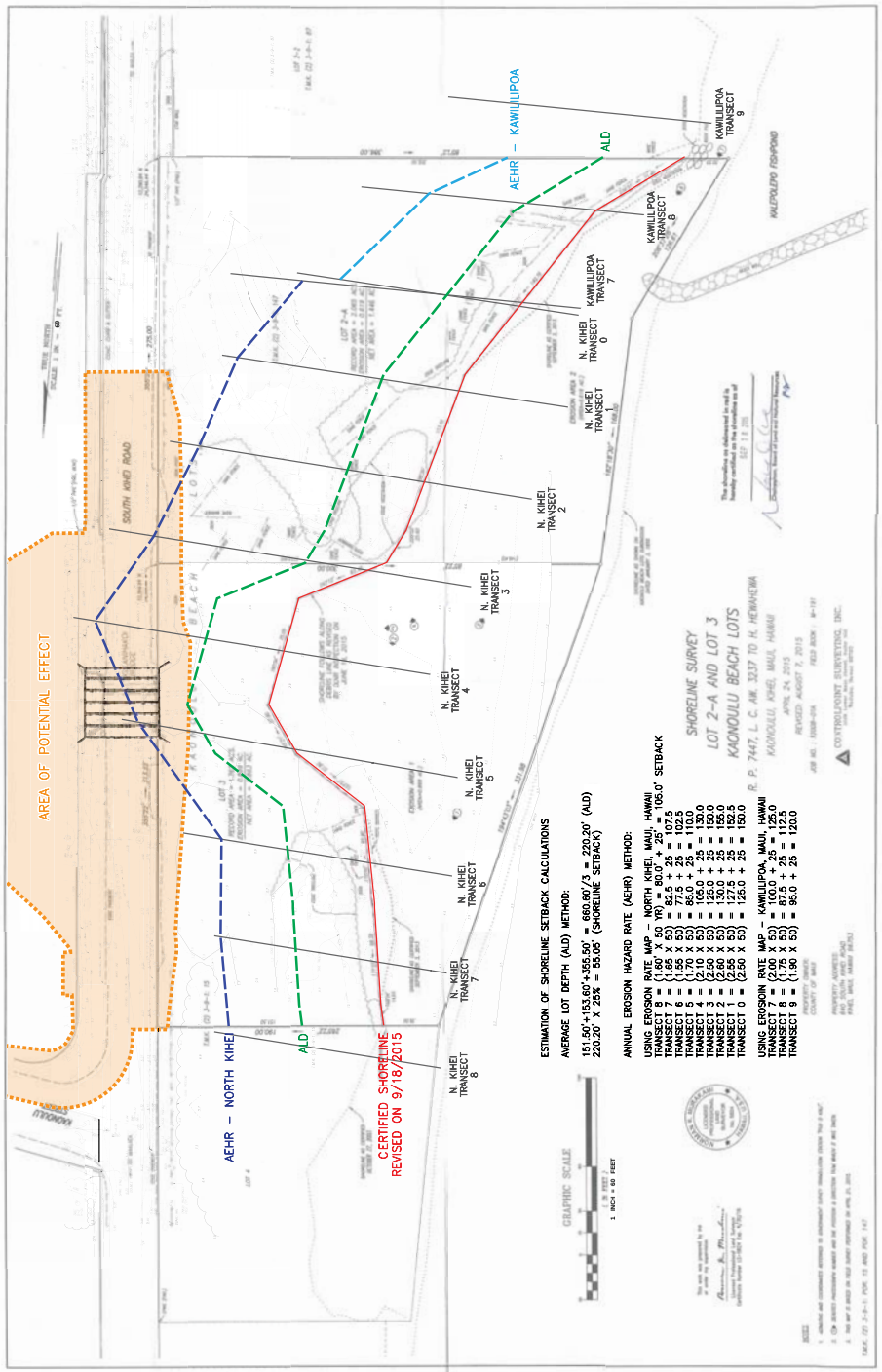
I, the Notary Public whose name is signed and printed in the signature area immediately below, do hereby certify that I notarized the foregoing Letter of Authorization for TMK: (2) 3-9-001:162 (por.), with an effective date of APRIL 13TH, 2015, consisting of 2 pages in the State of Washington.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal.

Notary Public, State of Washington

Print Name: Alaina M. Parry
My commission expires: 4/19/2017

Notary Public
State of Washington
ALAINA M PARRY
My Appointment Expires Apr 19, 2017




ALAN M. ARAKAWA
Mayor

RECEIVED
2013 JUL 18 PM 3:11
COUNTY OF MAUI
PUBLIC WORKS

RECEIVED
COUNTY OF MAUI
2013 JUL 24 AM 9:59
ENGINEERING DIVISION
DEPARTMENT OF PUBLIC WORKS

JO ANNE JOHNSON-WINER
Director
MARK I. TAKAMORI
Deputy Director
Telephone (808) 270-7511

**DEPARTMENT OF TRANSPORTATION**
COUNTY OF MAUI
200 South High Street
Wailuku, Hawaii, USA 96793-2155

July 12, 2013

Mr. David Goode
County of Maui
Director of Public Works
200 South High Street
Wailuku, Hawaii 96793

Subject: EA for Kulanihakoi Bridge Replacement

Dear Mr. Goode,

Thank you for the opportunity to comment on this project. We have no comments to make at this time.

Please feel free to contact me if you have any questions.

Sincerely,

Jo Anne Johnson Winer

Jo Anne Johnson Winer
Director

838 ☐ RUSH
DEPT. OF PUBLIC WORKS

| | INFO | ACTION | SEE ME | COMMENTS | COPY | FILE |
|---|---|---|---|---|---|---|
| DIRECTOR | ✓ | | | | | |
| DEPUTY DIR. | | | | | | |
| PERS. | | | | | | |
| DSA | | | | | | |
| ENGR. | | | | | | |
| HWY. | ✓ | | | | | |
| SECTY. | | | | | | |

Return to _____ Due _____
By: _____ Date: _____

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

November 2, 2015

Ms. Jo Anne Johnson Winer, Director
Department of Transportation
County of Maui
200 South High Street
Wailuku, Hawai'i 96793

Subject: Draft Environmental Assessment
for Kūlanihāko'i Bridge Replacement
Kīhei, Maui, Hawai'i
TMK: (2) 3-9-001:015 (por.), 147 (por.), 162 (por.)
and South Kīhei Road Right-of-Way (por.)

Dear Ms. Johnson Winer:

Thank you for your letter dated July 12, 2013 regarding the subject Draft EA. We would like to acknowledge receipt of your letter and note that no comments were provided.

Your letter, along with this response, will be reproduced and included in the forthcoming Final EA. We appreciate your participation in the Draft EA review process.

Sincerely,

DAVID C. GOODE
Director of Public Works

DG/WYK(ED15-1153)
S:\ENG\PROJECTS\01 FAP\BR\BR-3100(015) Kulanihakoi Bridge Replacement\C Environmental\EA\FINAL EA\ED15-1153 Response to CoM DOT.docx

cc. Mr. Will Spence, Department of Planning
Mr. Milton Arakawa, Wilson Okamoto Corporation

ALAN M. ARAKAWA
Mayor

**DEPARTMENT OF WATER SUPPLY**
**COUNTY OF MAUI**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793-2155
www.mauiwater.org

DAVID TAYLOR, P.E.
Director

PAUL J. MEYER
Deputy Director

August 7, 2013

Mr. David Goode, Director
Department of Public Works
County of Maui
200 South High Street, 4th Floor
Wailuku, Hawaii 96793
Attn: Ms. Wendy Kobashigawa

Project Name: Kulanihakoi_Bridge_Replacement_DEA_&_SMA
TMK: 2-3-9-001:015 (por.), 147 (por.), 162 (Por) and South Kihei Road Right-of-Way (por.)

Dear Mr. Goode:

Thank you for the opportunity to provide comments on this EA Early Consultation.

The proposed project involves replacing the existing Kulanihakoi Bridge as well as various roadway improvements.

A 12-inch water line runs parallel to South Kihei Road and approximately 32-feet mauka of the existing bridge.

Construction plans need to be reviewed by the DWS Engineering Division. Water valve covers must be lifted to match the finished grade of the roadway, if relevant roadway work is planned.

The applicant should use brackish or reclaimed water for irrigation and dust control during construction/demolition. Reclaimed water is available at the Kihei Sewage Treatment Plant.

Should you have any questions, please contact Alex Buttaro at our Water Resources and Planning Division at 463-3103, or by email alex.buttaro@co.maui.hi.us.

Sincerely,

David Taylor, Director

c: Engineering Division

*"By Water All Things Find Life"*

Printed on recycled paper

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

November 9, 2015

Mr. David Taylor, Director
Department of Water Supply
County of Maui
200 South High Street
Wailuku, Hawai'i 96793

Subject: Draft Environmental Assessment
for Kūlanihāko'i Bridge Replacement
Kīhei, Maui, Hawai'i
TMK: (2) 3-9-001:015 (por.), 147 (por.), 162 (por.)
and South Kīhei Road Right-of-Way (por.)

Dear Mr. Taylor:

Thank you for your letter dated July 19, 2013 regarding the subject Draft EA. We would like to take this opportunity to provide a response.

We acknowledge the existence of the 12-inch waterline which extends parallel to South Kīhei Road approximately 32 feet mauka of the existing bridge. We will coordinate review of the construction plans for the proposed bridge as well as the temporary detour road and bridge with the DWS. Applicable work to lift water valve covers to match the finished grade of the roadway will also be coordinated with the DWS.

The use of brackish or reclaimed water for irrigation and dust control will be recommended to the Contractor for the project.



Your letter, along with this response, will be reproduced and included in the forthcoming Final EA. We appreciate your participation in the Draft EA review process.

Sincerely,

DAVID C. GOODE
Director of Public Works

DG/WYK(ED15-1155)
S:\ENG\PROJECTS\01 FAP\BR\BR-3100(015) Kulanihakoi Bridge Replacement\C Environmental\EA\FINAL EA\ED15-1155 Response to CofM DWS.docx

cc. Will Spence, Department of Planning
Milton Arakawa, Wilson Okamoto Corporation

ALAN M. ARAKAWA
MAYOR

OUR REFERENCE
YOUR REFERENCE

# POLICE DEPARTMENT
COUNTY OF MAUI

55 MAHALANI STREET
WAILUKU, HAWAII 96793
(808) 244-6400
FAX (808) 244-6411

GARY A. YABUTA
CHIEF OF POLICE

CLAYTON N.Y.W. TOM
DEPUTY CHIEF OF POLICE

RECEIVED
2013 AUG 19 AM 6:21
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

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August 13, 2013

Mr. David Goode
Director
Department of Public Works
County of Maui
1200 South High Street, 4th Floor
Wailuku, HI 96793
Attn: Ms. Wendy Kobashigawa

Dear Mr. Yamashita:

SUBJECT: JOINT REVIEW FOR DRAFT EA APPLICTION FOR SPECIAL MANAGEMENT AREA USE PERMIT AND SHORELINE SETBACK VARIANCE PERMIT KULANIHAKOI BRIDGE REPLACEMENET

This is in response to your letter dated July 3, 2013, requesting comments on the above subject.

The Application and Report submitted on CD was reviewed. There are no comments or concerns at this time.

Thank you for giving us the opportunity to comment on this project.

Sincerely,

Assistant Chief Victor K. Ramos
for: GARY A. YABUTA
Chief of Police

c: William Spence, Department of Planning

Enclosure

---

TO : GARY YABUTA, CHIEF OF POLICE, COUNTY OF MAUI

VIA : CHANNELS

FROM : ALAN BROWN, POLICE OFFICER III, DISTRICT VI KIHEI

SUBJECT : KULANIHAKOI BRIDGE REPLACEMENT ENVIRONMENTAL ASSESSMENT

8/06/13

This To-From is in response to a request for review of Environmental Assessment for Special Management Area, in regards to the replacement of Kulanihakoi Bridge on S. Kihei Rd. in Kihei. This project is being proposed by the County of Maui and submitted by Wilson Okamoto Corp. The project will replace the existing bridge, which is a box culvert system, of four 6'by 4' sections with six 6' by 4' sections. The replacement will also widen the roadway from the existing 28' to 30' width to an approximate 50' width. Prior to replacement of the bridge the contractor will construct a temporary bridge just east of the existing unit. This will include large concrete bases on each side of the river with a metal expansion bridge. The temp bridge will have two lanes and a separate pedestrian walkway attached to the side of the bridgeway.

**IMPACT ON POLICE:**

Upon review of the plans I find that there should be no negative impact on police services. The replacement of the bridge will make the area safer for both vehicular, bicycle and pedestrian traffic.

**TRAFFIC IMPACT:**

As with any roadway construction project there will be impacts on traffic. However from reading the proposed plans it appears that the placement of the Temp Bridge prior to the permanent bridge replacement should alleviate any major traffic issues.

**RECOMMENDATIONS:**

After review of the project I recommend that the county move forward with the project as planned.

Refer to Ofc. Brown's comments.
H. Stepp
08/05/13 @ 1045hrs.
Recommend forward to Dept of Planning for final review
Capt [illegible] 8/5/13

Respectfully Submitted
Officer Alan Brown E1505
080213 @ 0930 hrs

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

November 3, 2015

Mr. Victor Ramos, Assistant Chief
County of Maui
Maui Police Department
55 Mahalani Street
Wailuku, Hawai'i 96793

Subject: Draft Environmental Assessment
for Kūlanihāko'i Bridge Replacement
Kīhei, Maui, Hawai'i
TMK: (2) 3-9-001:015 (por.), 147 (por.), 162 (por.)
and South Kīhei Road Right-of-Way (por.)

Dear Mr. Ramos:

Thank you for the Department's letter dated August 13, 2013 regarding the subject Draft EA which noted no comments or concerns at this time.

Your letter, along with this response, will be reproduced and included in the forthcoming Final EA. We appreciate your participation in the Draft EA review process.

Sincerely,

DAVID C. GOODE
Director of Public Works

DG/WYK(ED15-1159)
S:\ENG\PROJECTS\01 FAP\BR\BR-3100(015) Kulanihakoi Bridge Replacement\C Environmental\EA\FINAL EA\ED15-1159 Response to CoM Police.docx

cc. Mr. Will Spence, Department of Planning
Mr. Milton Arakawa, Wilson Okamoto Corporation

---

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ENGINEERING DIVISION
DEPARTMENT OF PUBLIC WORKS

# KCA

Community Association
"Together to shape our Community's future"

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Return to_____ Due_____
By:_____

August 6, 2013

Mayor Alan Arakawa
Office of the Mayor
200 S. High Street
Wailuku, Maui, HI 96793

Aloha Mayor Arakawa,

We are writing regarding the proposed bridge replacement on South Kihei Road at Kulanihakoi Gulch.

The KCA Planning Committee met with David Goode and Milton Arakawa of Wilson Okamoto Corporation. After that meeting we wrote a letter following up on comments we had made during the meeting. We stated that we prefer a bridge rather than a culvert, with open rather than closed railings, and with the pedestrian way separated from vehicular traffic. The temporary bridge that they showed us is preferable to the final proposed culvert.

On July 16, at the KCA general meeting, the county made another presentation to our community. The proposal was unchanged from their initial proposal. The community's recommendations were recognized, yet not incorporated, nor even analyzed. We had hoped to see more progress in reviewing our input.

The bridge site is at a crucial location in a Federal Flood zone and contributes to the flooding. Neighbors in the surrounding area are concerned that the new bridge is not going to improve that situation. We feel that the suggestions we made to the designers would reduce significantly the flood zone, and should be be investigated.

South Kihei Road is the gateway to the South Maui tourist area. This water crossing could set a standard as a scenic spot where pedestrians will want to linger, rather than the eyesore of the existing culvert.

We hope that you will encourage the Planning Department and Department of Public Works to think of the impact that this project has on our residents and on our valuable the tourist industry.

Thank you,

Mike Moran
KCA President

cc: Donald G. Couch, Jr., Councilman
William Spence, Director of Planning
David Goode, Director of Public Works

P.O. Box 662, Kihei, HI 96753 www.gokihei.org 508 499 9996

194

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# KCA

Kihei Community Association
"Working together to shape our Community's future"

(left on Jo-Anna's desk on 8/12/13)

August 9, 2013

Mayor Alan Arakawa
Office of the Mayor
200 S. High Street
Wailuku, Maui, HI 96793

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ENGINEERING DIVISION
DEPARTMENT OF PUBLIC WORKS

Aloha Mayor Arakawa,

The KCA understands that the county is preparing to move ahead with the new culvert design as proposed. We still believe that a complete bridge could provide significantly added drainage flow during a flood. As you are aware, this area of Kihei has been the subject of several floods in the last years and has a large flood plain requiring many homeowners to purchase expensive flood insurance.

It is also important to minimize delays in getting this project completed. But the temporary bridge being installed by the County does provide an opportunity to extend the timelines to accommodate a redesign. The key element at this time would appear to be the EIS that is currently under preparation. In our comments to the EIS contractor, we recommended that alternate designs be considered that would improve the performance of the bridge during flood events. We don't know it that request is being honored.

If you could direct your engineering staff to provide an alternate design for a full bridge, with separation of bikes and pedestrians from vehicles, the EIS contractor could include that in their document. That would allow the processing of the plans to continue while the detailed redesign of the bridge was completed. .

Thank you,

Mike Moran
KCA President

cc: Donald G. Couch, Jr., Councilman
William Spence, Director of Planning
David Goode, Director of Public Works

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8/13

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P.O. Box 662, Kihei, HI 96753 www.gokihei.org 508 499 9996

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

November 9, 2015

Mr. Michael Moran
President
Kīhei Community Association
P.O. Box 662
Kihei, Hawai'i 96753

Subject: Draft Environmental Assessment
for Kūlanihāko'i Bridge Replacement
Kīhei, Maui, Hawai'i
TMK: (2) 3-9-001:015 (por.), 147 (por.), 162 (por.)
and South Kīhei Road Right-of-Way (por.)

Dear Mr. Moran:

Thank you for your letters of August 6, 2013 and August 9, 2013 to Mayor Alan Arakawa regarding the subject Draft EA. On behalf of the County of Maui Department of Public Works, we would like to provide a response.

First, we would like to note that we have earnestly considered the comments of the Kīhei Community Association. We understand that flood insurance requirements have changed over the last several years with the result that additional homeowners will now have to purchase flood insurance. The proposed six culvert design will provide an incremental increase in accommodating storm flows over the existing four culverts. That increase in drainage capacity is 204 cubic feet per second (cfs) to 306 cfs, assuming that the sand plug outlet is not blocked.

Should a bridge rather than a culvert design be pursued, a slightly greater drainage capacity may, in fact, be achieved. However, a bridge in this location, no matter the extent to which it is raised, will not completely solve drainage or flooding issues. The existing South Kīhei Road crossing is located at the makai end of the 10,298 acre Kūlanihāko'i Watershed which extends from approximately the 9,600 foot elevation near the summit of Haleakalā to the shoreline. The 100 year storm flows at South Kīhei Road have been calculated at 14,148 cfs. This is significantly greater than the existing capacity of the culverts.

For example, if the velocity of the flows is assumed to travel at 10 feet per second, the volume of water is roughly 10 feet high by 140 feet wide. By comparison, the existing culverts are 4 feet high and 24 feet wide. Thus, when significant runoff occurs, the flows overtop South Kīhei Road.

The key point, however, is that significant storm flows fan out from the relatively flat drainageway before it reaches South Kīhei Road. Although the Kūlanihāko'i Watershed is fairly well defined at upper elevations, the drainageway flattens out considerably makai of Pi'ilani Highway. Moreover, the existing sand plug acts as a dam until flows are able to puncture through it. It is noted that the proposed six culvert design will provide an incremental increase in drainage capacity. However, runoff and flooding would still occur in the surrounding area. Because of the relatively undefined drainageway upstream of the project area and the amount of storm flows, runoff and flooding will still occur even if larger culverts or a bridge were implemented.

A bridge has other drawbacks. Because a bridge in this location will not be able to accommodate large storm flows, the bridge will become an obstacle for runoff, as well as debris such as branches, rocks and boulders. Culverts are also an obstacle and have been damaged by significant storms in the past. Storm flows can be deflected off of obstacles and result in flooding over a wider area. Storm flow deflection from a larger obstacle such as a bridge may pose an additional flooding concern.

Repair and maintenance of the existing culverts have been able to be effectuated relatively quickly minimizing the impact on the community. Damage to a bridge, however, may require structural engineering analysis to determine whether it is safe for use. Repairs may also be more extensive causing a longer period of time when the bridge will not be able to be utilized resulting in additional disruption to the community.

It is recognized that flooding is a major concern in the District. There are a number of major and distinct watershed areas in the Kīhei region which extend up to the Southwest Rift Zone along the slopes of Haleakalā. Issues of dealing with peak runoff in the Kīhei region are much larger than the replacing culverts in the Kūlanihāko'i Watershed at South Kīhei Road. Drainage in Kīhei is obviously a regional issue. An updated drainage master plan is needed in the area. Our Department is working on updating the Kīhei Drainage Master Plan. We look forward to working cooperatively with the Kīhei Community Association in formulating applicable regional drainage solutions for the District.



Your letter, along with this response, will be reproduced and included in the forthcoming Final EA. We appreciate your participation in the Draft EA review process.

Sincerely,

DAVID C. GOODE
Director of Public Works

DG/WYK(ED15-1160)
S:\ENG\PROJECTS\01 FAP\BR\BR-3100(015) Kulanihakoi Bridge Replacement\C Environmental\EA\FINAL EA\ED15-1160Response to KCA.docx

cc. Alan Arakawa, Mayor
Will Spence, Department of Planning
Milton Arakawa, Wilson Okamoto Corporation

168

Mr. David Good, Director
County of Maui
Department of Public Works
Engineering Division
200 South High Street, 4th Floor
Wailuku, HI 96793
Attention: Ms. Wendy Kobashigawa

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2013 JUL 24 PM 4:44
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DEPARTMENT OF PUBLIC WORKS

**SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT FOR THE KULANIHAKOI BRIDGE REPLACEMENT PROJECT WAILUKU, ISLAND OF MAUI, HAWAII**

and other related matters

Please see attached 2 pages.

1. (cc). The Mayor Alan Arakawa Maui County
2. Senator Roy Baker
3. Editor, Maui News
4. Mr William Spence. Dept Planning Maui County

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Return to _____ Due _____
By: _____ Date _____

(include additional sheets as necessary)

PLEASE PRINT: Name: ANN M. BLYDE Phone: 875-6769

Organization: —

Address: 30 HALILI LANE #31
KIHEI HI 96753

Email: annblyde@hotmail.com

Please submit comments by **Wednesday, August 7, 2013**.

cc: Mr. William Spence, County of Maui Department of Planning

July 22 2013

To: David Good Dir Public Works
County Maui

Page 1 Afterthoughts meeting July 16 2013, Kihei Community Assoc.

1 Could the Army Corps of Engineers be consulted about the bridge reconstruction?

It involves ocean, flood, tsunami waters ( the latter last one sent water up the gulch as far as The Villas at Kenolio), is the only backup disaster escape route other than the Piilani Hwy for S. Kihei residents and is being built almost entirely using Federal funds. Surely they could have useful optional input given the stated impossibility of control of lower gulch large flood waters in the future?

2 The various Wailea land development plans to date mentioned several times the use of flood catchment basins. Why can't these be included in the proposed developments ("mall", school) inland of the Piilani Hwy in the vicinity of the gulch to divert initial mountain/gulch flood runoff . I am not thinking of merely controlling the runoff from the respective developments but controlling/deferring to some degree the initial flooding runoff from the mountain/ranch lands down the gulch in a big storm. Large catchment areas would go some way towards mitigating the appalling decision made when the Piilani culverts were allowed to be so large as to preclude any hope of the same flood water egress escaping at the ocean end of the gulch without causing back up flooding of the area at the clearly inadequate old culverts. As far as seems acknowledged and planned, the same situation will occur at any newly built S. Kihei Rd bridge culverts .

One suggested option, the Wailea development keep it own low income housing in Wailea and use the proposed land or equivalent acreage for it in the development near Kaonoulu as flood catchment basins. I suggest we use Kaonoulu land to help protect local residents affected by gulch flooding and not facilitate Wailea developers. Surely, these residents deserve as much consideration as those in Wailea in the alternative use of development lands, in this case as catchment basins, particularly in view of past decisions which cannot be corrected and the inevitable current flood threat levels?

It is to be hoped that when weighing the full measure of the value of N. Kihei homes, Maui County can look beyond the $ worth used by Wailea developers particularly in terms of consideration in matters such as flood protection.

3

Condo development on fill in the gulch was another potentially disastrous Maui County decision in 2001.

The gulch is supposed to be kept largely clear of growth/debris. The Villas at Kenolio clears the land 30-60ft out from its fill all the way up to the Piilani but the remaining considerable width in the gulch has not been cleared in 2+ years and is now covered in dense tree/shrub growth to 15+ feet . Betsill Co as the last owner of the gulch land has now walked away from its responsibility in what I am told is supposed bankruptcy. Their creation of the so called "nonprofit" organisation to maintain the gulch was a poorly disguised attempt to renege on responsibilities and give them to someone totally incapable of assuming same....this as described by that now deceased person.

Having observed floods in the 8 years I have lived here, any flood of major proportions will immediately wash the current tree/growth into the new bridge culverts effectively blocking them and worsening any back up flooding in the lower gulch below the Piilani.

Maui County used to require clearance of the gulch by the owner and I have seen past letters to that effect. This no longer seems to be the case, possibly due to the ownership issue and the inevitable question of payment of costs.

To my knowledge the other developments abutting the gulch and consequently also flood prone do not contribute to gulch clearance maintenance.

Based on this, could the large excavating equipment which will have to be brought into work on the temporary/new bridge later this year be used to clear the gulch of the current growth at the same time?

Thankyou for your attention,

Ann Blyde

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

November 9, 2015

Ms. Ann M. Blyde
30 Halili Lane #3D
Kīhei, Hawai'i 96753

Subject: Draft Environmental Assessment
for Kūlanihāko'i Bridge Replacement
Kīhei, Maui, Hawai'i
TMK: (2) 3-9-001:015 (por.), 147 (por.), 162 (por.)
and South Kīhei Road Right-of-Way (por.)

Dear Ms. Blyde:

Thank you for your letter of July 22, 2013 regarding the subject Draft EA. We would like to take this opportunity to provide a response.

It is recognized that flooding and tsunami issues are a major concern in the District. There are a number of major and distinct watershed areas in the Kīhei region which extend up to the Southwest Rift Zone along the slopes of Haleakalā. Issues of dealing with peak runoff in the Kīhei region are much larger than the replacing culverts in the Kūlanihāko'i Watershed at South Kīhei Road. Drainage in Kīhei is obviously a regional issue. An updated drainage master plan is needed in the area. Our Department is working on updating the Kīhei Drainage Master Plan. In the process, as well as during the implementation of the Plan, the Department will be consulting with the Corps of Engineers.

Your suggestion of flood catchment basins may be part of the solution to address flooding in the District. However, this should be part of implementation of a cohesive drainage master plan for the District.

Regarding maintenance of drainageways, that responsibility falls to the landowner. In the case of the Villas at Kenolio, this issue will be reviewed by our Department and appropriate action will be taken.

Ms. Ann Blyde
Page 2
November 9, 2015

Your letter, along with this response, will be reproduced and included in the forthcoming Final EA. We appreciate your participation in the Draft EA review process.

Sincerely,

DAVID C. GOODE
Director of Public Works

DG/WYK(ED15-1151)
S:\ENG\PROJECTS\01 FAP\BR\BR-3100(015) Kulanihakoi Bridge Replacement\C Environmental\EA\FINAL EA\ED15-1151 Response to Ann Blyde.docx

cc. Will Spence, Department of Planning
Milton Arakawa, Wilson Okamoto Corporation

---

Mr. David Good, Director
County of Maui
Department of Public Works
Engineering Division
200 South High Street, 4th Floor
Wailuku, HI 96793
Attention: Ms. Wendy Kobashigawa

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By: ____ Date: ____

**SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT FOR THE KULANIHAKOI BRIDGE REPLACEMENT PROJECT WAILUKU, ISLAND OF MAUI, HAWAII**

Recognizing the emergency situation (to receive) re safety there are still two issues I would like additional attention during the long term replacement bridge development 1. water catchment areas for Kaonoulu St. and similar to the considerations in the Wailea Project 2. Bridge replacement design with the least amount of concrete dividers etc. minimize construction impacting the view to the ocean & possible impediment to water flow. More is not always better re walkway dividers etc.
A last consideration on my concern list is attention to the area left disrupted after removal of the temporary bypass removal eg. planting landscaping on mauka side.

(include additional sheets as necessary)

PLEASE PRINT: Name: Annette Probst Phone: 206 819-8088

Organization:

Address: 2F 20 Halili Lane
Villas at Kenolio

Email: annetta_probst@yahoo.com

Please submit comments by **Wednesday, August 7, 2013**.

cc: Mr. William Spence, County of Maui Department of Planning

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

November 2, 2015

Ms. Annette Probst
20 Halili Lane #2F
Kīhei, Hawai'i 96753

Subject: Draft Environmental Assessment
For Kūlanihāko'i Bridge Replacement
Kīhei, Maui, Hawai'i
TMK: (2) 3-9-001:015 (por.), 147 (por.), 162 (por.)
and South Kīhei Road Right-of-Way (por.)

Dear Ms. Probst:

Thank you for your letter of July 22, 2013 regarding the subject Draft EA. We would like to take this opportunity to provide a response.

It is recognized that flooding and tsunami issues are a major concern in the District. There are a number of major and distinct watershed areas in the Kīhei region which extend up to the Southwest Rift Zone along the slopes of Haleakalā. Issues of dealing with peak runoff in the Kīhei region are much larger than the replacing culverts in the Kūlanihāko'i Watershed at South Kīhei Road. Drainage in Kīhei is obviously a regional issue. An updated drainage master plan is needed in the area. Our department is working on updating the Kīhei Drainage Master Plan. Your suggestion of water catchment areas may be part of the solution to address flooding in the District. However, this should be part of implementation of a cohesive drainage master plan for the District.

Thank you for your comment on minimizing the amount of concrete dividers. That will be taken into consideration as we move forward to final design.

We also want to mention that after the removal of the temporary bridge and detour road, the area will be restored to pre-construction condition to the extent possible, including the planting of landscaping.



Your letter, along with this response, will be reproduced and included in the forthcoming Final EA. We appreciate your participation in the Draft EA review process.

Sincerely,

DAVID C. GOODE
Director of Public Works

DG/WYK(ED15-1152)
S:\ENG\PROJECTS\01 FAP\BR\BR-3100(015) Kulanihakoi Bridge Replacement\C Environmental\EA\FINAL EA\ED15-1152 Response to Annette Probst.docx

cc. Mr. Will Spence, Department of Planning
Mr. Milton Arakawa, Wilson Okamoto Corporation

# APPENDIX I

***Additional Comment and Response Letters Included in Revised Final Environmental Assessment***

13/3953

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

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

LORRIN W. PANG, M.D., M.P.H.
DISTRICT HEALTH OFFICER

STATE OF HAWAII
DEPARTMENT OF HEALTH
MAUI DISTRICT HEALTH OFFICE
54 HIGH STREET
WAILUKU, HAWAII 96793

'13 AUG -1 P3:14
DEPT OF PLANNING
COUNTY OF MAUI
RECEIVED

July 31, 2013

Mr. David Goode
Director
Department of Public Works
County of Maui
200 South High Street, 4th Floor
Wailuku, Hawai'i 96793

Attention: Ms. Wendy Kobashigawa

Mr. William R. Spence
Director
Department of Planning
County of Maui
2200 Main Street, Suite 315
Wailuku, Hawaii 96793

Attention: Ms. Anna Benesovska

Dear Mr. Goode and Mr. Spence:

**Subject:** **Joint Review for Draft Environmental Assessment, Application for Special Management Area Use Permit (Major), and Shoreline Setback Variance Permit for Kulanihakoi Bridge Replacement, Maui, Hawaii**
**Applicant:** **County of Maui, Department of Public Works and Department of Planning**
**Project Description:** **Kulanihakoi Bridge Replacement**

Thank you for the opportunity to review this project. We have the following comments to offer:

1. National Pollutant Discharge Elimination System (NPDES) permit coverage maybe required for this project. The Clean Water Branch should be contacted at 808 586-4309.



2. The noise created during the construction phase of the project may exceed the maximum allowable levels as set forth in Hawaii Administrative Rules (HAR), Chapter 11-46, "Community Noise Control." A noise permit may be required and should be obtained before the commencement of work. The Indoor & Radiological Health Branch should be contacted at 808 586-4700.

It is strongly recommended that the Standard Comments found at the Department's website: http://health.hawaii.gov/epo/home/landuse-planning-review-program/ be reviewed, and any comments specifically applicable to this project should be adhered to.

Should you have any questions, please call me at 808 984-8230 or E-mail me at patricia.kitkowski@doh.hawaii.gov.

Sincerely,

Patti Kitkowski

Patti Kitkowski
District Environmental Health Program Chief

c EPO

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

Highways Division

February 16, 2016

Ms. Patti Kitkowski
District Environmental Health Program Chief
State of Hawai'i
Department of Health
Maui District Health Office
54 High Street
Wailuku, Hawai'i 96793

Subject: Draft Environmental Assessment for Kūlanihāko'i Bridge Replacement
Kīhei, Maui, Hawai'i
TMK: (2) 3-9-001:015 (por.), 147 (por.), 162 (por.) and
South Kīhei Road Right-of-Way (por.)

Dear Ms. Kitkowski:

Thank you for your letter dated July 31, 2013 regarding the subject Draft EA. We would like to take this opportunity to provide a response.

We appreciate your recommendation regarding possible applicability of National Pollutant Discharge Elimination System provisions. We intend to work cooperatively with the Clean Water Branch in providing the requisite application submittals.

We acknowledge that a noise permit will be required if noise levels from construction activities are expected to exceed allowable levels stated in DOH Administrative Rules. If necessary, a noise permit shall be obtained.

We appreciate the recommendation to review DOH's Standard Comments and intend to comply with applicable comments.

Your letter, along with this response, will be reproduced and included in the forthcoming Final EA. We appreciate your participation in the Draft EA review process.

Sincerely,

DAVID C. GOODE
Director of Public Works

DG/WYKK(ED16-117)
S:\ENG\PROJECTS\01FAP\BR\BR-0100(015) Kulanihakoi Bridge Replacement\C Environmental\EA\Revised FINAL EA (Feb 2016)\Addl comment ltrs and draft responses\DOH M and OP Responses\2016.02.16 ED16-117 (resp to SDOH-M).doc

xc: Mr. William Spence, Department of Planning
Mr. Milton Arakawa, Wilson Okamoto Corporation

---

DAVID Y. IGE
GOVERNOR OF HAWAII

**STATE OF HAWAII**
**DEPARTMENT OF HEALTH**
**MAUI DISTRICT HEALTH OFFICE**
54 HIGH STREET
WAILUKU, HAWAII 96793-3378

VIRGINIA PRESSLER, M.D.
DIRECTOR OF HEALTH

LORRIN W. PANG, M.D., M.P.H.
DISTRICT HEALTH OFFICER

MA

December 28, 2015

RECEIVED
DEC 30 2015
WILSON OKAMOTO CORPORATION

Mr. Milton Arakawa
Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, Hawaii 96826

Dear Mr. Arakawa:

| | |
|---|---|
| **Subject:** | **Kulanihako'i Bridge Replacement 5(b) FEA (FONSI)** |
| **Applicant:** | **County of Maui** |
| **TMK:** | **(2) 3-9-001:015 (por.), 147 (por.), 162 (por.)** |
| **Project Location:** | **Wailuku, Maui** |

Thank you for the opportunity to review this project. We have the following comments to offer:

1. National Pollutant Discharge Elimination System (NPDES) permit coverage may be required for this project. The Clean Water Branch should be contacted at 808 586-4309.

2. A Section 401 Water Qualification Certification (WQC) may be required. To determine if your project requires a federal permit, license, certificate, approval, registration, or statutory exemption, please contact the appropriate federal agencies (e.g. Department of the Army, US Army Corps of Engineers, Pacific Ocean Division Honolulu District Office; US Environmental Protection Agency; Federal Energy Regulatory Commission; US Coast Guard, etc.). To request a Section 401 WQC, you must complete and submit the Section 401 application. This application is available on the e-Permitting Portal website located at: https://eha-cloud.doh.hawaii.gov/epermit/.

It is strongly recommended that the Standard Comments found at the Department's website: http://health.hawaii.gov/epo/home/landuse-planning-review-program/ be reviewed and any comments specifically applicable to this project should be adhered to.

Mr. Milton Arakawa
December 28, 2015
Page 2

Should you have any questions, please contact me at 808 984-8230.

Sincerely,

Patti Kitkowski

Patti Kitkowski
District Environmental Health Program Chief

c EPO

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

Highways Division

February 16, 2016

Ms. Patti Kitkowski
District Environmental Health Program Chief
State of Hawai'i
Department of Health
Maui District Health Office
54 High Street
Wailuku, Hawai'i 96793

Subject: Final Environmental Assessment for Kūlanihāko'i Bridge Replacement
Kīhei, Maui, Hawai'i
TMK: (2) 3-9-001:015 (por.), 147 (por.), 162 (por.) and
South Kīhei Road Right-of-Way (por.)

Dear Ms. Kitkowski:

Thank you for your letter dated December 28, 2015 regarding the subject Final EA. For your information, the FEA-FONSI which was published in the December 8, 2015 edition of the *Environmental Notice* was withdrawn due to procedural issues. However, we intend to file a revised FEA-FONSI and would like to take this opportunity to provide a response to your December 28, 2015 letter.

We appreciate your recommendation regarding possible applicability of National Pollutant Discharge Elimination System and Section 401 Water Quality Certification provisions. We intend to work cooperatively with the Clean Water Branch in providing the requisite application submittals.

We acknowledge that a noise permit will be required if noise levels from construction activities are expected to exceed allowable levels stated in DOH Administrative Rules. If necessary, a noise permit shall be obtained.

We appreciate the recommendation to review DOH's Standard Comments and intend to comply with applicable comments.

Your letter, along with this response, will be reproduced and included in the forthcoming revised FEA-FONSI. We appreciate your participation in the EA review process.

Sincerely,

DAVID C. GOODE
Director of Public Works

DG/WYKK(ED16-118)
S:\ENG\PROJECTS\01 FAP\BR\BR-6100(015) Kulanihakoi Bridge Replacement\C Environmental\EA\Revised FINAL EA (Feb 2016)\Addl comment ltrs and draft responses\DOH M and OP Responses\2016.02.16 ED16-118 (resp to SDOH-M).doc

xc: Mr. William Spence, Department of Planning
Mr. Milton Arakawa, Wilson Okamoto Corporation

13/388


# OFFICE OF PLANNING
# STATE OF HAWAII

235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

NEIL ABERCROMBIE
GOVERNOR

JESSE K. SOUKI
DIRECTOR
OFFICE OF PLANNING

Telephone: (808) 587-2846
Fax: (808) 587-2824
Web: http:/planning.hawaii.gov/


Ref. No. P-14061

DEPT. OF PLANNING
COUNTY OF MAUI
JUL 29 2013
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July 25, 2013

Mr. David Goode, Director
Department of Public Works
County of Maui
200 South High Street, 4th Floor
Wailuku, Hawaii 96793

Attention: Ms. Wendy Kobashigawa

Dear Mr. Goode:

Subject: Joint Review for Draft Environmental Assessment, Application for Special Management Area Use Permit and Shoreline Setback Variance, Kulanihakoi Bridge Replacement, Wailuku, Island of Maui, Hawaii

Thank you for the opportunity to provide comments on the joint review for Draft Environmental Assessment (Draft EA), Application for Special Management Area (SMA) Use Permit, and Shoreline Setback Variance (SSV) for the Kulanihakoi Bridge Replacement Project, located at Wailuku, Maui, Hawaii, at TMK: (2)3-9-001: 015 (por.), 147 (por.), 162 (por.), and South Kihei Road Right-of-Way.

The proposed project includes construction work within Kulanihakoi Gulch and the muliwai, and involves construction activities within the shoreline setback area. Proposed work within these areas includes demolition of existing culverts, excavation for new culverts, and excavation for inlet and outlet wing walls.

The Office of Planning has reviewed the subject application and has the following comments to offer:

1. It is noted that based on the site inspection, the State Historic Preservation Division (SHPD), Department of Land and Natural Resources, requested that an Archaeological Inventory Survey (AIS) be prepared for the project site. The Final Environmental Assessment (Final EA) should disclose the information of the AIS as required by SHPD.

2. The Final EA should provide information about the life-span of the proposed Kulanihakoi Bridge Replacement. The alternatives to the proposed replacement should consider the climate change adaptation priority guidelines enacted by Act 286, Session Laws of Hawaii 2012, and codified as Hawaii Revised Statutes (HRS) Section 226-109, to meet the objectives and policies, contained in HRS Section 205A-2, to reduce hazard to life and property from coastal hazards, including storm waves and shoreline erosion.



3. The Draft EA on page 3-4, mentions that a best management practices (BMPs) plan will be prepared for construction activities within the project site. For mitigation measures, this BMP plan should be submitted with the application for SMA Use Permit and Shoreline Setback Variance.

   The applicant should refer to the *Hawaii Watershed Guidance* document (August 2010), available at http://files.hawaii.gov/dbedt/op/czm/initiative/nonpoint/HI%20Watershed%20Guidance%20Final.pdf. Specifically, the sections on management measures for bridges (p. 132), and bridge runoff systems (p. 134) provide guidance on selecting the most effective BMPs to control erosion, streambed scouring, and surface runoff from project activities.

4. The Draft EA and SMA Permit Assessment Report uses $125,000 as the valuation threshold for SMA Use Permit. Please note that Act 153, Session Laws of Hawaii (SLH) 2011, has raised the valuation threshold for SMA Use Permit from $125,000 to $500,000.

5. The Draft EA, page 3-6, states that Kulanihakoi Gulch appears on the State Department of Health's 2012 list of impaired waters in Hawaii, prepared under the federal Clean Water Act. Please consider utilizing the Office of Planning's *Stormwater Impact Assessment* to identify and evaluate information on hydrology (i.e., proximity to drainage ways, stream channels, sensitive ecosystems in receiving waters), stressors (i.e., water quality and pollutants), sensitivity of resources (i.e., aquatic resources and riparian resources), and management considerations. This guidance document will assist in integrating stormwater impact assessment within your review process. The Appendices include a list of Data Resources, Best Management Practice Techniques, and a Reviewers Checklist. The *Stormwater Impact Assessment* guidance document can be found at http://files.hawaii.gov/dbedt/op/czm/initiative/stomwater_imapct/final_stormwater_impact_assessments_guidance.pdf.

The comments in this letter provide guidance and are not regulatory. The planning department of the various counties is charged with assessing SMA permit applications. Final

decision-making is vested in the respective county planning commissions, or the city council for the City and County of Honolulu.

Should you have questions or require clarification, please contact Leo Asuncion, Coastal Zone Management Program Manager, at (808) 587-2846.

Sincerely,

Jesse K. Souki
Director

c: Mr. William R. Spence,
Department of Planning, County of Maui

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

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COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
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GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

Highways Division

February 16, 2016

Mr. Leo Asuncion
Acting Director
State of Hawai'i
Office of Planning
235 South Beretania Street, 6th Floor
Honolulu, Hawai'i 96813

SUBJECT: Draft Environmental Assessment for Kūlanihāko'i Bridge Replacement
Kīhei, Maui, Hawai'i
TMK: (2) 3-9-001:015 (por.), 147 (por.), 162 (por.) and
South Kīhei Road Right-of-Way (por.)

Dear Mr. Asuncion:

Thank you for your letter dated July 25, 2013 regarding the subject Draft EA. We would like to take this opportunity to provide a response.

We note that an archaeological inventory survey for the project has been completed. The findings of the survey are discussed in the Final EA. By letter dated June 25, 2014, the State Historic Preservation Division has accepted the archaeological inventory survey as final.

The proposed project involves replacing four 6' x 4' deteriorated culverts with six 6' x 4' culverts. The proposed project is part of South Kīhei Road which extends parallel to and in close proximity to the shoreline providing access for properties makai and mauka of the road. The proposed improvements are located in roughly the same location as the existing improvements and are being reconstructed in a manner very similar to the existing situation. The two additional culverts are being proposed in order to incrementally increase drainage capacity and decrease flood risk. The proposed project is necessary for drainage purposes and is not contrary to the HRS Section 205-2 relating to reducing a hazard to life and property from coastal hazards, including storm waves and shoreline erosion.

We appreciate the information provided by the *Hawai'i Watershed Guidance* as well as the *Stormwater Impact Assessment* documents. The proposed project will be required to undergo Special Management Area Use Permit review, Section 404, Section 401, Coastal Zone Management Federal Consistency, and County grading permit review and approval. Erosion and sediment control measures will be instituted in accordance with the site specific assessments, incorporating appropriate structural and/or non-structural BMPs. Specific BMPS may include, but may not be limited to the following:

1. Minimizing soil loss and erosion by revegetation and stabilization of slopes and disturbed areas of soil, possibly using hydromulch, geotextiles, or other applicable alternatives, as soon as possible after working;

2. Minimizing time of exposure between construction and landscaping;
3. Application of protective covers to soil and material stockpiles;
4. Minimizing disturbance of soil during periods of heavy rain;
5. Implementing erosion control measures by emplacement of structural controls such as silt fences, filter berms, gravel bags, fiber rolls, sandbag barriers and other barriers in order to retard and prevent the loss of sediment from the site;
6. Phasing of the project to disturb the minimum area of soil at a particular time;
7. Use of drip pans beneath vehicles not in use in order to trap vehicle fluids;
8. Routine maintenance of BMPs by adequately trained personnel; and
9. Significant leaks or spills, if they occur, shall be properly cleaned up and disposed of at an approved site.

In addition to the SMA Use Permit and Shoreline Setback Variance, the project is also required to comply with Section 404, Section 401, CZM Federal Consistency, Stream Channel Alteration, National Pollutant Discharge Elimination System, and County grading permit provisions. Additional BMPs may be required during the specific permit processes.

References to the SMA valuation threshold of $500,000 have been corrected in the Final EA and SMA Use Permit application.

Your letter, along with this response, will be reproduced and included in the forthcoming Final EA. We appreciate your participation in the Draft EA review process.

Sincerely,

DAVID C. GOODE
Director of Public Works

DG:WYKK(ED16-116)
S:\ENG\PROJECTS\DT FAP\BR\BR-6100(015) Kulanihakoi Bridge Replacement\C Environmental\EA\Revised FINAL EA (Feb 2016)\Addl comment ltrs and draft responses\DOH M and OP Responses\2016.02.16 ED16-116 (resp to SOP).doc

xc: Mr. William Spence, Department of Planning
Mr. Milton Arakawa, Wilson Okamoto Corporation

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